University of Reading

CREDIT, HOUSE PRICE, INSTITUTIONS AND THE MACROECONOMY

Thesis Submitted to the School of Real Estate and Planning in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

By

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DECLARATION

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

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ABSTRACT

Abstract

This study investigates the relationship between mortgage markets and house prices. It also looks at how these are associated with the macroeconomy, particularly the external dimension of the economy (i.e. current account balances) as well as institutions. The study utilises a three-essay approach in which econometric analyses are conducted to examine various dimensions of the relationship between the aforementioned variables in the context of the European Union (EU).

The first essay explores the dynamic relationship between credit supply and house prices at both the cross-country and country level by classifying the EU countries. To this end, vector autoregressive (VAR) model is applied. The findings of the study show that there is a dynamic causal relationship between house prices and credit; monetary policy may affect the size and direction of this relationship, but also, this relationship can be different at cross-country and country level even if they are subject to the same monetary policy. Thus, one suggestion is that besides monetary policy, other factors can affect the relationship between mortgage markets and house prices, such as the economic structure, type of housing finance systems and the institutional environment etc.

Considering the findings of the first essay, the second essay examines the institutional characteristics of the mortgage credit markets of the EU member countries. The findings of empirical analysis convey there are notable differences between the institutional characteristics of mortgage markets in North and South European countries as well as Central and East European countries and indicate that the institutional environment in the mortgage markets are heterogeneous in nature.

In the third essay, the relationship between house prices and current account imbalances is examined and the role of institutions in this relationship also is investigated. For this aim, simultaneous equations modelling is used. The findings of the empirical analysis demonstrate there is a strong positive relationship between house prices and current account imbalances; and credit channel contributes to strength this relationship and that institutional features can affect the relationship between house prices and current account balance and result in different outcome for different countries.

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LIST OF ABBREVATIONS

AREAER : Annual Report on Exchange Arrangements and Exchange Restrictions

ASEAN : Association of Southeast Asian Nations

BIS : Bank for International Settlements

CAB : Current Account Imbalances

CDO : Collateralized Debt Obligation

CFA : Confirmatory Factor Analysis

CMO : Collateralized Mortgage Obligation

DSGE : Dynamic stochastic general equilibrium model

EBA : European Banking Authority

EC : European Commission

ECB : European Central Bank

EFA : Explanatory Factor Analysis

EMF : European Mortgage Federation

EMU : Economic and Monetary Union (Eurozone)

EU : European Union

EUT : European Union Treaty

Euribor : Euro Interbank Offered Rate

Eurostat : Statistical Office of the European Union

FA : Factor Analysis

GIIPS : The group of the countries covers Greece, Ireland, Italy, Portugal and Spain

GIIS : The group of the countries covers Greece, Ireland, Italy and Spain

GDP : Gross Domestic Product

GMM : Generalized method of moments

ICA : Independent Component Analysis

IMF : The International Monetary Fund

IPD : Investment Property Databank

IS : The group of the countries covers Ireland and Spain

M3 : Broad Money Supply

NOEM : New Open Economy Macroeconomy

OECD : The Organisation for Economic Co-operation and Development

PCA : Principal Component Analysis

PPP : Purchasing power parity

PVAR : Panel vector autoregressive model

SEM : Simultaneous equations model

UK : The United Kingdom

US : The United States of America

VAR : Vector autoregressive model

VECEM : Vector Error Correction Model

WB : World Bank

2SLS : Two-stage least squares

3SLS : Three-stage least squares

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CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Housing, from both a social and an economic point of view, enjoys special significance compared to other types of real estate. This can be easily understood by looking at housing's share among total real estate market value: World Bank estimates reveal a global real estate market value of approximately $217 trillion, of which 75% is housing (Nanda, 2019).

In addition, housing is among the important sectors in many economies. Enjoying a dual role in the economy as both a consumer good and an investment good, it has a direct impact on other sectors of the economy because of its forward and backward links. House building makes up a significant percentage of construction industry activity and is one of the prominent sources of employment, particularly of unskilled labour. Most of housing construction inputs are also produced domestically. In European Union (EU) countries, for example, housing investment usually makes up about a fifth of gross domestic capital formation; and employment in the construction sector comprises between 5% and 10% of total employment (Eurostat).

From a social science perspective, we can observe a link between housing and individual status. Desire for social status is a well-documented phenomenon, and one's home is a visible indicator of relative wealth, which tends to serve as a proxy for status (Frank, 2013). Moreover, housing has a role to play in maintaining social order, being crucial to a sense of security as well as physical and mental health. The negative social consequences of inadequate housing, not least sanitation problems, are well understood. The unique characteristics of the housing sector, as outlined here, have led to this particular market seeing more government intervention than possibly any other, even in those economies regarded as the most liberal.

Almost invariably, a home is the most expensive asset owned by households and the highest share of household expenditure is related to the house itself: a ratio of 24.2% on average for EU households as of the end of 2017, which equates to 13.1% of the GDP of the EU (Eurostat). According to Baker (2016), 55% of US households spend more than half of their income on rent, mortgage loan repayments and utilities (as of 2016).

The significance of the housing market is what earns mortgage markets their exalted position in so many countries. Mortgage markets are those that fund individuals and agencies purchasing real estate and those to which securities are issued tied to mortgage loans or pools of mortgages and who then trade these securities (Ficek, Henderson and Johnson, 1994). The financial commitment that housing represents for most households, whether as a consumption good or an investment good, means most need to borrow from the financial sector. Thus, mortgage and housing markets are closely linked.

Mortgage debt makes up a large proportion of household debt, as well as national GDP and total credit. Mortgage debt comprises a massive 70% of total household debt in 120 countries, both developed and developing; and in only six of these countries is it lower than 40% (Cerutti 2017). It is also the biggest single item from the lenders' point of view, ranging from 60% to 85% among EU nations (EBA, 2017); and it accounts for almost half of EU GDP (EMF, 2017). As such, in all these countries, there is regular monitoring of housing and mortgage markets indicators in the interest of economic stability, and an accompanying diligence regarding macroeconomic indicators. This is indicative of the importance of the two markets.

Correspondingly, both markets have the potential to affect the whole financial sector. Over the last two decades, the importance of the relationship between the housing and mortgage markets has increased significantly, with the mortgage credit markets more intricately connected with other financial sector sub-markets (e.g. capital markets and insurance markets) on account of a diversification of the funding sources of mortgage credit, diversification of credit payment alternatives (e.g. interest-only loans, hybrid adjustable-rate mortgage [ARM] loans, etc.), increased securitization and structural finance backed mortgage credit (e.g. mortgage-backed securities, mortgage bonds, collateralized mortgage obligations [CMOs], collateralized debt obligations [CDOs], credit default swaps [CDSs]),[1] increasing degrees of financial liberalisation, increasing dependency of the domestic financial markets on international financial markets and economies, etc. The US subprime mortgage crisis is a conspicuous indicator of the importance of the relationship between the credit and housing markets.

All the above makes a compelling case for studying the relationship between the two markets. Not only is it a crucial factor in an economy's financial stability but it can easily become an international issue when one country's financial shock spreads elsewhere in today's globalised world, as evidenced by the most recent global crisis. As such, the relationship can be examined both at cross country and individual country level.

[1] More information for credit payment alternatives and securitization and structural finance, see. Fabozzi (2007) and Criado and Van Rixtel (2008).

However, literature review reveals most studies in this field to be at country level (e.g. Gerlach and Peng, 2005; Oikarinen, 2009; Bastion and Koch, 2015; Öhman and Yazdanfar, 2018); only three were found with a cross-country focus (Collyns and Senhadji, 2005; Goodhart and Hofmann 2008; Jordà, Schularick and Taylor, 2015). As such, we are yet to see a full examination of this interaction at a cross-country level. In addition, there are no studies focusing on the relationship between credit supply and house prices in the EU as a regional bloc; neither are there any studies focusing on this interaction across Eurozone and non-Eurozone countries, with their different monetary policies. Furthermore, the GIIPS countries (Greece, Italy, Ireland, Portugal and Spain), the sovereign debt crisis countries of the EU, have not been investigated as a group with respect to the interaction between credit and house prices although some of them were examined separately (e.g. Fitzpatrick and McQuinn, 2007; Gimeno and Martínez-Carrascal, 2010; Nobili and Zollino, 2017).

On the other hand, over the last two decades, the increasing strength of the relationship between credit and house prices has meant that the significance of developments in these markets has further increased at the macroeconomic scale because of the social and economic dimensions of the housing sector and the importance of housing finance within many countries' financial intermediation activities, particularly those countries with advanced financial markets, such as the Netherlands, the UK and the US.

Developments in the macroeconomy, such as changes in household income and unemployment levels and economic expectations (e.g. higher expectations of the returns from housing investment), also have an impact on these two markets, while developments in the credit markets and/or housing markets also affect the economy itself. Even if there is no change in credit markets (e.g. in interest rates or credit standards), a change in household income may have an impact on housing demand and hence credit demand. In addition, even if income levels do not change, an increase in monetary expansion in domestic financial markets can raise credit affordability and/or affect changes in credit terms (e.g. looser credit standards), and thus increase housing demand and stimulate investment in housing. But since housing supply cannot simultaneously meet the increased demand, an upward movement of house prices is the result. Higher house prices and hence increased housing value are reflected in the credit markets.

Increasing housing value positively impacts the wealth of the private sector (households and companies) leading them to increase consumption and decrease their savings. It also affects private-sector investment decisions. Since lenders see houses as a strong collateral, increasing housing value augments the private sector's borrowing capacity and hence their indebtedness. (e.g. Goodhart and Hofmann, 2008; Anundsen and Jansen, 2013). Thus, the final effects of such developments will be seen in the economy, such as an increase in housing-based investment, an increase in inflation, and an increase in the investment–saving deficit. To a large extent, the magnitude of these impacts will depend on the share of the mortgage markets in the financial sector and the strength of the link between the credit and housing markets.

In addition, developments in the triadic relationship (credit–housing–economy) may have very serious consequences not only for the financial sector but also for the whole economy, and may even trigger an economic crisis. Furthermore, the serious risks engendered by developments in the two markets have risen not only at a country but also at cross-country level in today's globalizing world with its attendant financial liberalisation. An example of this is the recent global financial crisis (i.e. the 2007-2008 global crisis): the first of the 21st century, as history has recorded it, accepted as having been the worst crisis since the 1929 Great Depression (Reinhart and Rogoff, 2008; Goodhart, 2008).

Financial liberalisation has increasingly integrated economies into international markets and increased mutual dependency between economies. Since the 1990s, financial liberalisation, which has begun to dominate in many countries, has strengthened the relationship between the credit and housing markets, especially in economies with advanced financial markets, and increased the impact of this relationship on the economy. Since the 1990s, increasing capital movements and rapidly globalizing capital have been highly influential factors, along with advanced technology and developments in the credit markets (e.g. an increase in capital-based funding rather than deposit accounting funding with regard to housing loans, increases in both asset securitization and structured finance transactions, and diversification of credit payment alternatives) (Ocampo and Stiglitz, 2008; Shambaugh, 2012).

In fact, in the pre-2008 period, developments in the credit markets, housing markets and the macroeconomy evinced a similar trend in many countries. Financial liberalisation has brought some advantages for the financial markets, such as reducing the cost of capital, raising credit availability for borrowers, mitigating information asymmetry, and decreasing adverse selection and moral hazard (Eichengreen, Gullapalli and Panizza, 2011; Chin and Ito, 2006, 2007; Broner and Ventura, 2010). Within this period, domestic financial institutions, which enjoyed increased access to international markets, could obtain resources easily and at a low cost. Hence, the volume of international capital movement reached $11.8 trillion in 2007 (IMF 2008; McKinsey Global Institute, 2013).These developments have resulted in monetary expansion, falling interest rates and increased credit supply in domestic financial markets. In fact, in the EU, the volume of outstanding mortgage credit in the pre-crisis period rose much more than the volume of the banks' assets: outstanding mortgage credit increased by 62.04% from 2001 to the end of

2007, reaching $7.94 trillion[2] (EMF, 2017), while bank assets increased by 39.9%, reaching $43.1 trillion in the same period (IMF, 2001, 2008).

Again, in the same period, asset prices, especially house prices, also rose considerably. From 2000 to 2007, many economies were experiencing a housing boom, with house prices rising 50% in real terms in the median advanced economy and by almost 30% in the median developing country (Igan and Loungani, 2012). Thus, the interaction between the two markets manifested, simultaneously in many countries, as the 'credit boom' and the 'house price boom.' (Kim and Renaud, 2009; Anundsen, et al., 2016; Armstrong and Davis, 2018; Justiniano, Primiceri and Tambalotti, 2019)

While such developments were observable in the housing and credit markets in the pre-crisis period, similar developments could be witnessed in the economy – one of the features of this period being an unprecedented increase in current account imbalances[3] For example, the current account balance to GDP ratio went up from 2% in 2000 to 6% in 2007 in the Netherlands, while Greece's ratio increased from -5.9% to -15.2% in the same years (Eurostat).

So credit boom and house price boom, along with current account imbalances, were to become the defining characteristics of the period leading up to both the global financial crisis and the EU's sovereign debt crisis.

In seeking confirmation of a link between house prices and current account imbalances, researchers have hypothesised a positive correlation between rising house prices and capital inflows, with either the latter driving the former, (e.g. Aizenman and Jinjarak, 2009; Tillmann, 2013) or else both being affected simultaneously by other factors (e.g. demand shock) (e.g. Laibson and Mollerstrom, 2010; Ferrero, 2015). It was generally found that foreign capital inflows were a big factor: capital from countries with a current account surplus flowed in to those with a deficit, decreasing interest rates in their domestic markets and causing credit terms to relax, and thereby driving house prices upwards. However, although the literature on this

[2] The EMF's figures are denominated in euro. With regards to comparability, they are converted from euro to US dollar by using the ECB's foreign exchange reference rates as of annual average. (https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/index.en.html (15.03.2019).

[3]Current account balance is the sum of net exports of goods and services, the receipt of payment wages and interest earned on assets abroad (net primary income), and current payments for development aid and to international organisations (net secondary income) (IMF, 2016).When the current account becomes unbalanced; in other words when there is a deficit or a surplus in the current balance, it is seen as an economic problem and it is called 'current account imbalance'.

relationship is vast, very few studies have examined the relationship by following financial liberalisation approach (e.g. only Favilukis at al., 2012).

Similar trends both before and after the global crisis can be observed in both credit markets and housing markets as well as in the wider economy. However, specificities are noticeable at a country level. For example, in the EU, there are differences in house price volatility from country to country: between 2000 and 2007 real house prices rose by 87% in Spain, 78% in the UK, 65% in Sweden, and 60% in Ireland, yet dropped by 14.1% in Germany and 8.32% in Portugal (OECD).The same can be seen in the credit markets: in real terms, the average growth rate of mortgage credit has varied year by year among the countries, for example, Greece (25%), Ireland (18%), Italy (13%), Portugal (8%) and Spain (16%) (EMF, 2017). Again, looking at the same period, annual growth in real gross fixed investment in housing exhibits differences among countries: the average annual growth of residential housing investment was 10.1% in Sweden, 7.4% in Greece and 1.4% in the UK (EMF, 2017). The mortgage loan to GDP ratio also varies by country: during 2000–2007, in Spain it increased from 29.9% to 61.3%, in Ireland from 31% to 74%, in the UK from 47% to 70.5% in Sweden from 42.2% to 77%, and in Greece from 8.2% to 30.5% (EMF, 2017).

The situation in the housing and mortgage markets is reflected in the macroeconomy, for example in current account imbalances, which vary from economy to economy: some countries have current account deficits, while others have a surplus. Germany had a current account deficit in 2000, but in 2007 joined the ranks of those countries with a high current account surplus: its current account balance to GDP ratio is currently 6.7%. Ireland went in the opposite direction, going from a current account surplus to a high current account deficit. The Netherlands' current account surplus increased threefold between 2000 and 2007, while Greece's deficit increased threefold with a high current account to GDP ratio, rising to 15.9% in 2007 (Eurostat). Other examples could be cited.

These trends have had a range of different effects. For example, changes in default and foreclosure rates for mortgage loans, comparing figures from 2008 with those from 2007, show a small increase in Austria (3.52%) and the Netherlands (8.28%) but a much higher increase in Spain (126.12%) and the UK (68.59%) (EC, 2011). This has spelled crisis for some, such as Spain and the UK. Also, some countries hit by crisis (e.g. the UK) were quicker to recover than others.

Such differentiation can be attributed in part to the institutional environment, such as access to credit information, the cost of financial services, transparency, contract enforcement, investor protection, the quality of regulation and effectiveness of government. According to North (1990, p.3), "Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction." There are different theoretical approaches that may be taken in examining institutionalism,[4] but they all share the premise that institutions exert an influence on the economy and the way resources are distributed (North, 1993, Rodrik, 2004; Acemoğlu, Johnson and Robinson, 2005). It is therefore important to identify and measure the institutional features of the economy, especially with regard to credit markets, because the credit channel plays a key role in transmitting developments in the housing market to the economy (e.g. Kashyap and Stein, 1997; Iacoviello and Minnetti, 2008; Taltavull de La Paz, 2014; Anundsen and Jansen, 2013).

The literature review reveals a great deal of material – both descriptive and empirical – on mortgage credit markets, in which the significance of institutional characteristics is acknowledged (e.g. Maclennan, Muellbauer and Stephens, 1998; Calza, Moncelli and Stracca, 2013; Martins, Martins and Stevenson, 2015). However, when it comes to studies measuring the institutional features of these markets, only three were found (i.e. Wyman, 2003; London Economics, 2005; IMF, 2008). And, in these, the mortgage markets were only briefly touched on. Furthermore, there is to date no study focused on benchmarking the institutional quality of mortgage credit markets. Neither are there any studies on the effects that institutional factors have on the relationship between house prices and current account imbalances.

This research therefore aims to examine the relationship between credit supply and house prices. It will also look at how these are associated with the macroeconomy, particularly current account balances, which represent the external dimension of the economy. In addition, it will measure the institutional features of mortgage credit markets and investigate the role of the institutional environment in the triadic (credit–housing–economy) relationship.

The three essays presented here employ a tripartite approach in addressing the research aim. They follow a quantitative methodological approach and focus on the regional economic bloc that is the EU[5] in the period between 1995-2017**.**

[4] 'Conflict institutionalism' focuses on understanding and solving conflicts among different parties (e.g. interest groups and the state; or real estate developers, landlords and local administrators). 'Behavioural institutionalism' assumes that institutions and cultural factors underlie the behaviour of the key agents in real estate markets, such as land developers, landlords and home buyers. According to 'structure-agency institutionalism', the institutions in the real estate markets comprise a more comprehensive set, such as social, economic and political institutions; this approach focuses on the relationships between the institutions.

[5] While the second essay's sample covers all the 28 EU countries, in the empirical analyses of the first and third essays the 14 countries are coveredbecause data availability has limited the number of the countries considered.

This chapter is structured as follows: Section 1.2 presents research hypotheses. Sections 1.3 includes research questions. Sections 1.4 and 1.5display research design and contribution of the thesis respectively. Section 1.6 covers outline of the research.

1.2. Research Hypotheses

As aforementioned, this research is based on three- essay approach, the main aim is to investigate the relationship between credit supply and house prices and the macroeconomy, particularly current account balances and to investigate the role of the institutional environment in this triadic (credit–housing–economy) relationship.

The first essay aims at examining the relationship between private credit supply and house prices in the EU. For this, the following three hypotheses are tested:

***H1*:** There is a dynamic relationship between credit supply and house prices.

***H2*:** Monetary policy makes a difference in this relationship.

***H3*:** This relationship looks different at a cross-country and an individual-country level, even when the countries involved have the same monetary policy.

The second essay's aim is to measure the institutional characteristics of the mortgage credit markets by testing the following a hypothesis measuring the institutional characteristics of the mortgage credit markets:

***H1*:** Institutional characteristics in the EU mortgage markets are heterogeneous.

The aim of the third essay is to explore the relationship between house prices and current account imbalances and the role of the institutions in this relationship. It does this by testing two hypotheses:

***H1*:** There is a relationship between house prices and current account imbalances through an increased monetary expansion caused by financial liberalisation.

***H2*:** Institutions influence the relationship between house prices and current account dynamics by affecting the extent to which monetary expansion influences domestic credit markets

1.3. Research Questions

In the research examining the triadic (credit–housing–economy) relationship and investigating the role of the institutional environment in this relationship, the following research questions are addressed:

1. What is the relationship between credit supply and house prices?

- In what ways are credit supply and house prices linked at a cross-country level?
- Does being subject to a common monetary policy make any difference to the relationship between credit supply and house prices with regard to their size and direction?
- Does being a member of the Eurozone make a difference to the relationship between credit and house prices?
- Is this relationship different between countries when they are subject to the same monetary policy?

2. What are the institutional features of mortgage markets?

- Are institutional features determinants of the heterogeneous nature of EU mortgage markets?
- Is there a relationship between institutional quality and the development of mortgage credit markets?

3. What is the relationship between house prices and macroeconomy and institutions?

- Is there the relationship between house price movements and current account imbalances?
- Do the institutions play a role in this relationship?

1.4. Research design

To achieve the aim of the research based on three essays addresses questions 1, 2 and 3, respectively by using the three methods: vector autoregressive model, simultaneous equations model and factor analysis.

Essay 1: Private Credit and House Prices from a European Perspective

The first essay explores the dynamic relationship between private credit supply and house prices in the EU. Three hypotheses are tested by employing two methods: 1) vector autoregressive modelling (VAR) with panel and country-level data; and 2) simultaneous equations modelling (SEM model). The second method is used to check for robustness.

In this essay, by using the tools of the VAR approach, the relationship is first analysed for the whole sample. Second, the relationship is tested by grouping the countries according to the monetary policy (Eurozone and non-Eurozone countries). The third analysis is of the countries, which have experienced sovereign debt crisis; whether these crisis countries were simultaneously facing a credit boom and house price boom; and whether the main reason for the crisis is a house price boom–bust cycle. Finally, this relationship is estimated for each country within the sovereign debt crisis countries.

At the end of the empirical analysis, we can look for differences 1) between Eurozone and non-Eurozone, 2) among the sub-groups of the Eurozone, and 3) among individual countries within the Eurozone, with regard to the size and direction of the relationship between credit supply and house prices.

Essay 2: Measuring the Institutional Features of European Mortgage Credit Markets

Bearing in mind the limited amount of literature in this field, the objectives of the second essay are therefore as follows: to measure the institutional features of EU mortgage markets and to create an institutional quality benchmark for these markets. In pursuing this aim, a composite index method will be employed by using factor analysis.

In the first stage, an overall index, referred to as the Institutional Index, is constructed using factor analysis. In the second stage, the sub-indices are developed using the same method. These indices reveal the institutional quality of the credit markets with respect to the different dimensions of the institutional environment. The last stage examines whether these indices depict reality. To achieve this, first the robustness of the Institutional Index is checked using a different technique (scoring technique). Second, the relationship between institutional quality and the development of financial intermediation in the mortgage markets is tested using all the indices. For this, linear regression model (the ordinary least squares-OLS*)* is applied. Third, this relationship is exhibited using a graphical method.

Essay 3: House Price and Current Account Imbalances: Credit Channel and Institutions

The final essay examines the relationship between house prices and current account imbalances and the role of the institutions in this relationship.

For this, a simultaneous equations model and the three-stage least squares (3SLS) technique is employed. In testing these hypotheses, the empirical analysis comprises two stages. In the first, the relationship between house prices and current account imbalances is investigated by examining both a range of periods and the level of current account imbalances. In this stage, firstly, the model is estimated by considering the three periods: an overall period (1995–2016), a pre-crisis period (2000–2007) and a post-crisis period (2008–2016). Secondly, by grouping the sample countries according to their current account balance to GDP ratio, the model is re-estimated. In organising this grouping, the risk threshold of –4% for economic stability, as acknowledged by the European Commission (EC), is taken into account with regard to current account balance to GDP ratio. Countries are divided into two groups accordingly: those with current accounts imbalances over –4% and those equal to or below –4%.

In the second stage, the role of institutions in the relationship between house prices and current account imbalances is explored. This stage also comprises two steps. The first is to include the institutional characteristics of mortgage markets in the simultaneous equations model by grouping EU countries. The grouping is based on the position of each country in the Institutional Index, which was produced in the second essay of this research. The countries fall into two categories, depending on whether they have high or weak institutional quality. The simultaneous equations model is then tested. The second step is to introduce into the model the governance features of each country (e.g. regulation quality and government effectiveness). This should allow us to gauge the effect of institutions on the relationship between house prices and current account imbalances.

1.5. Contribution

This study makes some contributions to better understand the relationship between credit and housing markets as well as the macro economy; it also serves as a resource for policy makers to reduce and remove a probability of risks that may create for financial system and thus the economy, at the EU. Its main contribution is to examine the triadic (credit-housing-economy) relationship by including the role of institutions in this relationship. One contribution is to examine the relationship of credit supply with house prices at both cross country and country level in the EU alone in the different perspectives (e.g. monetary policy, house price boom and credit boom) and to reveal whether there is differentation between the sub-groups of the EU, as well as individual countries. Another is to create a benchmark for the EU mortgage markets relating to the quality of institutional environment of these markets. Finally, the role played by house prices in current account imbalances is explored by following the financial liberalisation approach and revealed the role of the institutional environment in the relationship between house prices and current account imbalances.

1.6. Outline of the study

Following this introduction, the second chapter provides a review of the relevant literature on the relationship between credit supply and house prices, and how this is associated with the macroeconomy and institutions, current account balances in particular. In this chapter, which helps to frame the overall approach of three empirical essays, there will be analysis and discussion of developments within the EU.

The third chapter presents the first essay titled ‘Private Credit and House Prices from a European Perspective’. The fourth chapter is the second essay, ‘Measuring the Institutional Features of European Mortgage Markets’, proposing a benchmark for the institutional quality of mortgage credit markets. The fifth chapter is the final essay of the thesis titled ‘House Prices and Current Account Imbalances: Credit Channel and Institutions’. Finally, this thesis closes with a discussion of the results of the empirical studies, their contribution as well as their limitations, and suggestions for further research.

CHAPTER TWO
LİTERATURE REVİEW

2.1. Introduction

The main purpose of this thesis is an empirical examination of the relationships between credit supply, house prices and the macroeconomy looking at the countries of the EU. In examining this triadic relationship, three-essay approach is followed, with the literature review being subdivided into three parts. The first essay (Chapter 3) and the third (Chapter 5) need the model specification to test their research hypotheses, and this is presented as a new subsection.

2.2. Private Credit and House Prices

In the first essay, the relationship between credit supply and house prices is investigated at cross-country and country-specific levels by considering different sub-samples within the EU, where have an implementation of two different monetary policies. Thus, the literature review of the first essay covers the existing literature on two topics: (1) the relationship between credit supply and house prices; and (2) EU monetary policy.

2.2.1. The Relationship between Credit Supply and House Prices

Existing literature shows that a large number of studies have examined the relationship between credit and house prices.[6] While most of these studies are at individual country level (e.g. Oikarinen, 2009; Öhman and Yazdanfar, 2018), few are at a cross-country level (Collyns and Sendhadji, 2005; Goodhart and Hofmann, 2008; Jordà, Schularick and Taylor, 2015).

Hofmann (2004) examined the factors determining the capacity of the banking sector to lend to the non-finance private sector in the long term taking into account 16 industrialised countries. He claims that credit demand cannot be explained by standard factors (e.g. economic activity and interest rate) in the long term. He concludes that house prices are an important determinant in credit movements; that they significantly affect bank lending; that innovations have a significant impact on both house prices and bank lending; and that house prices are an important determinant in lending to the private sector in the long term due to the widespread use of

[6] Some studies focus on the interaction between commercial real estate prices and bank lending (e.g.Davis and Zhu, 2004; Vogiazus and Alexiou, 2017), but these can be ignored here as the focal point of this study is the relationship between bank lending and residential house prices.

housing as collateral. Moreover, Hofmann's (2004) findings demonstrate a one-way relationship between house prices and bank lending and show that the effect of house prices on credit is much stronger than the effect of credit on prices.

Collins and Senhadji (2005) investigate the relationship between bank lending and commercial and residential real estate prices as well as other asset prices and whether these factors were significant in the Asian financial crisis of 1997. Their sample covers 10 ASEAN (Association of Southeast Asian Nations) countries and employs two techniques: OLS (ordinary least squares) regression for cross-country analysis and VAR (vector autoregressive) model for country-level analysis. They reached similar results to those of Hofmann (2004), their analysis differs from his and includes cross-country and country level analyses. The regression analysis results for four East Asian countries shows that property prices are strongly procyclical: bank lending has affected significantly real estate prices, the response of real estate prices was stronger before the 1997–98 Asian crisis, and the response of real estate prices to credit was asymmetric. The VAR model estimations for eight South-East Asian countries support the theory and show that there is a two-way relationship between real estate prices and bank lending. This interaction is stronger in the bank lending to real estate prices direction. In addition, they found that, in these countries, bank lending contributed to both asset and real estate price increases. The relationship between bank lending and real estate prices was stronger than the relationship between bank lending and other asset prices during the pre-crisis period.

Gerlach and Peng (2005) explored whether there was causality between house prices and bank lending in Hong Kong. They concluded that changes in house prices directly (e.g. leading to the appreciation of banks' real estate portfolios) or indirectly (e.g. influencing the size of non-performing loans) have an impact on banks' financial positions and consequently their lending capacity. They also point out that, in Hong Kong, the main reason for excessive growth in bank lending is the house price boom. Their results are similar to those of Hofmann (2004), demonstrating a one-way relationship in Hong Kong between house prices and bank lending over the long term and the direction of this relationship is from house prices to bank lending.

A number of studies have examined the relationship between house prices and bank lending in China (e.g. Liang and Cao, 2007; Che, Bin and Wang, 2011; and Qi and Zheng, 2014). Qi and Zheng (2014), who looked at housing loans from 28 commercial banks in China, show that this relationship is bidirectional and positive in the long run while Liang and Cao (2007) and Che, Bin and Wang (2011) conclude that the relationship between housing loans and house prices is unidirectional. Liang and Cao (2007) indicate that the direction of the relationship is from loans to house prices, while Che, Bin and Wang (2011) find the opposite (i.e. the direction is from house price to loans). In addition, Liang and Cao (2007), using a different model (i.e. autoregressive distributed lag [ARDL]) to previous studies, argue that in China it is unlikely that the interest rate tool will be enough to control house price fluctuations.

Considering the example of Ireland, Fitzpatrick and McQuinn, (2007) modelled the determinants of house prices and residential mortgage credits. In both short- and long-term analyses, they examined newly opened housing loans and, in contrast to previous studies, they used numerous estimation techniques.[7] Their analysis produced similar results to those of Collyns and Senhadji (2005) and indicate a mutual relationship between house prices and housing loans in the long run. They point out that, in the short term, credit growth had a significant positive impact on house price increases in Ireland, but house prices did not have a similar effect on credit growth.

Greiber and Setzer (2007) examined the relationship between monetary developments and housing markets using a vector error correction model (VECEM). Their model, which was tested on the US and the Eurozone, covers the residential property price index, economic activity (GDP) and interest rates in real terms, similarly to previous studies. Moving on from Hofmann (2004), they added further macroeconomic variables (inflation and broad money) to the standard credit model of economic activity and short-term interest rates. The results of their empirical analysis are in line with those of earlier studies, i.e. loose monetary conditions and house prices are related phenomena. In both the Eurozone and the US, there is also a significant two-way relationship between monetary variables and house prices. Another finding is that monetary policy affects developments in housing markets not just through interest rates but also through liquidity of money.

In contrast to most previous studies, Goodhart and Hofmann (2008)'s analysis, like that of Collyns and Senhadji (2005), is at a cross-country level. It examines a group of 17 industrialised countries with a model specification similar to that of Hofmann (2004) and Greiber and Setzer (2007). They also added further macroeconomic variables (inflation and money supply) to the standard credit model. They sought to determine which monetary variable (credit size or money supply) was more relevant in the interaction between house prices and bank lending and investigated the effects of fluctuations in both house prices and monetary variables on total production and inflation. They sought to determine which monetary variables (credit size or money supply) were more relevant in the interaction between house prices and bank lending and investigated the effects of fluctuations in both house prices and monetary variables on total

[7] For example, dynamic ordinary least squares (DOLS), fully modified OLS (FM-OLS) and static OLS (SOLS).

production and inflation. Their findings show a multifaceted relationship between house prices, monetary variables and the macroeconomy; they show that the relationship between house prices and credit, as well as money supply, is strong and bidirectional and this relationship is further strengthened, particularly after financial liberalisation; and that all shocks to house prices, credit and money supply have a significant impact on economic activity and inflation. Their suggestion is that monetary policy can be used to mitigate asset price boom cycles and the probability of financial instability in the long term.

Following the approach of Hofmann (2004), Gerlach and Peng (2005), Oikarinen (2009) ve Gimeno and Martinez-Carrascal (2010) have used the same technique (VECEM) to examine the relationship between credit and house prices for Finland and Spain respectively. Unlike Hofmann (2004), both used long-term interest rates and housing loans in their model rather than short-term interest rates and total private credit. Oikarinen (2009), who also examined the relationship between stock prices and credit, along with the role of financial liberalisation, reached similar conclusions to those of Collyns and Senhadji (2005). His findings show: (a) no correlation between stock prices and household borrowing in Finland; (b) an impact of mortgage credit supply not only on price movements but also to a considerable and positive degree on consumer credit; (c) since the beginning of financial liberalisation, a two-way and significant relationship between house prices and credit stock; and (d) this relationship towards house prices from bank lending is stronger over the long term. It is also seen that this relationship increased significantly after the beginning of financial deregulation at the end of the 1980s. These results concur with those of Wolswijik (2006), who found that financial deregulation plays an important role in mortgage debt growth in some EU countries. The findings of Gimeno and Martinez-Carrascal (2010) differ from those of Oikarinen (2009), but are similar to those of Gerlach and Peng (2005). They found a one-way relationship between house prices and bank lending in Spain and the direction of the relationship is from house prices to loan. However, their findings in relation to the short term differ from those of Gerlach and Peng (2005), who found a two-way relationship between these two variables.

Brissimis and Vlassopoulos (2009) investigated the relationship between house prices and bank lending in Greece over both the short and long term, considering the mortgage and housing markets. Like Oikarinen (2009), they focused on housing loans, in contrast to Hofmann (2004) and Gerlach and Peng (2005). Their findings show a one-way relationship between credit and house prices in the long term, but a two-way relationship in the short term. They found that the direction of the relationship is from house prices to credit.

Using the VAR method, Park, Bahng and Wang (2010) deduced a causal relationship between access to bank lending and house prices for five sub-markets in and outside Seoul in South Korea. They looked at a sub-market that had experienced a rapid increase in house prices (the hottest market) in Seoul and four ‘cold’ sub-markets outside Seoul. Their findings indicate that the short-term impact of bank lending on house prices is clear to see, and that it is stronger in the hottest markets, and that tight credit conditions in 2005 affected bank lending in cold markets but not the overheated ones. However, the evidence is mixed with regard to the direction of relationship between bank lending and house prices.

In examining this relationship for Norway, Anundsen and Jansen (2013), unlike most of the previous studies, included household expectations in their model and undertook a system-based cointegration analysis. They examined the relationship over both the short and long term using a structural vector error correction model (SVAR), and found a two-way relationship between credit expansion and house prices in the long run; they found that the expectations of households have a significant impact on this relationship; that the effect of interest rates on house prices is an indirect one via credit aggregates; and that, when the supply side of the housing market is added to the model, this interaction weakens. They also point to the presence of a credit–house price spiral in Norway.

The findings of Addae-Dapaah and Anh (2014), who analysed the relationship between housing loans and house prices in Singapore in the short and long run, showed that there is a significant and two-way relationship between both variables in the long term but no significant relationship in the short term. In addition, the direction of this relationship is obscure. This study also points out that household borrowing in Singapore provides important information about housing demand and house prices. They suggest that it is not possible to control house price increases in a short time-frame as a means of housing credit targeting.

In contrast to previous studies, Ibrahim and Law (2014) examined the long-term interaction between house prices and bank loans on both macro and micro levels from both aggregated and disaggregated perspectives. For this, they looked at the aggregate house price index and house price sub-indices. Like Goodhart and Hofmann (2008), they examined the interaction between macroeconomic variables (real output and interest rates) and house prices as well as bank loans. From an aggregated perspective, their results show a causal relationship between both house prices and bank loans with real output and interest rates in the long run; they found a strong interaction between house prices and bank loans; and the direction of interaction is from housing loans to bank loans. They suggest that changes in house prices as well as in credits might have substantial impacts on real GDP in the short term.

Basten and Koch (2015) investigated whether house prices have a causal effect on both mortgage demand and supply at canton level in Switzerland. They used instrumental variable methodology to determine the direction of this relationship, with immigration included in their model as an instrumental variable. Their analysis at canton level covering Geneva and Zurich shows a strong mutual relationship between mortgage loans and real estate boom–bust cycles; it shows a (stronger) positive reverse causality from mortgage loans to house prices; and higher house prices means increasing mortgage demand.

Jordà, Schularick and Taylor (2015) investigate the relationship of house price boom-bust cycles with the monetary indicators (credit and interest rates) in the 14 advanced economies. They also discuss the developments in mortgage lending, house prices and homeownership. In contrast to previous studies, In contrast to previous studies, they utilized the Instrumental Variable Local Projection Method and examined this relationship over a 140 year period (i.e.1870 to 2012) Their findings show that house price and mortgage booms are predictors of future economic crises, especially since the Second World War; the sensitivity of house prices and mortgage lending to changes in the monetary conditions has increased significantly Their main findings show that house price and mortgage booms have been predictive of crises in the future, especially since the Second World Wae and the sensitivity of house prices and mortgage lending to changes in the monetary conditions has increased significantly. At the end of their analysis, they suggested that central banks cannot successfully work towards achieving a stable macroeconomic environment without paying keen attention to developments in mortgage markets.

Taltavull de La Paz and White (2012) explored the interaction between the housing market and financial sector as well as the macroeconomy. They applied the VECEM methodology while evaluating the impact of liquidity on the housing market. In contrast to previous studies, they compared Spain with the UK in relation to the effects of house prices and their model included housing stock and liquidity variables by incorporating both money supply (M3) and mortgage loan as an exogenous variable. In addition, like Basten and Koch (2015) they added a migration variable to their model. Their findings show that in both countries, the long term relationship between housing and financial markets and the macroeconomy, but with some differences. For example, when liquidity shocks occur, the effects of both income, and mortgage loan as well as of money supply on house prices is stronger in the UK than Spain. This case exists in respect to the effects of migration on house prices. On the other hand, there is a difference between Spain and the UK relating to the effects of inflation and interest rates on house prices. In the case of presence of liquidity shocks, interest rates and inflation have a negative and strong effect in Spain, not in the UK.

For four developed countries (the Netherlands, Norway, Sweden and the US), Punzi (2016) examined whether there is a simultaneous movement between three variables (i.e. asset prices, bank lending and economic activity) during the period 1896–2014. The results indicate that the relationships among this trio of variables, as well as between house prices and credit, has strengthened to a much greater degree since World War II, as well as showing increases following the 1928 Great Depression and the 2007–2008 global financial crisis. In addition, Punzi concludes that monetary shocks are more important in explaining these co-movements and that inflation shocks also have an important role to play in the relationship between house prices and credit in Scandinavian countries.

Nobli and Zolina (2017) examined the multidimensional interaction between house prices and private credit, looking at lending to households and construction firms in Italy. They diverge from previous studies in considering both housing and construction loans and using different methods (i.e. a simultaneous equations model with a three-stage least squared technique).In addition, their model include a large number of control variables that affect both housing supply and demand as well as both mortgage loan supply and demand. Their findings show that in Italy, house prices are affected more by disposable income and demographic factors and that bank lending conditions (especially mortgage lending) have a significant impact on house prices through its impact on housing demand.

The novelty of Öhman and Yazdanfar's (2018) study is that it considers prices of two types of housing (apartments and villas) separately and adds inflation to the standard credit model. They go on to explore the interaction between house prices and both inflation and mortgage interest rates. Their results confirm previous studies and indicate that there is an interaction between bank lending and house prices over the long term in Sweden. Their results are similar to those of Fitzpatrick and McQuinn (2007) and Okikarinen (2009) and show this interaction to be bidirectional in Sweden. These findings also support the existence of the financial accelerator mechanism. However, the relationship between house prices and interest rates, as well as inflation, is a mixed picture. The relationship between apartment prices and both interest rates and inflation is a two-way, while the relationship between villa prices and the same two variables is one-way and the direction is from villa prices to bank loan.

Some studies have focused on the role of monetary policy in the relationship between credit and house prices (e.g. Calza, Moncelli and Stracca, 2013; Igan et al., 2011; Zhu, Betzinger and

Sebastian (2017). Calza, Moncelli and Stracca (2013) explored the relationship between the structure of the housing finance system and the monetary transmission mechanism and the effects of monetary policy shocks on house prices as well as on investments. Their work is based on a cross-country analysis. In this study, in which they use a VAR model, countries are grouped according to interest structures (e.g. fixed or variable rate contracts). Their findings show that: the structure of the mortgage finance system significantly affects the monetary policy's transmission mechanism; the size of this effect varies from country to country; monetary policy in the more advanced and flexible mortgage markets has a strong impact on house prices and investments; the effect of the monetary transmission mechanism on consumption is stronger only in countries in which mortgage equity release is widespread and mortgage loans are offered with more variable interest rates. In addition, the flexibility of the mortgage markets (e.g. loan-to-value [LTV] ratio or mortgage debt to GDP ratio) is not relevant in those cases where consumption has different responses to monetary policy.

Zhu, Betzinger and Sebastian (2017) examined how house price stability might be influenced by the structure of the mortgage market and by monetary policy. They considered 11 Eurozone countries and concluded that in those with more regulated markets monetary policy has no significant impact on non-fundamental house prices; and the less liberal housing markets react less to changes in interest rates. Like previous studies, their findings show that the LTV ratio is an important determinant for the housing markets. They suggest that the LTV ratio may be used as a macro-prudential policy tool; and that policy-makers should observe the LTV ratios and tax policy, and limit mortgage equity withdrawals, in order to mitigate the negative impacts of monetary policy on housing markets.

In general, one common feature of previous studies is that most of them are based on country-level analyses, even when the study considers multiple countries (e.g. Hofmann, 2003, 2004). A second feature in common is that they follow a VAR approach except for a few studies.[8] A third is that they use the standard credit model, adding a house price variable. However, the monetary variables (e.g. bank lending and interest rates) in the various models differ: for example, some include credits to the private sector as a credit variable (e.g. Hofmann, 2004; Stephanyan and Guo, 2011); some consider both total credits and housing credits (e.g. Gerlach and Peng, 2005); some include just housing loans (e.g. Oikarinen, 2009; Brissimis and

[8] For example, Nobli and Zolina (2017) used a simultaneous equations model. Liang and Cao (2007) and Qi and Zheng (2014) used autoregressive distributed lag (ARDL) and a simultaneous equations model (2SLS) respectively, while Fitzpatrick and McQuin (2007) employed many techniques, such as dynamic ordinary least squares (DOLS), fully modified OLS (FM-OLS) and static OLS (SOLS). Anundsen and Janse (2013) used a structural vector error correction model (SVAR).

Vlassopoluos, 2009); and some have both construction loans and housing loans (e.g. Nobli and Zolina, 2017). Some studies use the funding cost of financial institutions (i.e. the short-term interest rate) to conform to the standard model (e.g. Hofmann, 2004), while others include only long-term interest rates (e.g. Gimeno and Martinez-Carrascal, 2010), and some include both in their analysis (e.g. Nobli and Zolina, 2017); elsewhere variable mortgage interest rates are used (e.g. Brissimis and Vlassopoulos, 2009). Some studies have added macroeconomic indicators (e.g. inflation, employment, population) to the standard model (e.g. Liang and Cao, 2007; Goodhart, and Hofmann, 2008; Nobli and Zolina, 2017; Öhman and Yazdanfar, 2018)

Previous studies show that, even where a similar model specification is used, the relationship between credit and house prices differs from country to country over both the short and long term. Some studies support the theory that there is a bidirectional relationship between credit and house prices (e.g. Fitzpatrick and McQuinn, 2007, Oikarinen, 2009; Qi and Yang, 2009; Addae-Dapaah and Anh, 2014; Öhman and Yazdanfar, 2018), whereas some have concluded that there is a one-way relationship (e.g. Gerlach and Peng, 2005; Gimeno and Martinez-Carrascal, 2010). Again, in some cases, the long-term relationship is stronger from house prices to loans (e.g. Hofmann, 2004; Brissimis and Vlassopoluos, 2009; Che, Bin and Wang, 2011), whereas in others this relationship seems to be of an opposite nature (e.g. Liang and Cao, 2007; Gimeno and Martinez-Carrascal, 2010), or else it is not clear in which direction the effect is stronger (e.g. Addae-Dapaah and Anh, 2014). Some studies have concluded that there is a two-way relationship in the short term (e.g. Garlach and Peng, 2005), while others have found a one-wayrelationship (e.g. Fitzpatrick and McQuinn, 2007) or no such relationship in the short term (e.g. Addae-Dapaah and Anh, 2014).

In conclusion, the existing empirical literature offers a vast amount on the relationship between credit and house prices at a country level, but little at a cross-country level; of the latter we found only three (Collyns and Senhadji, 2005; Goodhart and Hofmann, 2008; Jordà, Schularick and Taylor, 2015). As such, the cross-country examination of this relationship undertaken here can make a contribution to the literature. In addition, based on the literature review, although some of the cross-country studies may include some European countries, there is no study that is EU-specific. And so this EU-specific examination of the relationship may also contribute to the literature. Moreover, the EU is a regional economic bloc with two distinct monetary policies, i.e. a common policy and national monetary policies (non-Eurozone), thus separating member countries into two groups: the countries being subject to common monetary policy (Eurozone countries) and countries implementing their national monetary policies (non-Eurozone countries). Yet there is no study examining the effect of monetary policy on the relationship in question which distinguishes between Eurozone and non-Eurozone countries.

Therefore, a contribution to the literature can also be made by investigating the relationship between credit and house prices at both EU level and Eurozone/non-Eurozone level and making comparisons with respect to the effect of the monetary policy on this relationship.

2.2.2 The European Union versus Eurozone

One of the objectives of this study is to see whether monetary policy causes a change in the interaction between credit and house prices in the economy. To that end, the EU member countries considered in this study are divided into two groups: Eurozone and non-Eurozone. Despite belonging to the same regional bloc (i.e. the EU), non-Eurozone countries are able to regulate their own monetary policies, whereas Eurozone countries are subject to the common monetary policy. Among the current examples in the world of economic integration, the EU (formerly known as the European Economic Community [EEC]), established in 1957, is at the most advanced stage of integration. The Eurozone, created in this regional bloc on 1 January 1999, is the economic and monetary union of the EU, also known as 'the Eurozone'. (For more information, see Baldwin and Wyplosz, 2009; El-Agraa, 2011.)

In the current EU-28, member states need to meet certain criteria to join the Eurozone. These criteria are divided into three groups: legal and economic convergence and other criteria. The legislative convergence aims to provide the compatibility between the national legislation of each Member State with a derogation, including the statutes of its national central bank. It is expected that the national legislation of the member country be in compliance with Articles number 130 and 131 of the Treaty on the Functioning of the European Union (TFEU) and the Protocol on the European System of Central Banks (ESCB) and European Central Bank (ECB).

There are four economic convergence criteria: price stability, interest rate, exchange rate, and government's fiscal position (TFEU, Article 140). The last criterion relates to the government's budget and debt situation and has the aim of ensuring fiscal discipline; the aim of the other three criteria is to ensure the monetary discipline of the Eurozone.[9] Economic indicators also have a bearing on economic integration but fall outside the convergence criteria. These include, for example, the level of integration of product and financial markets, developments in the balance of payments, developments in labour unit costs and other price statistics, and these are considered within the scope of 'other' criteria.

[9] In calculating the price stability and the interest criteria, the unweighted arithmetic average of the three member states with the lowest inflation rate (HICP) and the lowest long-term interest rates are taken into account. The upper limit of the price stability criterion is the average of the three countries with the lowest inflation rate plus 1.5 percentage points, while the upper limit of the interest rates is the limit, and the lowest long-term interest rate should be 2% more than the average of the three countries with the lowest long-term interest rates plus 2 percentage points. Unlike these two criteria, the upper limit of the government fiscal position is determined by the Treaty. Member states' budget deficits should not exceed 3% of the GDP of the country (budget criterion), and public debt should not exceed 60% of the GDP of the country (debt criterion). A member state's fulfilment of the exchange rate criterion requires that the national currency of that member state has not been devalued in the last two years and the fluctuation margin of the national currency remains within the range ± 15%. See EC (2016).

These criteria are intended to increase economic convergence among EU economies and promote the sustainability of macroeconomic stability in the Eurozone. On its establishment in 1999 the Eurozone was a collaboration of 11 EU countries; today it comprises 19 states.[10]

The main characteristics of the Eurozone are the existence of a single monetary authority (i.e. the use of a single currency in the region) and the implementation of a single monetary policy as well as a single exchange rate policy. For Eurozone countries, the only monetary authority is the European Central Bank (ECB). The primary objective of the ECB, which operates entirely independently, is to ensure and maintain price stability in the Eurozone; its secondary objective is to implement monetary policy in line with the objectives of the European Union Treaty (e.g. full employment, economic and social progress, etc.). The countries in the zone must relinquish their national currency and use the common currency (i.e. the euro). Monetary and exchange rate policies are common policies and the sole responsibility for them lies with the ECB. The exchange rate policy is based on an adjustable fixed exchange rate system. (See. Chang, 2009; ECB 2011).

Consequently, in the EU, there are two group countries according to monetary policy: the Eurozone countries, that have a common monetary policy determined by the ECB and outside of the Eurozone (i.e. non-Eurozone) countries, that determine own monetary policy.

[10] The Eurozone countries consist of Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain.

2.3. Measuring the Institutional Features of European Mortgage Markets

The results of the empirical analysis in the first essay showed that the size of the relationship between credit supply and house prices, as well as the existence of causality and its direction, changes from one county to another, even if they have the same monetary policy. One suggestion following the empirical analysis was that other factors might play a role in this differentiation between countries, such as institutional environment, type of housing finance system, or economic structure. Building from this proposition, the aim of the second essay is to measure the institutional features of the mortgage credit markets and to create a benchmark for these markets. Therefore, the second essay links to the extant literature in four ways: in the first instance, the essay relates to the literature on institutions at a conceptual level; secondly and thirdly, it connects with the literature on determining the institutional features of the mortgage credit markets and on measuring these features. Finally, since the composite index method has been selected as a means of creating a benchmark for the institutional features of the mortgage markets, the essay also is also concerned with composite index methods. Thus, in this section, the literature related to the second essay is reported under three separate headings.

2.3.1. Institutions at a Conceptual Level

In the social sciences (e.g. economy, sociology, politics), the term ‘institution’ has been used extensively for a long time. In the literature, it can be seen that, in addition to geographic and other factors, institutions shape the decisions of the economic actors in an economy and influence the allocation of resources (e.g. North, 1990; Williamson, 2000). It is a generally accepted fact that institutions play an important part in economic development, and that institutional features are the primary factors accounting for development differences among countries (e.g. Rodrik, 2004; Acemoğlu, Johnson and Robinson, 2005).

However, there is no single definition of ‘institution’ in the literature. For example, Nabli and Nugent (1989, p.1335) offer two definitions, in both a narrow and a broad sense. According to their narrow definition, institutions are ‘…a set of rules to facilitate co-ordination via allowing the expectations to form’; whereas the broad definition states that they are ‘…the persistent group of the norms of behaviour which serve collectively valued purposes’. North (1990, p.3) states ‘…the institutions are rules, enforcement characteristics of rules, and the norms of behaviour that structure repeated human interaction…’ According to the definition of Hodgson (1998, p.179), ‘…institutions are durable systems of established and embedded social rules and conventions that structure social interactions…’

Subsequently, Hodgson (2006, pp. 17-18) added more detail to his earlier definition, proposing six defining features:

- Social structures include all sets of social relations, including the episodic and those without rules, as well as social institutions.
- Institutions are systems of established and embedded social rules that structure social interactions.
- Rules in this context are understood as socially transmitted and customary normative injunctions or immanently normative dispositions that in circumstances *X* do *Y*.
- Conventions are particular instances of institutional rules.
- Organizations are special institutions that involve (a) criteria to establish their boundaries and to distinguish their members from non-members, (b) principles of sovereignty concerning who is in charge, and (c) chains of command delineating responsibilities within the organization.
- Habituationis the psychological mechanism by which individuals acquire dispositions to engage in previously adopted or acquired (rule-like) behaviour.

The generally accepted definition is that institutions embody the norms, regulations and laws that establish the rules of the game. In other words, institutions condition the behaviour of individuals and groups and modify it; thus their behaviour can be more predictable. Institutions accomplish this both through official rules (laws and contracts) and the social norms and traditions that change and develop over time. If we consider economic institutions in a narrow sense, they perform three functions: the establishment and the protection of property rights, facilitating transactions, and allowing economic cooperation and organisation (Wiggins and Davis, 2006).

In fact, the economic analysis of institutions (i.e. institutional economics) has a long history. Initially, in such economic analyses, assumptions around a neoclassical approach were the generally accepted norm. One such assumption is that institutions are functioning properly and can be taken as a constant. That is, the neoclassical approach sees the rules, social norms and preferences as constant. Only after the long domination of this approach in the social sciences did a new approach begin to have an influence: institutional theory, which suggests that the quality of institutions causes big differences between economies, has enjoyed growing acceptance in the social sciences since the mid-1980s (Eggertsson, 1999; Gibb, 2015).

Institutional economics considers the economy as an institutionalised process. In the literature, institutional economics is separated into two phases from an economic point of view: ‘old’ and ‘new’ institutional economics (Gibb, 2015). Hamilton, Commons, Mitchell and Veblen are the primary representatives of old institutional economics, which claims that economics is an entirely institutionalised process and covers a much larger area than the market. This approach has established a relationship between the fundamental views of both evolutionary economics and behavioural economics. Old institutional economics concerns itself with how markets reflect the institutional structure of society and how they have contributed to making this institutional structure functional. The focal point of the old institutional approach is habits, inertia and routine behaviours (Eggertsson, 1999). However, the influence of this approach diminished after the 1930s.

It is widely accepted that new institutional economics, which is regarded as a separate discipline, starts with Coase (1960), who asserts the importance of property rights in the development of subcontracts and ties the transaction costs generated by market mechanisms to property rights. Coase has drawn attention to how transaction costs arising in the market tend towards zero. Subsequently, North (1990) combined transaction costs with human behaviour. Later, Williamson (2000) excluded traditions and customs, and powerful norms, from the analysis; for him, property rights to a great extent focus on implementation of contracts and their governance, and he discussed about the effects of institutions on the allocation of resources.

Empirical studies show that institutions, which create differences among countries from a macro point of view, influence the structure of sub-markets of the economy (e.g. financial markets, and housing markets) and their level of development (e.g. La Porta et al., 1998; Ball, Lizieri and MacGregor, 1998; Aggarwal and Goodwel, 2009). Recently, we have seen this kind of institutional analysis applied to markets at micro scales, such as urban land, housing markets and other real estate markets.

According to Ball, Lizieri and MacGregor (1998), there are many reasons for this intersection between institutions and real estate markets. The first is that the importance of institutional concepts has been felt in areas other than economics. In recent years, researchers in fields such as sociology and human geography have used concepts such as structure–agency, actor–networks and structure of provision to explain policy-making as well as the developments in construction environment. The second reason is the communication taking place between disciplines outside of economics with regard to reformulating institutional economics based on evolutionary economics. The type of institutional economics based on state–market relations in the real estate sector has been labelled a political economy approach by Hodgson (1998, 2006).The third reason is that numerous economists who study non-market housing and the real estate sector have used the tools of new institutional economics (e.g. analysis of property rights, cost of transactions, or institutional incentives provided for the real estate sector) in order to better understand questions related to the formation of non-profit organisations and analysis of neighbourhood as well as political decisions about home ownership in the future.

Different forms of institutional analysis basically use the relationship of housing with individual, social, economic, technical and legal relationships when addressing the relationship between institutions and housing. Housing as a field of study covers not just housing in the narrowest sense but by its very nature society as a whole. Firstly, housing can be categorised as an economic good and a durable good, but also a consumption good from the point of view of tenants in the rental sector; secondly, it is static – houses don't move; thirdly, individuals have an emotional relationship with their homes – it is usually not simply a piece of property. In addition, housing is linked with regional and neighbourhood-level developments; and state intervention can affect housing markets directly or indirectly, even in today's world of a generally accepted liberal economics approach. All these factors serve to create new areas or opportunities in which traditions, customs, power relationships and institutions play an important role. At the same time, it may serve as a lens onto a linkage between the market and for-profit housing construction (or indeed non-profit), problems related to property rights, contractual relations, organisational design, agency problems, reduction of transaction costs, the functioning of the housing sector, and policy-making in housing markets. This all goes to show the potential importance of: the limited rationality of households as economic actors; the multi-dimensional complexity involved in studying housing; and the relationship between housing and access to information (Gibb, 2015).

Ball, Lizieri and MacGregor (1998) classified the institutional theories that may apply to the housing and real estate markets into five groups: The first covers those theories that concentrate on the role of individuals in commercial real estate markets. Such theories are opposed to broader markets and other institutions. The second group goes under the name of the theory of conflict institutionalism. It states that much of the development process concerns disputes among different parties (e.g. interest groups and the state, real estate developers, landlords, local administrators, etc.) and that these groups have different aims and interests. Conflict institutionalism is an approach that focuses on understanding and solving the conflicts among these different parties. The third group is known as the theory of behavioural institutionalism. According to this approach, there are institutions and cultural factors behind the behaviour of the key agents in the real estate markets such as land developers, landlords and home buyers. The fourth group is structure–agency institutionalism, which is associated with sociological, institutional and urban analysis. According to this approach, the institutions in the real estate markets comprise a more comprehensive institutional set, encompassing for example social, economic and political institutions. Such a framework establishes a basis for the analysis of the certain development phase concerned with institutions' relationships. The fifth group concerns structure of building provision, a category described by Ball, Lizieri and MacGregor (1998). It employs multiple economic perspectives in order to understand the modern network related to the supply of certain types of buildings. This approach claims that the provision of buildings is itself an institution, and thereby enables an understanding of how the process phase of real estate development is performed; here there is no dissimilarity between structure and institution. In other words, this approach views the institutional relationship as one of the institutions of the real estate sector and accepts that the markets, organisations and agencies are part of the housing supply process.

As it can be seen, no matter which approach is taken, all show that institutions play an important role in the developing, shaping and functioning of every dimension of the real estate sector (e.g. commercial real estate, the housing sector, the construction sector, mortgage markets).

2.3.2. Institutional Features and Mortgage Markets

Earlier mentioned, the findings of the first essay indicate that the relationship between credit and house prices varies from country to country, even if they have the same monetary policy. Thus, the second essay focuses on institutional features of European mortgage credit markets (Chapter 4). It is linked to the existing literature on institutional features of these markets and their measuring. Within the literature much attention is paid to the financial features of the mortgage credit markets (e.g. accessibility of credit information, LTV ratio, loan maturity, diversification of mortgage products) (e.g. IMF, 2008; ECB, 2009) and/or their legal features (e.g. strength of legal rights, enforcement of rules, foreclosure procedures) (e.g. Wornock and Wornock, 2008; Kutlukaya and Erol, 2016).

Some studies emphasised the importance of institutions for mortgage markets are descriptive (e.g. Boleat, 1985; Malpezzi, 1996) and some are cross-country empirical studies (e.g. Wyman, 2003; Tsatsaronis and Zhu, 2004).

Descriptive Studies

The descriptive studies of Boleat (1985) and Diamond and Lea (1992) compare the housing financing systems in multiple countries with regard to types of financial intermediaries, usage of social funds, contract systems etc. in the mortgage markets. Boleat (1985) focused on both developed and developing countries in the regions covered (i.e. Asia and Europe) and described the advantages and disadvantages of different housing finance systems (direct finance, a contractual system, deposit taking and mortgage banking). He concluded that no housing finance system is perfect while highlighting the importance of institutional structure in housing finance. Diamond and Lea (1992) reviewed the historical development of housing finance arrangements in five developed countries (Denmark, France, Germany, the UK and the US), where the special circuits of credit intermediation, such as building societies and savings and loan associations, have been predominant. They show that the role of these special circuits had declined significantly, especially in the UK, the US and France, by the early 1990s, whereas competition and diversification of mortgage products and funding sources had increased. However, the effects of these developments were not consistent from country to country. Their results confirmed those of Boleat (1985).

Malpezzi (1996) analysed housing markets in developing and transition economies and indicated the importance of institutions in the mortgage markets for the relationship between housing investment and both economic development and the business cycle. Their significance lies in, for example, the design of mortgage instruments, the proper roles and regulation of various primary and secondary institutions, insurance, settlement procedures, foreclosure procedures, risk management techniques and many regulatory issues.

McCrone and Stephans (1995) and Maclennan, Muellbauer and Stephens (1998) are works of comparative research which follow an economic and financially oriented approach. McCrone and Stephans (1995) focused on national housing policies and housing finance systems in six EU member countries (Germany, France, the Netherlands, Spain, Sweden and the UK). Having identified differences among the countries, one of their observations is that EU countries' current legal structures represent a big obstacle across the EU to using housing as collateral. Maclennan, Muellbauer and Stephens (1998) examined differences across 15 EU member countries with respect to housing and financial market institutions. They observe that the effects of changes in house prices differ among the countries studied, and suggest that one reason for this concerns the institutional features of the mortgage markets (e.g. LTV ratio, mortgage loan maturity, type of housing finance system) and of the housing markets (e.g. rent controls, social housing, cost of transactions, housing taxes and subsidies).

The studies of Hardt and Manning (2000) and ECB (2003, 2006, 2009), which discuss the performance of EU mortgage markets, also belong to the descriptive group. They reveal differences in institutional features among the mortgage markets of EU member countries in relation to funding methods, mortgage-related securities, types of financial intermediaries, LTV ratio, type of mortgage rate (variable or fixed rate), maturity and refinancing, etc. They observe that the EU mortgage markets retain national characteristics. In contrast, Hardt and Manning (2000) examined the effects of developments in the EU (e.g. deregulation, internal market, single currency and e-economy) on the mortgage markets, showing that the mortgage markets have grown faster than national income by protecting a fragmented structure among EU members. They also compared mortgage markets in the EU and the US with respect to their institutional features, finding that US mortgage markets function differently to those of the EU markets on account of their different structure.

Empirical Studies

This empirical literature on the institutional features of the mortgage markets is divided in two groups. In the fhe first group the institutional features of the mortgage markets are included in their model while examining the development of the mortgage markets or the factors that affect the mortgage loan supply (e.g. Calza, Moncelli and Stracca, 2013; Kutlukaya and Erol, 2016; Ceruti, 2017). The second group covers studies that measure the institutional features of the residential mortgage markets by constructing an index (e.g. Wyman, 2003; London Economics, 2005; IMF, 2008).

Wolswijk (2006), BIS (2006) and Wornock and Wornock (2008) are examples of empirical studies claiming the importance of institutions in the mortgage markets. Those that included institutional features in their analyses, emphasise the importance of regulations in the mortgage markets.

Wolswijk (2006) investigated the sources of growth in mortgage debt in the mortgage markets of 15 EU countries by using the pooled regression method. Unlike previous studies, stock market growth, the effect of financial deregulation and fiscal factors are included in his model. Deregulation and stock market variables are put in his model as dummy variables. His findings show the importance of regulations (i.e. deregulation) for mortgage supply and hence the growth of mortgage debt.

BIS (2006) analyses the causes and consequences of supply-and-demand developments for housing loans in the mortgage markets of 16 OECD countries before the 2007–2008 crisis. It discusses the institutional similarities and differences that shape the development of housing finance systems in these countries, and points out that housing finance may be highly sensitive to conditions in the financial markets created by increasing globalisation. It also concludes that, despite progressive economic integration, the pace of transformation in the mortgage markets varies considerably among EU countries, whether they share a similar development profile, and that institutional differences between their housing finance systems persist.

In their study of the effects of macroeconomic environment on the housing finance system, Wornock and Wornock (2008) observe that, besides a stable macroeconomic environment, institutions are important for a well-functioning housing finance system. They added institutional features of mortgage markets (strength of legal rights and credit information) to their model, and the results of cross-sectional regression show that differences in the housing finance system among countries are caused by: lenders and borrowers having stronger legal rights; the presence of more advanced credit information systems; and the presence of a stable macroeconomic environment. They conclude that countries with advanced information systems and stable macroeconomic environments have more developed mortgage finance systems.

Tsatsaronis and Zhu (2004) examine that differences in the institutional structures of mortgage markets, such as the spread between long-term interest rates and short-term interest rates and the growth rate in inflation-adjusted bank credit, have an impact on the relationship between macroeconomic indicators (e.g. economic growth rate, inflation rate) and house prices. The results of this study, covering 17 developed countries, show a permanent and strong link between institutional structure and this relationship. The findings overlap with those of Wornock and Wornock (2008).

Djankov, McLiesh and Shleifer (2007) examined credit determinants at a cross-country level for developed and developing countries over a 25-year period using panel regression analysis. Their credit model covered institutional variables such as creditor rights, contract enforcement and legal origin in addition to macroeconomic variables. Their findings show that institutional factors are critical for credit supply. Among these institutional factors, creditor protection, credit rights and information-sharing are the most significant in determining the credit supply to the private sector.

Miles and Pillonco (2008) focused on developments in housing and mortgage markets before the global financial crisis. Using regression analysis, they evaluated recent house price increases and mortgage lending in 10 OECD countries, and estimated the contributions of key factors to rising house prices. They also quantified the role of rising expectations of future capital gains in house price increases. They concluded that, besides expectations, changes in house prices, as well as volatility, are affected by the institutional features of the mortgage markets (e.g. mortgage rate or features of mortgage contracts – i.e. fixed or variable rate and index-linked mortgages).

Calza, Moncelli and Stracca, (2013) examined whether the effects of the monetary transmission mechanism had a role to play in house price cycles and private consumption behaviour, and whether differences in the mortgage markets affected the emergence of these effects and their magnitude in industrialised OECD economies. Their model is based on a two-sector DSGE (dynamic stochastic general equilibrium) model with financial constraints. The results of the study, of the period 1980–2004, show that institutional differences cause differentiation in the elasticity of the markets; this affects the strength of monetary shocks and the impacts of these shocks is stronger in flexible markets than others. In addition, the findings indicate that monetary policy shocks are influenced by three key institutional features: mortgage repayment rate, down-payment rate and interest rate mortgage structure (variable vs. fixed rate).

In contrast to previous studies, Martins, Martins and Stevenson (2015) focused on only the institutional features of both mortgage and housing markets. They consider some of institutional features of mortgage markets, such as adjustment rate of interest rates, securitisation of mortgage loans, mortgage equity withdrawal valuation methods and maximum LTV ratio, while those of housing markets included rates of owner-occupation, level of control of the landlord over property, and proportions of social rented and private rented housing. They employed a cluster analysis for 15 EU countries. At the end of the cluster analysis, it is observed that the countries were divided into five groups. The group that includes Italy and Greece is characterised by important legal and institutional barriers to the use of housing as collateral. The Denmark, Finland and Sweden group all have more highly developed securitisation and information systems about the credit risk of potential borrowers, high protection of the legal rights of lenders and borrowers, a generous tax system, aggressive lending practices and high LTV ratios. Martins, Martins and Stevenson (2015) suggest that formation of clusters may depend on distinctions in the relative importance of owner-occupation, property-specific fiscal systems and mortgage finance systems. Following an empirical analysis, they determined the importance of heterogeneity of institutional characteristics among the mortgage markets of EU member countries.

Looking at how to control the effect of housing loans on the financial sector, Kutlukaya and Erol (2016) followed the approach of Wornock and Wornock (2008) and included institutional characteristics of mortgage markets in a model that considered 31 European countries. Their findings confirm previous studies and show that strength of legal rights and the urbanisation rate have a positive relationship with the depth of mortgage markets as well as financial institutions' orientation towards mortgages. They suggest that, in developing countries, policy-makers should pay attention to improving the legal and regulatory framework to support the development of mortgage markets.

Like Djankov, McLiesh and Shleifer (2007), Castoro and Martins (2019), in examining the determinants of credit booms, focused not only on economic determinants (e.g. GDP growth rate, capital inflows, interest rate spread) but also on political and institutional factors (e.g. political orientation, the number of government changes, central bank independence). They used a logit model over a panel data set which included both developed and developing countries. The results of their analysis demonstrate the important positive effect of both a stable political environment and central bank independence on credit expansion in domestic markets.

The second group of the empirical studies measure the institutional features of the mortgage markets by using an indexing method.An index is a measure of change, so such a method offers a more direct representation of change (Ralph, O'Neill and Winton, 2015). Indices have also proven useful in benchmarking performance in many fields, such as the economy, society and the environment (OECD and JRC, 2008).Because of this, a large number of indices have been developed for real estate markets at either country or regional level.Some have been prepared to trace the price changes in the housing markets (e.g. Case-Shiller Index for the US markets) and some to monitor the returns in the commercial real estate markets (e.g. CBV Real Estate Index for Vietnam). International agencies also develop some indices for their member countries, such as Residential Property Price Indices (RPPIs) prepared by the OECD. It is also seen that many indices developed for the international real estate investors in the commercial real estate markets to make a comparison with the property investment risks of the countries, such as the GRET index (Jones Lang LaSalle), the GRER index (Chen and Hobbs 2003), and the Global REIA index (Lieser and Groh, 2011) or to compare the returns (e.g. the IPD indices) or to assess the real estate investment potential of countries, such as the REP index (Lee, 2005). However, in the current literature review, despite a large number of indices for housing and commercial real estate markets, there is a very limited number produced for mortgage markets, and these are namely: the MBA Indices, the Completeness Index, the Product Availability Index and the Mortgage Market Index.

The oldest mortgage market indices are those developed for the US mortgage markets by the Mortgage Banking Association (MBA). The MBA has been publishing these market indices, compiled from data obtained from the US housing and mortgage markets, on a weekly basis since 1990. They are constructed as composite indices and are based on questionnaires. Data are grouped according to market dimensions such as purpose of loan, type of loan and type of product, after which the seven indices are produced (market index, purchase index, refinance index, conventional index, government index, fixed rate mortgage [FRM] index and adjustable mortgage [ARM] index). These indices cover over 75% of mortgage loan applications for purchases of single-family homes.

Wyman (2003) and London Economics (2005) aimed to evaluate the integration of EU mortgage markets. Considering four criteria (credit risk tolerance, product range, ease of the distribution process, and availability of information and advice), Wyman (2003) created a 'Completeness Index' according to data based on surveys covering eight EU member countries.[11]A Product Availability Index developed by London Economics (2005) measures only the availability of mortgage products.[12] In contrast to Wyman (2003), this index adopts a supply perspective rather than a demand perspective (i.e. borrower perspective). Nonetheless, its findings approximately concur with the Wyman index, which adopts a demand perspective.

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[11] Denmark, France, Germany, Italy, the Netherlands, Portugal, Spain and the UK.

[12] Borrowers are classified as young and older households (either under or over 30), low-equity borrowers (LTV >90%), self-certified income borrowers, previously bankrupt borrowers, credit-impaired borrowers and self-employed borrowers, while products are classified as second mortgages and buy-to-let mortgages.

The IMF (2008) developed its Mortgage Market Index to compare the development level of the mortgage markets of 18 industrialised countries.[13] This index is based on both qualitative information (e.g. equity withdrawal options) and quantitative information (e.g. volume of mortgage securities issues). It is prepared by scoring between 0 and 1 with the highest scores indicating countries with the most advanced housing finance systems.

What these indices have in common is that they are all composite indices.[14] Also, with the exception of the Mortgage Market Index, they are all based on surveys. The MBA indices covers US markets only, whereas the others cover multiple countries. In conclusion, it can be observed that not only is there a low number of indices dealing with residential mortgage markets, but in addition they are not produced and published regularly, with the exception of the MBA indices. Moreover, none covers multidimensional institutional features of the mortgage markets to create a benchmark for institutional quality of mortgage credit markets as well as all the EU (28) countries.

[13]These countries are Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Norway, Spain, Sweden, the UK and the US.

[14] All these previous studies have applied the same technique -factor analysis- to construct an index. To avoid much repetition in the thesis, how previous studies built an index is not explained in detail in this subsection because in the chapter 4, the same technique to construct the overall index and sub-indices is used and because how to construct an index by using factor analysis was technically explained step by step (see subsections 4.3, 4.4 an 4.5 in the chapter 4).

2.3.4. Composite Index Methods

As the aim of the second essay (chapter 4) of this thesis is to measure the institutional features of EU mortgage markets and construct a benchmark for these markets, an index is the appropriate tool. An index is defined as a measure of change in data collected (e.g. prices and quantities) over a period (week, month, quarter, year).[15] It summarises and rank specific observations. An index number shows by the changes of a magnitude over time or space. There are many index types used in the statistical production process, such as, Paasche, Laspeyres, Value-Added and Fisher indices etc. Important features in the construction of an index number are its coverage, base period, weighting system and method of averaging observations (UN, 2018).). Indices are designed to give an indication of the performance of a particular market. For example, a price index reflects an average of the proportionate changes in the prices of a specified set of goods and services between two periods of time (e.g. OECD's Residential Property Price Indices, the Down Jones Insdustrial Average).

To create a benchmark for mortgage credit markets in the second essay, first of all, the institutional features of the mortgage credit markets are measured by using a composite index method. Thereby, a benchmark is created for these markets by constructing an overall index and sub-indices. The institutions qualify as latent factors as they do not show significant change over time. However, since an institutional environment needs to be described across multiple dimensions, it is difficult to represent as a single indicator. Therefore, to obtain a benchmark for the institutional characteristics of the credit markets, the index is calculated as a composite index.[16]

A composite index is the mathematical combination (or sum) of a set of separate individual variables representing the distinct components of a multidimensional concept to be measured (e.g. development, quality of life, well-being, etc.) (Mazziotta and Pareto, 2013). Composite indices are used to compare countries' performance and are also, increasingly, admitted as a useful tool in policy analysis. There are two reasons for their popularity. The first is their simplicity. It is generally seen as being easier to interpret composite indices than it is to identify common trends across many separate indicators. They present a summary picture of complex and multidimensional phenomena, enabling evaluation and providing information on which to base decisions (Becker et al., 2017). The second is that the rankings they provide compel governments to re-evaluate their operations and to make the necessary adjustments. Although

[15] For more information on index numbers, see Ralph, O'Neill and Winton (2015).
[16] Such indices are also called performance indices or synthetic indices (see Becker et al., 2017).

composite indices sometimes attract criticism,[17] they have proven useful in benchmarking a country's performance and in monitoring progress (see Nardo et al., 2005; OECD and JRJ, 2008; Mubareka, et al., 2011; Mazziotta and Pareto, 2013; Hair, et al., 2013; Becker et al., 2017). Many widely accepted indices use a composite method, including the Human Development Index (UNDP), the World Competitiveness Index (WEF) and the Programme for International Student Assessment index (OECD).

Since a composite index includes many different variables, multivariate data analyses are employed to develop it. These allow a more in-depth analysis of possible patterns in the data, graphically representing the complex interrelationships of multiple variables and allowing the data dimensions to be further analysed and summarised (Hair et al., 2013). Regression-type models are also employed for indices using a broader interpretation of multivariate methods (Abeyasekera, 2005; Mazziotta and Pareto, 2013).

In the literature on the real estate sector, as with other sectors of the economy, three multivariate data analysis techniques are widely used in constructing composite indices. These are: principal component analysis, factor analysis and independent component analysis. Principal component analysis (PCA) is the simplest true eigenvector-based multivariate analysis method, with the other two being extensions of PCA, but more developed (see Tobachnick and Fidel, 2014; Hair et al., 2013). PCA, and especially its derivative, factor analysis, are the techniques most often observed in the literature with regard to production of composite indices.

Principal Component Analysis

Principal component analysis (PCA) is the oldest technique of the three. It is a statistical process that uses orthogonal transformation to convert a set of observations of (possibly) correlated variables into a (smaller) set of variables. It is hence known as a variable reduction technique. It is also a large-sample procedure. Its function is to reduce a large number of observed variables and to explain the variation of the observed data using fewer linear combinations than the original data (OECD and JRC, 2008). These variables, which are called principal components (PCs), are the linear combinations of the original variables in the data set**.**

PCA is used when the variables are highly correlated with each other. All the variances in the observed variables are analysed. PCA decomposes a correlation matrix with ones on the

[17] Although accepted as useful tools for comparing performance across countries, composite indices are sometimes accused of being misleading on account of the complexity of their configuration as well as the differences in their underlying variables. For more information, see Mubareka et al., 2011; Mazziotta and Pareto, 2013.

diagonals. The amount of variance is equal to the trace of the matrix, the sum of the diagonals, or the number of observed variables in the analysis. PCA is used to obtain the minimum value for the sum of the squares of the perpendicular distances to the component axis (Suhr, 2009). PCs are not to be interpreted, i.e. there are no underlying constructs. PCs contain the maximum variation. The component score is a weighted linear combination of observed values with eigenvectors. Component scores are a transformation of observed variables ($x_1 = b_{11}C_1 + b_{12}C_2 + b_{13}C_3 + \ldots$) (see Hair et al., 2013)

The PCA Model is:

$$\mathrm{Y} = B\mathrm{X}$$

where *Y* is a matrix of observed variables; *X* is a matrix of scores on components; *B* is a matrix of weights. The steps in a PCA are: (1) select a set of variables, measure them and prepare the correlation matrix; (2) obtain the factor matrix from the correlation matrix; (3) determine the number of components; (4) increase the interpretation of the components by rotating them; and (5) interpret the results.

Factor Analysis

Factor analysis (FA) is similar to PCA. Like PCA, FA is a variable reduction technique which defines the number of latent structures of a set of variables, and the basic factor structure. Traditionally, a measured cluster variable has an underlying factor structure which is obtained without any preconception about the output (Suhr, 2009; Hair et al., 2013). The main goal is to determine the minimum number of common factors that will provide correlation between the original variables.

For the given correlation matrix, if there is no error in terms of measurement and sampling, and if the assumed cause of the factorial is appropriate for the data, the minimum number of common factors responsible for the given correlation matrix and the rank of the corrected correlation matrix will match in terms of their similarity, and if the assumed cause of the factorial is suitable for the data, there will be full similarity between the minimum number of common factors responsible for the given correlation matrix and the rank of the adjusted correlation matrix. So when there is a perfect match between any sampling errors, the factorial model and the data, then common factors – together with the communalities – can be obtained using the rank of the adjusted correlation matrix. The final criterion for determining the minimum number of common factors is that the assumed common factors can restore the observed correlation. Hence, the goal is to redefine the criteria for solving the statistical problem in terms of ‘where we should stop extracting the common factors’. If we follow standard statistical logic, this involves determining when the discrepancy between the reproduced correlations and the observed correlations can be attributed to sampling variability (Kim and Mueller, 1978; Hair at al., 2013).

FA operates under the assumption that the observed variables are linear combinations of underlying factors. There are some common values among these factors, possibly having more than one variable or possibly considered to be specific to each variable. Thus, covariance among the original variables is not a contribution of the unique factors (i.e. the unique factors do not contribute to the inter-variable variation), but covariance among the original variables is is contributed by common factors. An FA’s basic assumption is that some underlying factors, which are less in number than the original variables, are responsible for the covariance among the original variables (Kim and Mueller, 1978).

So where the FA model diverges from PCA is its assumption that the data is based on the underlying factors of the model and that data variance can be decomposed into that which is accounted for by common and unique factors.

There are two types of FA: explanatory and confirmatory.

There are two types of FA: explanatory and confirmatory. Explanatory factor analysis (EFA) identifies a set of common core dimensions by analysing the relationship between a multiple of variables. In this type of factor analysis (EFA) variables may or may not be selected depending on the potential underlying process considered. In confirmatory factor analysis (CFA), using empirical research or theoretical knowledge, or both are possible. This technique allows the hypothetical testing of the relationship between the researcher’s original variables and the existence of their underlying latent structures. However, it is a much more complex technique than explanatory factor analysis. It allows the hypothetical testing of the relationship between the researcher’s original variables and the existence of their underlying latent structures. Using empirical research or theoretical knowledge, or both, the researcher must first assume the relationship pattern is correct and then test the hypothesis statistically. In other words, EFA relates to developing a theory, while CFA is associated with its testing (Kim and Malluer, 1978; Tobachnick and Fidel, 2014; Hair et al., 2013).

FA analyses only shared variance. As PCA, FA needs a large sample size (see Tobachnick and Fidel, 2014; Hair et al., 2013) since it is based on a correlation matrix of the variables, and a large sample size is usually required by correlation matrices before they stabilise. EFA enables us to identify and determine the number of latent structures (factors), and it contains unique factors (error variations) because of unreliability in the measurements.

EFA decomposes an adjusted correlation matrix. The diagonals are adjusted according to the unique factors. The amount of variance explained is equal to the trace of the matrix, the sum of the adjusted diagonals or communalities, which is the sum of the diagonals. Factors describe a common variance in a data set. The original variables are a linear combination of the underlying unique factors. Factors are estimated, $X_1 = b_{11}F_1 + b_{12}F_2 + b_{13}F_3 + . . + e_{11}$) where e_1 is a unique factor.

The FA model is represented as follows;

$$Y = B\,X + \mathrm{e}$$

Where Y is a matrix of measured variables: X is a matrix of common factors; B is a matrix of weights (factor loadings): e is a matrix of unique factors (i.e., error variation.)

The steps in FA are similar to those in PCA. They are: (1) select the variables and control the correlation matrix of variables; (2) normalise all the data; (3) extract a set of factors from the adjusted correlation matrix; (4) determine the number of factors; (5) rotate the factors with the expectation of increasing interpretation; (6) measure the internal consistency of individual factors (Tobachnick and Fidel, 2014).

In the literature, examples of indices developed for real estate markets using the FA technique are: the Completeness Index of Wyman (2003) and the Product Availability Index of London Economics (2005) for mortgage markets; the Global Real Estate Investment Attractiveness prepared by Lieser and Groh (2010), which evaluates attractiveness of 66 countries with respect to commercial real estate investment; the EU index developed by Konig and Rohr (2013), which measures economic integration in EU member countries; and the Financial Development Index developed by Svirydzenka (2016).

Independent Components Analysis

Another composite index method is independent components analysis (ICA). Although developed in the 1980s, ICA is a novel technique which separates data, in contrast to PCA and FA. ICA’s aim is to reveal latent factors that underlie a set of random variables, signals or measurements. When appropriate hypotheses are not possible, or when data are thought to be very limited or simple, ICA can be used to examine the data’s structure. In the literature, it is seen that ICA has been widely used in biomedicine, audio science, neuroscience and many other fields (Lizieri, Satchell and Zhang, 2007).

Although ICA is an extension of PCA, it is a nonlinear form of that approach. In ICA, the first assumption is that all the independent components are statistically independent. Another assumption is that the independent components must have a non-Gaussian distribution (Leach, 2002; Hyvärinen, 2013). The objective in using this technique is to estimate independent components using only observed data. The basic definition of ICA is: if x_1 (t), x_2 (t), ... ,x_n (t) are observed random variables. Its assumption is that the random variables are a linear mixture of independent components, given by (Leach, 2002):

$$x\,(\mathrm{t}) = \mathrm{As}(\mathrm{t})$$

where x *(t)* are observed random variables; *s(t)* are independent components; *A* is unknown mixing matrix for the non-gaussian, independent components. When ICA is applied, a mixture *A* matrix is estimated and the inverse of the *A* matrix is calculated. This matrix is known as the demixing matrix (W) and is represented as follows:

$$\mathrm{W} = \mathrm{A}^{-1}$$

Therefore, the independent components are calculated using below equation;

$$\mathrm{s}(\mathrm{t}) = \mathrm{Wx}(\mathrm{t})$$

The main achievement of ICA is that it finds a way of diagnosing the model by making an unconventional assumption that the independent components are non-Gaussian **(**Leace, 2002; Hyvärinen, 2013). Many decisions need to be made to decide as to how ICA is to be put to use with the data. The first phase is to decide whether the preliminary process is needed. The data used in ICA could be in an undesired state, in which case they can undergo pre-processing to bring them to a desired state in which the ICA algorithm can accept them. This pre-processing consists of whitening, centring, and then whitening the data again by reducing the size using PCA. The mean of the white data is zero, uncorrelated, and it has a unit variance. After whitening and centring, the demixing matrix (W) can be determined. The second phase is to decide how to estimate the mixture matrix, for which many different algorithms are available, covering maximisation of non-Gaussianity, maximum likelihood estimation, minimisation of mutual information, tensorial methods, nonlinear decorrelation, and nonlinear PCA components. Thus, only once these decisions have been made can the individual components be found **(**Leach, 2002).

Differences and Similarities among Composite Index Methods

PCA, FA and ICA have similarities and differences. FA and ICA are more developed versions of PCA, which is the simplest of the true eigenvector-based multivariate analyses. Indeed, all of them are variable reduction techniques. That is, their purpose is to reduce the large number of original variables to a smaller number of components (or factors). In general, the main difference among them stems from their assumptions or implementation of data.

PCA and FA have similar analytical phases. A further similarity is that they produce many linear combinations of original variables, and each linear combination is a component (or a factor). A potential similarity is the measurement scale at the interval or rate level. They also align in using a large sample size, and share the same assumptions: that is, they assume a linear relationship between the original variables and a normal distribution for each original variable.

There are also some differences between the PCA and FA. One difference is that PCA analyses all variances in the original variables whereas FA only analyses the common variances. A second difference relates to the correlation matrix: PCA decomposes the correlation matrix, whereas FA decomposes the adjusted correlation matrix. A third difference is that FA estimates the factors that affect the responses given to the original variables, whereas PCA minimises the sum of the squares of the perpendicular distance to the component axis. A final difference is that, in PCA, component scores are the weighted linear combinations of the observed variables, while in FA the original variables are the linear combinations of the underlying and unique factors.

ICA is dissimilar to PCA and FA despite also being an extension of PCA. In fact, all three techniques share a common assumption: that is, all components are statistically independent (Leach, 2002). However, ICA operates under a further assumption which fundamentally differentiates it from PCA and FA: the components are non-Gaussian. ICA’s use of a non-Gaussian data structure, which is crucial for recovering the underlying components that created the data, is a major departure. A non-Gaussian approach adds new meaning to the concept of independence: for variables with a common Gaussian distribution there is no correlation or independence, whereas a non-Gaussian situation is about independence more than correlation. The absence of correlation is presumed in PCA and FA, but this is not usually the case in non-Gaussian independence.

2.4. Relationship between House Prices and Current Account Imbalances

As stated, the main goal of this research is to investigate the relationship between credit supply and house prices, its effects on the linkage between house prices and the macroeconomy, and the role of institutions in this linkage. In the main, the linkage is most prominent between house prices and current account balance, which is an external dimension of the economy. Thus, the third essay here focuses on the existing literature relating to the relationship between house prices and current account imbalances. Following the theoretical framework of previous studies, the current literature in this field falls under four areas: (1) global savings glut; (2) global banking glut; (3) demand shock; and (4) financial liberalisation.

The first study aims to analyse the correlation between house prices and current account dynamics was conducted by Matsuyama (1990). He undertook a theoretical analysis of the effect of government spending on housing subsidies and housing investment. Matsuyama argues that housing investments are different from non-housing investments and that, alongside other constraints, housing dynamics are related to current account imbalances. He also indicates that anticipated government spending shocks cause a drop in both housing investment and house prices, but that their impact on current account depends on whether nondurable consumption and housing are complements or substitutes.

In recent years, many studies have investigated this correlation using different theoretical approaches, which can be categorised under four headings: savings glut, banking glut, demand shock, and financial liberalisation. The current literature on house prices and current account dynamics will be examined here under these headings.

2.4.1. Global Savings Glut

The savings glut theory assumes that a country with a current account surplus makes its savings available to other countries (Bernanke 2005, 2010; Caballero, Fahri and Gourinchas, 2008; Aizenman and Jinjarak, 2009, 2014; Fratzscher, Juvenal and Sarno, 2010; Büyükkarabacak and Mykhaylova 2010, Adam, Kuang and Marcet, 2012; Tillmann, 2013, Hepşen and Aşıcı, 2013; Sa and Wieladek , 2015; Punzi and Kauko, 2015). This approach suggests that foreign capital from a surplus country has a depressing impact on market interest rates, which, in turn, causes house prices to rise in a deficit country. Hence, the conclusion is reached that current account dynamics have a direct impact on house price dynamics. The first scholar to propose a global savings glut hypothesis was Bernanke (2005), who advanced the hypothesis in discussing the reasons behind the crisis in the US. According to Bernanke (2005), in the aftermath of the Asian crisis, a savings glut gave rise to international markets because the savings levels in developing economies had increased, as had the revenues of oil-exporting countries; consequently, these countries had current account surpluses. Due to limitations in their secure investment instruments, investors from within these countries turned to international markets. As a result, the increase in foreign capital inflows depressed interest rates while raising asset prices – just as happened in the US after the beginning of the mortgage markets crisis. In other words, in countries where current accounts are negative and there is more capital inflow, the increase in housing value is higher.

This hypothesis was later tested by numerous studies through theoretical and empirical modelling. Caballero, Fahri and Gourinchas (2008) were the first to model Bernanke's hypothesis. Their model emphasised the role that global asset markets played in 2007 in directing global capital movements and determining interest rates and portfolio investments. Furthermore, they were among the first to analyse the interactions among emerging economies, developed economies with a current surplus and oil-producing economies, rather than interactions among similar economies (e.g. the US, the UK and Austria), demonstrating that the private sector plays a significant role in capital movements. They showed a correlation between house prices and current account imbalances.

Reinhart and Rogoff (2008), who discussed capital movements with viable data to explain real estate dynamics through the example of the US, reached similar conclusions to those of Caballero, Fahri and Gourinchas (2008). In contrast to previous studies, Aizenman and Jinjarak (2009, 2014), who analysed a vast number of developing countries, reached the conclusion in both their studies that there is a strong positive correlation between current account deficits and appreciation of real estate. In their first study, they examined the relationship between lagged current account deteriorations and the appreciation of real estate prices. In their second study, they used a different method (dynamic panel regression), analysing this correlation by focusing on a shorter time span (2005–2012) – the period preceding and following the economic crisis. In this study they added credit growth in domestic markets, appreciation of the equity market and the variables of growth patterns, alongside current account causing real estate appreciation. They found a positive correlation between credit growth and current account deficit and an increase in real estate value.

Using similar variables as in earlier studies, Fratzscher, Juvenal and Sarno (2009, 2010) analysed the correlation between current account and house prices. Unlike previous studies, however, they used relative variables for the sake of consistency and identification. They showed that wealth and exchange rates each had impact on asset prices in all the G7 countries. One of the main findings is a substantial cross-country heterogeneity in the sensitivity of the trade balance to asset price shocks. They also analysed the impact of asset prices on trade balance by comparing it to other factors that affect trade balance, especially exchange rate. What initially distinguishes Fratzscher, Juvenal and Sarno' second paper from their first is their employment of a different method: Bayesian structural VAR. A further difference is that the second measures the impact of the exchange rate channel on current account by distinguishing it from other asset prices. They concluded that both housing and equity prices are key determinants of current account balance and that exchange rates have little impact on current account balance in the US.

In contrast, Büyükbacak and Mykhaylova (2010), who modelled the transmission mechanism from foreign capital inflows to house prices, concluded that interest rates and foreign capital flows can explain a considerable portion of the volatility in house prices and residential real estate investment in the US before the global crisis. They also found that, prior to 1997, the correlation between house prices and capital inflows was only 0.22 in the US, but increased to 0.88 during the 1997–2008 period.

Guo and Huang (2010) investigated the impact of foreign capital movements on Chinese real estate and equity markets during the Asian crisis and the global financial crisis and discovered foreign capital inflows to be the second most effective factor in the increase in real estate prices. They also observed that the magnitude of speculative capital flows and their short-term investment nature cause an increase in volatility in both real estate and equity markets. What distinguishes their work from previous studies is that they test the impact of foreign capital on markets by focusing only on speculative capital flows (hot money) rather than total foreign capital flows. Another difference is that in analysing real estate markets they distinguish between residential and commercial markets. Their study emphasises the importance of the type of foreign capital for real estate and equity markets. Their findings also confirm the widely accepted understanding that short-term foreign capital creates a risk for financial stability.

Adam, Kuang and Marcet (2012), who examined the house price boom and current account dynamics under collateral constraint using a small open economy asset pricing model, reached similar conclusions to those of earlier studies. Their model empirically identifies the link between house prices and current accounts, and indicates that this correlation is negative in G7 countries with a current account surplus. Their findings suggest that, in some of the G7 economies, the strong decline in real interest rates after 2000 played an important role in igniting the house price boom and that house price booms can create significant welfare distortions. The main feature distinguishing their study from previous ones is that their model is the first formal one to show that a persistent reduction in real interest rates can create a persistent and sizeable increase in house prices. Another difference is that in their analysis they included households' subjective attitudes which are open to a wide range of interpretations based on personal opinions, feelings, emotions, etc. Adam, Kuang and Marcet (2012) assumed that a belief structure that is near rational, while being tethered to conventional assumptions about rationality, will nonetheless display enough flexibility to generate more extreme price swings.

Tillman (2013), in contrast, included only the emerging Asian economies and, like Guo and Huang (2010), analysed the movements of both housing and equity prices. According to Tillman (2013), capital inflow shocks play an important role in increasing house and equity prices, and they find heterogeneity between Asian and OECD countries. The reason behind this heterogeneity, he argues, stems more from the different macroeconomic policies in effect in the countries in question than the difference in their housing markets, asserting that policy-makers' decisions have a direct influence on current account and asset prices.

Hapşen and Aşıcı (2013) measured the correlation between current account and house prices using a classical linear regression model, basing their analysis solely on Turkey. They reached the conclusion that house prices and current account deficits move in the same direction.

Investigating which theoretical mechanism lies at the core of the causal correlation between house prices and current accounts, Geerolf and Thomas (2013) undertook the first empirical study instrumenting house prices. In line with Caballero, Fahri and Gourinchas (2008), Geerolf and Thomas emphasise the role housing demand plays in shaping current account balance. What distinguishes their study from earlier ones is that they provide a new instrument (percentage share of real estate taxes within total taxes) for house price changes. Additionally, they analyse current account by dividing it into four components.[18] Finally, demonstrating a correlation between asset price increase and current account, Geerolf and Thomas (2013) also concluded that it is not clear whether the rapid increase in house prices has an impact on wealth.

Like many researchers before them, Sa and Wieladek (2015), who examined the impact of capital inflow shocks on housing markets in the US, found a strong correlation between capital inflows and house prices. What distinguishes their study is their consideration of the four shocks (two foreign and two domestic) that lead to capital inflows. Foreign shocks include savings glut shock and monetary policy expansion shock, whereas domestic shocks include those that occur due to an increase in the LTV ratio and housing demand alongside domestic monetary

[18] These are: private savings, public sector surplus, residential investment and non-residential investment.

expansion shock, as per Gete (2010). According to their findings, both foreign and domestic shocks have a significant positive impact on house prices and housing investment. However, foreign monetary expansion and the two domestic shocks affect the housing market in the long run, and these shocks are less important in explaining housing investment. This study also shows how US monetary policy had a limited effect on the housing boom, contrary what was expressed in the Taylor rule.[19]

2.4.2. Global Banking Glut

The global banking glut hypothesis is a theoretical approach that analyses the relationship between house prices and current account imbalances and shows how foreign capital flows from various sources affected credit terms in the US (e.g. Shin, 2011, 2012; Punzi and Kakuo, 2015). During the period preceding the global financial crisis, foreign banks made serious investments in long-term U.S. assets, but many of these were bought by European banks instead of China or oil exporting countries.[20] Therefore, contrary to the argument posed by savings glut, a predominant inflow of funds by European banks provided grounds for a decline in interest rates and a relaxation of credit standards in the U.S. financial markets. According to Shin (2011), who first claimed the 'global banking glut' approach (i.e. cross border lending), the great role played by the European banks invalidates the global savings glut which falls short of explaining the current account imbalances not only in the U.S. but also in other countries (e.g. Germany, Ireland and Spain).[21] His findings indicate that with the introduction of the bank capital requirements in Basel II Accord in the Eurozone, and the use of a common currency (euro), the cross- border transactions have grown in number and the amount of loans lent by surplus countries' to the banking sector of the deficit countries. A similar situation exists in the U.S. As a matter of fact, Bertaut et al. (2012)'s study confirms the Banking Glut's argument.[22]

On the other hand, Justiniano, Primiceri and Tambalotti (2014) and Punzi and Kauko (2015) have analyzed savings glut together with banking glut testing their impact on markets. Using

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[19]A Taylor ruleis amonetarypolicyrule which predicts how much thecentral bankshould change thenominal interest ratein response to changes in economic conditions (e.g. inflation, output, etc.).

[20] The sum of U.S. assets held by foreigners was 7.8 trillion dollars in 2006 and 2007. It was as high as 9.8 trillion dollars. Of this number, European banks bought 3.2 trillion in 2006 and 4.2 trillion dollars in 2007 China on the other hand bought 699 billion dollars and 922 billion dollars worth assets respectively within the same time frame. See. Bario and Disyatat, 2011.

[21] In 2000, while Ireland's ratio of current deficit/GDP was -0, 4%, and that of Spain was -4%; by the end of 2007 the ratio for Ireland became -5, 3% and -10% for Spain. Within the same time frame the current account /GDP ratio in Germany was -1.7% and 6.9% respectively. See. EC, 2011.

[22] The findings of Bertaut et al. (2012) show that European investors looking for a higher return bought personal assets rather than U.S. treasury securities and by way of reducing the yield ofU.S. assets they affected the credit conditions.

different methods, they reached similar conclusions showing that the volatility of housing prices can be explained with capital that flows in through banking rather than securities issuance. In addition, some studies show that a savings glut has not taken place before the global financial crisis (i.e. the 2007-2008 crisis) (e.g. Chin and Ito, 2007; Taylor, 2008; Jinjarak, and Sheffrin, 2011).

2.4.3. Demand Shock Approach

Some studies (Gete, 2010, 2015; Punzi, 2010, 2013; Laibson and Mollerstrom, 2010; Ferrero, 2015; Arestis and Gonzalez-Martinez, 2016) criticise the savings glut hypothesis and explain the correlation between current account and housing dynamics by means of domestic demand shock. According to this approach, an increase in domestic demand causes an increase in house prices and current account deficits and the correlation moves from domestic demand towards house prices. They conclude that there is a negative correlation between current account balance and housing dynamics.

Gete's (2010) study is the first to show that, in a boom period, an increase in demand for non-tradable goods such as housing may have an enlarging effect on trade deficits. In addition, Gete's model indicates that an increase in housing demand may generate trade deficits without wealth effects or trade in capital goods. Following Uhlig's (2005) approach, Gete (2010) theoretically shows that housing demand shocks play an important role in current account dynamics. According to Gete's model, the consumption smoothing channel ties the housing market to current account dynamics, and the conclusion is a strong negative correlation between housing and current account dynamics. In other words, an increase in demand results in both a high increase in house prices and high current account deficits. In a later study, Gete (2015) expanded on his earlier one using a quantitative two-country model in which exchange rate adjustments play no part. Having focused on the boom cycle in his previous study, in this later study Gete undertakes his analyses by taking both house price cycles (house price boom and bust) into consideration. Also, unlike his previous study, Gete (2015) addresses the recent financial crisis by using two separate headings: pre-crisis and post-crisis, concentrating on the impact of a combination of savings gluts on current account dynamics and reaching a similar conclusion to that of his previous study.

Investigating the relationship between asset bubbles and capital account imbalances under the assumptions of behavioural bubble and aggregate wealth effects, Laibson and Mollerstrom (2010), like Gete (2010), focus on the price boom cycle and discuss whether the direction of causality is from house prices toward current account. Their findings show a strong negative correlation between an increase in house prices and trade surplus and show that, by boosting consumption, a housing boom triggers an expansion of trade deficits. Unlike Gete (2010), Laibson and Mollerstrom consider equity markets alongside housing markets but reach similar conclusions: an increase in house prices has an enlarging effect on consumption and current account deficits. Both studies conclude that savings glut shocks, by themselves, are not sufficient to explain housing dynamics. Also, and consistent with the findings of Chin and Ito (2005) and Taylor (2008), Laibson and Mollerstrom (2010) show that during the period in question there was no global boom in investment and savings, and also show that, when interest rates decline, investment and savings rates decrease too.

In two studies Punzi (2007, 2013) reaches similar conclusions to those of Gete (2010, 2015) and Laibson and Mollerstrom (2010). Her first paper evaluates the dynamic impulse response of one selected variable to shock in another variable using structural VAR model for 10 OECD countries. She finds that house price shocks have a positive impact on growth, investment and consumption. Hence, the findings point to a negative relationship between house prices and current account imbalances. In her second paper, Punzi (2013) brings together Iacoviello's (2005) and Matsuyuma's (1990) models and expands the scope of her analysis. Here she uses a two-sector and two-country DSGE model with flexible prices and heterogeneous agents and housing collateral constraint and evaluates the quantitative impact of the relationship between house prices and current account. In her model, housing preference shocks create a negative link between house prices and current accounts. Her findings indicate that, when financial liberalisation is on the rise, the correlation between current account and housing dynamics is stronger and there is a negative correlation between them.

Although Ferrero (2015) explains the relationship between house prices and current accounts by means of the demand shock approach in the US, he tackles the issue from the viewpoint of financial liberalisation and claims that an increase in house prices can cause an increase in current account deficits because of the borrowing of households from international markets, and also that there is a negative correlation between house price and current account dynamics. According to Ferrero (2015), financial liberalisation facilitates access to foreign resources which in turn lowers interest rates while increasing consumption and demand for housing, which leads to an increase in house prices and an expansion of current account deficits. In describing financial liberalisation as the gradual easing of credit standards, Ferrero (2015), like Tillman (2012), points out the role of economic policies in low interest rates. According to him, domestic shocks (credit and preference shocks) were the main drivers behind the deterioration of the current account balance and increasing of house prices in the U.S., with monetary factors only playing a minor role.

Arestis and Gonzalez-Martinez (2016), who discuss the drivers triggering the interaction between housing markets and current account imbalances, conclude that a common driver is the impact of strong total demand. Furthermore, they demonstrate a negative relationship between house prices and current account deficits in the long term, yet a positive relationship in the short term; and that controlling of house prices can be possible via credit and mortgage rate channels. Their study differs from previous ones that seek to explain this relationship to some extent by means of a domestic demand approach in that they examine this relationship by taking into account two periods (before and after joining the European Exchange Rate Mechanism [ERM]) and that they emphasise the role of the public sector in a slowdown of house price appreciation.

2.4.4. Liberalisation Approach

Favilukis et al., (2013) suggest that studies that aim to explain the correlation between house prices and current account by means of savings glut or domestic shock have their shortcomings. In their opinion, it is economic and political forces that affect the flow of capital and house prices. They argue that the easing of credit standards is the most important factor behind the price boom and that low transaction costs trigger an increase in refinanced home mortgages and house acquisition. In addition, they conclude that foreign acquisition of government bonds has no significant impact on house prices or domestic credit volume.

Like Ferrero (2015), Favilukis et al., (2013) consider the issue from the viewpoint of financial liberalisation; however, rather than accepting lenient credit conditions as the sole indicator of financial liberalisation, they also consider other indicators. Unlike Ferrero (2015), they analyse the impact of current account imbalances on housing markets by considering both boom and bust cycles. They also depart from Ferrero (2015) in explaining the correlation between house prices and current account by means of financial liberalisation rather than domestic demand shock. Favilukis et al., (2013) claim that interest rates are low during bust cycles as well as during boom cycles (in fact, the interest rates drop even lower during bust cycles) and that there is no significant indicator to suggest that the foreign capital present during the boom cycle is also present in the bust cycle. The third departure from Ferrero is that they claim there is no significant correlation between the dynamics of current account and house prices. They conclude that, in the time frame covered by their analyses, capital inflows had no meaningful impact on house prices and credit supply was the most significant factor influencing house prices increases.[23] Their findings, which concur with those of Kaminsky and Reinhart (1999), suggest that the key causal factor behind housing boom–bust cycles is financial market liberalisation and its subsequent reversal.[24]

2.4.5. Banking Gluts vs. Savings Gluts

Some studies have analysed savings glut along with banking gluts, testing their impact on the markets. Justiniano, Primiceri and Tambalotti (2014) and Punzi and Kauko (2015) were the first to combine the two approaches to explain housing and current account relationships and to question their influence on capital inflows, credit and house prices. Despite using different methods, the two studies reach similar conclusions. The findings confirm that both the capital flow channel and the banking sector channel have an impact on housing markets.

Unlike Punzi and Kakuo (2015) who utilize the Structural Vector Autoregressive (SVAR) model, Justiniano, Primiceri and Tambalotti (2014) use the quantitative general equilibrium model and show that in the 2000s, the capital inflows were responsible for at least one-fourth of the increase in house prices (at most one-third) and that a decline in foreign capital inflow had been caused by the savings glut channel-the channel that had the most impact on the US markets between the two—which then had triggered an increase in demand for housing. Moreover, in their evaluation of the domestic country wherein both the borrowers and the savers are included, Justiniano, Primiceri and Tambalotti (2014) have a unique stance that sets their study apart from any previous studies.Whereas Punzi and Kakuo (2015) use a structural vector autoregressive (SVAR) model, Justiniano, Primiceri and Tambalotti (2014) use a quantitative general equilibrium model and show that, in the 2000s, capital inflows were responsible for at least one-quarter of house price increases (one-third at most) and that a decline in foreign capital inflow had been caused by the savings glut channel – of the two channels this is the one that had the most impact on US markets – which then had triggered an increase in housing demand. Moreover, by evaluating the domestic situation in one country and including both borrowers

[23]Favilukis et al. (2013) considered the period 2002–2007 for the Eurozone countries (17), Canada and South Korea, and1990–2010 for the US.

[24] Kaminsky and Reinhart (1999) investigated whetherthe 2007–2008 US subprime mortgage financial crisis was a truly unique phenomenon. Their sample covered 76 currency crises and 26 banking crises. Theyfound stunning qualitative and quantitative parallels to 18 previous post-war banking crises in industrialised countries. Their paper focuses on data most relevant to the recent US case, so they consider neither the plethora of emerging-market crises, nor industrialised-country financial crises. Theydocument that the majority of historical crises are preceded by financial liberalisation.

and savers, Justiniano, Primiceri and Tambalotti (2014) have adopted a unique stance that sets their study apart from previous ones.

Punzi and Kakuo’s (2015) study has two major differences from that of Justiniano, Primiceri and Tambalotti (2014) or indeed any other previous study. Firstly, it explains the US credit and housing boom by distinguishing between gross and net capital flows. Secondly, they take into consideration the issue of (government and corporate) securities entering the international market, which represents one of the most important channels of foreign capital inflow. In conclusion, they show that house price volatility can be explained by means of capital flowing in by way of banking rather than that which enters via issue of securities. In other words, Punzi and Kakuo (2015) depart from Justiniano, Primiceri and Tambalotti (2014) by demonstrating that the banking glut channel is more influential on markets than the savings glut channel.

In contrast, some studies claim there was no savings glut before the crisis. Chin and Ito (2007), Taylor (2008) and Jinjarak and Sheffrin (2009) all argue this point and claim that the instability in both current account and house price dynamics came about as an outcome of the economic policies in effect at the time. Kamin and Gruber (2007) suggest that Asian surpluses contributed to the late 1990s financial crises and confirm the savings glut hypothesis of Bernanke (2005).. However, in a study that included 86 developed and developing countries, Chinn and Ito (2007) concluded that, in the aftermath of the 1998 Asian crisis, some Asian countries had a current account surplus because of the post-crisis halt in investment in domestic markets rather than because of rapid increases in savings, as Bernanke (2005) argued via the savings glut hypothesis. They further concluded that, in advanced countries such as the US, budget balance is an important indicator of current account balance and the dynamics of current account in industrialised countries depend on how developed the housing and equity markets are.

According to their findings, a one percentage point increase[25] in budget balance would cause a 0.16 percentage point increase in current account balance. However, ‘…in research they conducted elsewhere industrial country current account behaviour seems be related with equity and housing market development, especially since the end of the 1990s. Based on those results, the more pronounced a country’s asset market boom, the more likely that country is to experience a deterioration of its current account. Since these booms were temporary, policies

[25] In other words, a one percentage point increase above the world GDP-weighted average. See Chinn and İto (2007).

to spur similar booms in East Asian countries would not provide a durable solution to problems posed by global imbalances' (Chinn and Ito, 2005).

Taylor (2008) shows that there was no global savings glut in the pre-crisis period and suggests that monetary policy implemented in the U.S. is responsible for housing price boom-bust cycles. In fact, although he did not examine the correlation between housing prices and current account imbalances, he has found the same results with Chinn and Ito (2007), while analyzing the reasons of the latest financial crisis in the U.S.

Departing from Chinn and Ito (2007) and Taylor (2008), as well as other previous studies, Jinjarak and Sheffrin (2009) use graphic theoretical methods to clarify the relationship between two dynamics and connect the structure of causal models to conditional independence relationships among the variables. They find some small evidence that capital account surpluses (deficits) trigger real estate prices directly in the US, Ireland and Spain but not in the UK. Although there is some evidence for the UK, it is not permanent). And they conclude that savings gluts do not drive price booms in real estate markets.

Gruber and Kamin (2007) examined both the emergence and the determinants of large current account imbalances for 61 developed and developing countries. In contrast to Chinn and Ito (2007) and Taylor (2008), their findings have supported the view of Bernanke (2005), i.e. savings glut hypothesis. They suggest that the Asian surpluses are source of the latest financial crises.

In summary, the existing literature comprises a great number of studies investigating the correlation between house prices and current account imbalances. Although different theoretical approaches are used, they reach largely similar conclusions: that there is a negative and/or strong correlation between house prices and current account balance.

In conclusion, a gap concerning the correlation between house price movements and current account imbalances exits in the literature. Very few studies examined the relationship between house price movements and current account imbalances by following the financial liberalisation approach (e.g. only Favilukis et al., 2012). There is no study on the effect of institutional features on the relationship between house price cycles and current account imbalances among previous studies focused on both dynamics.

2.5. Model Specification

In the first and third essays, the relationship between house prices and credit supply and current account imbalances is explored empirically. This necessitates a literature review on the determinants of these variables, and thus the following subjects were researched: (1) determinants of current account balance; (2) determinants of house price; (3) determinants of credit supply.

2.5.1. Determinants of Current Account Balance

In open economies, 'current account balance' is an external dimension of the economy. It is important in being both an indicator of a country's economic and financial credibility, of its international solvency, and of the success of its government's economic policies. According to the International Monetary Fund definition, current account balance is the sum of net exports of goods and services, the receipt of payment wages and interest earned on assets abroad (net primary income), and current payments for development aid and to international organisations (net secondary income) (IMF, 2016).

When the current account becomes unbalanced (i.e. there is a deficit or surplus in the current account), it is acknowledged that there is a problem in the economy and it is referred to as 'current account imbalance'. Current account deficits in an economy occur when total investment exceeds total savings (S < I). Current account imbalances are a cause for concern for policy-makers for several reasons. Firstly, 'imbalances' reflect degradation in domestic markets (e.g. some economies may experience a huge government deficit whereas others may witness to a high increase in private savings); secondly, some imbalances may be a reflection of intentional distortions (e.g. unfair trade practices or foreign exchange rate policies) with a negative impact on trade partners; thirdly, economies with a high deficit and increased foreign liabilities may experience a sudden loss of trust and financial problems, leading to massive disruptions of the international monetary and financial systems (see IMF, 2014). Since current account imbalances can have significant effects on the economy, identifying current account balance determinants is important for policy-makers.

However, a literature review reveals no single theoretical model to explain the determinants of current account balance. Instead, there is a number of theories, the main ones of which can be grouped into three categories: traditional theories, an intertemporal approach, and new open economy macroeconomics (NOEM).

Traditional Theories

Traditional theories – also known as non-optimising theories – focus on the demand side of the economy and view current account as a static balance between exports and imports (Singh, 2007; Obsfeld, 2001; Ardalan and College, 2005). Traditional theories accept the external balance as the situation in which there is no change in central bank reserves (i.e. a zero official settlement balance). Primary traditional theories are: the elasticity approach, the absorption approach and the monetary approach. The first two are linked to Keynesian approach.

The traditional elasticity approach recognises that imports and exports are independent of relative prices and that the trade balance depends on export and import price elasticities (or exchange rate). It proposes devaluing the currency in the case of current account deficit. The condition for devaluation is that the sum of the demand elasticities of imports and exports as an absolute value exceeds one. This is known as the Marshall–Lerner condition. It aims to answer the question of whether a change in the value of a country's currency (i.e. depreciation or appreciation) will improve the current account balance. The Marshall–Lerner condition is based on two assumptions: that trade is in balance, and in the economy the elasticities of supply are infinite.

The absorption approach highlights the fact that the relationship between a country's total income and expenditure affects its trade balance, and focuses on the effect of total income (or total expenditure) on trade balance. According to this approach, a change in imports and/or exports is due to a change in expenditure, and if total income is more than expenditure (i.e. exports > imports), the current account shows a surplus; otherwise, there is a current account deficit. The absorption approach suggests that current account imbalances can be eliminated by pursuing expenditure-switching policies (i.e. the exchange rate) or expenditure-reducing policies (i.e. domestic demand relative to foreign demand), depending on the reason for the trade imbalance.

The monetary approach put forward in the 1970s takes balance of payments into account, not trade balance. It sees the imbalance arising in the balance of payments as a monetary event, arguing that the supply and demand of money are important in the balance of payments. Recommended measures to deal with current account imbalances are similar to those of the absorption approach. For example, in the case of a current account deficit, expenditure should be reduced by means of income. However, unlike the absorption approach, which focuses on real incomes and expenditures, the monetary approach focuses on the consequences of inadequate or excessive demand for goods and services as well as on the consequences of money accumulation or decumulation.

Intertemporal Approach

The intertemporal approach, unlike classical theories, is a microfounded one, and accepts developments in current account as a result of intertemporal choices by firms, households and governments (Obstfeld and Rogoff, 1995, 1996; Végh, 2013). It predominantly focuses on inter-time frame factors (e.g. relative demand and relative prices), while exploring the causes of developments in current account. It emphasises the role of those variables that affect investment and savings decisions (Dbyka, 2017).

The intertemporal approach analyses developments in the current account with regard to the optimisation behaviours of economic agents and the gains from financial globalisation (i.e. consumption smoothing and efficient investment). It extends the permanent income hypothesis of the monetarist approach, as developed by Milton Friedman, to optimal external borrowing in open economies. According to this approach, the current account acts as a shock absorber against temporal shocks and makes consumption smoothing possible. On the other hand, as a monetarist approach, it assumes perfect flexibility of prices in domestic markets and highly advanced integration among economies.

The intertemporal approach differs from traditional approaches in which net exports are largely determined by current income levels and in which external interest payments are largely ignored. It provides a conceptual framework that covers important and interrelated policy issues such as equilibrium real exchange rates, external balance and external sustainability.

In addition, this approach suggests that changes in current account are the result of changes in utility maximisation, profit maximisation, saving decisions and forward investment decisions. Here, the response of current account and trade balance to productivity shocks depends on the strength of savings and investment decisions. While an increase in investment depends on expected future increases in capital stock and total revenue, savings decisions are determined by a consumption smoothing motive. Continuous productivity increases cause to rise the likelihood of a reduction in savings. If the productivity shocks are long enough, current account and trade balance are countercyclical. The two main pillars of the intertemporal approach are consumption smoothing and being equal to the marginal product of capital on a global scale. Whenever a country's current income falls below constant income, or if the return of domestic capital exceeds the cost of borrowing from the international market, that country will need to borrow. The amount of debt is determined by the need to satisfy the long-term budget constraint and the return on capital.

New Open Economy Macroeconomics

A recent model is new open economy macroeconomics (NOEM), developed with the aim of explaining the determinants of the current account. It is also called portfolio choice model. This micro-based model is a synthesis of Keynesian nominal rigidities, the intertemporal approach to open economy dynamics, and the market structure of international trade (Obstfeld 2001). It provides an example of how to build 'a dynamic sticky-price general equilibrium model' while maintaining both the theoretical understanding of modern dynamic macroeconomics and the empirical logic of Keynesian models.

Kraay and Ventura (2000) presented 'the new rule of the current account' in this context. They interpret this rule as a portfolio-choice model of the current account. The new rule means that the response of the current account to temporary shocks is equal to the change in savings caused by the shock, multiplied by the net foreign asset/GDP ratio. In other words, the sign of the current account's response depends on the sign of the net foreign asset position.

Thus, if the investment risk is high and there is a diminishing return on capital is poor, the new rule is a natural implication of the intertemporal approach. According to the portfolio approach, capital movements are determined by agents' decisions about portfolio allocation. Therefore, investment in foreign assets is a reflection of the need for portfolio diversification. On the other hand, in the intertemporal approach foreign capital movements are based on consumption smoothing, which is determined by equality between savings and marginal products of capital between countries. If there is a constant return to scale, the marginal products of capital will not be related to the size of the capital stock. In this case, the portfolio allocation will determine investment and current account balance.

In the existing empirical literature, we see that all existing determinants of current account balance are based either on the intertemporal approach or the portfolio approach. In fact, most of the work on this topic has used the latter (e.g. Chin and Prasad, 2003; Gruber and Kamin, 2009; Dbyka, 2017).

In the literature that adopts the intertemporal approach, there is a large degree of consensus about the determinants of current account balance, being largely based on the model of Chin and Prasad (2003). They consider GDP per capita, growth rate, general government fiscal balance, demographic factors (e.g. population growth, age dependency ratios [young and old], trade openness, net foreign assets and fiscal development) (e.g. Chinn and Prasad, 2003; Guber and Kamin, 2007; Chin and Ito, 2008; Ca' Zorzi, Chudik and Dieppe, 2012; Cheung, Furceri and Rusticelli, 2013).

Common features of existing studies are: they generally use the same estimation technique (panel regression); they use the same dependent variable (i.e. current account balance/GDP); they make medium- and long-term estimations at cross-country level rather than country level; they consider a large number of countries with different development levels (i.e. developed, emerging and developing economies); and their findings largely show economic growth rate, government fiscal balance and population growth to be the main determinants of current account balance.

The main differences are: variations in sample size and period considered; choices about additions of new variables to the model of Chin and Prasad (2003), such as oil balance, real exchange rate, financial openness, total investment and institutions (e.g. Gruber and Kamin, 2007; Cheung, Furceri and Rusticelli, 2013); choices about omissions of variables from the Chin and Prasad model (e.g. Campa and Gavilla, 2011; Belke and Dreger, 2013); or use of different indicators entirely (e.g. private credit to GDP ratio as an indicator for financial development instead of money supply [M2] to GDP ratio, or population growth rate instead of age dependency ratios) (e.g. Chin and Ito, 2008; Ca' Zorzi, Chudik and Dieppe, 2012).

Chinn and Prasad (2003**)** focused on medium-term fluctuations by considering 89 developed and developing countries, and examined the relationship between current account balance and the macroeconomic variables that determine balance of savings and investment in the economy. They include current account balance/GDP in their model as a dependent variable, with the independent variables being relative income (per capita income), relative income squared, growth rate, general government fiscal balance, age dependency ratio (old and young), trade openness, terms of trade volatility, net foreign assets and financial deepening. Relative income and relative income squared were considered in order to perceive differences between the development level of countries and accessibility to international markets, respectively. They found a positive relationship between per capita income (i.e. relative income) and current account balance in the whole sample including both developed and developing economies; and they found that, in developing countries, terms of trade and financial deepening have a significant effect on current account balance. Chinn and Prasad's (2003) study is a seminal work, and their pooled OLS estimator has become standard.

Chinn and Ito (2007, 2008) and Guber and Kamin (2007, 2009) followed Chinn and Prasad's (2003) approach. They diverged in considering the private credit/GDP ratio instead of money supply (M2) as an indicator of financial deepening, and also added some new financial variables to the model (e.g. financial openness of the economy and certain institutional variables) to explain both the degree of heterogeneity and differences in political stability in domestic financial markets. Chinn and Ito's first study explores current account imbalances on a global scale. Their second discusses whether differences in financial development can explain current account imbalances and whether current account surpluses of developing countries can explain the current account deficit of the US. In this study, they also evaluated whether differences in return on assets can explain the structure of foreign capital movements.

Gruber and Kamin (2007) covered 61 developed and developing countries, and their results show that: the Asian crisis and Asian current account surpluses can be explained by the standard determinants of current account balance; that financial crises are linked to high current account imbalances; and that the global savings glut hypothesis overlaps with the US case. In their second study (Gruber and Kamin, 2009), they estimated the model of their earlier study by including indicators for the development of capital markets (e.g. stock market cap/GDP, stock market turnover, stock market cap and private bond market cap/GDP). Their findings show that: different quantity measures of financial development have no effect on current account balance in the direction expected; and that the surplus of developing economies cannot explain the US current account deficits, but does support the global savings glut hypothesis. On the other hand, Chinn and Ito (2007, 2008) also tested the dominant views on the global savings glut hypothesis as an explanation for current account imbalances by considering 89 countries. They reached a different conclusion to that of Gruber and Kamin (2007, 2009), despite using a largely similar current account balance model. They concluded that Asian countries' surpluses were not due to over-saving, but to decreasing investment after the Asian crisis; hence, current account imbalances could not be explained by the global savings glut hypothesis.

Campa and Gavilla (2011) and Belke and Greger (2012) focused on the determinants of current account balance in the Eurozone. Unlike previous studies, they did not use the standard current account balance model and considered only a few macroeconomic variables.[26] Campa and Gavilla (2011) evaluated fluctuations in current account balance among the Eurozone countries, the sustainability of the current account deficit and the structural change related to use of the

[26] In Campa and Gavilla's (2011) model, the determinants of current account balance are investment, public and private consumption, foreign assets stock, foreign exchange rate and world short-term interest rates, while Belke and Greger's (2012) model consists of net foreign capital inflows, foreign exchange rate, government debt and interest rates.

common currency. Their findings show that expectations about future income and relative prices are significant for current account balance over time in many of the Eurozone countries. (e.g. Belgium, France, Italy, Portugal and Spain). In other words, desire of smoothing consumption affects their current account balance, especially after the introduction of the common currency. However, these findings are not valid in some countries (e.g. Austria, Finland). Belke and Greger (2012) applied a different technique (VECEM). Their analyses reveal that, in the Eurozone: differences among countries in terms of current account balance increased after the introduction of the common currency; implementation of common monetary policy is difficult; and competitiveness is the basic explanatory factor behind current account deficits.

Yan (2005) and Yan and Yang (2012) investigated the causal relationship between current account and financial account. Yan (2005) tested this causality for developed and developing economies using a model consisting of fewer macroeconomic variables than the standard current account model. In contrast, Yan and Yang (2012) added more financial variables to the standard model, as well as energy variables (e.g. oil prices and oil production and consumption) and institutional variables. They achieved results partly similar to those of previous studies. The findings of Yan (2005) suggest that foreign capital inflows in developed economies serve to finance the current account, whereas in emerging economies they cause current account imbalances owing to the fact that financial systems in these countries are not sufficiently developed to direct these funds. The results of Yan and Yang (2012) show no causality between foreign capital inflows and current account in developed economies, yet a causal relationship in emerging economies, and in this relationship foreign direct investment plays a dominant role.

Ca' Zorzi, Chudik and Dieppe (2012), in a departure from all previous studies, used Bayesian Averaging of Classical Estimates (BACE) methodology for the first time in this context and examined the static relationship between a large number of variables (13 regressors) and current account. In their study, which included 77 developed and developing countries, they aimed to identify a model that best predicts the determinants of current account balance in the pre-crisis period, taking into consideration many alternative model specifications. Their results show that selected variables largely work in the same way for both developed and developing countries.

In their study of 94 countries, Cheung, Furceri and Rusticelli (2013) examined the relationship between both structural and cyclical factors and current account balance in the medium term. They included in their analysis more financial development indicators (e.g. stock market capitalisation, market turnover and private bond capitalisation) like Gruber and Kamin (2009). They concluded that global external imbalances can be – to a large extent – explained by structural factors (i.e. oil dependency, financial development, demographics, stage of economic development, fiscal deficit and regulatory quality); that foreign capital inflows can reduce precautionary saving in economies with an underdeveloped financial sector; and that the welfare effect in countries that have experienced an asset price boom could contribute to an increase in their current account deficit.

Gossé and Serranito (2014), who focused on the long-term determinants of the current account balance of 21 OECD countries, used a similar technique (panel VECEM) to Belke and Dreger (2013) but instead calculated excesses in current imbalances and estimated the speed of convergence with the long-term target. Their findings show that the long-term and short-term determinants of current account balance differ, with the competitiveness effect and oil balance being the main determinants in the short term, and fiscal balance and financial development level in the long term.

Alfosa and Silva (2017) examined the components of cyclicality and non-cyclicality in Portugal’s current account balance by taking into account as determinants financial factors (e.g. three-month Euribor rates, the share of monetary financial institutions’ cross-border holdings of euro-area sovereign debt securities, a volatility index and a composite indicator of systemic stress) and domestic factors (e.g. income, employment and compensation of employees), as well as external factors. Their results show Portugal’s current account balance to have been adversely affected by the 2009 EMU (Economic and Monetary Union) crisis, developments in labour markets, and European systemic risk.

Although Dayak (2017) used similar techniques to those of Ca’ Zorzi, Chudik and Dieppe (2012), he considered a larger sample (101 countries). His model also included institutional factors as per Gruber and Kamin (2007, 2009), Chinn and Ito (2007, 2008), Yan and Yang (2012), Cheung, Furceri and Rusticelli (2013). Unlike previous studies, he focused on the importance of intratemporal factors (i.e. relative demand and real exchange rates, etc.) and intertemporal factors (e.g. stage of development, fiscal balance, demographics, etc.) as determinants of current account balance, investigating the relative importance of these factors in developments in current account balance.

They found: that intertemporal factors are crucial in the external balance; that fiscal balance, investment rate and level of development are highly significant drivers of current account; that in higher-income countries investment and government expenditures are financed by external sources; and that the importance of institutional factors is more evident in developing countries than in developed economies. This confirms previous studies’ findings that the intertemporal approach better explains developments in the current account.

Using a dynamic form of the intertemporal current account model in the case of EU countries, Ban (2018) explored key determinants of current account balance, and added foreign exchange rate to the model, following Campa and Gavilla (2011) and Belke and Dreger (2013). She departs from previous studies in considering the structural budget balance variable as well as the economic crisis variable. Her findings show: that house prices and fiscal balance have a significant impact on current account balance in EU member countries; that in countries with low income but high investment current account deficits are higher than in developed countries; and that house prices and current account deficits move in the same direction.

In conclusion, the current empirical literature confirms the intertemporal approach for developed countries and shows that financial account serves to finance current account (see Fry, 1995; Wong and Caranza, 2009; Sarısoy ve Guerin, 2003; Yan, 2003; Yann and Yang, 2012). Thus, in the third essay (Chapter 5), because the sample for empirical analysis consists of 14 developed countries, the intertemporal approach is used.[27] It also follows Chinn and Prasad's (2003)specification of the current account balance model, in line with the majority of previous studies (e.g. Goober and Kaman, 2007; Chin and Ito, 2008; Ca' Zorzi, Chudik and Dieppe, 2012; Cheung, Furceri and Rusticelli, 2013; Dbyka, 2017).Where it departs from Chinn and Prasad (2003) is in the inclusion of private credit to GDP ratio instead of money supply (M2) to GDP ratio, as per Chinn and Ito (2007, 2008), Yan and Yang (2012), Ca' Zorzi, Chudik and Dieppe (2012), Cheung, Furceri and Rusticelli (2013) and Dbyka (2017).In this research, the current account equation also differs from previous studies except for Ban (2018) and covers house prices like her. In contrast to all previous studies with regard to current account balance model specification, our current account model covers only the strongest explanatory variables of current account balance (i.e. economic growth, population growth, fiscal balance and financial development).[28]

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[27]Empirical studies confirm the intertemporal approach for developed countries and show that financial account serves to finance current account. See.Fry, 1995; Wong and Caranza, 2009; Sarisoy ve Guerin, 2003; Yan, 2003; Yann and Yang, 2012.

[28]Before deciding the determinants of current account balance equation of our simultaneous equations model, we applied panel regression methodby considering all determinants of current account balance in the existing empirical literature that are income per capita, economic growth, population growth rate, government fiscal balance, net foreign assets, financial development, oil balance and foreign exchange rate**.** The estimation results are largely consistent with those of previous studies in related to the signs of the estimated coefficients and their significance statistically (See Appendix 5.14). Then, a few were chosen as the determinants of current account balance. They are the strongest explanatory variables of current account balance.

2.5.2. Determinants of Housing Price

The housing sector is important in many economies, not least because it forms a part of capital stock as well as having strong links with the whole economy(e.g Malpezzi, 1996; ECB, 2003; Muellbauer and Murphy 2008; Caldera and Johansson, 2011).In addition, housing is also important for the private sector (i.e. households and companies) because of being an important part of private sector value and because housing-related expenditures (e.g. housing loan payments or rents) make up a significant proportion of total household expenditure. Therefore, any developments in the housing market can be significant for the economy, affecting total demand, inflation, etc. This has spurred investigations into the micro and macro connections of housing markets with the economy. The housing market model consists of three equations, relating to: housing demand, housing supply and housing stock (see Chen and Patel 1998, Meen, 2001, 2012). The housing demand equation contains the determinants of house prices (e.g. mortgage loans, mortgage rate, population, etc.) which empirical studies confirm as being important. The housing supply equation includes supply of new housing. The third equation shows how new housing supply and housing stock change over time. In empirical examinations of the relationship between the housing sector and the economy, the housing demand equation – that is, house prices and their response to developments in the economy – is frequently used because house prices are the main transmission mechanism between the housing sector and the economy (Meen, 2001).

In the literature, it can be observed that in general three house price models are used in empirical analysis: hedonic, conventional and life-cycle housing price models.

The hedonic house price model demonstrates the implicit prices of housing characteristics. In this model, housing is considered a heterogonous good and its price is determined by the structural features of the house (e.g. number of rooms, size, and age) and locational and neighbourhood-related features (e.g. neighbourhood services, socio-economic aspects) (see Can, 1992; Wing, 2003; Owusu-Ansah, 2011). There are two types of hedonic house price model: standard and spatial. In the standard model, the price of a house in one location is assumed to be independent of the price of a house in another. In the spatial model, the price is assumed to depend on the prices of houses in nearby locations (Xiao, 2017). However, it is not possible to observe most of the housing characteristics directly, so the hedonic house price model is used to estimate the marginal contribution to house price of each property and the features of its location.

The conventional house price model is based on the neoclassical approach, in which house prices are determined by the law of supply and demand, and the intersection of housing supply and demand determines the equilibrium of house prices and quantity. In this case, it is expected that any factor affecting housing supply and demand will also affect house prices. The determinants of house prices are simply derived from a reduced form of housing supply and demand functions.

The life-cycle house price model is derived from the life-cycle framework,[29] in particular the consumption and savings life-cycle model as extended to the housing sector.[30]In this model, the user cost of capital is the main determinant of house price and it represents the price of housing services. Other determinants are household income, household marginal tax rate, market interest rate, purchasing price of housing, new housing purchases, new housing loans, depreciation rate on housing, inflation rate and net non-housing assets. In fact, the empirical studies show that it is difficult to distinguish empirically between conventional housing price model and the life-cycle housing price model since both model include similar housing price determinants regressors (Meen, 2012).

In the empirical studies, we find considerable consensus on the theoretical framework of house prices, but differences between them with regard to the variables selected as determinants. The existing empirical literature on house prices includes cross-country (e.g. Himmelberg, Mayer and Sinai, 2005; Agnello and Schuknecht, 2011; Beltratti and Morana, 2010) and country-level analyses (e.g. Case and Shiller, 2003; Taltavull de La Paz, 2014; Chow and Niu, 2015**)**.

Chen and Patel (1998) explored the relationship between house price and its determinants using the tools of a VAR model (e.g. Granger causality test, variance decomposition and impulse responses function). They found, in Taipei, household income, short-run interest rates, stock price index, construction costs and housing completions to be the main determinants of house prices. All variables were also found to be cointegrated using Johansen's test for cointegration.

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[29] The life-cycle framework has its roots in the infinite horizon models of Ramsey (1926), Friedman (1957), Fisher (1930) and Modigliani and Brumberg (1956). Since the 1950s, developments in the framework have considerably increased its coherence and depth such that its modern version provides a guide for modelling many life-cycle choices (e.g. consumption, savings, labour supply, human capital, marriage, fertility and education), while taking account of uncertainty in a rigorous way. In essence, the life-cycle framework simply states that by using current available information as best they can economic agents make sequential decisions to achieve a stable goal. The life-cycle framework allows for many possible empirical models which can explain many aspects of behaviour. The challenge is to capture important features of intertemporal decisions and develop models from within the life-cycle framework (see Browning and Crossley, 2001).

[30] One problem here is that, in a conventional life-cycle model, increases in credit supply do not necessarily boost housing demand in conventional borrowers who are not credit-constrained. But it can bring in new markets, e.g. second homes (Meen, 2001, 2012).

Their results also show causality between house prices and these five determinants and reveal that the larger part of the error variance (24%) can be explained by the housing demand side, including income, interest rates and stock price index.

Meen (2002) investigated whether there are differences in behaviour in real house prices in the UK and the US markets and, if so, sought to determine if these differences were not real but stemmed from different methodological approaches. For this purpose, he assumed the supply of housing to be constant or at least not elastic due to land constraints. As such, house prices are determined by the housing demand side (e.g. household income, long-term interest rate, housing loans). Despite using the same method, vector error correction model (VECEM), he reached a different conclusion from that of Chen and Patel (1998), who showed no cointegration between the US and the UK markets. Meen (2002), in contrast, found the two markets to operate in very different ways with significant differences in terms of tenure structure and mortgage markets.

Case and Shiller (2003) looked for the reasons behind the US house price bubble and considered household income and interest rates as determinants of house prices. One finding is that income and interest rates are important factors in movement of house prices. Another is that decreasing interest rates reduce households' cost of borrowing significantly and increase their ability to afford property in house price boom states (e.g. Massachusetts and California). They concluded that growth in income alone can explain virtually the entire increase in house prices in most US states.

Examining the effect of financial liberalisation on the relationship between house prices and monetary policy, Iacoviello and Minetti (2003) presented a small open economy model that was subject to credit constraints. They tested this relationship using the VAR model in their analysis of three European countries (Finland, Sweden and the UK), all highly affected by financial liberalisation in the 1980s. In their model, GDP, housing loans and total loans lent by both banks and the non-banking sector, mortgage rates and short-term interest rates were all taken into account as determinants of house prices. Their findings show that house prices in the UK and Sweden are sensitive to interest rates and that this sensitivity increases with financial liberalisation. Their results confirm that housing markets play a crucial role in the transmission of monetary policy to the economy.

Tsatsaronis and Zhu (2004) explored macroeconomic factors that impact on house prices and the effects of mortgage finance systems on house price and its determinants. They examined cross-country differences and showed that the relationship between house prices and credit growth is very strong in many countries. They suggest that the monetary policy being implemented is critical for the trend in house prices and emphasise the significance of inflation, interest rates and credit supply. Monetary authorities, they argue, should therefore closely observe developments in housing value.

Himmelberg, Mayer and Sinai (2005) assessed developments in house prices and the underlying factors determining housing demand, considering major cities in the US. Their findings indicate that developments in house prices are a local phenomenon and that long-term interest rates, expected house price appreciation, taxes and expected inflation were the main factors behind the volatility in house prices. In addition, like Iacoviello and Minetti (2003), they emphasise that house prices are particularly sensitive to long-term interest rates.

Égert and Mihaljek (2007) examined the determinants of house prices in eight Central and Eastern European (CEE) and 19 OECD countries by applying a mean group panel dynamic OLS estimator. They considered conventional factors (e.g. GDP per capita, real interest rates, housing credit and demographic factors) and transition-specific factors (e.g. institutional development, housing finance and quality effects) as house price determinants. Their findings show that conventional fundamentals have a significant impact on house prices, but that the magnitude of impact differed between the CEE and the OECD countries. In addition, they found house prices in the CEE countries to be determined largely by the underlying conventional fundamentals and some transition-specific factors.

(2008) investigated the effect of macroeconomic factors on house prices in 20 metropolitan areas in the US. Their findings indicate that the size of the metropolitan statistical area, per capita income, population growth and unemployment rate drove house prices before 2004, but these factors are not significant in influencing house prices in this date and later. They also found that mortgage rates and regulation relating to land had no significant effect on house prices. Coleman, Le-Cour and Vandell (2008) concluded that, rather than being the cause of the house price bubble, the subprime mortgage market can be seen as a joint outcome, along with house price increases, of the changing regulatory, political and institutional environment after late 2003.

Muellbauer and Murphy (2008) sought to answer the question of how far house prices might fall, a key issue for households, policy-makers and investors, by focusing on the role of the credit channel in transmitting house price fluctuations to the economy. Their study, in which they followed the spatial approach, examined the interaction between housing markets and the economy. The spatial approach determines housing demand by means of real house prices, real income and other drivers (e.g. real and nominal interest rates, demographic factors and measures of credit conditions), thus determining house prices by supply and demand interactions at a spatial level. Their proposed determinants of house prices are income, demographics, credit availability, interest rates, housing stock and lagged appreciation; they argue that there is little agreement on the determinants of housing on the supply side, especially new housing construction. They also emphasise that institutional differences affect the linkages between house prices and economic activity.

Agnello and Schuknecht (2011) examined high and persistent deviations in house prices over the long run. In an analysis covering 18 industrialised countries in the period 1987–2007, they applied the random effects panel probit model. For dating procedure, they used the so-called triangular methodology initially proposed by Harding and Pagan (2002). They concluded that developments in the magnitude of money and credit supply, as well as in interest rates in domestic and foreign markets, were a significant cause of deviations in house prices (i.e. house price boom–busts), along with financial liberalisation.

Adams and Füss (2010) and Bouchouicha and Ftiti (2012) investigated the link between the real estate market and macroeconomic factors (e.g. economic activity, money supply, construction cost, interest rates). They used different techniques as well as different samples. Adams and Füss (2010) examined 15 OECD countries using cointegration analysis, while Bouchouicha and Ftiti (2012) considered only the UK and the US and applied a new approach based on a dynamic coherence function (DCF). Distinct from previous studies, Adams and Füss (2010) separated the effect of short-term interest rates on house price dynamics from that of long-term interest rates. Their findings show that economic activity and interest rates affect house prices more than other macroeconomic factors, and that short-term interest rates adversely influence housing demand because of their impact on mortgage rates as well as on financing costs for construction firms.

Bouchouicha and Ftiti (2012) focused on three distinct markets (residential housing, commercial real estate and securitised markets) in the UK and the US and explored the degree of dependence between these markets and the macroeconomy (especially the monetary environment). Their model includes economic activity, money supply, employment, inflation, and long- and short-term interest rates as the determinants of prices (or valuation) in the three markets. Their results show, despite differences between the UK and US markets in relation to volatility of prices (or returns): a common trend in real estate markets, particularly over the long term related to the determinants of prices; a divergence in the interaction between real estate markets in both countries in the short run, which is more pronounced in the securitised markets;

and real estate prices in the US being more dependent on short-term interest rates than those in the UK. As regards differences, regarding transmission channels during real estate market crises, in the UK only the wealth effect is important whereas in the US both housing expenditure and wealth channels are significant. Also, the UK and US markets responded differently to institutional shocks.

Unlike previous studies, Beltratti and Morana (2010) looked at international house prices and investigated the drivers behind them as well as the effects of housing price shocks on the real economy. Their model includes eleven macroeconomic variables (GDP, private consumption and investment, CPI [consumer price index] inflation, short- and long-term interest rates, monetary aggregates, real house prices, real stock prices, real effective exchange rates. The study covers the US, Japan, the Euro-12 area, the UK and Canada and uses a factor-augmented vector autoregressive (FVAR) model. Their findings indicate that: house prices moved concurrently at an international level during 1980–2007 and that this co-movement is due to both macroeconomic and housing market factors, such as economic activity; that nominal variables and stock returns are important for returns associated with owning houses; that there is a two-way relationship between house prices and macroeconomic development, with consumption and output showing in general a weaker reaction than that of investment to real house price shocks; that real house price shocks play a larger role in the business cycle than stock market shocks; and that, while the average contribution of housing price shocks is close to 20% of global fluctuation, global macroeconomic shocks account for, on average, about 40%.

Ooi and Te (2012**)** investigated the price adjustment of existing houses to a marginal change in the housing stock at the aggregate level in Singapore. They used a VAR model and focused on the private apartment market. Their VAR model includes housing stock, the marginal supply of private non-landed residential properties, average income growth and change in real interest rates. Their findings show an inverse relationship between house prices and marginal supply in primary housing, but not a significant one statitically. The results also indicate that when new housing is physically completed, such new stocks are only accepted as competitors; in addition, new housing stock has a contagion effect on house prices in a positive way.

Nenji, Brooks and Ward (2013) examined the effects of macroeconomic factors on house prices in US real estate markets under different regimes (‘boom’, ‘steady-state’ and ‘bust’). They were the first to use a three-state Markov switching model to examine the relationship between macroeconomic factors and house prices, and were the first to discuss the effectiveness of policy tools used to escape the housing price boom–bust cycle. Their model includes GDP, inflation, disposable income growth, short-term interest rates and interest rate spread as macroeconomic variables. Their findings show that the sensitivity of developments in house prices to changes in the macroeconomy depends on the regime: in the steady-state and boom periods, inflation and short-term interest rates have a greater effect on house prices, but in the bust period this sensitivity disappears. They also highlight the impact of policies on the relationship between macroeconomic variables and house prices.

Chow and Niu (2015) investigated the rapid increase in the relative price of housing in cities in China and aimed to explain the drivers of urban house prices by following a conventional supply and demand approach. When testing the model by applying the two-stage least squares (2SLS) technique, they reveal that increases in house prices in urban residential areas can be satisfactorily explained by housing supply and demand factors, i.e. demand determined by income and supply determined by cost of construction. In addition, they found that, in China, the price elasticity of demand (1.1) is larger than the price elasticity of supply of the total housing stock (0.5).

Arestis and Martinez-Carrascal (2016) looked at the relationship between house prices and current account imbalances, and, focusing on the role of monetary and fiscal policies in this relationship, presented a theoretical framework along with empirical evidence. In laying out their theoretical framework, they followed a housing supply and demand approach, considering disposable income, housing loans, housing investment, mortgage rates and taxation on property as housing price determinants. The results empirical analysis covered 17 OECD countries show that investment is an important determinant of house price increases and that there is a relationship between house prices and current account imbalances. They also found monetary policy to be an important tool in controlling house prices.

Bahmani-Oskooee and Ghodsi (2018) explored the determinants of house prices in the US by considering each state in turn. Their aim was to test, using both panel and time series models, whether economic fundamentals have symmetrical or asymmetrical impacts on house prices. Their model uses income and mortgage rate variables as house price determinants. They depart from previous studies in separating increases in interest rates from decreases, doing the same for income, and use nonlinear models, which symmetric cointegration and error-correction models require. Their main finding is revealing that, in both the short and long run, changes in income and interest rates have asymmetrical impacts on house prices in nearly all states. They also concluded that interest rates and income significantly affect house prices in the short run in almost all states but have a long-run impact in only 30 states.

Some house price studies have focused only on the supply side of housing (e.g. Caldera and Johansson, 2013; Taltavull de La Paz, 2014; Lerbs, 2014; Gu and Michael, 2015). Caldera-Sances and Johasson (2013) investigated the responsiveness of housing supply to changes in prices, and estimated long-run price elasticity of new housing supply in 17 OECD countries. The long-run price elasticity of new housing supply is estimated separately for each country and their model is based on a stock-flow model of the housing market. This model considers the dual role of housing as a capital investment and a consumption good and it distinguishes between the stock of housing and the flow of housing investment. It includes real income, real interest rates, the stock of housing, demographic variables, real residential investment and residential construction costs. The findings show that, in the short run, growth in house prices has a significant positive effect on growth of investment, while other explanatory variables (e.g. changes in construction costs and population) do not typically influence changes in housing investment. They conclude that cross-country differences in the long-run price responsiveness of housing supply can be ascribed to policy factors (e.g. land use and planning policies) as well as non-policy factors (e.g. constraints on land use and density of population) and that elasticity of housing supply can have multiple differentiated impacts on developments in housing markets and the economy.

Taltavull de La Paz (2014) examined the role of housing supply in developments in both house prices and housing starts since the beginning of the 2007 credit crunch. The study analyses housing supply, and measures the effect of the credit crunch on the Spanish housing market from the supply side. The findings show that new housing supply elasticities are very stable in Spain during all periods, but vary in response at a regional level, and that building decisions are guided by a non-market-oriented mechanism. Another finding is that, due to high sensitivity to small changes in prices, the 2007–2012 housing market shock dramatically reduced house-building in Spain.

Lerbs's (2014) work focuses on the determinants of new single-family housing supply in Germany's local housing markets and estimates the price elasticity of new housing supply. His model includes house prices, land and construction costs, marginal profitability and local permit rates. This work differs from previous studies in that sub-markets are considered and different techniques (i.e. dynamic stationary panel data techniques) are used. One finding indicates important differences in average supply elasticities across Germany. Another is that the supply of new housing, in relation to the price of existing homes, is not elastic in rural areas and also less elastic in urbanised regions. The analysis indicates that new single-family housing supply responds to house price changes in cities of over 100,000 inhabitants.

Gu and Michael (2015) examined the determinants of housing supply and the relationships between land supply and housing supply in Shanghai, China. Using multiple linear regression analysis, they tested a model that covers house price index, housing construction, house sales, housing investment, construction costs and GDP variables. They found that, while land supply has an impact on housing supply with a three-year time lag, the impact of construction costs and house prices has only a one-year time lag.

In conclusion, the existing literature combines to reiterate that demand- and supply-side factors both affect house prices. The demand-side factors are household income, mortgage rates, credit availability and demographic factors, while the supply-side variables are construction costs, user fees, existing housing stock, land costs, housing depreciation, transaction costs, credit availability and the price of the asset itself (e.g. Meen, 2001; Agnello and Schuknecht, 2011). The empirical literature shows that income, interest rates, credit supply and housing supply on the whole account for most of the variance associated with house prices, and therefore it is these variables that have a strong effect on house prices (e.g. Himmelberg, Mayer and Sinai, 2005; Bahmani-Oskooee and Ghodsi, 2016). Since the conventional approach (i.e. supply and demand) has been widely used in prior empirical studies, this approach is also followed in this thesis to specify the house price model in the empirical analyses of Chapters 3 and 5.[31]

[31] In this thesis, the empirical literature based on the hedonic model has not been extensively reviewed, because our research questions are not related to the marginal contribution to house price of each property taken individually orthe location thereof.

2.5.3. Determinants of Credit Supply

The development of the financial sector is considered an important contributor to the economic development (e.g. economic growth, job creation and poverty reduction). Indeed, Becerra et al. (2012) define financial development as the presence of stable and deep credit markets in an economy. This has led to many empirical studies taking credit markets (e.g. size of credit supply, accessibility of services and interest rate spread) as indicators of the development of the financial sector (e.g. King and Levine, 1993a; Fry, 1995; Chin and Ito, 2007; Beck et al., 2008). Credit markets are where intermediation between lenders and borrowers is carried out, and these markets also include debt offerings, such as notes and securitised obligations. The extent to which financial intermediaries (e.g. banks, mutual funds and mortgage companies) supply funds to borrowers and how they determine lending amounts is important for an economy. This has led to a vast literature focusing on credit markets and their effects on the economy in different dimensions (e.g. Bernanke and Gertler, 1995; Levine, Loayza and Beck, 2000; Calza, Moncelli and Stracca,2013). Some studies focus on only the determinants of credit supply (e.g. Stepanyan and Guo, 2011; Gözgör, 2016), while others examine the different dimensions of the relationship between credit markets and the economy, such as the relationship between monetary policy and credit supply or bank lending (e.g. Bernanke and Blinder, 1988; Calza, Gartner and Sousa, 2003) or the relationship between house prices and bank lending (e.g. Oikarinen, 2009; Nobli and Zollina, 2017).

In the existing literature, total credits to the private sector from financial intermediaries (e.g. Stepanyan and Guo, 2011; Imran and Mohamed, 2013) or credits lent in sub-markets of the financial sector, such as housing loans (e.g. Bardhan and Edelstein, 2007; Kutlukaya and Erol, 2016) are used as indicators of credit supply in the economy. Some of these studies are conducted at country level (e.g. Bernanke and Gertler; 1995; Shahbaz, Shamim, and Aamir, 2010) and some at cross-country level (e.g. Calza, Gartner and Sousa, 2003; Djankov, McLiesh and Shleifer, 2007). Chosen samples also vary among studies, with some covering only developed economies (e.g. Wolswijik, 2006; Al-Shammaria and El-Sakkab, 2018), some developing economies (e.g. Stepanyan and Guo, 2011; Gözgör, 2014) and some both (e.g. Wornock and Wornock, 2008; Djankov, McLiesh and Shleifer, 2007).

Bernanke and Blinder (1988) examined the role of the credit channel in the economy via the standard credit model, a model that includes two indicators: economic activity and short-term interest rates. Regardless of indicator, the results of their empirical analysis were similar. In their study, which examines how monetary policy affects the economy, they suggest that the conventional view is not sufficient to explain this effect, assigning bank liabilities a central role in the monetary transmission mechanism without considering bank assets. They therefore looked at the federal funds rate and its spreads to treasury securities. Their findings show that in order to ascertain the effect of monetary policy a more symmetrical treatment of money and credit is feasible.

Kashyap, Stein and Wilcox (1993) and Bernanke and Gertler (1995) focused on the importance of the credit channel in the economy using the standard credit model. Kashyap, Stein and Wilcox (1993) examined whether the credit supply channel functions as the channel of the monetary policy transmission mechanism. They examined not only how liabilities and bank assets reacted to change in monetary policy, but also noted the reaction of commercial papers, which are important in a bank's external finance. They added long-term interest rates, credit lending, issues of commercial paper and prime commercial paper spreads to the standard credit model. The results of their empirical analysis indicate that a change in monetary policy affects the composition of a bank's external finance and subsequent investment in the economy.

Bernanke and Gertler (1995), in contrast, explored the response of the US economy to monetary policy changes employing the vector autoregressive (VAR) method. They followed the financial accelerator approach and considered the credit channel covering both the balance sheet channel and the bank lending channel. As per previous studies, they used the standard credit model but included variables such as interest rate spreads, terms of lending, firms' financial condition, corporate cash flows and mortgage burden in the standard credit model. Bernanke and Gertler (1995) show that the conventional analysis is not sufficient to explain the transmission of monetary policy to the economy and that the credit channel is important for monetary transmission. They also conclude that monetary policy affects household expenditure on durable goods (e.g. housing) via both the balance sheet and bank lending channels of the credit markets.

As described, Bernanke and Blinder (1988), Kashyap, Stein and Wilcox (1993) and Bernanke and Gertler (1995) all examined the role of the credit channel in the economy using the standard credit model covering the two indicators of economic activity and short-term interest rates. Although each study added its own variables, the results were similar.

The aim of Fase (1995) was to predict a structural two-equation model for the commercial credit markets in the Netherlands. In testing his model, which covered commercial loan demand and lending rate equations, his assumption was that the stock of outstanding bank credit is determined by the demand side. His model includes many more variables than those of Kashyap, Stein and Wilcox (1993) and Bernanke and Gertler (1995), such as the stock of outstanding short-term debt of the private sector, amount of expected sales, price level, and returns of long-term government bonds, as determinants of the short-term credit demand of the private sector (i.e. households and firms) as well as the share of short-term deposits of the domestic sector in the banking system's total liabilities, and money market rate as the determinant of lending rate. In general, his findings support the importance of the credit channel, as per Kashyap, Stein and Wilcox (1993) and Bernanke and Gertler (1995), and show that, in many countries, monetary policy has shifted from monetary targeting to credit targeting as an effective tool of credit control.

The common features of two studies by Calza, Gartner and Sousa (2003) and Calza, Manrique and Sousa (2006) on credit supply are that they both use the same sample (i.e. 11 countries in the Eurozone) and the same credit supply variable (i.e. credit to private sector) as well as the same econometric model (i.e. vector autoregressive VAR model). In the first study, a vector error correction model (VECEM) includes three variables as the determinants of credit supply: long-term credits to private sector, GDP, and short- and long-term interest rates. Following their empirical analysis, the authors suggest that the determinants of credit lending are related to domestic factors (e.g. economic activity and interest rates) and that long-term interest rates have a stronger effect on credit supply than short-term interest rates. In their second study, Calza, Manrique and Sousa (2006) analysed conjunctural developments in lending by the banking sector in the Eurozone countries. They also assessed whether developments in the credit supply are in line with those in their fundamental determinants. Diverging from the first study, the credit determinants of this model consist of composite lending rate and the annualised quarterly realised inflation rate. They conclude that this model can provide a quantitative benchmark with which to assess conjunctural developments in bank lending in the Eurozone and provide information about the state of the economy and the emergence of financial imbalances.

Djankov, McLiesh and Shleifer (2007) examined credit determinants at a cross-country level for 129 countries over 25 years using panel regression analysis. Unlike previous studies, the credit model here covers institutional variables, such as creditor rights, contract enforcement and legal origin in addition to macroeconomic variables (e.g. economic activity, per capita GDP, economic growth rate and inflation). Their findings show that institutional factors are highly important for credit supply. They also found that, among the institutional factors, creditor protection, credit rights and information-sharing are the most important in determining the size of credit to the private sector.

Shahbaz, Shamim and Aamir (2010) investigated the effect of the macroeconomic environment on financial-sector performance in Pakistan over both the long and short term. In contrast to previous studies, this work is at a country level and uses a different technique (the fully modified ordinary least squares approach) for long-run relationships. Like Calza, Gartner and Sousa (2003) and Calza, Manrique and Sousa (2006), they also used the VECEM to examine short-run relationships between financial performance and the macroeconomic environment. In this study, the development of credit markets is considered as an indicator of financial development by taking the size of credit supply (the share of credit to the private sector in GDP). Their model covers both internal and external variables, such as per capita GNP, government spending, skilled human resources, inflation, savings, remittances, openness to trade and foreign capital inflows. The empirical results show that economic growth and skilled human resources have the highest positive impact on financial-sector performance, and also that the quality of financial intermediaries contributes to the development of the financial sector in Pakistan.

Stepanyan and Guo (2011) explored determinants of credit growth in emerging economies in both Europe and Asia before and after the global crisis. As in previous studies, in addition to the variables in the standard credit model they add further credit determinants, such as credit supply factors (e.g. domestic deposit growth, money supply, non-performing loans and non-resident liability growth) and credit demand factors (e.g. economic growth and inflation). They found that, in the pre-crisis period, external sources played a significant role in an expansion of bank lending in all these emerging economies, while in the post-crisis period economic activity plays a role in a change in credit lending.

Gözgör (2014) determined domestic credit expansion for 24 emerging economies within a dynamic panel data estimation framework. Like most previous studies, the credit supply indicator here in both a long- and short-run analysis is the ratio of credit to the private sector in GDP. In contrast to previous studies, he considers external financial factors (private capital flows, nominal exchange rates, domestic and global liquidity conditions and differences between the domestic and global lending rate) along with internal factors (e.g. GDP per capita, inflation, current account balance, M2/GDP, deposit rate, non-performing loans/total loans). The findings show that, out of all the factors, it is easy monetary policy, openness and the differences between global and domestic lending interest rates that positively affect credit expansion, but global tail risk and current account balance negatively affect credit supply.

Al-Shammaria and El-Sakkab (2018) explored the determinants of credit growth in 24 OECD countries using a VAR approach. Their credit supply indicator is the ratio of credit to the private sector in GDP. They also add further economic variables (e.g. fixed capital formation, foreign liabilities, the nominal exchange rate, deposit rate) to the standard credit model. One finding is that the main determinants of bank lending to the private sector are money supply, GDP, inflation, interest rates, exchange rates, foreign liabilities and fixed capital formation. In general, their findings show that macroeconomic stability is vital for the flow of credit to the private sector in OECD countries. Al-Shammaria and El-Sakkab (2018) suggest that policy-makers should control variations in factors linked to monetary policy actions (i.e. growth of money supply, exchange rates and inflation) in order to maintain credit supply stability.

Like Djankov, McLiesh and Shleifer (2007), Castoro and Nartins (2019), who examined the determinants of credit booms, focused not only on macroeconomic determinants (e.g. GDP growth rate, capital inflows, interest rate spread) but also on political and institutional factors (e.g. political orientation, number of government changes, central bank independence). In contrast to previous studies, with regard to the determinants of the credit boom, the ratio of private credit to bank deposits, rather than total private credit to GDP, is considered as an indicator of credit supply. The authors used a logit model over a panel data set and included both developed and developing countries. They found that, among macroeconomic variables, high economic growth, degree of openness of the economy and capital inflows largely support the expansion of credit supply (credit boom) in addition to the cost of credit. They also indicate the important influence of both a stable political environment and central bank independence on credit expansion in domestic markets.

In the literature on the credit markets, some empirical studies have focused only on mortgage markets, where are one of the sub-markets of the financial sector and have taken in the ratio of housing credit to GDP rather than the ratio of total credit to private sector in GDP (e.g. Wolsjewik, 2006; Bardhan and Edelstein, 2007; Kutlukaya and Erol, 2007).

Leece (2004) examined the determinants of mortgage credit demand in both perfect and imperfect markets at country level (the UK). He concluded that household preferences could not be completely separated from the structure of housing finance systems and that institutional and policy differences of markets were important in household choices. In his UK-wide analysis, he took two different variables (loan to value ratio and mortgage balance) as a sign of mortgage loan demand. The main findings of his analysis are as follows; in the UK, there is a statistically significant relationship between house prices and interest rate and LTV rate as well as mortgage debt; households make contracts by comparing the costs of fixed and variable interest; this cost is determined externally; In the UK, the income elasticity of the demand in terms of housing expenditures is smaller than in the US.

Wolswijk (2006) investigated the sources of growth in mortgage debt in the mortgage markets of 15 EU countries by using the pooled regression method. Unlike previous studies, stock market growth, the effect of financial deregulation and fiscal factors (e.g. the deductibility of mortgage interest payments from personal income tax) are included in his model. The results of the study pointed out that financial liberalisation and stock market growth played an important role in the growth of mortgage debt. Like Oikarinen (2009), he emphasized the importance of the use of tax tool (interest rate deductability) in developments in mortgage and housing markets.

Bardhan and Edelstein (2007) who focused on housing finance systems in emerging economies, investigated the factors affecting the supply of housing loans and identified the constraints of the existing housing finance systems. They used the same technique as Wolswijik (2006). Unlike previous studies, they included more variables in their model, such as savings rate, financial assets of depository institutions and factors related to housing markets (e.g. urbanization rate and housing stock; they compared the developed OECD economies with advanced mortgage finance systems to emerging economies by creating a benchmark procedure. They found that the supply of mortgage loans in emerging economies is quite small than that of the developed economies according to this criterion and that within this, the size of households and urbanization rate play an important role. They suggested that if necessary reforms are made, the emerging economies (e.g. Chine and Russia), the mortgage markets have a significant potential for growth.

Wornock and Wornock (2008) examined the factors determining the size of the mortgage loan for 63 developed and developing countries. Differently from previous studies besides macroeconomic variables (GDP and inflation), the institutional features of mortgage markets (strength of legal rights and credit information) were included in the analysis like Djankov, McLiesh and Shleifer (2007). The results of cross-sectional regression show that lenders and borrowers having stronger legal rights; the existence of more advanced credit information systems and the existence of stable macroeconomic environment create differences in the housing finance system among countries. They came to the conclusion that countries with advanced information system and stable macroeconomic environment have more developed mortgage finance system

Igan et al. (2011) examined whether the trilogy of house prices, economy and credit had co-movement in the developed economies taking into account both domestic and international context. In their analysis, they add more macroeconomic variables to the standard credit model, such as house prices, consumption, residential investment, international trade and international portfolio etc. They have found that although the house prices, credit and production trio can simultaneously move at both cross-country and country-level, but the house prices and credits have different characteristics among the countries.

Like Bardhan and Edelstein (2007), Badev et al. (2014) have examined mortgage finance systems. Their study differs from previous studies in some respects. The first difference is that their sample covers larger number of developed and developing countries (148-country). The second difference is that they explore the development of mortgage markets in terms of both the depth of the markets and housing loan penetration. Another difference is that they include the insurance sector in the analysis. They applied a similar model (panel regression model) with Wolsjwik (2006) ve Bardhan and Edelstein (2007). Their findings coincide with that of Wornock and Wornock (2008). The results of the analysis show that the countries with deep mortgage markets have advanced mortgage systems; the development of insurance and capital markets is important in long-term housing credit supply; there is a weak relationship between government support and the development of mortgage finance system and the policies relating to the development of the financial sector affect the development of the mortgage market.

Kutlukaya and Erol (2016) aim at measuring the depth of mortgage markets by considering 31 European countries. They took the share of housing loan in GDP as an indicator of the depth like Bardhan and Edelstein (2007) and Badev et al. (2014). Unlike them, they included the share of housing loans in total loans in their model in order to control the impact of the housing loan on the financial sector. Another difference is that they use the "R-software tool" to find the variables that best explain the depth of these markets. In addition, like Djankov, McLiesh and Shleifer (200) and Wornock and Wornock (2008), the institutional features of mortgage markets have also put into the credit model. Their findings confirm previous studies. The finding show that strength of legal rights and urbanization rate have positively relationship with the depth of mortgage markets as well as financial institutions orientation towards mortgages. They suggest that in developing countries, policy makers should pay attention to improving the legal and regulatory framework to support the development of the mortgage markets.

On the other hand, while some studies examined the relationship between credit supply and house prices, they used the standard credit model by adding house prices to this model (e.g. Goodhart and Hofmann, 2008; Brissimis and Vlassopoulos, 2009; Nobili and Zollino, 2017). Their findings indicate that house prices have an important role in credit supply. As there is literature focused on this relationship between credit supply and house prices as a sub-section in Chapter 2, it is not detailed here.

In summary, in existing empirical literature, the standard credit model is widely taken into consideration while examining determinants of the magnitude of credit supply or the relationship of credit markets with the economy in different dimensions. The standard model explains the long-term movements of credit and consists of economic activity and financing cost (i.e. short term interest rates) (Bernanke and Gertler, 1995; Calza, Gartner and Sousa, 2003).[32] Over time, the standard credit model has been estimated by adding more variables, such as macroeconomic variables (e.g. unemployment, exchange rate, inflation dependency ratios) and / or financial variables (M2, foreign liabilities, capital inflows) and / or institutional variables (e.g. credit information, strength of legal rights) and / or housing markets (e.g. urbanization rate, housing taxation, house prices).

In this research, while the hypotheses of two essays (Chapter 3 and Chapter 5) are being tested, the standard credit model is used. Differently from Chapter 3, in Chapter 5, financial liberalisation, current account balance, house prices and some institutional variables (e.g. regulation quality, corruption etc.) are also added to the standard credit model to test the relationship between house prices and current imbalances and the role of the institutions of this relationship.

[32]In fact, it can be suggested that economic activity adversely affects credit demand. Because if the economic growth is expected to be temporary or not to be a long term, the private sector (households and firms) may prefer to make savings rather than investing or consuming. In case of an improvement in the cash-flow position of the firms during the economic expansion period, they may give up borrowing credit in order to invest.

CHAPTER THREE

PRIVATE CREDIT AND HOUSING PRICES FROMA EUROPEAN PERSPECTIVE[33]

Abstract

This chapter focuses on the relationship between credit supply and house prices. This relationship can have an important effect on the economy because developments in either the housing markets or the mortgage markets can influence the whole financial sector or even the economy. In fact, the US subprime mortgage crisis which started in the second half of 2007 confirmed the importance of the relationship between both markets. Although there are numerous studies on the relationship between credit and house prices at a country level, there are few cross-country studies. the first aim of the study is to examine the dynamic relationship between private credit and house prices at both cross- country and country level in the EU. Secondly, the effect of the different monetary strategy within the EU on this relationhip will be investigated. Thirdly, the direction and size of this relationship will be explored by considering the different sub-samples as well as some individual countries in the EU. For this purpose, two methods are used: the vector autoregressive (VAR) model and the simultaneous equations model. The latter is applied for robustness check. The findings of the study show that the direction and size of this relationship change among the sub-groups of the EU. This is the same for the individual countries in the Eurozone.

3.1. Introduction

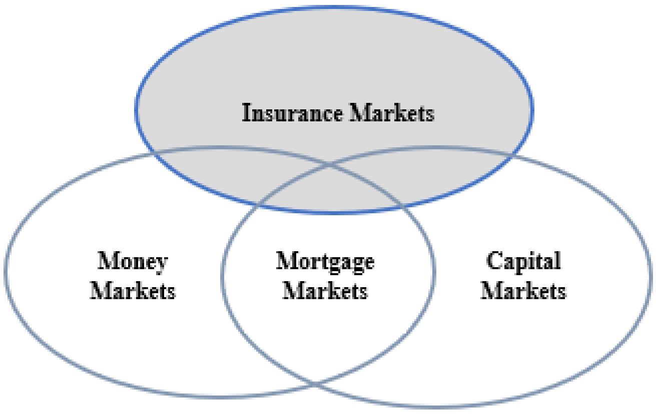
The housing sector, from both a social and economic point of view, is one of the leading sectors in many economies. Therefore, governments most frequently intervene in this sector even in countries with a liberal economic system. It enjoys its status as a privileged sector in a country's economy because of the contribution that residential construction makes to high employment of unskilled labour and the production of most of construction inputs within the country. However, developments in this sector can have positive and negative impacts on the economy. Housing is regarded as sound collateral in credit markets, which has an effect on aggregate consumption, investments, and also household indebtedness. Lack of development of housing markets can lead to inadequate housing and homelessness along with social problems (e.g. destruction of social peace, happiness and mental health**)**.

A house represents the most expensive commodity for most households, and home buyers need to borrow from the financial sector. Thus, credit affordability is important for people wanting to buy their own homes. Because of this, housing and mortgage markets are closely related, boosting the importance of the mortgage market in many countries. Mortgage debt accounts for a significant portion of household debt and of the GDP in many countries. Cerutti (2017) -

[33]I would like to thank participants of the ERES`s refereed seesion and the AREUEA conferences in the 2019 for their comments.

examined mortgage markets of 120 developed and developing countries, concluded that housing credits make up 70% of aggregate household debts in most of those countries.[34] Within the European Union (EU), housing credit relative to total credit varies between 60% and 85% credits (EBA, 2017), and the share of mortgage debt in GDP is high in many countries in the EU (53.3% in Belgium, 42.3% in Germany and 95.5% in the Netherlands in 2017) (EMF, 2018).

Figure 3.1. Sub-markets of Financial Markets



The diversification[35] of funding sources in mortgage markets and the necessity of insurance for housing credit work to strengthen the connection between mortgage markets and other sub-financial markets (i.e. capital markets, money markets and insurance markets) (see. Figure 3.1). So, effects of developments in housing or mortgage markets can be observed in the whole financial sector. Furthermore, especially since the 1990s, there has been an increase both in credit payment alternatives and availability of new hybrid financial instruments,[36] which have strengthened the connections between credit markets and other sub-financial markets. As such, the importance for the economy of the interaction between housing and credit markets has significantly increased because developments in either of these markets can affect the whole financial sector and even the

[34] He also found that the rate is lower than 40% in only six of the countries surveyed, and yet even in these countries, housing still constitutes the highest proportion of total credit (See Cerutti, 2017).

[35]With regard to housing credit, developed mortgage markets since the 1990s have seen an increase in capital-market-based funding relative to deposit-account funding. This evinces a steady shift from an 'originate-to-hold' model to an 'originate-to-distribute' one. In the first model, banks originate credits and keep them on their balance sheet until maturity. In the second model, credits are transferred to other entities (e.g. special-purpose vehicles) by the banks for the purpose of structured finance transactions, asset securitisation, etc. Thus, such debts are taken off the banks' balance sheets. They can therefore create additional funds and also isolate any risk deriving from their debt. This process contributes to an increase in non-bank financial intermediaries. See. Criado and Van Rixtel (2008), FCIC, (2010a), and FCIC (2010b).

[36] Adjustable-rate mortgage (ARM) loans, only interest loan and hybrid ARM loans are some of these credit payment alternatives. Collateralised Mortgage Obligations (CMOs), credit default swaps (CDSs) and credit debt obligations (CDOs) are examples of new hybrid financial instruments (for more information see. Fabozzi, 2007).

whole economy (Thompson et al., 2007). The US subprime mortgage crisis confirmed the importance of the interaction between these two markets.

For these reasons, it is proposed that an investigation of the relationship between credit and housing markets is of key importance with respect to financial and economic stability; it would enhance prediction and allow policy-makers to set appropriate policies thereby mitigating economic instability.

In today's globalised financial markets, shocks occurring in one country can easily spread to other, as evidenced by the latest global crisis (2007-2008). Developments in the US housing and mortgage credit markets soon affected many countries, resulting in the first global crisis of the 21st century. It is also therefore, necessary to investigate the relationship between the two markets, especially with regard to the relationship between credit and house prices at a cross-country level. Most studies in the literature are at country level (e.g. Gerlach and Peng, 2005; Oikarinen, 2009; Öhman and Yazdanfar, 2018) with only few cross-country studies (e.g. Collyns and Sendhadji, 2005; Goodhart and Hofmann, 2008; Jordà, Schularick and Taylor; 2015). Even so, neither the direction nor the size of this interaction at cross-country level has been fully examined yet.

Neither have existing cross-country studies examined separately focused on either the interaction between credit and house prices in the regional block at an advanced stage of economic integration, such as the EU. The EU comprises two groups of countries with respect to phases of economic integration: Eurozone and non- Eurozone. Eurozone countries[37] belong to the economic and monetary union area of the EU, whereas non-Eurozone countries are yet to fulfil the required criteria (e.g. Hungary and Poland) or choose to remain outside (e.g. Denmark, Sweden and the UK). Crucially, Eurozone countries cannot implement their own monetary policy, which affects credit supply and hence the relationship between credit and house prices by using monetary policy. Research on the relationship between these markets may yield different results for Eurozone and non-Eurozone countries. Nonetheless, even countries are in the same group may be differently affected by developments in credit and housing markets and also show evidence of a different level of relationship between the two

[37]Countries eligible to join Eurozone need to fulfil certain criteria, known as convergence criteria or Maastricht convergence criteria, namely price stability, interest rate, exchange rate and the government's fiscal position (budget and debt criteria). The last one relates to the position of government budget and debt. For more information see. ECB, 2016.

markets. The EU's crisis countries, known as GIIPS,[38] exemplify this situation. It may also therefore be useful to examine the GIIPS countries separately.

A literature review reveals no studies that focus on the relationship between credit and house prices in the EU alone. Nor are there any studies on this relationship that consider the Eurozone and non-Eurozone countries separately. Also, the special position of the GIIPS countries, which experienced a sovereign debt crisis, has not been investigated at cross-country. This study therefore examines the interaction between credit and house prices in EU countries by classifying the countries based on: monetary policy strategy (Eurozone and non-Eurozone); whether they have experienced a sovereign debt crisis (GIIPS); whether they have simultaneously faced a credit boom and house price boom (GIIS); and whether or not the main reason for the crisis was a house price boom–bust (IS). The relationship is also explored at country level by considering the GIIPS countries separately.

Thus, the first aim of the study is to examine the relationship between private credit and house prices at both cross-country and country level within the EU. Private credit covers loans that deposit money banks and other financial institutions lend to the non-financial sector (households and non-financial companies excluding general government (BIS, 2018). Second, the effect on this relationship of differing monetary strategies within the EU will be investigated. Third, the direction and size of this relationship will be explored by considering different sub-samples as well as individual countries within the EU.

For this, three hypotheses are tested in this chapter. First, there is a dynamic relationship between credit supply and house prices. Second, Monetary policy makes a difference in this relationship**.** Third, this relationship looks different at a cross-country and an individual-country level, even when the countries involved have the same monetary policy.

In this study, the following research questions will be addressed:

- In what ways are credit supply and house prices linked at a cross-country level?
- Does being subject to a common monetary policy make any difference to the relationship between credit supply and house prices with regard to their size and direction?
- Does being a member of the Eurozone make a difference to the relationship between credit and house prices?

[38]The GIIPS consists of Greece, Ireland, Italy, Portugal and Spain.

- Is this relationship different between countries when they are subject to the same monetary policy?

This study covers the period between 1990q1 and 2017q3, and focuses on 14 EU countries that are early EU members.[39] It estimates the relationship in question by employing two methods: a vector autoregressive (VAR) and a simultaneous equations model. The second method is applied to check the robustness of the main results. First, the relationship is analysed for the whole sample using a panel VAR model. Then, it is estimated a second time by grouping the countries at EU and Eurozone levels. The EU-level grouping is based on implemented monetary policy strategy, and the Eurozone groups are sorted by: whether the country has experienced a sovereign debt crisis; if so, whether it simultaneously faced a credit boom and housing price boom, and whether the main reason for the crisis was a house price boom–bust cycle. Finally, this relationship is examined for each of the sovereign debt crisis countries (i.e. Greece, Ireland, Italy, Portugal and Spain). Thus, it is possible to discover whether there is a difference between Eurozone and non-Eurozone countries, as well as between the sub-groups of the Eurozone, and also between individual countries with regard to the size and direction of the relationship between credit and house prices.

The cross-country results show differences in terms of both size and direction of this relationship as well as the existence of causality in the lag order one. The results indicate a dynamic relationship between credit supply and house prices for all samples, but with differing magnitudes. These results are similar across individual countries.

The contribution of this study to the literature is to examine the relationship between credit supply and house prices at cross country and country level in the EU and reveal the direction and the size of this relationship; to consider the effect of different monetary policy on this relationhip and to compare the sub-groups of the Eurozone as well as individual countries; to identify the diffrences between them; to reveal the importance of the direction of casuality between credit and house prices for governing this relationship in order to implement more efficient micro and macro policies in the economy.

The paper is structured as follows: Section 3.2 introduces the literature review; Section 3.3. includes the theoretical framework. Sections 3.4 and 3.5 cover methodology and data

[39]These countries all joined the EU before 2004. They are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the UK. Luxembourg is also in this category, but is not included in the analysis due to lack of data.

description; Section 3.6 is an empirical analysis and discusses the main findings; Section 3.7 presents the results of the robustness check; and Section 3.8 draws the main conclusions.

3.2. Literature Review

Numerous studies have examined the relationship between credit and house prices in in Europe and Asia.[40](e.g. Fitzpatrick and McQuinn, 2007; Ibrahim and Lae, 2014; Öhman and Yazdanfar, 2018), but few studies examining this interaction at cross-country level (e.g. Collyns and Senhadji, 2005; Goodhart and Hofmann, 2008; Jordà, Schularick and Taylor, 2015). There are both similarities and differences between these studies emerge.

In general, one common feature of previous studies is that most of them are based on country-level analyses, even when the study considers multiple countries (e.g. Hofmann, 2003, 2004; Greiber and Setzer, 2007; Taltavull de La Paz and White, 2012). A second feature in common is that they follow a VAR approach except for a few studies.[41] A third is that most of them use the standard credit model, adding a house price variable.

However, in previous studies the monetary variables (e.g. bank lending and interest rates) in the various models differ: for example, some include credits to the private sector as a credit variable (e.g. Hofmann, 2004; Stephanyan and Guo, 2011); some consider both total credits and housing credits (e.g. Gerlach and Peng, 2005); some include just housing loans (e.g. Oikarinen, 2009; Brissimis and Vlassopoluos, 2009); and some have both construction loans and housing loans (e.g. Nobli and Zolina, 2017). Some studies use the funding cost of financial institutions (i.e. the short-term interest rate) to conform to the standard credit model (e.g. Hofmann, 2004; Goodhart and Hofmann, 2008), while others include only long-term interest rates (e.g. Gimeno and Martinez-Carrascal, 2010), and some include both in their analysis (e.g. Nobli and Zolina, 2017); elsewhere variable mortgage interest rates are used (e.g. Brissimis and Vlassopoulos, 2009). Some studies have added macroeconomic indicators (e.g. inflation, employment, financial wealth, population) to the standard model (e.g. Liang and Cao, 2007; Goodhart, and Hofmann, 2008; Nobli and Zolina, 2017; Öhman and Yazdanfar, 2018)

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[40] Some studies focus on the interaction between commercial real estate prices and bank lending (e.g.Davis and Zhu, 2004; Vogiazus and Alexiou, 2017), but these can be ignored here as the focal point of this study is the relationship between bank lending and residential house prices.

[41] For example, Nobli and Zolina (2017) used a simultaneous equations model. Liang and Cao (2007) and Qi and Zheng (2014) used autoregressive distributed lag (ARDL) and a simultaneous equations model (2SLS) respectively, while Fitzpatrick and McQuin (2007) employed many techniques, such as dynamic ordinary least squares (DOLS), fully modified OLS (FM-OLS) and static OLS (SOLS). Anundsen and Janse (2013) used a structural vector error correction model (SVAR).

The findings of previous studies show that, even where a similar model specification is used, the relationship between credit and house prices differs from country to country over both the short and long term. Some findings support the theory that there is a bidirectional relationship between credit and house prices (e.g. Fitzpatrick and McQuinn, 2007, Oikarinen, 2009; Qi and Yang, 2009; Addae-Dapaah and Anh, 2014; Öhman and Yazdanfar, 2018), whereas some conclude that there is a one-way relationship (e.g. Gerlach and Peng, 2005; Gimeno and Martinez-Carrascal, 2010). Again, in some cases, the long-term relationship is stronger from house prices to loans (e.g. Hofmann, 2004; Brissimis and Vlassopoluos, 2009; Che, Bin and Wang, 2011), whereas in others this relationship seems to be of an opposite nature (e.g. Liang and Cao, 2007; Gimeno and Martinez-Carrascal, 2010), or else it is not clear in which direction the effect is stronger (e.g. Addae-Dapaah and Anh, 2014). Some studies conclude that there is a two-way relationship in the short term (e.g. Garlach and Peng, 2005), while others find a one-way relationship (e.g. Fitzpatrick and McQuin, 2007) or no such relationship in the short term (e.g. Addae-Dapaah and Anh, 2014).

In conclusion, the existing empirical literature offers a vast amount on the relationship between credit and house prices at a country level, but little at a cross-country level; of the latter I found only three (Collyns and Senhadji, 2005; Goodhart and Hofmann, 2008; Jordà, Schularick and Taylor, 2015). As such, the cross-country examination of this relationship undertaken here can make a contribution to the literature. In addition, the literature review demonstrates that, although some of the cross-country studies may include some European countries, there is no study that is EU-specific. And so this EU-specific examination of the relationship may also contribute to the literature. Moreover, the EU is a regional economic bloc with two distinct monetary policies, i.e. a common monetary policy and national monetary policies, thus separating member countries into two groups: the countries being subject to common monetary policy (Eurozone countries) and countries implementing their national monetary policies (non-Eurozone countries). So far, no study examines with reference to the distinction between Eurozone and non-Eurozone countries. Also, in the EU the special position of the GIIPS, which experienced a sovereign debt crisis, has not been investigated at cross-country level as well as country level. Thus, in considering a sample of EU countries, this research makes a further novel contribution to the literature on the relationship between credit and house price.

3.3. Theoretical Framework

The theory suggests housing as a dual good, since it is both an investment good and a consumption good. This aspect is important when examining the relationship between credit supply and house prices. Theory suggests that there is a two-way causal relationship between credit and house prices. There are different approaches to explain this relationship: the financial accelerator mechanism approach, the life-cycle approach of household consumption, and adjustment mechanisms of optimal portfolio.

According to the approach of financial accelerator mechanism, monetary policy affects the size of bank lending (see Bernanke and Gertler, 1995; Kashyap and Stein, 1997; Anunsend and Jansen, 2013) and there is a mutual relationship between house prices and credit supply. In this approach based on monetarist view, when monetary expansion occurs, it causes an increase in banks' credit supply by affecting the level of interest rates as well as that of the external finance premium (the credit channel of monetary policy transmission). The credit channel causes to change the size of lending in the economy by influencing both lending of overall depository institutions (e.g. banks) and the behaviour of households and firms, as well as the allocation of credit. This approach explains how the credit channel influences household and firm behaviour by using two mechanism: the bank lending channel and the balance sheet channel (i.e. the net worth channel). Both channels can play significant roles in housing markets by affecting the financial positions of both households and firms, which in turn affect investment and spending decisions. When credit supply increases, households prefer to buy durable goods (e.g. housing), while firms choose to invest or buy more inventory.[42] The balance sheet channel arises by changing both market interest rates and, directly or indirectly, the financial positions of potential borrowers (i.e. their net worth, liquid assets and cash flows). The bank lending channel focuses on the possible impact of monetary policy on banks' credit supply. For example, an increase in credit supply encourages an increase in demand for housing and hence inflates house prices because housing supply cannot immediately meet the increase in demand. Increasing house prices also encourage firms to invest in housing[43] and raises the value of collateral secured against credit.

In addition, higher house prices also increase house value and its collateral effect. Since housing is considered strong collateral by banks, this puts homeowners and firms in a stronger financial position. Thus, the borrowing capacity of both households and firms will rise. In this case, they will borrow more, invest more and also spend more.

[42]In this study, firm behaviour will not be analysed in detail.
[43] Iacoviello (2005) and Anundsen and Jansen (2013) show that a financial accelerator impact occurs in the household sector via house prices, when the borrowing capacity of a household depends on the collateral value of housing.

The life-cycle model of household consumption suggests that the relationship between credit and house prices may be a result of the wealth and collateral effects that increasing house value has on credit demand and credit supply. According to this approach, households plan their consumption and investment decisions at every stage of their life and try to keep them stable (see. Meen, 2001; Deaton, 2005; Muellbauer and Murphy, 2007). In this case, the increase in house prices leads to an increase in household expenditures and debts by creating both a wealth effect and a collateral effect. Increasing house prices mean increased house value which makes people feel more secure. Thus, they save less and consume more (the wealth effect).

The increase in the value of housing also positively impacts households' borrowing capacities, facilitating more borrowing due to the fact that housing is secure collateral as far as lenders are concerned (the collateral effect). The banks' willingness to lend is dependent on the strength of the collateral. As a result, the banks can lend more and households can borrow from the financial intermediaries more and spend more.[44]

Another approach that explains the relationship between credit and house prices in an environment of monetary expansion is the optimal portfolio adjustment approach. This is based on the traditional monetarist view as financial accelerator mechanism approach. According to this approach, there is a two-way relationship between monetary variables and house prices. Monetary expansion changes the return on stock and the marginal utility of both liquid assets and other assets relative to the stock. In other words, this approach claims that extensive changes in interest rates and asset prices can be explained by monetary expansion (Meltzer, 1995; Goodhart and Hofmann, 2008). In this case, the result is that economic actors try to adjust their balances by controlling their spending and asset portfolios. For example, in the case of decreasing interest rates, households will enjoy greater affordability, and their housing demand as well as their credit demand will increase, and house prices will rise.

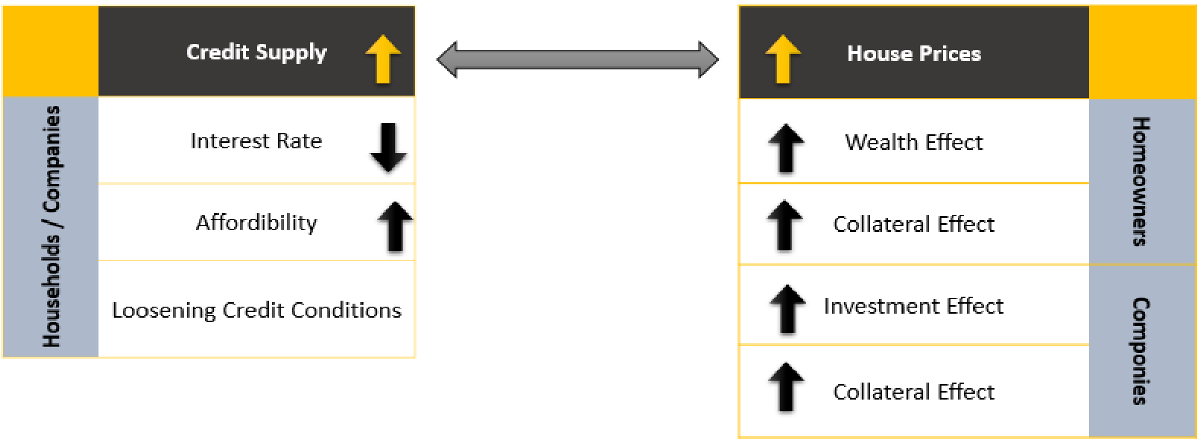
Similarly, in the case of house price increases, the value of the housing asset and the portfolio balance will change due to the welfare effect and collateral effect of the housing (Greiber and Setzer, 2007; Gooharth and Hofmannn, 2008). These effects either cause the economic actors to review their current investment or they lead to new investment. This, in turn, causes housing to bring about welfare, collateral and investment effects within the economy by increasing the affordability of credit. Thus, interaction can occur in two different ways: a change in house

[44] Mian and Sufi (2014), who investigate the effects of increasing house prices in the U.S. on spending and borrowing of households show that house price increases between2002 and 2006 had a large impact on their spending. Borrowing of American homeowners became 0.19 dollars on average per 1 dollar when their home equity gains increase 2002 to 2006.

prices can lead to changes in house value, or monetary expansion can change interest rates. Both encourage a portfolio rebalancing.

The common factor in these approaches is that they all acknowledge a causal relationship between credit supply and house prices and accept that this is a mutual interaction, as illustrated in Figure 3.2. The main difference between the approaches concerns the starting point of the relationship. In the financial accelerator and portfolio adjustment approaches, the starting point is monetary expansion and then an increase in credit supply; in the life-cycle approach, it is an increase in house prices and then an increase in credit demand and hence credit supply.

Figure 3.2. Interaction between Credit and House Prices



3.4. Methodology

In this study, which focuses on the dynamic relationship between private credit and house prices, the 14 chosen developed countries of the EU[45] are investigated for the period 1999–2017, using quarterly data.[46] Private credit covers those loans in an economy that deposit money banks and other financial institutions lend to households and companies (BIS, 2018). The present analysis, at both cross-country and individual-country levels, is based on certain

[45] They are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the UK.

[46] While deciding whether the countries in the sample are in the same group with regard to economic development, the United Nations (UN) and the International Monetary Fund (IMF) classifications are used. Although their classification criteria differ, in the case of the sample countries see them all as developed economies according to both classifications. The UN divides the world's 193 countries into three groups - developed economies, developing economies and transition economies- according to their gross national per capita income using the World Bank Atlas method. In this approach, countries with incomes over $12,615 as of 2017 are counted as developed economies (or high-income countries) The IMF with 189 member countries considers the relative size of the economies (gross domestic product [GDP]based on purchasing power parity, population and total exports. Like the UN, its classification also comprises three groups: developed, emerging and developing economies. Countries with incomes over $12,235 as of 2017 are counted as developed economies (or high-income countries) (see. UN, 2018; IMF, 2018).

assumptions, namely: there is a two-way interaction between private credit and house prices in the EU and its sub-groups; the size and direction of this interaction may vary depending on the monetary policy being implemented; the magnitude and direction of the interaction between credit and house prices may differ from one country group to another even if they are subject to the same monetary policy strategy; the same can apply in the country to country analysis.

Two methods are used to examine the relationship between credit and house prices, the vector autoregressive (VAR) model and the simultaneous equations model. The second model is applied for a robustness check.

In the panel VAR model, a cross-sectional dimension is added to the time series VAR approach. Such a model increases the sample size and this approach also allows for unobserved individual heterogeneity. The VAR model is a powerful tool in terms of revealing dependencies between sectors, markets and input-output links in an economy to capture the structural time variation in the dissemination of impacts of the shocks or the connections between regions or countries in today's increasingly globalised world (Canova and Ciccarelli, 2013).The VAR model captures the linear interdependencies among many time series and allows consideration of more than one evolving variable. In VAR modeling, the equation for each endogenous variable derived from its lagged value, the lagged values of the other endogenous variables, and possibly some other exogenous control variables.

The approach of Abrigo and Love (2016) is followed in our VAR model and the same restriction is applied. The underlying structure is the same for each cross-sectional unit. The ensuing problem of individual heterogeneity in the levels of the variables can be overcome by introducing fixed effects in the model. In addition, the generalised method of moments (GMM) technique is applied to alleviate the ‘endogeneity’ problem that exists in the model due to the lagged variables. This technique is appropriate when the shape of data distribution is not known. It is also suitable when there is a loss of large degrees of freedom due to an increasing number of lags as instrumental variables; hence, the approach of Holtz-Dakin, Newey and Rosen (1988) is followed to replace missing observations with zeros in order to ensure efficiency of the GMM. In addition, a reduced form of VAR is estimated (Brooks, 2008).

The panel VAR model with panel -specific fixed effects consists of a two equations system in which private credit and house prices are specified as endogenous variables. The empirical analysis comprises two stages: First is the estimation of the VAR model at cross country. Second is the estimation at individual country level (Figure 3.3).

The first stage consists of three steps. In the first step, our model is tested for the whole sample using the panel VAR method to test the first hypothesis - that is, whether there is a dynamic relationship between credit and house prices. This represents the benchmark model of the analysis.

The second step investigates whether the interaction between credit and house prices changes due to monetary policy implementation (i.e. the second hypothesis is tested). The monetary policy (i.e. whether 'easy' or 'tight'), determines the amount of money in the economy by affecting both money supply and the cost of financing (i.e. the market interest rates) of both lenders and borrowers.[47] Since in the EU, two different monetary policies are operated, the countries are divided into two groups: Eurozone and non-Eurozone.[48] The Eurozone is the EU's area of monetary union, in which countries accept the euro is their common currency and recognize the euro system as their monetary authority. These countries are therefore subject to the monetary policy set by the European Central Bank (ECB) and are not free to implement their own. Non-Eurozone countries are able to implement their own national monetary policies (Baldwin, 2012; ECB, 2011).

In the context of the relationship between credit and house prices, the reason for such a classification is that the credit channel of the monetary policy has an important role in the distribution of funds and the size of credit supply in financial markets. The credit channel plays a highly effective role in achieving monetary policy targets, especially considering the banking sector's domination the financial markets in the majority of EU countries (Bijlsma and Zwart, 2013). In the period in which easy monetary policy is implemented, banks can lend more and extend the maturity of loans since the credit channel of monetary policy transmission affects the credit supply and credit allocation in the banking sector. 'Tight' monetary policy is the opposite. In the sample, 11 countries are in the Eurozone (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain) while three are non-Eurozone (Denmark, Sweden and the UK). The Eurozone economy is significant for the EU with regard to its stability and economic integration: at the end of 2017, it accounted for more than 70% of the EU's total output (i.e. 15.3 trillion (PPP) and had 66.3% of the total EU population (i.e. 337,143 million).

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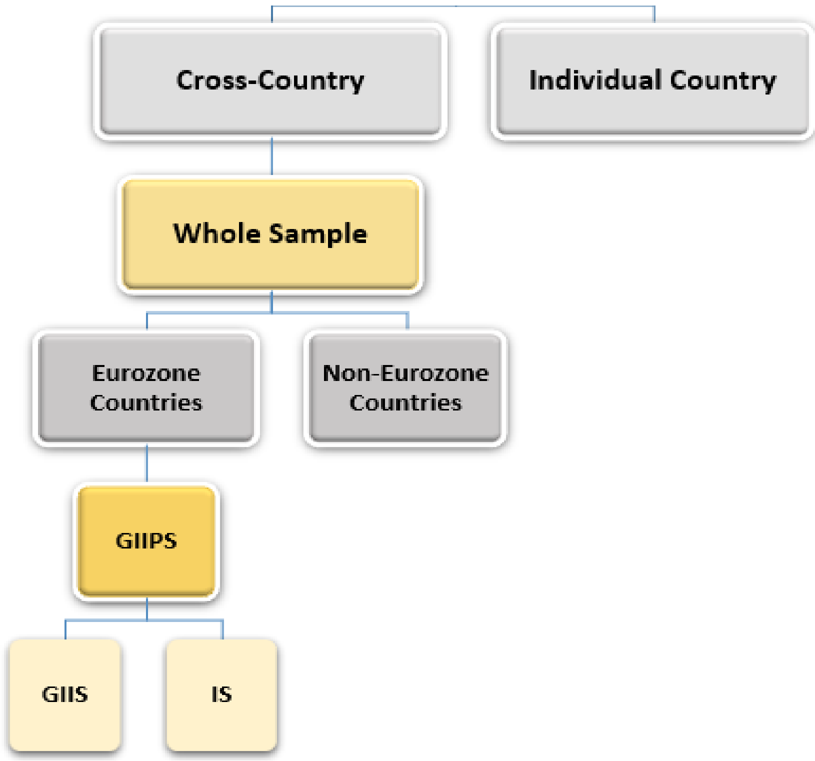
[47] In this study, money creation process, transmission mechanism of the monetary policy and its effect on housing markets and/or housing finance are not examined and thus, money creation is excluded in the model specification.
[48] The sub-title 2.2.2 in the second chapter includes more information about the monetary policy of the EU as well as the Eurozone.

Figure 3.3. Samples of the Empirical Analysis



Note that: The whole sample covers the 14 EU countries; The Eurozone is the countries in the monetary and economic union are of the EU. Non-Eurozone includes ones in outside area from the Eurozone. The GIIPS consists of Greece, Ireland, Italy, Portugal and Spain; the GIIS covers Greece, Ireland, Italy and Spain, except for Portugal and the IS includes Ireland and Spain; Individual countries cover the GIIPS countries.

The third step examines the relationship between credit and house prices by grouping some of the Eurozone countries undertakes an analysis at both cross country and country level (Figure 3.3). The grouping is based on whether the countries have experienced a sovereign debt crisis (i.e. the GIIPS group), whether these crisis countries are simultaneously facing both credit boom and house price boom (i.e. the GIIS group); and whether or not the main reason for their crisis is a house price boom-bust (i.e. the IS). In this step, therefore the benchmark model is estimated for these sub-groups. In the last step, this relationship is estimated for the individual countries in the GIIPS group.

The GIIPS includes five countries: Greece, Ireland, Italy, Portugal and Spain. The reason to examine this group separately is that it comprises the main actors in triggering and spreading the sovereign debt crises, which was the first crisis in the EU after the establishment of the monetary and economic union area (i.e. the Eurozone). This has led to them being labelled as the crisis countries of the EU. When the crisis began to spread, the GIIPS group was responsible

1/3 of the total production in Eurozone. Before the crisis hit, the GIIPS countries shared numerous economic problems: high current account deficits, high labour costs, high public debt, high external debt and gradually decreasing debt payment capacity. In addition, they figured higher than the EU average with respect to such indicators -budget deficits, external debt, higher labour cost and so on (Wyplosz, 2012; Mody and Damiano, 2012). The estimation of the model for GIIPS allows the group of the crisis countries to be compared to the Eurozone more widely.

In the second step, the benchmark model is estimated again but this time excluding Portugal from the GIIPS group (i.e. now the GIIS). The GIIS countries -Greece, Ireland, Italy, and Spain, unlike Portugal, experienced large increases in both credit supply and house prices in the pre-crisis period as seen in Figure 3.4.[49] In all these countries, a credit boom and a house price boom occurred simultaneously (e.g. Hilbers et al., 2008; Buzaglo, 2011; Mody and Damiano, 2012). In this way, it is possible to draw a comparison between the Eurozone and its sub-groups in terms of the size and direction of interaction.

In the third step, our model is estimated by considering only Ireland and Spain (i.e. IS). This group has been suggested that the main reason for these countries' deep crisis was the bust following their house price boom (IMF (a), 2011; IMF (b), 2011; Jordà, Schularick and Taylor, 2015). Following this estimation, any differences between IS and other sub-groups in terms of this dynamic relationship might be identified.

The final stage of the analysis is to examine the EU's crisis countries (i.e. GIIPS) individually. This makes it possible to test the last hypothesis and discover whether there are differences between individual countries with the same monetary policy and belonging to the same development group as a part of advanced economic integration, both in terms of the size and direction of this relationship and the effects of monetary policy.

At the end of empirical analysis, it is expected the confirmation of monetarist theory, that is, credit and house prices are mutually reinforcing, and that the direction of the casuality is from credit supply to house price for all samples. Another expectation is that implementation of two monetary policies at national and non-national level changes the relationship of credit supply with house prices in two zones of the EU (i.e. Eurozone and non Eurozone) since the credit

[49] Increase in real house prices between 2000-2007, real house prices increased about 50 % in Greece and Italy, 60% in Ireland, and 95% in Spain. The change in real credit volume in the period 2000-2007 was 175.46% in Greece, 182.7% in Ireland, 103.65% in Italy and 163.51% in Spain (BIS, 2018).

channel of monetary policy's transmission mechanism causes to change the size of lending in the economy by influencing both lending of overall depository institutions (e.g. banks) and the behaviour of households and firms in housing markets, which in turn affect investment and spending decisions.

The contribution of this study is to examine the relationship between credit supply and house prices at cross country and country level in the EU and reveal the direction and the size of this relationship; to consider the effect of different monetary policy on this relationhip and to compare the sub-groups of the Eurozone as well as individual countries; to identify the differences between them; to reveal the importance of the direction of casuality between credit and house prices for governing this relationship in order to implement more efficient micro and macro policies in the economy.

3.4.1. Model Specification

A reduced form of the panel VAR model comprises two equations; a private credit equation and a house price equation. To identify the model, two control variables (i.e. exogenous variables) are included in each of the equations.

In the private credit equation (Equation 1), the control variables are economic activity (*gdp*) and short- term interest rates (*sint*). The choice of the control variables was based on the standard credit model as used as previous studies (e.g. Bernanke and Gertler, 1989; Hofmann, 2004). In the literature, it is assumed that credit supply is mostly determined by demand (e.g. Bernanke and Gertler, 1995; Calza, Gartner and Sousa (2003). In the standard model, private credit supply positively depends on lenders' financing cost and on economic activity. Since economic activity influences total investment and consumption, there is a positive relationship between credit and economic activity.[50] Financing cost is reflected in market interest rates and credit lending is expected to be negatively related to financing cost, i.e. an increased cost of financing makes the cost of borrowing more expensive for households and firms and thus we should expect to see a decrease in credit demand.

[50] In fact, it is also suggested that economic activity has a negative impact on credit demand. Because if economic growth is expected to be temporary, the private sector (i.e. households and companies) may choose to make savings instead of investing or consuming. Again, in case of the improvement of the cash-flow position in the economic expansion period of the companies, they may give up to borrow the loan with the aim for investment. Yet, empirical studies show that credit supply is positively affected by economic activity) (e.g. Helbling et al., 2011; Gertler and Kiyotaki, 2015).

In the house price equation (Equation 2), the control variables are selected according to the traditional approach (i.e. supply-demand approach) commonly used in empirical studies. The existing literature suggests house building costs, housing stock and credit availability for housing builders as the determinants of housing supply, and household income, house prices, and availability of credit to home buyers, demographic factors, and interest rates as the factors of housing demand (see. Meen, 2001; Ball, Meen and Nygaard, 2010; Arestis and Gonzales-Martinez, 2016; Bahmani-Oskooee and Ghodsi, 2018).

For the second equation in the VAR model, income and interest rate are selected under the assumption that supply factors do not significantly affect house prices in the long run.[51] In a departure from previous studies (e.g. Oikarinen, 2009; Gimeno and Martinez-Carascal, 2010), we use term spreads in the housing price equation (see below for definition) rather than long term interest rates, to avoid a multicollinearity problem.

As such, both the private credit and the house price equations cover two control variables. The first equation includes economic activity and short term interest rates while the second one covers incomeand term spread.[52] Thus, in testing the relationship between credit and house prices , the analysis is based on a panel VAR with fixed effects given by:

$$credit_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i}\, credit_{t-p} + \sum_{i=1}^{P} \beta_{2i} hprice_{t-p} + \sum_{i=1}^{P} \beta_3 control\ variables_t + U_1 \quad (1)$$

$$hprice_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i}\, hprice_{t-p} + \sum_{i=1}^{P} \beta_{2i} credit_{t-p} + \sum_{i=1}^{P} \beta_3\, controlvariables_t + U_2 \quad (2)$$

i= 1, 2, 3, N; t= 1, 2, 3…T

Where *credi*t is the quarterly private credit to households and companies in country *i* at time *t*; *hprice* is the quarterly house prices in a country *i* at time t; *p* is the lag length and U_1 and U_2 are the error terms.

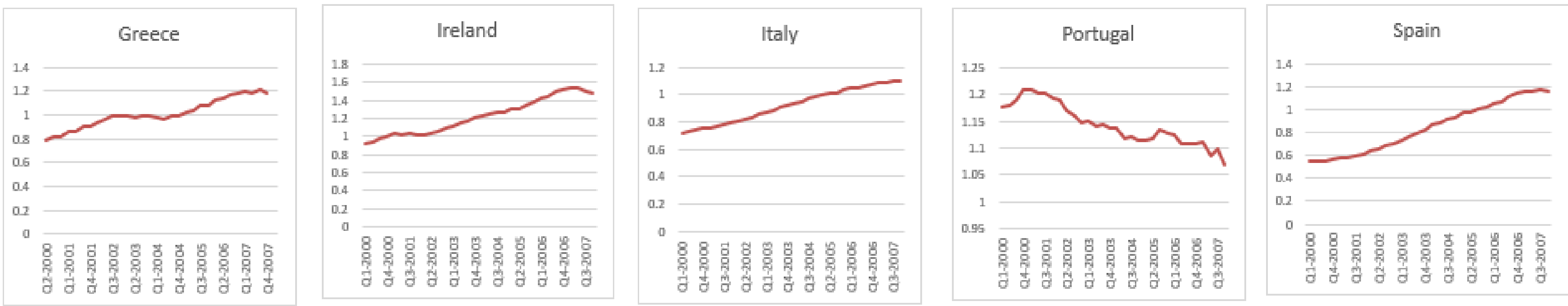
[51] A supply variable is not added in most of previous studies that examine the dynamic relationship between credit and house prices. Because they generally assumed that supply factors do not significantly affect house prices in the long run (Meen, 2002; Oikarinen, 2009; Basten, and Koch, 2015). One of the reasons for this is that it is difficult to include factors affecting housing supply, such as regional policies, in empirical studies.

[52] In our model is, the number exogenous variables (i.e. regressors) are equal to the number of instruments, i.e. our panel VAR model is just identified.

Figure 3.4. Real Private Credit vs. Real House Prices (2000-2007)

Real Private Credit (1)

Real House Prices (2)



Source: BIS and IMF.
(1) Real private credit (billions of US dollar)
(2) Real house price index (2010=100)

All variables are used first-differenced in real terms. In addition, their natural logs are used, except for short term interest rates (*sint*) and term spread (*dfin*t). Following cross-country and country level analyses, the expectation is that private credit has a positive relationship with house prices; that both credit and house prices also have a positive relationship with economic activity and total income (*gdp*) respectively while short interest rates and term spread will have a negative effect on credit and house prices.

3.4.2. Data Description

In this study, the sample consists of 14 EU developed countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom) over the period 1999q1 to 2017Qq3.[53] The data set consists of six variables,: private credit (*credit*), house prices (*hprice*), economic activity (*gdp*), consumer price index (*cpi*), term spread (interest rate spread) (*dfint*) and short-term interest rates (*sint*).

Definitions of the quarterly panel data set and their sources are included in Appendix 3.1. Private credit and house prices are the endogenous variables that are examined in their interaction. Private credit covers the total credit that deposit money banks and other financial institutions lend to the non-financial sector (households and non-financial corporations) excluding general government. The nominal house price index – which is a measure of changes in house prices – is used as the house price variable.

Other variables are exogenous, with the exception of the consumer price index. The consumer price index (2010 = 100) is used to convert all variables from nominal to real values. These variables are also converted into logarithms except for short-term interest rates and term spreads. Short-term interest rates represent lenders' financing costs and include the interest rates under which short-term borrowings (i.e. overnight, or between one and twelve months) between financial institutions are realised in the market, or the rates through which short-term government securities are issued or traded in financial markets. Term spread (or interest rate spread) measures the difference between long-term and short-term interest rates. It is a predictor of changes in future interest rates. If the time spread is positive, it is predicted that inflation rises over time.

[53]A lack of data, especially on private credit and interest rates as a long time-series, restricts the number of the EU countries included in our empirical analysis.

The volume of total output is used for economic activity and total income in the economy.[54] In the analysis, quarterly GDP (current prices in US dollars) is taken as the indicator for total output. It is defined as the monetary value of all the final goods and services produced in a country in a period of time (often annually or quarterly).

3.5. Initial Assesment

Descriptive statistics

Appendix 3.2 provides the main descriptive statistics for the quarterly dataset. The first column points out the number of observations for every variable, while mean and standard deviation of our data are reported in the second and third columns. Minimum and maximum values of the variables are displayed in the fourth and fifth columns respectively.

The market value of private credit (*credit*), an indicator of total credit to the non-financial sectors lent by commercial banks and other financial institutions, averaged 935.7 billion US dollars with a standard deviation of 913.49 billion dollars in our sample period, ranging from a low of 47.6 billion to a high of 3.5 trillion dollars per quarter. These indicate that there is a large difference between the 14 EU member countries in relate to the size of the credit markets. Both mean and standard deviation of nominal housing price index (2010=100) are 91.07% and 21.13% respectively, while its maximum and minimum values are 18.8% and 38.4% per quarter.

Except for two endogenous variables, the other variables are the control variables of the VAR model. In the sample, while the average volume of economic activity (g*dp*) is 946.9 billion dollars with a standard deviation of more than 1 trillion dollars over the sample period, its maximum and minimum values are 4.03 trillion dollar and 88.021 billion dollars respectively. The variation in economic activity shows that there is large differences between our sample countries in respect to economic size.

In the period between 1999q1 and 2017q3, the average of short- term interest rates is 0.002%, the minimum is -0.77% and the maximum is 10.8% with a standard deviation of 1.84% and with a mean of 2.11%. In the same period, the highest value of term spread for the quarter with an average of 1.78% is 18.71% and the lowest value is -4.17%. Both short term interest rates

[54]We use the same measure for both economic activity and total income in an economy because of data availability on household income as a long time-series.

and the term spread have their maximum values during the period when the Eurozone was newly established.

Correlation Matrix

At the beginning of the empirical analysis, first, a correlation matrix is evaluated. It indicates whether there is the presence or absence of a relation between sets of variables. Appendix 3.3 displays correlations between the variables of 14 countries. Its first column indicates that total private credit (*credit*) and economic activity (*gdp*) have positive correlation with house prices (0.247% and 0.196% respectively) while its correlation with both short term interest rates and term spread is negative (-0.382% and -0.097%). This case is the same for housing price variable. But, economic activity's correlation with private credit is larger than that with house prices (i.e. 0.946%). This is consistent with the view that economic activity drives important changes size of private credit. The correlations among the variables of our dataset are largely significant statistically at the 5% level.

Appendix 3.4 shows the correlations between the variables after the non-stationary variables have been made stationary by removing the unit root. This table represents correlations between our variables with first differences as well as with natural logs except short- and long-run interest rates. Endogenous variables have a positive and statistically significant correlation with each other.

Multicollinearity tests

To make better estimation, a multicollinearity among the regressors of the VAR model is also assessed. If there is multicollinearity, the standard errors may be high. It also decreases the precision of the estimate coefficients, which negatively affects the statistical power of the model. For this aim, multicollinearity is tested by using Variance Inflation Factors (VIF) and the multicollinearity (or collinearity) diagnostic (Brooks, 2008).

The VIF identifies correlation among the regressors and determines the strength of their correlation. The value of VIF is the ratio of variance in a model many terms, divided by the variance of a model with one term alone. Tolerance is the percentage of variance in the regressor that cannot be calculated for by other regressors. When the values of VIFs are higher than 5 and/or if a tolerance less than 0.20, this shows the presence of a multicollinearity problem.

Like the VIF, the collinearity diagnostics enable us to see whether there is significant multicollinearity. They produce condition indices, the eigenvalues, and the decomposition of the variances of the estimates in related to each eigenvalue. If eigenvalues are close to zero, this means that the regressors highly intercorrelated, and that small changes in the values of data can cause large changes in the coefficients' estimates. Condition indices are calculated as the square root of the ratios of the largest eigenvalue to each successive eigenvalue. If the values of indices are larger than 15, this shows the possibility of a collinearity problem. If they are larger than 30, it indicates a serious problem.

When both tests are applied to two equations of the VAR model (i.e. private credit and housing price equations), the results show that there is no multicollinearity among the regressors. Appendix 3. 5 and 3.6 reports the main results. The values of VIF for each regressors are less than 1.5 and tolerance is greater than 0.10. Collinearity diagnostics also confirm these results and values of the eigenvalues and condition indices indicate have satisfactory figures.

Unit Root Tests

Before the VAR model is estimated, Unit root tests are also carried out to ensure that all the variables are stable. In stationary time-series, the mean and variance are fixed over time; the covariance value depends on the distance between the two periods and is not related to the actual period in which this covariance is calculated. If the condition is not fulfilled, the causal relationship may vary depending on time (Brooks, 2008). In this study, a series of unit root tests are applied to the data to check whether our variables are stationary: these are the Levin-Lin-Chu test, the Im-Pearson-Shin W statistic test, the Augmented Dickey-Fuller test and the Phillips-Perron test,[55] while the Augmented Dickey-Fuller test is used for the data of the individual countries.

As illustrated in Tables 3.1 and 3.2, the results of the unit root tests show that all variables in levels are non-stationary at cross-country and country level. However, once they are first-differenced, they are all stationary. Therefore, in our VAR model, all variables are as first-differenced at cross-country and individual-country level.

[55] In the Levin-Lin-Chu test, null: unit root (assumes common unit root process). In the other three tests, null: unit root (assumes individual unit root process). In the Augmented Dickey-Fuller and Phillips-Perron tests, the probabilities for Fisher tests were computed using an asymptotic Chi-square distribution. All the other tests assume asymptotic normality.

Table 3.1. Unit Root Tests for Cross-country Level

	Levin-Lin-Chu		Im-Pearson-Shin W Statistic		Augmented Dickey-Fuller		Phillips-Perron	
	Level	First difference	Level	First difference	Level	First difference	Level	First difference
hprice	-1.9887**	-2.9385***	3.1792	-67.172***	26.3312	-84.9064***	26.0758	143.556***
credit	-3.82317	-9.07089***	0.3363	-11.4573***	26.4691	215.204***	26.9751	301.918***
dflint	-2.25785	-19.2483***	-5.80217***	-18.6812***	84.5619*	340.937***	56.5860	337.561***
gdp	-1.77235	-27.4057***	0.68574	-26.2216***	15.2388	443.489***	15.5779	442.871***
sint	-0.76448	-14.8665***	-0.28292	-13.8172***	21.6691	233.495***	16.9438	240.221***

Note that: The table presents Im-Pearson -Shin (IPS) test statistics for the null hypothesis of a unit root. In Levin-Lin-Chu method, Null: unit root (assumes common unit root process). In the other three tests, Null: unit root (assumes individual unit root process). In Augmented Dickey-Fuller and Phillips-Perron, probabilities for Fisher tests are asymptotic normality**.** (***), (**) and (*) indicate that null hypothesis is rejected at the statistical significance levels of 1, 5 and 10 percent respectively.

Table 3.2. Unit Root Tests for Individual Countries (Augmented Dickey-Fuller (ADF) Test)

	Private Credit		**House Prices**		**Economic Activity**		**Short-term Interest rates**		**Term Spread**	
	Level	First difference	Level	First difference	Level	First difference	Level	First difference	Level	First difference
Greece	-0.1704	-4.3196***	-0.0802	-1.6187*	0.2108	-4.8397***	1.1047	-3.4362***	-2.283141	-4.797629 ***
Ireland	0.2635	-3.6369***	-0.2045	0.3605	1.1544	-4.5252***	1.1047	-3.1564***	-1.887331	-0.068486***
Italy	-0.1318	-5.0052 ***	-3.2935	0.2591	-0.0701	-5.2382***	1.1047	-3.1564***	-1.960304	-0.073640***
Portugal	-4.8997	-4.8997***	-.4517***	1.9622**	0.0184	-5.0233 ***	1.1047	-3.1564***	1.985104	-0.052083***
Spain	-4.2464	-4.2464***	-.4517***	-0.4871	0.0184	-5.0233 ***	1.1047	-3.1564***	-1.970476	-0.067607**

Note that: The table presents Augmented Dickey-Fuller (ADF) test statistics for the null hypothesis of a unit root. In ADF, probabilities for Fisher tests are asymptotic normality. (***) indicates that null hypothesis is rejected at the statistical significance levels of 5 and 10 percent respectively.

3.6. Empirical Analysis and Main Findings

This section presents the results of the empirical analysis at cross-country and individual-country level. In the first stage, the interaction between private credit and house prices is examined in the period between 1999q1 and 2017q3 by using the VAR model with panel data. First of all, the panel VAR model is estimated for the whole sample by investigating the interaction between private credit and house prices. This is the main model for the analysis. Afterwards, the interaction is re-estimated for Eurozone and non-Eurozone countries. Finally, the model is run for the sub-groups of the Eurozone (GIIPS, GIIS and IS). In the second stage of the analysis, the interaction between credit and house prices is estimated for individual countries in the crisis countries group, i.e. the GIIPS countries.

Before the estimation of the model, the lag length needs to be selected to identify the VAR structure. The aim here is to incorporate the error term into the model to eliminate autocorrelation. Determining an appropriate lag is of critical importance. An implication of an increasing number of lags as instrumental variables is the loss of large degrees of freedom.

For choosing the appropriate lag length, one approach is to use of information criteria. With such criteria, a normality assumption, which is related to the error terms distribution, is not required (Canova, 2011; Brooks, 2008). It is preferable that the number of lags selected is the same in each equation. The chosen lag number is the number that minimises the value of the information criteria considered.

In this study, considering the quarterly frequency, to select the number of lag orders, up to five lags are tested for validity and the lag length is decided according to the lowest value of the Bayesian information criterion (BIC) (or Schwarz information criterion) which is based on the estimated standard errors. BIC is one of the most widely used information criteria, and it is accepted as the most accurate criterion for quarterly VAR models with realistic sample sizes (Ventsizlav and Killian, 2005; Brooks, 2008).

As such, first, the lag length is chosen for whole sample according to the BIC criterion. Table 3.3 shows that the first lag order is the one to be considered for the whole sample because the BIC criterion has the lowest value. Then, by using the same information criterion, the number of lags is decided for other samples of the analysis (i.e. Eurozone, non-Eurozone, GIIPS, GIIS, IS and individual countries) (see Tables 3.3 and 3.4). Results show that the first order should be selected for all samples.

Table 3.3. Lag order Selection for Cross-country Level

LAG	CD	J	J pvalue	BIC	AIC	HQIC
Whole Sample						
1	0.6426164	275.634	2.38E-18	-409.8015	75.63397	-109.3429
2	0.6753727	168.39	3.93E-09	-345.6866	18.38997	-120.3427
3	0.7723646	109.9376	-2.33E+02	-344.5823	18.37847	-82.55083
4	0.8130356	79.74592	1.25E-07	-91.61295	29.74592	-16.49829
Eurozone						
1	0.3756601	237.5695	3.30E-13	-423.6346	37.56949	-140.209
2	0.5904205	173.0438	3.06E-08	-3.23E+02	23.04381	-110.2901
3	0.6906436	106.112	6.45E-06	-224.4901	6.111974	-82.77726
4	0.7499692	81.13025	7.58E-08	-84.17077	31.13025	-13.31437
Non-Eurozone						
1	0.7870708	127.8996	3.14E-02	-403.9124	-72.10044	-206.3244
2	0.9649697	88.30912	1.40E-01	-310.5499	-61.69088	-162.3589
3	0.9810885	63.46267	9.56E-02	-202.4433	-36.53733	-103.6493
4	0.9861237	39.18845	3.53E-02	-93.76455	-10.81155	-44.36754
GIIPS						
1	-1.16356	141.9117	3.75E-03	-440.9829	-58.08833	-210.6556
2	-0.4552748	105.1537	1.24E-02	-332.0172	-44.84629	-159.2717
3	-0.1439652	68.82327	3.99E-02	-222.624	-11.01432	-107.4603
4	0.1437795	43.04937	1.38E-02	-102.6743	-6.950632	-45.09244
GIIS						
1	-2.122041	127.3449	3.38E-02	-433.2353	-72.65508	-217.4155
2	-1.22193	97.99243	3.86E-02	-322.4427	-52.00757	-160.5779
3	-0.6830876	62.20223	1.15E-01	-218.0879	-37.79777	-110.178
4	-0.1682503	35.52977	7.90E-02	-104.6153	-14.47023	-50.66033
IS						
1	-0.8424443	104.7997	3.52E-01	-386.465	-95.20029	-213.5632
2	-3.413228	98.05565	3.82E-02	-270.3935	-51.94435	-140.7165
3	0.1222264	48.14353	5.48E-01	-96.24214	-51.85647	-111.0379
4	0.6041483	26.57423	3.77E-01	-96.24214	-23.42577	-53.01649

Note that: *CD*: over-all coefficient determination; *J statistic*: statistics of over identifying restrictions in the model (i.e. the Sargan–Hansen test*); J pvalue*: p-values for Hansen`s J statistics; *BIC:* Bayesian information criteria (or Schwarz information criterion); *AIC*: Akaike information criteria; *HQIC*: Hannan-Quinn information criteria.

The whole sample covers the 14 EU countries; The Eurozone is the countries in the monetary and economic union are of the EU. Non-Eurozone includes ones in outside area from the Eurozone. The GIIPS consists of Greece, Ireland, Italy, Portugal and Spain; the GIIS covers Greece, Ireland, Italy and Spain, except for Portugal and the IS includes Ireland and Spain; Individual countries cover the GIIPS countries.

Table 3.4. Lag order Selection for Individual Countries

LAG	LL	LR	df	p	FPE	AIC	HQIC	BIC
Greece								
0	633.997				1.40E-13	-18.2608	-18.2694	-18.1313
1	680.216	53.242	16	0.000	5.70E-14	-19.1367	-18.8798	-18.4891
2	706.837	109.9376	16	0.000	4.20E-14	-19.4445	-18.9821	-18.2789
3	714.59	15.506	16	0.488	5.50E-14	-19.2055	-18.5375	-17.5218
4	724.104	19.028	16	0.267	6.70E-14	-19.0175	-18.144	-16.8158
5	740.723	33.238	16	0.007	6.90E-14	-19.0354	-17.9564	-16.3157
Ireland								
0	665.368				5.60E-14	-19.1701	-19.1187	-19.0406
1	718.361	105.99	16	0.000	1.90E-14	-20.2423	-19.9854	-19.5948
2	730.117	23.513	16	0.101	2.20E-14	-20.1193	-19.6569	-18.9537
3	742.263	24.292	16	0.083	2.40E-14	-20.0076	-19.3397	-18.324
4	755.872	27.217	16	0.039	2.70E-14	-19.9383	-19.0648	-17.7366
5	762.211	12.679	16	0.696	3.70E-14	-19.6583	-18.5793	-16.9385
Italy								
0	848.841				2.70E-16	-24.4881	-24.4368	-24.3586
1	949.936	202.19	16	0.000	2.30E-17	-26.9547	-26.6977	-26.3071
2	975.008	50.144	16	0.000	1.80E-17	-27.2176	-26.7552	-26.052
3	985.13	20.245	16	0.209	2.10E-17	-27.0473	-26.3793	-25.3636
4	1003.18	36.099	16	0.003	2.10E-17	-27.1067	-26.2332	-24.9049
5	1008.76	11.169	16	0.799	2.90E-17	-26.8048	-25.7257	-24.085
Portugal								
0	801.395				1.10E-15	-23.1129	-23.0615	-22.9834
1	839.988	77.186	16	0.000	5.60E-16	-23.7678	-23.5108	-23.12
2	856.856	33.737	16	0.006	5.50E-16	-23.7929	-23.3305	-22.6273
3	867.444	21.177	16	0.172	6.50E-16	-23.6361	-22.9681	-21.9524
4	881.259	27.629	16	0.035	7.10E-16	-23.5727	-22.6992	-21.371
5	892.994	23.47	16	0.102	8.30E-16	-23.4491	-22.3701	-20.7293
Spain								
0	764.718				3.10E-15	-22.0498	-21.9984	-21.9203
1	850.391	171.35	16	0.000	4.10E-16	-23.7745	-23.8124	-23.4217
2	875.461	50.14	16	0.000	3.20E-16	-24.3322	-23.8698	-23.1666
3	887.654	24.387	16	0.081	3.60E-16	-24.2219	23.5539	-22.5382
4	906.285	37.261	16	0.002	3.40E-16	-24.2981	-23.4246	-22.0964
5	919.049	25.527	16	0.061	3.90E-16	-24.2043	-23.1253	-21.4845

Note that: The number of observations is 69 for each of the countries. *LL*: Likelihood; *LR*: Likelihood ratio; *df:* degree of freedom; *p:* p-value; *FPE*: Final prediction error; *AIC*: Akaike information criteria; *HQIC*: Hannan-Quinn information criteria; BIC*:* Bayesian information criteria (or Schwarz information criterion).

Having determined the VAR structure, the model is estimated and then, the four tests are also performed: the Granger causality, the eigenvalue stability, forecasting error variance decomposition, and impulse response functions.

3.6.1. Estimation Results

Table 3.5 and Table 3.6 present the estimation results of VAR model with the first order at the cross-country and the individual country level respectively.

Estimation results at cross-country level

Table 3.5 includes the estimation results for all samples in three phases covering the results for the whole sample as well as the sub-samples while investigating whether there is a dynamic relationship between endogenous variables (i.e. credit and house prices). Both **e**ndogenous variables with their lagged values are present in the analysis. In addition, all variables are included with their first difference values in real terms. Natural logs of all the variables are also used except for short term interest rates and term spread.

In Table 3.5, Panels A and B show the private credit and house price equations respectively. Model 1 covers the estimation results with fixed effect for the whole sample, while Models 2 and 3 present the results for Eurozone and non-Eurozone countries. The last three columns of the table (i.e. Models 4, 5 and 6) give the test results for three sub-samples of the Eurozone (i.e. GIIPS, GIIS and IS).

The estimation results for the whole sample (i.e. Model 1) confirm the hypothesis being tested and demonstrate a relationship between credit and house prices. In both the credit equation (Panel A) and the house price equation (Panel B), the signs of the estimated coefficients of the endogenous variables (*dlnrcredit and dlnrhprice*) indicate that there is a positive relationship between credit and house price variables. Panel A shows that changes in house prices have caused credit to change in the same direction. The same can be seen in the relationship between both endogenous variables in Panel B. A 1% increase in house prices increases credit by 0.08687%, while a 1% increase in credit size positively affects house prices by 0.02194%. The estimated coefficients of both credit and house price variables are statistically significant. These results of panel VAR also indicate that for all samples, the effect on credit supply of a change in house prices is stronger than the effect on house prices of a change in credit supply.

Table 3.5. Estimation Results of Cross-country Level

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		Whole Sample	**Eurozone**	**Non-Eurozone**	**GIIPS**	**GIIS**	**IS**
Panel A: Private Credit	dlncredit$_{t-1}$	-.01124	-.02258*	.02389***	-.06231**	-.07064**	-.05122
		(0.343)	(0.063)	(0.000)	(0.015)	(0.053)	(0.107)
	dlnrhprice$_{t-1}$	.08687**	.08240**	.11715	.14600	.17736	.20129**
		(0.043)	(0.038)	(0.341)	(0.135)	(0.151)	(0.062)
	dlnrgdp	.98727***	.98065***	1.00698 ***	.97418***	.96517***	.97923***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	drsint	-.53745	-.10937	-1.36291	-.95047	.96517	-2.16510
		(0.359)	(0.861)	(0.130)	(0.419)	(0.147)	(0.111)
	drdfint	-.27588	-.17572	-.36955	-.97356	-1.59030	-.92987
		(0.532)	(0.675)	(0.516)	(0.250)	(0.168)	(0.223)
Panel B: House Price	dlnrhprice$_{t-1}$	-.35897***	-.39778***	-.03011	-.17164**	-.12859	-.11663
		(0.000)	(0.000)	(0.576)	(0.040)	(0.176)	(0.250)
	dlncredit$_{t-1}$	.02194***	.01168	.05590***	.00077	.00500	.01651
		(0.005)	(0.232)	(0.008)	(0.968)	(0.840)	(0.595)
	dlnrgdp	.02670***	.02140**	.05721***	.01926	.01191	.04067***
		(0.001)	(0.038)	(0.002)	(0.325)	(0.621)	(0.353)
	drsint	-.45190	-.44354	-.87341	-1.5921*	-1.98101**	-3.21479***
		(0.158)	(0.363)	(0.212)	(0.095)	(0.068)	(0.010)
	drdfint	-.27211*	-.36511	-.01563	-.967285	-1.28197*	-1.11021
		(0.077)	(0.298)	(0.975)	(0.122)	(0.091)	(0.178)

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The variables are transformed in logarithms except for short term interest rates and term spread. Also, all variables with their first difference at real terms. The lag order is one for all samples. *dlnrlhprice*: house prices, *dlncredit*: private credit, *dlnrgdp*: economic activity (and total income); *dlrsint*: short- term interest rates; drdfint: term spread

Similarly, the signs of estimated coefficients of the exogenous variables (i.e. economic activity, total income, short-term interest rates and term spread) are as expected in both Panels A and B. The economic activity and total income affect credit and house prices in the same direction, and the estimation results are also statistically meaningful. A change in interest rates adversely affects both endogenous variables as expected. A 1% increase in short-term interest rates (*drsint*) and term spread (*drdfint*) reduces credit supply by 0.53745% and 0.27585% respectively. However, their coefficients are statistically insignificant. Economic activity accounts for most of the variance in credit supply. In Panel B, a 1% increase in short-term interest rates and in term spread also has a depressing effect on housing demand, and thus house prices, by 0.45190% and 0.27211% respectively. The coefficient of short-term interest rates is not significant statistically, but that of term spread is.

Moreover, Panel B in Model 1 shows that house prices, and hence housing demand are the most sensitive to a change in interest rates, more so than a change in either credit or total income. In fact, the impact of a 1% change in short-term interest rates is almost 22 times stronger for house prices than the impact of a change in income. This is the strongest predictor of house prices. This may be taken as an indication that affordability of credit is a more important factor than income in households' borrowing decisions. In this case, it might be suggested that potential house buyers give the affordability of mortgages greater weight than their income in making decisions in the EU. In addition, this may be an indication why housing credit has a much longer maturity than other types of credit (e.g. consumer credit). Given that for the vast majority of households who want to own their own home, this will be the most expensive asset they will ever buy, and given that households mostly require financing to do so, it could also be argued that affordability of credit is more important for households than the actual amount borrowed.

Then, the VAR model is estimated to test the second hypothesis to see whether monetary policy affects the relationship between private credit and house prices. To achieve this, the whole sample is divided into two groups: Eurozone and non-Eurozone countries, according to their monetary policy, and the main model is re-estimated. Model 2 comprises the estimation results for the Eurozone, where a common monetary policy determined by the ECB exists, and Model 3 comprises the estimation results for the group of the countries that determines their own monetary policies independently (i.e. non-Eurozone).

Results in the two models are consistent with the results of the whole sample (Model 1). The signs of the estimated coefficients of all the variables in Models 2 and 3 are as expected and similar to those of Model 1. In both models, a 1% change in house prices in Panel A causes a 0.08240% change in credit supply in Model 2 and a 0.11715% change in Model 3. In the non-Eurozone group, the impact of a change in house prices on credit is higher than it is in the Eurozone group. However, the estimated coefficient of the house price variable is statistically significant in the Eurozone group but not in the non-Eurozone. In Panel B, a 1% change in credit supply alters house prices in Models 2 and 3 by 0.01168% and 0.05590% respectively; in Panel A the coefficients are statistically significant for non-Eurozone but not for Eurozone countries. Although the relationship between credit and house prices has a positive sign, it can be observed that the size of the relationship in the two zones is different. In addition, this relationship is stronger in the non- Eurozone than in the Eurozone. In the Eurozone, one suggestion can be that a common monetary policy of the ECB may weaken the relationship of credit with house price while a national monetary policy may have an opposite impact like in non-Eurozone. Another one can be argued that a differentiation in monetary policy strategy affects the magnitude of the relationship between credit supply and house prices.

At a whole-sample level, in both the Eurozone and non-Eurozone, there is an inverse relationship between credit supply and the short-term interest rates as well as term spread, and this is also the case with respect to the relationship of house prices with term spread and the short term interest rates. Nonetheless, their coefficients are insignificant in both regions. Again, economic activity is the most important determinant of credit supply in both Eurozone and non-Eurozone (Panel A) and short-term interest rates represent the main driver of house prices in the whole sample (Panel B).

Models 4 to 6 in Table 3.5 show the results in the Eurozone countries for three different groups: the GIIPS group and its sub-groups (i.e. the GIIS and IS). The GIIPS covers the sovereign debt crisis countries in the Eurozone (i.e. Greece, Ireland, Italy, Portugal and Spain). the GIIS comprises four countries in the GIIPS except for Portugal that experienced simultaneous sharp increases in both credit supply and house prices (i.e. a credit boom and a house price boom) before sovereign debt crisis in the Eurozone (Figure 3.4); and IS where is one of the main reasons for sovereign debt crisis was the house price boom turning into a bust (IMF, 2011a and 2011b). This group covers Ireland and Spain. The results for these three Eurozone sub-groups are also consistent with the results from Models 1 and 2, as are the signs of the estimated coefficients. These results indicate differences between the sub-groups with regard to the magnitude of the relationship between credit and house prices. This may can stem from different country-specific features covered by the sub-sample (e.g. economic structure, institutional environment etc.)

Among all sample groups, the impact on credit of a change in house price is strongest in the IS group (0.20129) and weakest in the Eurozone group (0.08240) in Panel A. The estimated coefficients of the housing variable are also statistically significant in both groups. The strongest impact on house prices of a change in credit is in the non-Eurozone (0.05590), while the weakest is in the GIIPS group (0.00077), but in both groups, the estimated coefficient is not statistically significant.

When the panel VAR model is tested for these different samples, the estimation results share some common features: first, although the sample size is different, the lag order of the panel VAR model for all is the same and is equal to one; second, the signs of the estimated coefficients are the similar and also as expected; third, the relationship between credit and house prices is positive, yet the impact on credit of a change in house prices is stronger than the impact on house prices of a change in credit; fourth, in the credit equation the main determinant of credit supply is economic activity; finally, interest rates are the main explanatory variable for house prices for all samples. This result may be taken as an indicator that house buyers pay much more attention to the affordability of credit than they do to either their income or their level of borrowing.

In conclusion, in the first phase of the analysis, all results, including both the whole sample and sub-samples, confirm the accuracy of this study's three hypotheses. There is a dynamic relationship between credit and house prices, and monetary policy can change the size of the relationship between credit and house prices in the Eurozone and non-Eurozone. However, this is also the case in the Eurozone sub-groups, even though they belong to the same group of countries with regard to economic development and are subject to the same monetary policy. From the findings, other factors can also be observed to play a role in the relationship between house prices and credit, besides monetary policy (e.g. economic structure, the features of the housing finance system and institutional features).

Estimation results at country level

In the second phase of the analysis, the relationship between credit supply and house prices is examined for each of the countries in the GIIPS group of the Eurozone.That is, this relationship is explored for Greece, Ireland, Italy, Portugal and Spain. As earlier mentioned, to achieve this, we re-estimate the VAR model at country level, which uses the first order lag for each of the individual countries according to the BIC criterion as displayed in Table 3.4.

Table 3.6 exhibits the estimation results of our model. Panel A and Panel B indicate the private credit and house price equations respectively. The results for the five countries in Panels A and B are similar to those of the sample groups at cross country level: the signs of the credit and housing price coefficients are as expected and there is a positive relationship between the two endogenous variables. In Panel A, a 1% change in house prices affects credit supply in Greece by 0.25233%, in Ireland by 0.08074%, in Italy by 0.18496%, in Portugal by 0.37687 and in Spain by 0.47746%. The estimated coefficients of the house price variable are statistically significant in all countries. In Panel B, a change in credit supply has a lower impact on house prices than that of house prices on credit in all the individual countries. A 1% change in credit supply affects house prices in Greece by 0.06002%, in Ireland by 0.01501%, in Italy by 0.00922%, in Portugal by 0.06738% and in Spain by 0.02174%. The estimated coefficients of the credit variable are statistically significant for all except for Italy and Portugal.

The individual country findings are the similar to those of the cross-country and asserts the first hypothesis. That is, there is a dynamic relationship between credit and house prices, but with different magnitude. Again, the effect on credit supply of a change in house prices is stronger than the effect on house prices of a change in credit supply for all individual countries in the lag order one, but with different strength. Among the GIIPS group, this effect is strongest in

Spain and weakest in Ireland. Conversely, the strongest impact of a change in credit on house prices is in Portugal while the weakest is in Italy.[56] From these findings, one suggestion can be that the common monetary policy determined by the ECB produces different outputs for each member country of the Eurozone relating to the relationship of credit of house price.

Table 3.6. Estimation Results for Individual Countries

		Greece	Ireland	Italy	Portugal	Spain
Panel A: Credit Market	$dlnrealhp_{t-1}$	.25233***	.08074*	.18496**	.37687**	.477761***
		(0.000)	(0.090)	(0.098)	(0.022)	(0.000)
	$dlncredit_{t-1}$	.11031***	.49873***	-.00832	.11977***	.056885*
		(0.003)	(0.000)	(0.716)	(0.002)	(0.099)
	dlnrealgdp	.96696***	1.0403***	1.0020***	1.01241***	.99588***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	drealsint	-.38433	-1.37691	.13236	-.91179	-.43856*
		(0.110)	(0.102)	(0.137)	(0.154)	(0.077)
	drdfint	.30405	-.96453	-.14378	.41791	1.3735**
		(0.250)	(0.890)	(0.613)	(0.426)	(0.050)
Panel B: House Price	$dlnrealhp_{t-1}$	.60085***	.7690***	.9696***	.61047***	.87689***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	$dlncredit_{t-1}$	.06002**	.01447*	.01270	.03827	.02174*
		(0.048)	(0.093)	(0.125)	(0.109)	(0.096)
	dlnrealgdp	.02445	.10423**	.00473	.01883	.04563*
		(0.365)	(0.070)	(0.672)	(0.398)	(0.065)
	drealsint	-.97019**	-.42392	-.64285**	.09934	-.63592
		(0.012)	(0.799)	(0.014)	(0.800)	(0.255)
	drdfint	-.15534	-.45002	-.40682	-.05680	-.36589
		(0.194)	(0.641)	(0.106)	(0.855)	(0.391)
	Observations	72	72	72	72	72

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The variables are transformed in logarithms except for short term interest rates and term spread. Also, all variables with their first difference at real terms. The lag order is one for all samples. *dlnrlhprice*: house prices, *dlncredit*: private credit, *dlnrgdp*: economic activity (and total income); *dlrsint*: short-term interest rates; *drdfint*: term spread.

[56]In fact, in the real world, all variables of the VAR model, could be regarded as endogenous. Indeed, the empirical study of Goodhart and Hofmann (2008) on this issue confirm the results. As a matter of fact, when we estimate the VAR model for each of individual countries without any assumption based on the fact that there are control variables, the results themselves confirm this (see Appendix 3.8). In this case, all variables are treated as endogenous and that each variable's equation has its own lagged value, the lagged values of the other model variables, and an error term. As the focus of this study is to examine the relationship between credit supply and house prices, we estimate the panel VAR model by assuming that all other variables are exogenous except for house prices and credit variables.

3.6.2. Further Tests

Stability condition

Having tested the VAR model at cross-country and individual-country level, a check is carried out of whether the models estimated for each of the whole sample, its sub-groups and the GIIPS countries fulfil the stability condition. If our model is stable, the variables in the VAR model will be stationary. Appendices 3.9 and 3.10 illustrate the results in relation to the stability conditions of all estimated models at cross country and country and show that all meet the stability condition, because all the eigenvalues lie inside the unit circle for all cross-country samples and individual countries.

In practice, the VAR model estimates are rarely interpreted alone but are evaluated together with Granger causality tests, forecast-error variance decompositions and impulse response functions (Brooks, 2008; Canova and Ciccarelli, 2013; Wooldridge, 2016).

Granger causality test

An examination of causality in the VAR model helps identifying whether an endogenous variable in the model has a statistically significant effect on the future values of each of the other endogenous variables in the system. In other words, the Granger causality tests show only an association between the current value of one of the endogenous variables and the past values of other(s) (Brooks, 2008; Wooldridge, 2016). Thus, the causality test results show whether a change in one of the endogenous variables gives rise to a change in the other. In addition, they point out whether one of the endogenous variables has a unidirectional, a bidirectional or no relationship with other endogenous variable(s).

When the Granger causality tests are applied in the VAR model of the present study, it is possible to see whether there is a causal relationship between credit supply and house prices – or vice versa – for the 14 EU countries and hence to determine the direction of the causality. Table 3.7 presents the results for the whole sample and the sub-groups (i.e. Eurozone, non-Eurozone, GIIPS, GIIS and IS), and Table 3.8 presents the results for the individual countries.

Results at cross-country level

The results for the whole sample show a two-way causal relationship between credit (*dlnrcredit*) and house prices (*dlnrhprice*) in lag order one (Table 3.7). This means that changes in house prices cause changes in credit supply and the same is true for credit: changes in credit cause changes in house prices. For the whole sample, the causality from credit to house prices is stronger than the one from house prices to credit.

The Granger causality test results for the sub-groups of the EU (i.e. Eurozone, non-Eurozone, GIIPS, GIIS and IS) are different from the whole sample in lag order one: there is a one-way relationship in all cases except for the GIIPS and the GIIS groups. In addition, the direction of the causality varies between certain groups. In the Eurozone and non-Eurozone, which have a one-way relationship between credit and house prices, the direction of the causality is different. In the Eurozone, which has a common monetary policy, the direction of the causality is from house prices to credit; in the non-Eurozone the direction is from credit to house prices. Given that there is one-way causality from house prices to credit in the Eurozone group, it can be concluded that the housing markets, not the credit markets, are decisive in this relationship. In this case, contrary to expectations, monetary policy alone may have a weak impact on housing markets in the Eurozone. As such, it is important for the European Central Bank (ECB) to consider both credit policies and housing market policies together[57] because the ECB is a single authority for governing the monetary policy in the Eurozone credit markets while housing markets are governed by national policy. This highlights the need for close coordination between the ECB and national authorities in order to achieve the objectives of financial and economic stability in the Eurozone.

In the situation of the non-Eurozone group, the causality of which goes from credit to house prices, a one-way causality shows that the credit market is more important than the housing market in the relationship between credit supply and house prices. Thus, it can be argued that, in non-Eurozone countries, monetary policy can mitigate or even eliminate the likelihood of financial and economic instability resulting from this relationship more effectively than in the Eurozone group.

In the IS group (Ireland and Spain), there is a one-way causality in the lag order one, with its direction being from house prices to credit, as in the Eurozone. Yet there is no causal relationship between credit and house prices in the GIIPS and GIIS samples in the same time period despite them having a common monetary policy as members of the Eurozone and being in the same category in terms of economic development. In these two groups, credit and house prices move independently in the lagged one quarter.

The results at cross-country level show a causal relationship between credit and house prices for all samples in lag order one, except for the GIIPS and GIIS groups. However, the direction of the causality and its strength differ among them as seen in the Eurozone and non-Eurozone

[57] Housing polices include: investment in social housing, rent controls, and support for alternative types of rental housing (such as co-ops).

groups. In the non-Eurozone, the causality is from credit to house prices, but the reverse in the Eurozone. In addition, in the non-Eurozone, the causality is stronger than in the Eurozone. This provides an evidence for how the two different monetary policies within the EU affect the relationship between credit supply and house prices in different ways. Nonetheless, this is also valid in lag order one in the Eurozone sub-samples, which share the same monetary policy. There is a causal relationship between credit and house prices in the IS group, but none in the GIIPS and GIIS groups.

It might be suggested that monetary policy can have an effect whenever a causality is present and can also alter the size of the relationship from one sample to another. However, it can also be argued that this case indicates that monetary policy is not the only determining factor: other factors, such as the characteristics of individual countries, may also affect the relationship between credit supply and house prices.

Results at country level

Finally, the Granger causality test is applied separately to the GIIPS (the Eurozone's sovereign debt) countries. These findings are consistent with results achieved at cross-country level. The presence or absence of causality and its direction in the relationship between credit supply and house prices can vary among these countries in one lagged quarter. As shown in Table 3.8, causality between credit and house prices can be observed only in Italy and Spain in one lagged quarter with no causality in the other GIIPS countries (i.e. Greece, Ireland and Portugal) in the same period. There is a one-way causality in Spain and its direction is from house prices to credit; in Italy, there is a two-way causality and the direction from house prices to credit is stronger than from credit to house prices; Italy also has a stronger causality than Spain.

Thus, the causality results at country level show differences between these countries regarding the direction of the causality and its size. While a causal relationship in Italy and Spain is evident in one lagged quarter, none is observable in Greece, Ireland and Portugal in the same period, and credit and house prices move independently in these three countries in the lag order one.

However, a causality between credit and house prices does occur in these three GIIPS countries (Greece, Ireland and Portugal) but only over a longer time period than in Italy and Spain. It is not observable over lag order one, but arises over lag order three or later. As shown in Appendix 3.11, a causality arises in three lagged quarters in Greece, four lagged quarters in Ireland and seven lagged quarters in Portugal. In addition, as in Spain, both Greece and Ireland demonstrate a one-way causality and its direction is from house prices to credit. Portugal has a two-way relationship, like Italy, but differs in that, in the former, the direction of causality between credit and house prices is stronger than from credit to house prices.

Consequently, the causality test results in lag order one at cross-country and individual-country level are quite similar to each other and and confirm the hypotheses of the essay. They show a causal relationship between credit and house prices for most of samples of the analysis, but with some differences, such as size of relationship and its direction at cross-country and individual-country level. Monetary policy affects the direction of the causality of the relationship between credit supply and house prices as well as its strength. However, a differentiation also exists with regard to the presence/absence and direction of the causality between credit and house prices, even where there is a common monetary policy, as seen in the Eurozone. This differentiation cannot be explained by difference in monetary policy alone, so it is necessary to consider other factors, such as countries' economic structure and their institutional environment etc. Furthermore, the direction of the causality can be important in managing and/or controlling the relationship between credit supply and house prices and hence in setting more efficient policies.

Heretofore, the Granger causality tests have been applied in the VAR model, allowing us to observe how changes in one endogenous variable (e.g. credit) alters the future value of another endogenous variable (e.g. house prices) for the whole sample and its sub-samples, as well as in individual countries. However, the complete story about the relationship between endogenous variables cannot be told in full by the Granger-causality test. It is also necessary to understand whether changes in the value of the endogenous variable being considered have a positive or negative effect on the other endogenous variables in the equations system of the VAR and, if so, how long it takes (Brooks, 2008).

Table 3.7. Results of Granger Causality Test for Cross-country Level

	Housing Price Equation		Credit Equation		Relationship	Direction
Excluded	dlnrcredit	All	dlnrhprice	All		
Whole Sample	8.017***	8.017***	4.095**	4.095**	Two way	HP ↔ CRE (1)
Eurozone	1.426	1.426	4.284**	4.284**	One way	HP → CRE
Non-Eurozone	0.908	0.908	7.084***	7.084***	One way	CRE → HP
GIIPS	2.234	2.234	0.002	0.002	No relationship	
GIIS	2.058	2.058	0.041	0.041	No relationship	
IS	3.495**	3.495**	0.001	0.001	One way	HP → CRE

Note that: (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. In all samples, the lag order is one. HP: house price, CRE: private credit.
(1) The effect of credit on house price is stronger than that of housing prices on credit.

Table 3.8. Results of Granger Causality Test for Individual Countries

Excluded	Credit Equation		Housing Price Equation		Relationship	Direction
	dlnrhprice	All	dlnrcredit	All		
Greece	1.473	9.2523*	2.213	8.9072*	No relationship	
Ireland	2.412	16.699***	0.049	1.951	No relationship	
Italy	6.432**	16.001***	3.4612*	9.6275**	Two way	HP ↔ CRE [(1)]
Portugal	1.079	5.646	0.804	7.339	No relationship	
Spain	8.3349 ***	29.602***	0.41434	2.2421	One way	HP → CRE

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. In all samples, the lag order is one. HP: house price, CRE: private credit.
(1) The effect of house prices on credit is stronger than that of credit on house price.

For this purpose, other tools of the VAR model – error variance decompositions and impulse response functions – are applied. The impulse response technique is used in order to observe the effects of the impulses of shocks to the responses of our endogenous variables in the VAR model. The variance decomposition tool reveals the proportion of movements in the endogenous variables attributable to their own shocks received, in relation to shocks to the others.

Variance Decomposition

In examining the dynamics of the VAR model in error variance decompositions, a slightly different method is followed. Variance decompositions determine the extent to which the forecast of error variance in every variable can be explained by external shocks to other variables and show how much each endogenous variable contributes to other variables.

The results from variance decomposition are displayed in Tables 3.9 and 3.10. Table 3.9 shows the contribution of the previous lags of each of two endogenous variables (i.e. credit and house price) to their error variance in the whole sample as well as in the sub-groups. Table 3.10 presents the results of variance decomposition in individual countries. These results are for a shock of one standard deviation

Results at cross-country level

In Table 3.9, house price (*dlnrhprice*) explains 2.692% of the error variance of credit (*lnrcredit*) in the case of the whole sample in the ten-year period, while credit explains 0.025% of error variance of house price. The contribution of house prices in forecasting the error variance of credit is higher than the contribution of credit in forecasting the error variance of house prices. In other words, at 2.692%, the contribution of house prices in explaining the error variance of the credit variable is higher than that of credit.

The findings from variance decomposition for all the sub-groups are similar to the results for the whole sample. That is, the contribution of house prices in forecasting the error variance of credit is higher than that of credit. The results indicate that, in the Eurozone, house price explains 3.412% of the error variance of private credit but 2.299% in the non-Eurozone. Credit explains 0.042% and 0.107% of the error variance of house price in the Eurozone and non-Eurozone respectively.

Table 3.9. Variance Decomposition for Cross-country Level

Response Variable	Period	Impulse Variable : dlnrcredit					
		Whole Sample	Eurozone	Non-Eurozone	GIIPS	GIIS	IS
dlnrhprice							
	1	0	0	0	0	0	0
	5	.00025	.0000421	.0010751	.00000107	.0000159	.000069
	10	.0002501	.0000421	.0010751	.00000107	.0000159	.000069
Response Variable	Period	**Impulse Variable: dlnrhprice**					
		Whole Sample	Eurozone	Non-Eurozone	GIIPS	GIIS	IS
dlnrcredit							
	1	.0158946	.0270484	.0205548	.0444907	.0695902	.0109482
	5	.0269158	.0341129	.0229954	.0568586	.0804468	.0572295
	10	.0269217	.0341218	.0229954	.0568588	.0804468	.0572296

Note that: the GIIPS consists of Greece, Ireland, Italy, Portugal and Spain; the GIIS covers Greece, Ireland, Italy and Spain, except for Portugal and the IS includes Ireland and Spain; Individual countries cover the GIIPS countries.
dlnrcredit: private credit; *dlnrhprice*: house prices.

the contribution of credit in explaining the error variance of house price is higher in the whole sample (0.250%), considered at sub-sample level, the lowest one is the GIIPS group (0.0001%).

In the panel VAR model, a common feature of the samples is the higher contribution of house price in forecasting the error variance of credit because house prices are more likely to explain the error variance of credit than credit explains the error variance of house prices. Thus, these cross-country results show that the size of the contribution of house price to the explanation of the error variance of credit changes from one sample to another. The reverse is also true.

Results at country level

When the five GIIPS countries are taken individually, the results are similar to the results of the samples at cross-country level, with the exception of Portugal, yet the proportion of the contribution of one of the endogenous variables to the explanation of the error variance of the other is different from country to country, as shown in Table 3.10.

Table 3.10. Variance Decomposition for the Individual Countries

Response Variable	Period	Impulse Variable: dlnrcredit				
		Greece	**Ireland**	**Italy**	**Portugal**	**Spain**
dlnrhprice						
	1	0	0	0	0	0
	5	.046187	.000251	.000012	.083241	.001411
	10	.046811	.000381	.014993	.083912	.001603
Response Variable	**Period**	**Impulse Variable: dlnrhprice**				
		Greece	**Ireland**	**Italy**	**Portugal**	**Spain**
dlnrcredit						
	1	.02806	.07129	.000705	.009996	.076637
	5	.082626	.1112	.049249	.009949	.189198
	10	.083895	.112115	.049249	.009955	.218417

Note that: *dlnrcredit*: private credit; *dlnrhprice*: house prices.

In other words, even if the explanation rates of the variables' variance differ for Greece, Ireland, Italy and Spain, the results are similar to the cross-country ones. The house price variable goes most of the way to explain the error variance of private credit in these countries. However, the opposite obtains in Portugal, where the credit variable explains the error variance of the house price variable more than the other way around.

At 8.389%, the contribution of house price in explaining the error variance of the credit variable in Greece is the highest among the five GIIPS countries in the ten-year period but lowest in Portugal (0.995%). Again, while the contribution of credit in forecasting the error variance of house price is highest in Portugal (8.391%), among these countries, it is lowest in Spain (0.16%).

As a result, in all the samples of the analysis at both cross-country and individual-country level, with the exception of Portugal, house prices are more likely to explain the error variance of credit than credit is to explain the error variance of house prices. However, the size of the contribution in forecasting the error variance varies from one sample to another. One interpretation is that a relationship between credit supply and house prices exists in all cases, but the direction of causality may differ, even if they share the same monetary policy. Another interpretation is that these findings may be seen as an indicator that the integration of the two markets has not taken place at an advanced level among EU member countries, or perhaps as an indicator of the existence of integration but at varying rates between countries.

Impulse responses function

Impulse response functions are used to track impulses of the system's shocks to responses of system variables. They allow us to keep track of how the other variables react to a shock that occurs in one of the endogenous variables in the model. In the impulse response function, a unit of shock is applied for each endogenous variable in each equation, and its effect on the VAR system is observed within a certain time period. As such, an impulse response graph shows how a variable is affected after a unit of shock on one of the other endogenous variables. The shock within the model is also expected to disappear gradually in a stable system (Brooks, 2008; Wooldridge, 2016).

In order to observe the effects of impulses of shocks vis-à-vis the responses of the endogenous variables (i.e. credit and house prices) in our VAR model, first a unit of shock is applied to the model by taking the whole sample, then the sub-samples, as well as each country in the GIIPS group.

Figure 3.5 displays the impulse responses for the whole sample in a 95% confidence band as well as for the Eurozone and non-Eurozone. For the GIIPS, GIIS and IS, the impulse responses figures are shown in Figure 3.6. Figures 3.7 and 3.8 present the impulse responses for each of the individual countries (i.e. Greece, Ireland, Italy, Portugal and Spain). All figures display the effects on present and future values of the endogenous variables for one standard deviation shock (or a unit of shock) in one of the variables. Thus, in the model equations, it is possible to go beyond the average estimations illustrated in Tables 3.5 and 3.6.

Results at cross-country level

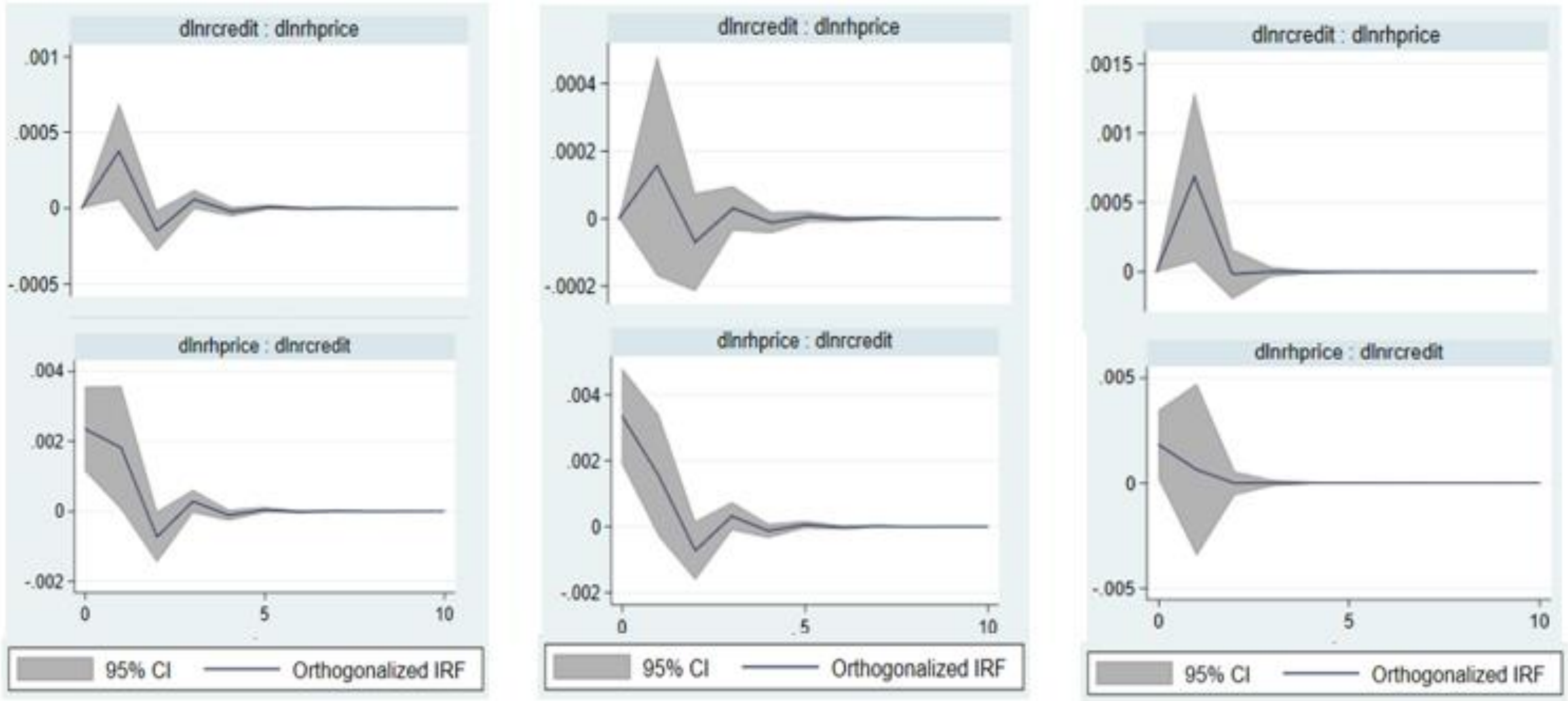
In whole sample, when a positive shock is delivered to credit (*dlnrcredit*) to house prices (*dlnrhprice*), the first effect for one step is significantly positive, but thereafter it is insignificant (Figure 3.5). When a unit of shock on house prices to credit is applied, the effects are initially positive in the first two periods, but then negative and insignificant.

Looking at both the Eurozone and non-Eurozone, when one standard deviation shock on credit is applied, the responses of house prices differ. In the Eurozone, the effect of the shock is insignificant, but significant in the non-Eurozone. In the non-Eurozone, the effect of the shock on house prices exhibits a similar trend to the whole sample and is significantly positive for one step and then insignificant (Figure 3.5). When a unit of shock on house prices to credit is applied, the response of credit is the opposite. In the Eurozone, a similar trend to the whole sample is observable, whereas in the non-Eurozone the effect of the shock on credit is not significant.

In the case of the GIIPS, the effects on house prices of shocks to credit are similar among constituent countries, as well as to the Eurozone, and insignificant (Figure 3.6). On the other hand, applying a positive shock to house prices elicits a response from credit displaying an almost similar trend to the Eurozone for the GIIPS and GIIS groups but not for the IS group. That is, the effect on credit of a shock to house prices is positive in the first two periods, but thereafter the responses of credit are negative and insignificant in the GIIPS and GIIS groups. However, the effect is not significant in the IS.

Figure 3.5. Impulse Response Functions for Cross-country Level (I)

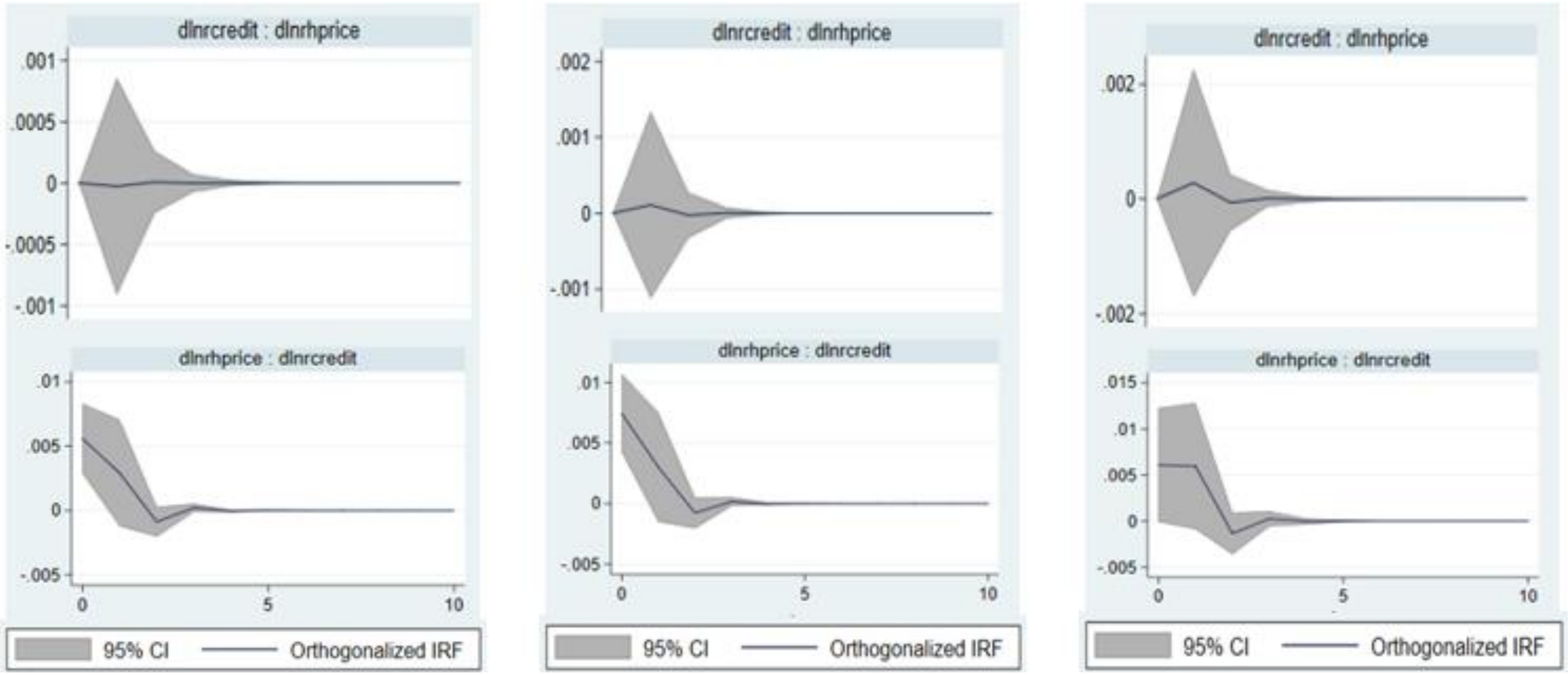
Whole sample **Eurozone** **Non-Eurozone**



Note that: *dlnrcredit:* private credit/GDP and *dlnrhprice*: house price.

Figure 3.6. Impulse Response Functions for Cross-country Level (II)

GIIPS **GIIS** **IS**



Note that:*dlnrcredit:* private credit/GDP and *dlnrhprice*: house price

Results at country level

Figures 3.7 and 3.8 show the impulses and responses of both endogenous variables for the five countries in the GIIPS. In Greece, when a positive shock on credit to house price occurs, the response of house prices is significant for two steps, in which prices increase; thereafter it is insignificant (see Figure 3.7). In Portugal, the effect of oneunit shock to credit is the similar to Greece. But, in Portugal, the response is significantly negative and occurs in a shorter time (see Figure 3.8).

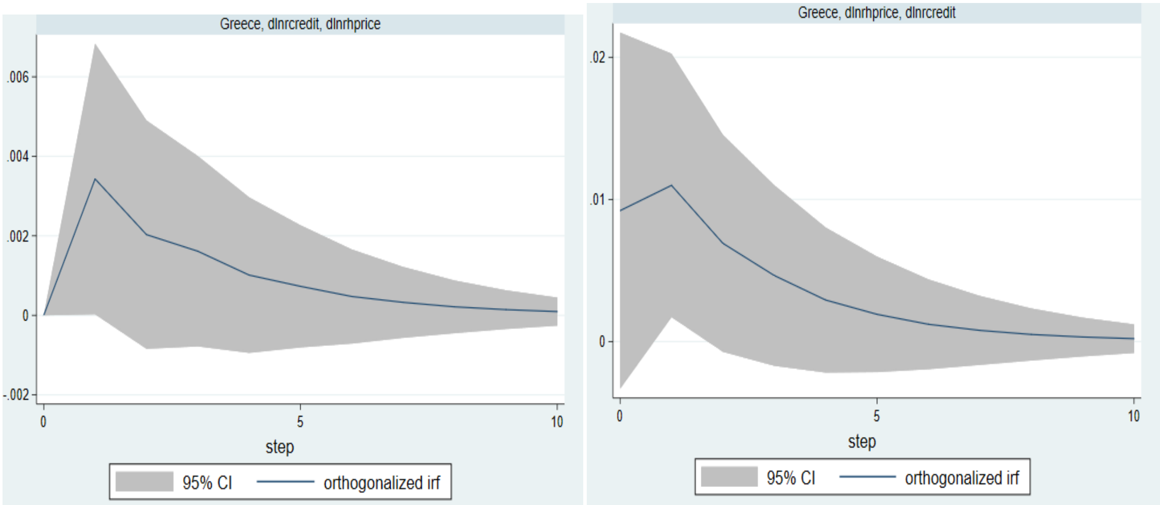
On the other hand, the impacts on house prices of a shock to credit are not significant in the rest of the GIIPS countries (i.e. Ireland, Italy and Spain). In applying a positive shock to house prices, the response of credit is almost similar in three of the GIIPS countries (Greece, Italy and Portugal) but not significant (see Figure 3.7 and 3.8). In Ireland, the impact of this shock is significant for the first step and then disappears, while in Spain this effect continues for longer (about five periods) than in Ireland until it disappears.

In summary, the cross-country and country level findings confirm the hypotheses of the study: There is a dynamic relationship between credit supply and house prices; Monetary policy changes this relationship from the Eurozone to non-Eurozone; This relationship looks different at a cross-country and an individual-country level, even when the countries involved have the same monetary policy.

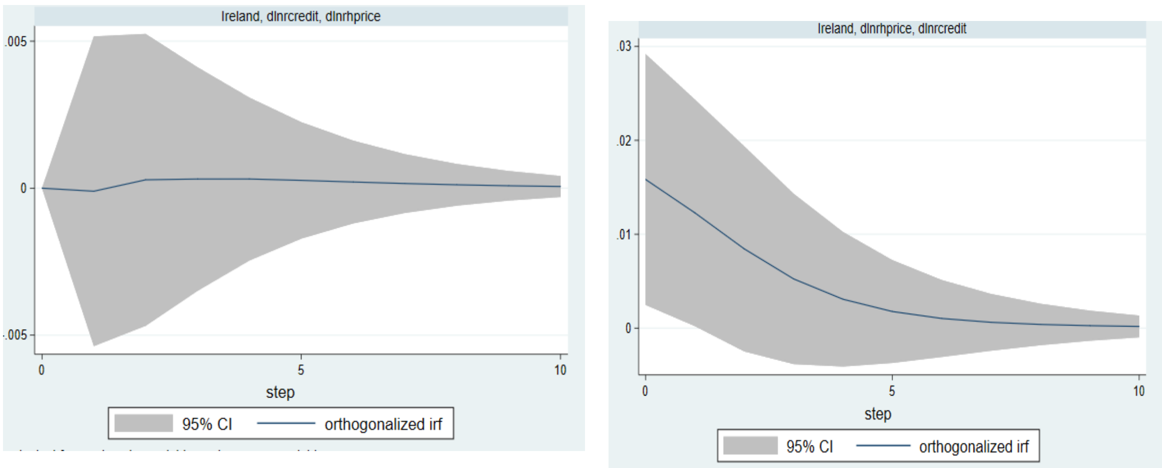
On the other hand, both cross-country and country findings are not largely consistent with the theory in the EU in the lag order one, except for the whole sample and Italy. That is, there is no two-way causality between credit and house prices for all samples. From these, one suggestion can be that country-specific features (e.g. economic structure, institutional quality) can create differences between the countries in addition to different monetary policy.

Figure 3.7. Impulse Response Functions for Individual Countries (I)

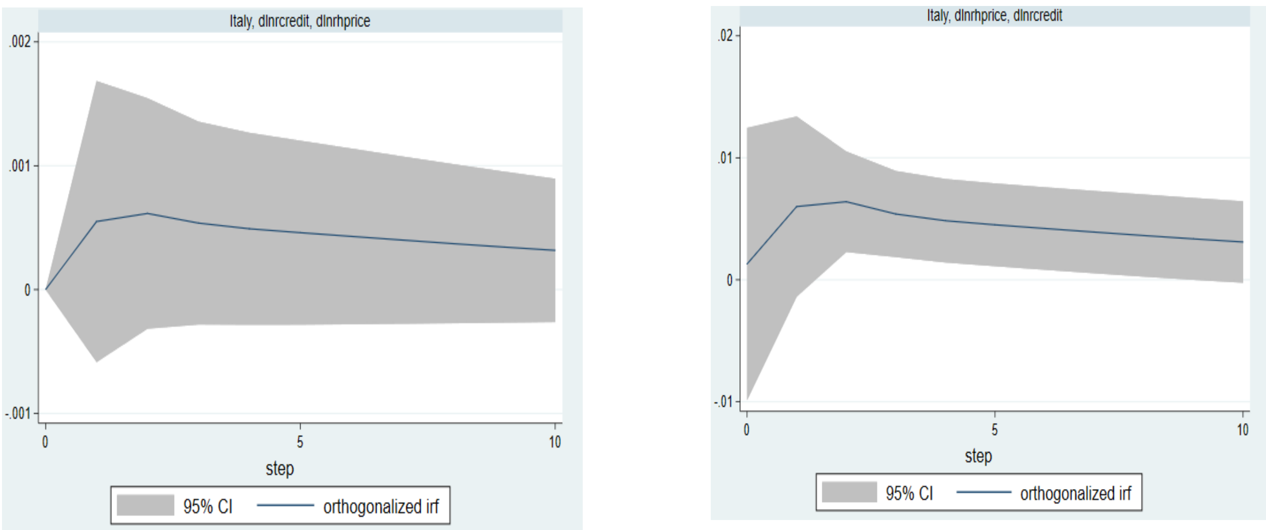
Greece



Ireland



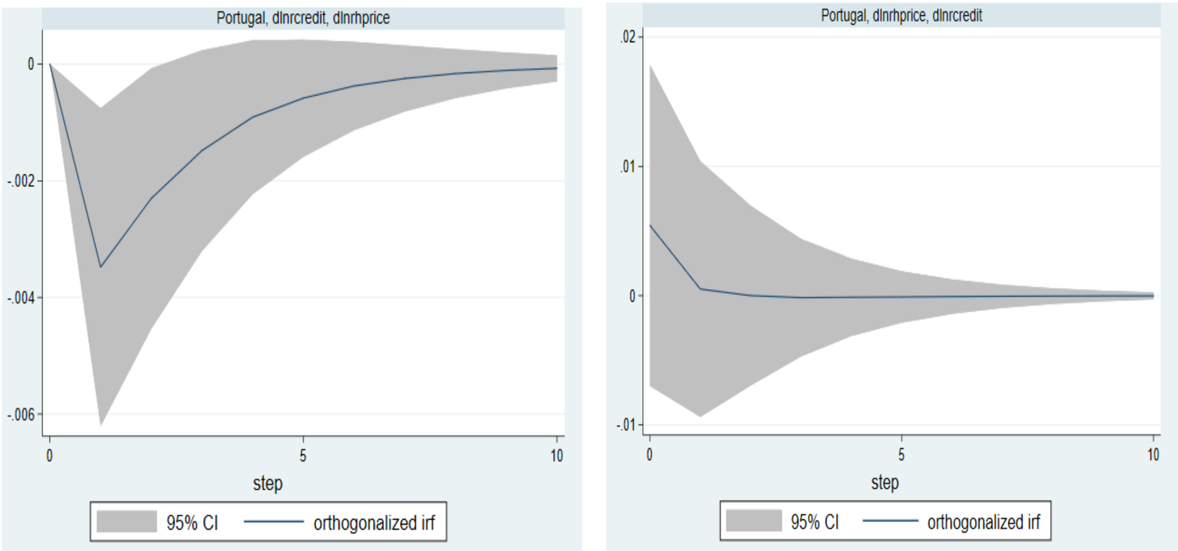
Italy



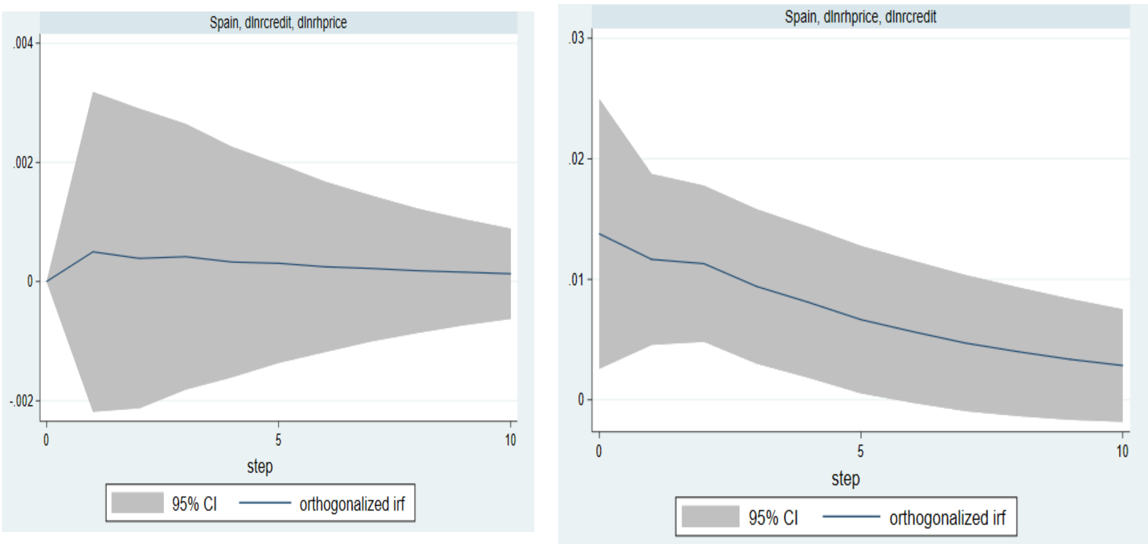
Note that: *dlnrcredit:* private credit /GDP and *dlnrhprice*: house price.

Figure 3.8. Impulse Response Functions for Individual Countries (II)

Portugal



Spain



Note that: *dlnrcredit:* private credit /GDP and *dlnrhprice*: house price.

3.7. Robustness Check

The robustness of the estimation results of the panel VAR is tested using an alternative method. For this purpose, the simultaneous equations model is estimated using the three-stage least squares (3SLS) technique.[58]

Although the simultaneous equations model and the VAR model are an alternative methods, there are some differences between these two methods.[59] In considering the reduced form of these models, the VAR model covers the actual lagged values of endogenous variables while in the simultaneous equations model current values of other endogenous and exogenous variables are expressed.

Unlike the VAR, the simultaneous equations model does not cover equations for all variables if they are the exogenous variables. In addition, in contrast to the VAR model, in the simultaneous equations model there is a distinction between endogenous and exogenous variables. Another difference is that the specification of the simultaneous equations model needs more information about the variables than the VAR model. In the case of the VAR model, only a list of variables that will intertemporally affect each other can be hypothesised.

In simultaneous equations model, the main assumption is that there is a relationship between the error term and one or more exogenous variables. In the VAR model, the error term is correlated with all variables, not just exogenous variables. Moreover, unlike in the simultaneous equations model, the VAR model may explain how the model's shocks (i.e. the effect of a shock to one of the endogenous variables on another variable) are transferred to other variables.

In conclusion, the main differences between these two models relate to the determination of the variables in the model, the determination of restrictions, the separation of the variables as endogenous or exogenous, the distribution of lags, the serial correlation features of the errors, and the information needed in the factors affecting a variable.

In checking the robustness of the results, as with the panel VAR, the simultaneous equations model consists of two equations: a private credit equation and a house price equation.

---

[58] It is accepted that the 3SLS yields an efficient estimation in a simultaneous equations model (Brooks, 2008; Kennedy, 2008).

[59] For the comparison of two models to each other, we benefited from the following sources: Chan and Chang, 1995; Wickens, 2007; Brooks, 2008; Wooldridge, 2016.

The equations include the same variables. That is, the variables in simultaneous equations model are credit supply (*credit*), house prices (*hprice*), economic activity (*gdp*), term spread (*dfint*), short-term interest rates (*sint*) and total income (*gd*p). Different from the panel VAR model, the endogenous variables' own lags are not included in the simultaneous equations model. Like in the panel VAR model, all variables are taken with their first differences in real terms. They are also expressed as their natural logs except in the case of the two interest rates (i.e. short-term interest rates and term spread).

The estimation results of the simultaneous equations model also cover the whole sample and its sub-groups (i.e. Eurozone, non-Eurozone, GIIPS, GIIS and IS). The results of the robustness check are presented in Table 3.11. In this table, Panels A and B show the private credit equation and the house price equation respectively.

Model 1 gives the estimation results for whole sample; Models 2 and 3 give the results for the Eurozone and non-Eurozone respectively; and Models 4, 5 and 6 give the findings for the Eurozone sub-samples (i.e. GIIPS, GIIS and IS).

The findings for the whole sample are consistent with the results for the panel VAR model. A change in one of the endogenous variables leads to a change in the other. That is, a change in house prices causes a change in credit in the same direction, even though the size of the impact changes. In Panel A, a 1% change in house prices causes a change in credit by 0.152% in a positive way.

The same is true for the effect on house prices of a change in the credit variable. A 1% change in credit supply positively affects house prices by 0.052%. In addition, similar to the panel VAR model, the impact on credit supply of a change in house prices is greater than the effect on house prices of a change in credit. Moreover, the relationship exogenous variables have with both credit and house prices are as expected and overlap that of the panel VAR model.

The estimation results for all the sub-samples confirm those of the panel VAR. Among all the samples, the strongest change in credit is in the IS, showing a 1% change in house prices causes a change in credit by 0.34407%. The same is true for the credit variable. As a result, the test results of the simultaneous equations model confirm the robustness of the results of the panel VAR model. The results show a relationship between credit supply and house prices, although the size of the relationship may vary among the different sub-samples of the EU.

Table 3.11. Estimation Results for a Robustness Check

		Model 1 Whole Sample	Model 2 Eurozone	Model 3 Non-Eurozone	Model 4 GIIPS	Model 5 GIIS	Model 6 IS
Panel A: Private Credit	$dlnhprice_{t-1}$	.16242***	.17658***	.11774**	.27180***	.31038***	.34407***
		(0.000)	(0.000)	(0.013)	(0.000)	(0.000)	(0.000)
	dlnrgdp	.98707***	.98346***	1.0050***	.98649***	.97777***	.98676***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	drsint	-.17841	-.04497	-.63843***	-.12471	-.25401	.07426
		(0.216)	(0.795)	(0.005)	(0.680)	(0.468)	(0.917)
	cons	.00245***	.00249***	.00260**	.00362***	.00352**	-0.0024
		(0.000)	(0.001)	(0.012)	(0.008)	(0.030)	(0.385)
	Chi2	7551.56	5143.18	3699.54	1595.79	1162.08	386.49
	R-sq	0.8812	0.8656	0.9441	0.8135	0.7988	0.7231
	P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: Housing Price	$dlnrcredit_{t-1}$	.04319***	.03348***	.06627***	.05227***	.07879***	.08565***
		(0.000)	(0.004)	(0.006)	(0.005)	(0.000)	(0.000)
	dlnrgdp	.06798***	.05849***	.08127***	.07183***	.08279***	.12781***
		(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
	drdfint	-.20188***	-.21745***	-.36906***	-.24933***	-.25831***	-.69967***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	cons	.00778***	0.0025***	.00252***	0.00825***	0.00892***	0.01868***
		(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)
	Chi2	133.99	120.27	33.34	103.09	105.3	70.13
	R-sq	0.1164	0.1313	0.1325	0.2164	0.2617	0.3077
	P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	Observations	1018	799	219	365	292	146

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The variables are transformed in logarithms except for short term interest rates and term spread. Also, all variables with their first difference at real terms. The lag order is one for all samples.*dlnrlhprice*: house prices, *dlncredit*: private credit, *dlnrgdp*: economic activity (and total income); *dlrsint*: short- term interest rates; *drdfint*: term spread

3.8. Conclusion

This study examines the size and direction of the private credit supply and house price relationship at both cross country and country level. In the empirical analysis, which comprises two stages, two alternative methods were used: the VAR model and its tools (granger-causality test, variance decomposition and impulse responses function) and simultaneous equations model. The second model was used for a robustness check.

Countries were also tested in groups, at the EU and Eurozone level. At the EU-level the countries were grouped according to their inclusion in the monetary policy (Eurozone and non-Eurozone countries). Within the Eurozone, three groups were examined: those which experienced a sovereign debt crisis (GIIPS group), those countries which were simultaneously facing a 'credit boom' and 'house price boom' (GIIS group); and those countries where the house price boom-bust cycle affected their crisis (IS group). Also, Greece, Ireland, Italy, Portugal and Spain, which are called as the GIIPS countries, were individually analysed.

The VAR Model results at cross-country, that is the Eurozone and non-Eurozone, as well as the sub-samples of the Eurozone (the GIIPS, GIIS and IS) were as follows. There is a dynamic relationship between credit supply and house prices for all cross-country samples in the first order, but with different magnitude. The whole sample has two-way causal relationship. Both the Eurozone and non-Eurozone have one-way causality, but the direction of casuality in the Eurozone is from house price to credit, in the non-Eurozone, it is the opposite. This proves that the monetary policy affects the size and direction of the relationship between credit supply and house prices. However, the existence of causality changes from sub-sample of the Eurozone to another. In the IS group, there is also a causality between credit and house prices, but not in the GIIPS and GIIS in the same period. This shows that besides monetary policy, other factors (e.g. economic structure and institutional environment) affect the relationship between credit supply and house prices.

Country level results are a quite similar to group results. In the case of five crisis countries (Greece, Ireland, Italy, Portugal and Spain), the size and direction of the relationship between credit supply and house prices changes from country to country in the lag order one, although they have the same monetary policy. In Italy, there is two-way causality between private credit and house prices, but one-way causality in Spain. However, there is no causality in Greece, Ireland and Portugal in the same period. Moreover, the whole sample confirms the theory, which suggests that credit and house prices mutual reinforcing in the lag order one, but not all the subsamples of the EU as well as individual countries.

The empirical analysis showed that the size of the relationship between credit supply and house prices, as well as the existence of causality and its direction, changes from one county to another, even if they have the same monetary policy. One suggestion following the empirical analysis was that other factors might play a role in this differentiation between countries, such as institutional environment, type of housing finance system, or economic structure. Building from this proposition, the aim of the second essay is to measure the institutional features of the mortgage credit markets.

CHAPTER FOUR

MEASURING THE INSTITUTIONAL FEATURES OF EUROPEAN MORTGAGE MARKETS[60]

Abstract

This chapter examines the institutional features of mortgage credit markets. Since institutions influence the allocation of resources and determine the rules of the game in the markets, they are among the factors affecting the development of these markets as well as their functioning. Institutional features of mortgage markets include: access to credit information, variety of mortgage products, foreclosure procedures, types of contracts, among others. National institutional variations are reflected in differentiations in mortgage markets between countries. However, although the relevant literature acknowledges the significance of the institutional characteristics, there are few studies that actually attempt to measure them. This chapter therefore aims to measure the institutional features of mortgage credit markets and create a benchmark by examining the European Union (EU) member countries. To achieve this, composite indices (overall index and its sub-indices) are developed using factor analysis. The findings show that the institutional features of the EU mortgage markets are heterogeneous and that the institutional environment, in addition to the other factors, plays a part in how these markets develop.

4.1. Introduction

In many countries, the housing market elevates residential mortgage markets to a privileged position in the financial markets and the economy. Ficek, Henderson and Johnson (1994) defines mortgage ~~markets~~ as those that provide funds to people and agencies purchasing real estate, and those that issue securities against mortgage loans or pools of mortgages, and which then trade these securities. Within the mortgage markets of the European Union (EU), mortgage finance accounts for a significant amount of the business of financial intermediaries. For example, as of the end of 2016, the outstanding mortgage debt to GDP ratio was 47.1% in the EU-28, the world's most advanced bloc of economic integration.[61] (EMF, 2017). In addition, mortgage credit represents the biggest share of total credit, with mortgage credit to total credit ratio standing at more than 70% in EU member countries (EBA, 2017). Although the volume of consumer credit has decreased in the EU in recent years, mortgage credits continue to grow

[60] I would like to thank participants of the AREUEA and the EBES Annual Conferences in the 2017.

[61] Economic integration is an agreement among countries to reduce and ultimately remove trade barriers and provide free movement of goods, services and factors of production between members. It can also refer to any type of arrangement in which countries coordinate their economic policies (see Baldwin, 2005).

(EBA, 2017). Moreover, mortgage debt also continued to grow in the EU despite the global financial crisis and the euro crisis post-2007. The growth rate in most years during the period 1995–2016 was above the economic growth rate.[62]

Because the EU mortgage credit markets are clearly so important, it is highly advisable to observe developments within them, as any such developments can have serious effects on the economy, potentially triggering a financial crisis, even at a global level. The 2007–2008 global financial crisis, which was more severe than the Great Depression of 1929, had its basis in the mortgage markets. Developments in these markets in EU member countries displayed similar trends pre- and post-crisis, but there were also marked differences. For example, in real terms, the annual average growth rate of mortgage credit between 2000 and 2007 was 8% in Portugal, 13% in Italy, 16% in Spain, 18% in Ireland, and 25% in Greece (EMF, 2017). The borrowing rate of home buyers from the credit markets varied from country to country within the EU (Eurostat). Similarly, differences were evident in default and foreclosure rates on the mortgage loans. In 2008, in comparison with 2007, the foreclosure rates in Austria (3.52%) and the Netherlands (8.28%) were much lower than in other EU countries, such as Spain (126.1%) and the UK (68.59%) (EC, 2011b). Many other examples can be cited.

Such differentiation may be in part attributable to the institutional features of the different mortgage markets. To investigate this, we would ideally begin with a clear definition of ‘institution’; however, a single accepted definition seems to be lacking. A definition widely cited in the new institutional economics literature is that of North (1990, 3), according to which institutions are rules, enforcement characteristics of rules, and the norms of behaviour that structure repeated human interaction. Some institutional characteristics of the mortgage markets are, among others: access to credit information, affordability of mortgage services, foreclosure procedures, types of contracts, and protection of the rights of market participants (lenders, borrowers and investors).

Furthermore, institutional characteristics are much more important for the EU member countries than for other countries, because the EU is aimed at the most advanced stage of economic integration, i.e. economic union, which requires a high level of harmonisation of institutional characteristics. Without this, institutional variations could cause differentiation in the development of mortgage markets – affecting the mortgage product that borrowers select,

[62]In the EU, the growth rate of mortgage debt has remained below the economic growth rate for only 2008 and 2013 in the period between 1990 and 2016 (see EMF, 2017; Eurostat).

the cost of the mortgage, the level of risk acceptable to financial intermediaries and other players in the mortgage markets, among other things. This, in turn, could affect how the integration of these markets progresses. For these reasons, it is important to identify and measure the institutional features of the mortgage markets of the EU.

A literature review reveals a vast amount emphasising the significance of institutional characteristics (e.g. Malpezzi, 1989; Maclennan, Muellbauer and Stephens, 1998; Calza, Moncelli and Stracca, 2013; Martins, Martins and Stevenson, 2015), yet very few studies actually measuring them by selecting particular features (e.g. Wyman, 2003; London Economics, 2005), and no previous attempt to create a benchmark for the institutional quality of the mortgage markets. Thus, the aim of this study is to measure the institutional features of EU mortgage credit markets and to create benchmark for these markets. Here, by institutional quality we mean simply having good institutions, although there is no consensus on what a ‘good institution’ is. In the case of the finance sector, it could be suggested that a good institution is one that enables the effective running of legal systems and well-functioning financial markets.

In this chapter, the following hypothesis is tested, namely: ‘Institutional characteristics in EU mortgage markets are heterogeneous’. The following questions are addressed:

- Are institutional features determinants of the heterogeneous nature of EU mortgage markets?
- Is there a relationship between institutional quality and the development of mortgage credit markets?

To address these questions and then to see whether the institutional characteristics of the EU mortgage markets are heterogeneous, an overall index with sub-indices is constructed by applying two techniques: explanatory factor analysis and scoring technique. The second is also used for a robustness check of the overall index. In addition, for other robustness check, the relationship between institutional quality and the development of the credit markets is examined using linear regression (OLS) and graphical methods. Thus, it will be possible to see whether the indices developed depict reality and also whether the institutions support the development of the mortgage markets.

The findings of the study show that EU mortgage credit markets have different institutional characteristics and do not have homogenous appearance. In addition, the findings indicate that institutional quality positively affects the development of financial intermediation in the mortgage credit markets.

This study's contribution to the literature is to produce an Institutional Index representing multiple dimensions of institutional features of the EU mortgage credit markets; to create a benchmark for the institutional quality of these markets; to use an alternative technique (i.e. scoring) in addition to factor analysis; and to examine the relationship between institutional quality and financial intermediation.

This chapter is organized as follows: The literature review is covered in Section 4.2. Sections 4.3 and 4.4 present the research methodology and data description. Sections 4.5 and 4.6 include the results of empirical analysis, and Section 4.7 draws the main conclusions.

4.2. Literature Review

Existing literature show that the developments and returns of real estate markets are measured by using an indexing method. An index is a measure of change, so such a method offers a more direct representation of change (Ralph, O'Neill and Winton, 2015). Indices have also proven useful in benchmarking performance in many fields, such as the economy, society and the environment (OECD and JRC, 2008). Because of this, a large number of indices have been developed for real estate markets at either country or regional level.[63] However, in the current literature review, despite a large number of indices for housing and commercial real estate markets, there is a very limited number produced for mortgage markets, and these are namely: the MBA Indices, the Completeness Index, the Product Availability Index and the Mortgage Market Index.

The oldest mortgage market indices are those developed for the US mortgage markets by the Mortgage Banking Association (MBA). The MBA has been publishing these market indices, compiled from data obtained from the US housing and mortgage markets, on a weekly basis since 1990. They are constructed as composite indices and are based on questionnaires. Data

[63] Some trace price changes in housing markets (e.g. the Case-Shiller Index for US markets), and some monitor returns in commercial real estate markets (e.g. the CBV Real Estate Index for Vietnam). International agencies have also developed indices for their member countries, such as the Residential Property Price Indices (RPPIs) prepared by the OECD. Many indices have also been developed for international real estate investors in commercial real estate markets to make a comparison among countries about property investment risks: these include the GRET index (Jones Lang LaSalle, 2016), the GRER index (Chen and Hobbs, 2003) and the Global REIA index (Lieser and Groh, 2011). Some compare returns (e.g. the IPD indices), and some assess countries' real estate investment potential, such as the REP index (Lee, 2005).

are grouped according to market dimensions such as purpose of loan, type of loan and type of product, after which the seven indices are produced (market index, purchase index, refinance index, conventional index, government index, fixed rate mortgage [FRM] index and adjustable mortgage [ARM] index). These indices cover over 75% of mortgage loan applications for purchases of single-family homes.

Wyman (2003) and London Economics (2005) aimed to evaluate the integration of EU mortgage markets. Considering four criteria (credit risk tolerance, product range, ease of the distribution process, and availability of information and advice), Wyman (2003) created a 'Completeness Index' according to data based on surveys covering eight EU member countries.[64] A Product Availability Index was developed for all member countries of the EU by London Economics (2005). It measures only the availability of mortgage products.[65] In contrast to Wyman (2003), this index adopts a supply perspective rather than a demand perspective (i.e. borrower perspective). Nonetheless, its findings approximately concur with the Wyman index, which adopts a demand perspective.

The IMF (2008) developed its Mortgage Market Index to compare the development level of the mortgage markets of 18 industrialised countries.[66] This index is based on both qualitative information (e.g. equity withdrawal options) and quantitative information (e.g. volume of mortgage securities issues). It is prepared by scoring between 0 and 1 with the highest scores indicating countries with the most advanced housing finance systems.

What these indices have in common is that they are all composite indices. Also, with the exception of the Mortgage Market Index, they are all based on surveys. The MBA indices covers US markets only, whereas the others cover multiple countries. In conclusion, it can be observed that not only is there a low number of indices dealing with mortgage markets, but in addition they are not produced and published regularly, with the exception of the MBA indices. Moreover, none covers multidimensional institutional features of the mortgage markets to create a benchmark for institutional quality of mortgage credit markets as well as all the EU (28) countries.

[64] Denmark, France, Germany, Italy, the Netherlands, Portugal, Spain and the UK.

[65] Borrowers are classified as young and older households (either under or over 30), low-equity borrowers (LTV >90%), self-certified income borrowers, previously bankrupt borrowers, credit-impaired borrowers and self-employed borrowers, while products are classified as second mortgages and buy-to-let mortgages.

[66]These countries are Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Norway, Spain, Sweden, the UK and the US.

4.3. Methodology

This study focuses on the institutional features of the mortgage credit markets in order to test the hypothesis ‘Institutional characteristics in EU mortgage markets are heterogeneous’. The sample is the 28 EU member countries.

To achieve this, first of all, the institutional features of the mortgage credit markets are measured by using a composite index method. Thereby, a benchmark is created for these markets by constructing an overall index and sub-indices. The institutions qualify as latent factors as they do not show significant change over time. However, since an institutional environment needs to be described across multiple dimensions, it is difficult to represent as a single indicator. Therefore, to obtain a benchmark for the institutional characteristics of the credit markets, the index is calculated as a composite index,[67] which is a mathematical combination of a set of individual variables (Mazziotta and Pareto, 2013).

Although composite indices can attract criticism,[68] they are frequently used to compare country performance and are increasingly accepted as a useful tool in policy analysis (Hair et al., 2013; Nardo, et al., 2005; OECD and JRJ, 2008; Mubareka, et al., 2011; Mazziotta and Pareto, 2013; Becker et al., 2017). Their popularity is attributable to two factors. First, interpreting composite indices is easier than identifying common trends across many separate indicators (Becker et al., 2017). Second, the rankings derived from them can put pressure on governments to question their policies. The Human Development Index (UNDP), the World Competitiveness Index (WEF), the PISA index (OECD) and the Financial Stress Index (IMF) are some examples of composite indices that potentially have strong effects on policy worldwide.

In constructing the composite indices the stages recommended by OECD and JRC (2008) are followed. These are: conceptualising institutional features (defining the concept for including variables) and selecting individual variables (checking correlation between potential variables and their reliability); normalising the individual variables (making the variables comparable); aggregating the normalised variables(combining all the variables to form one index);rotation (increasing the interpretability of the factors); calculating the index; and visualisation of the results (presenting the results of index clearly and accurately).

[67] Such indices are also called performance indices or synthetic indices (see Becker et al., 2017).
[68] They are sometimes accused of being unreliable because of the complexity of their configuration as well as the differences in underlying variables (e.g. Mubareka et al., 2011; Mazziotta and Pareto, 2013).

First of all, the conceptualisation of institutional features must be defined to decide individual variables to be included in the composite index. For this purpose, four approaches are considered: new institutional economics theory and law and finance theory, efficient markets theory, and financial liberalisation theory.

First, the new institutional economics theory and the law and finance theory are considered. The new institutional economics theory considers the economy as an institutionalised process. North (1990, 1993), one of the pioneers of this theory, combines the Coasian view of transaction costs with ideology of human behaviour. He suggests that institutions cover formal institutions (e.g. rules and laws), informal institutions (e.g. habits and customs) and their enforcement in the economy (e.g. enforcing contracts). The law and finance theory is based on the new institutional economics. It focuses on legal origins and effect of legal systems on financial development. An important aim of this approach is to identify the conditions under which different institutional choices are optimal to protect property rights (La Porta et al., 1998; Levine, 1999; Beck, Levine and Loayza, 2000; Schnyder, 2016; Schiell and Martins, 2016). Therefore, the legal institutional features and their enforcement as well as cultural features are chosen to measure the institutional environment in the mortgage markets, such as efficiency of legal framework, enforcing contracts, and habits and customs etc.

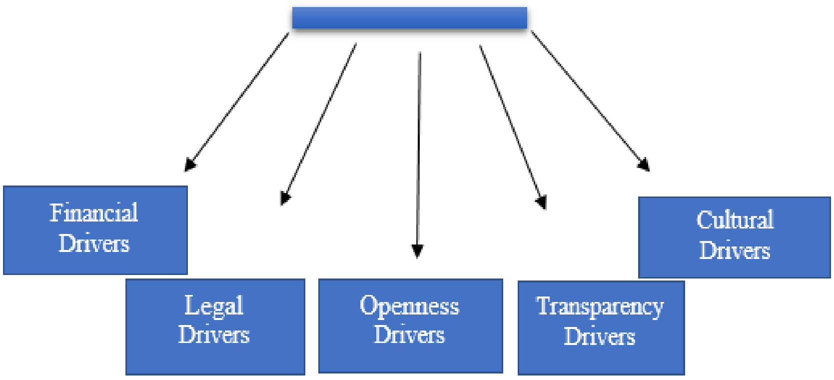
Subsequently, bearing in mind the goal of creating a benchmark for the mortgage credit markets, other features of these markets are selected according to the efficient markets theory and financial liberalization theory (McKinnon, 1973; Williamson and Mahar, 1998).

Efficient market theory states that in an efficient market, the market prices fully reflect the availability of information, and the market participants (i.e. investors, lenders and borrowers) often perform better on the market (Fama, 1970; Tobin, 1984). Then, it is expected that increasing market's efficiency contributes to the development of these markets. Thus, the study chooses the features of the efficient credit markets such as accessibility of credit information and the strength of financial intermediaries. According to the financial liberalisation theory (McKinnon, 1973), the elimination of direct or physical controls imposed by government can be achieved by increasing the level of non-domestic transactions in the economy (e.g. imports, exports and foreign capital inflows and outflows). With increasing financial liberalisation, domestic financial markets become more interconnected with international markets which contributes to the development of the financial sector (Mishkin and Eakins, 2016). Thus, we select the institutional features, which show the openness of the credit markets, such as investment freedom and trading cross-borders. In addition, for efficient and well-functioning credit markets, transparency also matters to all participants in financial markets because it contributes to an increase in accessibility of market information. We therefore consider the corruption indicator as another feature of the institutional environment in these markets.

These institutional features define the multidimensional phenomenon, and in collecting data on them the following factors need to be taken into account: (i) the variables are within the field of public authority; (ii) they are influenced by the market process; (iii) they are calculated using a similar method; (iv) they are available in all the EU countries.

At the end of the data selection process, 31 institutional features are determined and categorised within five sub-groups: financial drivers, legal drivers, openness drivers, transparency drivers and cultural drivers, as shown in Figure 4.1.Since the mortgage markets are a sub-market of the financial sector, financial drivers cover the variables relating to the institutional features of the development of the financial sector, such as access to financial services, soundness of the banks, availability of financial services and credit information. The specific features of the mortgage markets (e.g. mortgage equity withdrawal, availability of mortgage products and loan to value ratio) are also included in this category. Legal drivers consist of formal institutions and their enforcement in the markets (e.g. property rights, protection of investors and efficiency of legal framework). Openness includes the variables that relate to the opening-up of the markets to abroad (e.g. investment freedom, presence of trade barriers, burden of customs procedures). Cultural drivers refer to customs and habits, and transparency driver includes the level of corruption in the country.

Figure 4.1. Institutional Features of the Mortgage Credit Markets



After the data selection, an explanatory factor analysis is applied. The factor analysis considers the variance of the observed data and reveals any basic latent factors. To construct the indices, the factor analysis follows the approach of Noorbakhsh (1998) and Nicoletti, Scarpetta and

Boylaud (2000), in which the sub-indicators with the highest factor loadings are grouped into intermediate composite indicators.

At the end of the analysis, an overall index and five sub-indices are produced. The overall index is referred to as the Institutional Index. Taking into account the groups of institutional features, the sub-indices are labelled as follows: financial sub-index, legal sub-index, openness sub-index, transparency sub-index and cultural sub-index.[69] These indices reveal the quality of the institutional environment of the mortgage credit markets with respect to these five dimensions. They therefore enable us to evaluate the institutional environment of the EU mortgage credit markets from different angles and to compare these markets with respect to institutional quality. In addition, findings from these indices may allow us to see whether the EU mortgage markets are homogenous and thus, to make inferences about the convergence of EU mortgage markets.

After constructing the indices, firstly, a robustness of the Institutional index is checked by using an alternative method: scoring. In the scoring technique, follows the approach of Şener (2016) is followed[70] in which each variable's value is compared to the threshold value while both grouping individual variables and evaluating a country with respect to the institutional perspective. Secondly, whether the indices developed can be considered an indicator for institutional quality of the credit markets are investigated. Existing empirical literature shows that the institutions contribute to the financial development (Kwok and Tadesse, 2006; Aggarwal and Goodell, 2010; Ashraf, 2017). As such, if the indices developed do in fact represent reality, the relationship between institutional quality and the development of mortgage credit markets should be a positive one. We therefore anticipate a positive relationship between the development of the mortgage market and the Institutional Index as well as the sub-indices.

Thus, the relationship between the institutional environment and the development of the credit markets is also investigated using linear regression model and applying ordinary least squares (OLS) and graphical methods. An indicator for quality of institutional environment is taken to be the indices produced. For the development of the mortgage credit markets, the development

[69] In fact, the cultural sub-index and the transparency sub-index were produced by Hofstede (2010) and Transparency International respectively. Since they have different score numbers, we only rescaled them to compare the other sub-indices constructed in this study.

[70]The European Commission creates a benchmark to assess whether candidate or potential candidate countries fulfil the Copenhagen criteria using this technique. These criteria are the eligibility criteria for joining the EU, covering three areas: political, economic and the ability to take on the obligations of membership. For more information see EC (2017).

of financial intermediaries is examined with respect to their depth, accessibility and efficiency. Following the approach of the World Bank (2017), which uses conceptualisation of Cihak, Demirgüç-Kunt, Feven and Levine (2012) three measurements are included in the analysis: total mortgage loan to GDP ratio as an indicator of the depth of financial intermediaries; percentage of the population being owner-occupiers with a housing loan as an indicator of their accessibility; and net interest margin as an indicator of their efficiency.[71] This stage allows us to see whether institutional quality contributes to the development of the credit markets and hence whether the indices constructed represent reality. Moreover, this analysis acts as a second robustness check for all the indices.

This study demonstrates both similarities with and differences from previous studies constructing indices for the mortgage markets. It aligns with them as regards the chosen method, factor analysis, but differs in that the indices represent multiple dimensions of institutional features of the credit markets (i.e. financial, legal, openness, transparency and cultural). A further difference is that the second method (scoring) is used here for the first time in conjunction with factor analysis for mortgage markets. A third difference is that distinct approaches are followed, namely those of Noorbakhsh (1998) and Nicoletti, Scarpetta and Boylaud (2000). Fourthly, in contrast with Wyman (2003) and London Economics (2005), secondary data are used rather than data from surveys; and, finally, in addition to the overall index, sub-indices are calculated.

Considering the gaps identified in the literature review, this study's contribution to the literature is to produce an Institutional Index representing multiple dimensions of institutional features of the EU mortgage markets; to create a benchmark for the institutional quality of these markets; to use an alternative technique (i.e. scoring) in addition to factor analysis; and to examine the relationship between institutional quality and financial intermediation.

4.4. Data Description

The institutional variables cannot be measured directly because they lack dynamics (Djankov, McLiesh and Shleifer, 2007). The majority of the institutional variables are based on qualitative indices like in this study. The indices that we develop cover the most recent values

[71] In contrast to its approach, since this study focuses on residential mortgage markets, the total mortgage loan to GDP ratio is taken into account rather than total private credit/GDP, while percentage of owner-occupiers with a mortgage is considered rather than percentage of firms with a line of credit to show firms using bank loans to finance working capital. The latter ratio indicates the share of individuals in the population who take out a loan to purchase their own homes.

of institutional variables (i.e. 2014) of the 28 EU countries, with the exception of the culture, which is from 2010. However, we can claim that a difference of only four years will not affect the results of our analysis since changes in cultural factors happen over a longer time-frame (Hofstede, Minkov and Hostede, 2010; Minkow, 2011).

As aforementioned, in order to construct a composite index 31 institutional variables are selected and then classified under five drivers – financial, legal, openness, transparency and cultural – as shown in Figure 4.1. With the exception of the cultural variable, data are collected from internationally recognised organisations: the World Bank, the World Economic Forum (WEF), the European Central Bank (ECB), the European Mortgage Federation (EMF) and specialised agencies, including the Heritage Foundation and Transparency International. The cultural variable is taken from Hofstede, Minkov and Hostede (2010).[72]

Financial drivers

Financial drivers cover 11 variables relating to the financial features of the institutional environment, such as availability of financial services, credit information and affordability of financial services etc. (see Appendix 4.1). These variables are also accepted as the indicators for the development of the mortgage credit markets and hence they also show how well the financial sector is functioning along with its sub-markets (e.g. mortgage credit markets).

The general expectation is that developed and well-functioning markets also are more efficient markets. The efficiency of the financial sector is a motivating factor for the market's participants (e.g. financial intermediaries, lenders, investors and borrowers) to act efficiently. Fama's (1970) efficient market theory (the Efficient Market Hypothesis Theory)[73] states that in an efficient market, market prices fully reflect the availability of information and investors often perform better on the market. Also, in such markets there is no abnormal profit. In addition to information availability, there are other types of efficiency in a financial market: fundamental valuation efficiency, operational efficiency and full insurance efficiency (Tobin, 1984).

[72]While constructing index, all the members of the EU is considered and the data for all the EU members is available, except for Cyprus. In the cultural index, the index numbers for Cyprus (officially the Republic of Cyprus) shows those of Cypriot Republic, which became the member of the EU in 2004. In fact, Hofstede's cultural (indugence) index does not have the index numbers for Cyprus. In fact, Hofstede's cultural (indugence) index does not have the index numbers for Cyprus. Cyprus' index number covers the insex number of Greece because it is culturally Greek (see Kyritsi and Christofis, 2018).

[73]This theory also is called Random Walk Theory. There are three forms of this; the weak-form, the semi-strong form and the strong-form. In the weak form, the prices in the past are completely reflected in prices of securities. According to the semi-strong form, publicly available information as well as the prices in the past is completely reflected in the securities' market prices, while in the strong form, both public and private information is reflected in the prices fully (Lim, 2011).

Fundamental valuation efficiency involves lower risks and less profit opportunity, while operational efficiency reveals which products and services are provided for the least cost and are directly useful to market participants; insurance efficiency guarantees the permanent supply of financial products and services in contingencies.

A result of greater efficiency is a more competitive environment, i.e. one without excessive profit (i.e. normal profit), with maximisation of the rate of return on net worth. An increase in efficiency, and hence more competition, also reduces transaction costs while limiting corrupt lending practices (Auerbach and Siddiki, 2004).

Thus, it can be argued that the most efficient markets are those with the lowest risk, minimum transaction costs, normal profit opportunities, and access for all parties in the credit markets to full information – and thus essentially well-functioning. In such markets, no market participant has a privileged position in estimating market prices since there are no data that could provide any additional advantage.

In reality, each financial sector will demonstrate a mixture of efficiencies. Therefore, the level of its efficiency varies from market to market. Efficiency differentiation also can lead to differences between the markets with respect to the level of financial development.

Legal Drivers

The second driver relates to legal features of the institutional environment and includes nine variables. Like the financial drivers, a legal framework may lead to differentiation in development between mortgage credit markets. A high-quality legal structure can also support the development of these markets, for example by enforcing contracts quickly and fairly or protecting property rights. A number of studies on the mortgage markets emphasise the importance of the legal environment for these markets (e.g. Malpezzi, 1999; Johnson, McMillan and Woodruff , 2002; Wornock and Wornock, 2008). In the literature, the relationship between the legal system and financial development is explained with reference to law and finance theory.

The law and finance theory is based on legal origin theory,[74] which was developed by La Porta et al. (1998). The law and finance theory accepts the centrality of legal traditions in accounting

[74]English-origin laws (i.e. common law) based on common law are shaped by judges, and civil law is based on a Romano-Germanic tradition. French-, German- and Scandinavian-origin laws are identified by the civil law tradition. The UK and Ireland are the EU countries with a common law system, and the French legal tradition's

for cross-country differences in financial development and particularly pays attention to the nature of law and role of in the economy, its role in creating reasons for action and its link with morals (Beck, Demirgüç-Kunt and Levine, 2001; Schnyder, 2016; Schiell and Martins, 2016). It suggests that there are two channels to explain the effect of legal systems on financial development; a political channel and a legal adaptability channel. The political channel emphasizes the differences between private property rights, investor's rights and the protection of these rights, while the legal adaptability channel stresses the legal traditions differences in terms of their abilities to adjust to different conditions in financial markets.According to this theory, financial development has historically been determined by the shape of legal traditions as well as cultural factors.

Many empirical studies on the financial sector (e.g. La Porta et al., 1998; Kwok and Tadesse, 2006; Djankov, McLiesh and Shleifer, 2007)[75] as well as on the mortgage markets show the importance of the legal environment for these markets (e.g. Levine, Loayza and Beck, 2000; Wornock and Wornock, 2008). La Porta et al. (1998, 2013) classified countries according to legal origins (i.e. English, French, German or Scandinavian origin)[76] and focused on strategy differences between common law and and civil law. The findings of their empirical studies show that the legal environment seriously affects the development of financial sector (e.g. the size of capital markets, domestic companies' access to external resources). Their findings show that common-law countries (e.g. the UK and Ireland) are the strongest with respect to quality of law enforcement, while countries with a French-origin law system (e.g. Italy and Portugal) are the weakest.

While Levine, Loayza and Beck (2000) have found that cross-country differences in legal and accounting systems help to explain cross-country distinctions in financial development, Djankov, McLiesh and Shleifer (2007) and Qian and Strahan (2007) point out the importance of creditor protection and creditor rights in the banking sector. In addition, the findings of Djankov, McLiesh and Shleifer (2007) show the importance of information on private credits and that the private credit to GDP ratio increases when creditor rights are improved. Unlike

influence is seen in Belgium, Greece, Portugal, Spain and Italy among EU countries. Denmark, Finland and Sweden are the EU countries with Scandinavian-origin laws, while Austria and Germany have a German legal tradition. For more information, see La Porta et al. (1998, 2013).

[75] In fact, there are very few studies that conclude that legal elements do not have a big impact on credit markets. Of those that do, Alanso and Garcimartin (2013) found that legal indicators have no effect on financial institutions while Bae and Ghoyal (2005) state that creditor rights have no impact on loan spreads.

[76]There is a heavier hand of government ownership and regulation in civil law compared to common law. For more information, see La Porta et al. (2013).

Djankov, McLiesh and Shleifer, Qian and Strahan (2007) examined the effects of creditor protection and creditor rights on financial contracts and came to the conclusion that strong creditor protection and credit rights increase the availability of financial products with lower interest rates as well as mortgage loans with longer maturity. In addition, they assert that collateral might contribute to more secure loans. Svensson (1998) and Johnson, McMillan and Woodruff (2002) have emphasised the importance of strong property rights for productive investment. Johnson, McMillan and Woodruff (2002) claim that weakness of property rights may deter investment even when banks have available funds to lend. Bae and Gohal (2005) also suggest that protection of property rights has a positive impact on reducing spreads and increasing sizes of loans: that is, countries with better property rights protection have higher loan sizes and lower interest rate spreads. In contrast, McCrone and Stephans (1995) claimed that legal differences create obstacles to using housing as a collateral, while Malpezzi (1999) emphasised the significance of several legal issues (regulation of various primary and secondary markets, settlement, foreclosure procedures, etc.) in a well-functioning housing financing system.

In addition, Ashraf (2017) conclude that legal institutions influence the risk behaviour of financial intermediaries along with political institutions. In Wolswijk's (2006) study analysing the role of basic elements in the size of mortgage debt, he has drawn attention to the importance of implementation of regulations (especially deregulation) in the financial markets. The findings of Wornock and Wornock (2008) confirm those of previous studies and highlighted the importance of both lenders and borrowers in the mortgage markets having strong legal rights (e.g. bankruptcy law and collateral).

Transparency driver

The transparency of the credit markets is another driver for the quality of the institutional environment. Market transparency can be described as the ability of all market participants to obtain correct and timely information about credit markets (Lee, 2005). When markets are more transparent, market activities can be aligned with a high level of integrity. Transparency matters to all participants in financial markets (financial intermediaries, borrowers, lenders and investors). Free access to information for all parties is a necessary prerequisite for an efficient market, and transparency contributes to an increase in accessibility of market information. In addition, transparency increases competition and helps to lower risk in the financial sector because competition can trigger lenders to examine and collect information about low-risk lending by acting as a creator of information signals for market participants (Auerbach and

Siddiki, 2004). Nevertheless, access to information in the credit markets varies greatly between countries due partly to differences in market transparency.

The Corruption Perceptions Index is used as the indicator of the mortgage markets' transparency (Appendix 4.1). Since a lack of transparency allows corruption to thrive, transparency is regarded as negatively correlated with corruption (e.g. Lee, 2005; Aidt, Dutta and Sena, 2008; Blackburna and Forgues-Puccio, 2009). Consequently, removing corruption and creating more market transparency are significant actions to increase efficiency in the credit markets as well as to contribute to their development.

Openness

This driver covers nine variables and shows the extent to which the economy is open. Since openness positively influences the development of the financial sector (e.g.Rajan and Zingales, 2003; Chinn and Ito, 2007), openness variables are selected as the features of the institutional environment. Openness shows the level of non-domestic transactions in an economy (e.g. imports, exports and foreign capital inflows and outflows). The level of openness is increased through the liberalisation of the economy (i.e. an elimination of government-imposed direct or physical controls). Thus, an economy will be more open to international markets as both trade and financial liberalisation increase. The financial liberalisation theory suggests that being open to both trade and foreign capital can contribute to financial development in an economy because openness makes domestic financial markets more interconnected with international markets thereby contributing to a rise in the availability of funds for domestic markets via the free movement of funds from countries with fund surpluses to countries with insufficient funds (e.g. McKinnon, 1973; Rajan and Zingales, 1998; Obstfeld, 2009; Baltagi, Demetriades and Law, 2009). With an increase in the level of openness, borrowers will not need to depend only on domestic funds but will be able to access external funds at a relatively low cost. In addition, openness enables participants in the financial sector to raise their cross-border activities, since a significant aspect of financial liberalisation is the reduction (or removal) of constraints, for both domestic and foreign financial intermediaries, against operating in other countries (Auerbach and Siddiki, 2004; Alzer and Dadasov, 2013). Thus, a more competitive and more dynamic financial environment can be generated for the market's players through increasing financial liberalisation, i.e. an increase in the level of openness.

Such an environment can also contribute to an increase in institutional quality by reducing perceived investment risks, since foreign investors enforce market discipline on private and public borrowers at a macro and micro level (Schmukler, 2008; Mishkin 2009). In addition, openness enables dissemination of good practice from one country to another and contributes to the improvement of financial infrastructure by reducing the problems of asymmetric information,[77] such as adverse selection[78] and moral hazard.[79]Therefore, it is expected that openness of the financial sector will contribute to the development of credit markets, for example by creating a more competitive environment.

Cultural Drivers

The next driver is represented by the cultural variables. The literature offers a vast number of definitions of culture.[80] The point they share is that culture covers a set of values or beliefs that affects individuals' preferences, behaviours, decisions and perceptions. For the first time, North (1990, 1993) combines transaction costs with human behaviour and emphasises that in economic process, informal institutions (e.g. cultural features) are important like formal institutions (e.g. rules and laws) as well as their enforcement in the economy.

The existing literature shows that cultural factors have an impact on the configuration of the financial sector and the nature of financial activities as well as on individuals' buying and saving decisions (e.g. Stulz and Williamson, 2003; Kwok and Tadesse, 2006; Licht, Goldschmidt and Schwartz, 2007, Aggarwal and Goodell, 2009, 2010; Ashraf et al, 2016; Karolyi, 2016).

According to Stulz and Williamson (2003), cultural features can affect the finance sector through three channels. First, the values that are predominant in a country depend on its culture (e.g. charging interest can be a sin in one religion but not in another). Secondly, culture affects the design of institutional structure (e.g. the legal system is influenced by cultural values). Thirdly, culture affects how resources are allocated in an economy (e.g. religions that

[77] Asymmetric information occurs when there is an unequal level of information to parties in a transaction, which may result in unfair exchange (Mishkin and Eakins, 2016).

[78]Adverse selection is caused by asymmetric information prior to a transaction. This occurs when in a negotiation one market participant has relevant information but other does not. This leads to bad decisions(Mishkin and Eakins, 2016).

[79] Moral hazard is created by asymmetric information after a transaction. It occurs when one market participant learns of additional risks that negativelyaffect the other participant (Mishkin and Eakins, 2016).

[80]Hofstede (1983, p. 76) defines culture as 'the collective programming of mind that leads to patterned ways of thinking, feeling, and acting that distinguish the members of one group or category of people from others'; North (1990, p.37) describes culture as providing a 'framework for encoding and interpreting the information that the senses are presenting to the brain'; North (1990) cites a definition from the work of Boyd and Richerson (1985, p. 314), who described culture as 'transmission from one generation to the next, via teaching and imitation, of knowledge, values, and other factors that influence behaviour'.

encourage spending on churches or guns divert resources from investment in production). Stulz and Williamson (2003) shows that differences in religions cause differentiation in legal systems (investor protection, especially creditor rights), as well as per capita income across countries. For example, according to their findings, Catholic countries have dramatically weaker creditor rights than other countries.

Kwok and Tadesse (2006), Licht, Goldschmidt and Schwartz (2007), Aggarwal and Goodell (2010), Ashraf et al. (2016) and Karolyi (2016) emphasise the importance of cultural factors for the financial sector. Kwok and Tadesse (2006) considered the uncertainty avoidance variable as a cultural factor and have concluded that national culture plays a significant role in determining the nature of the financial sector. They found that countries with lower uncertainty avoidance have more of a tendency towards a market-based system than countries with higher uncertainty avoidance. Licht, Goldschmidt and Schwartz (2007), focusing on types of financial intermediation, investigated informal institutions' principles of governance and demonstrated the importance of cultural factors in relation to corruption levels in financial intermediation. They suggested that countries with a more individualistic culture might be less corrupt and thereby incur lower transaction costs through market participation.

Aggarwal and Goodell (2010) reached similar conclusions. They showed that national cultural factors influence the structure of financial intermediation (whether bank-based or market-based), along with political and economic factors. The findings of Ashraf et al. (2016) indicate that national culture has a significant impact on banks' risk-taking, with banks less risk-averse in countries with low uncertainty avoidance. Karolyi (2016) examined the impact of culture on financial decision-making by applying gravity models. He points out that culture strongly explains investment biases, such as a foreign bias in building international portfolio holdings.

Looking at the EU countries, it can be seen that some have financial markets with a market-based structure (e.g. Belgium and the Netherlands), while some have a bank-based system (e.g. Ireland and Italy), even though all have an advanced financial sector (Bijlsma and Zwart, 2013). This situation is naturally reflected in the configuration of mortgage markets. In countries with market-based financial markets, funds for mortgage credits are created to a much greater degree from issues of the securities than in those with bank-based financial markets. Moreover, the types of contracts (fixed-rate or variable-rate) that predominate might be affected by cultural factors (e.g. risk avoidance). Variable-rate contracts have dominated new loans in Ireland, while fixed-rate contracts have been the norm in the Netherlands (ECB, 2009). Culture may also be one of the factors influencing house buyers' preferences with regard to duration of mortgage loan: for example, although the mortgage system in a country may well allow loans over a longer term (e.g. 40 years), a majority of home buyers might still choose a shorter duration (e.g. 20–25 years) (e.g. Luxembourg).

According to the findings of the existing empirical literature, cultural features of a society are taken into account in creating a sound benchmark for mortgage credit markets. Our cultural variable here is 'indulgence',[81] which is one of the measurements of cultural factors developed by Hofstede, Minkov and Hostede (2010), whose study is the most widely cited in the literature. Hofstede, Minkov and Hostede (2010, 191) defines indulgence as'...the extent to which people try to control their desires and impulses, based on the way they were raised'. That is, this variable covers habits and customs in a society.

The existing literature reveals no consensus about which criterion is the most useful in determining the institutional features of the mortgage markets or financial markets (e.g. Lieser and Groh, 2011; Alonso and Garcimartin, 2013). In fact, the literature underlines the fact that it is difficult to decide suitable criteria for institutional features.

Indeed, how these criteria interact with financial markets is ambiguous because some criteria are argued to be more extensive and dramatically important than others. In addition, it is difficult to determine which countries have a more efficient legal framework. For instance, it is not easy to conclude whether the mortgage market activity in a country with strong investor protection is in fact more influenced by regulatory limitations.

Therefore, in developing the overall index and the sub-indices, all the drivers mentioned above would ideally be included. Since the goal is to determine the best variables to represent the institutional features of the credit markets, the variables in all, as shown in Appendix 4.1, are considered in order to create a benchmark for institutional quality of the markets.

Appendix 4.2 presents descriptive statistics for all variables used in the empirical analysis testing the hypothesis. The first column in this table gives the number of observations for every variable, while the mean and standard deviation are reported in the second and third columns.

---

[81]The literature review reveals two studies measuring cultural factors: those of Schwartz (1994) and Hofstede, Minkov and Hostede (2010). In this study, Hofstede's data set was used for two reasons. Firstly, Hofstede, Minkov and Hostede (2010)'s data are more established, having been used by many studies; secondly, their data is publicly available, whereas the full data set of Schwarz is not. However, we chose only one of his cultural measurements – indulgence (i.e. customs and habits) – because of limitations in the other measurements across all EU countries. In all, he established five cultural dimensions, which are largely independent of each other: (1) individualism vs. collectivism; (2) large or small power distance; (3) strong or weak uncertainty avoidance; (4) masculinity and femininity; and (5) indulgence.

Minimum and maximum values of each variable are displayed in the fourth and fifth columns respectively.

4.5. Empirical Analysis

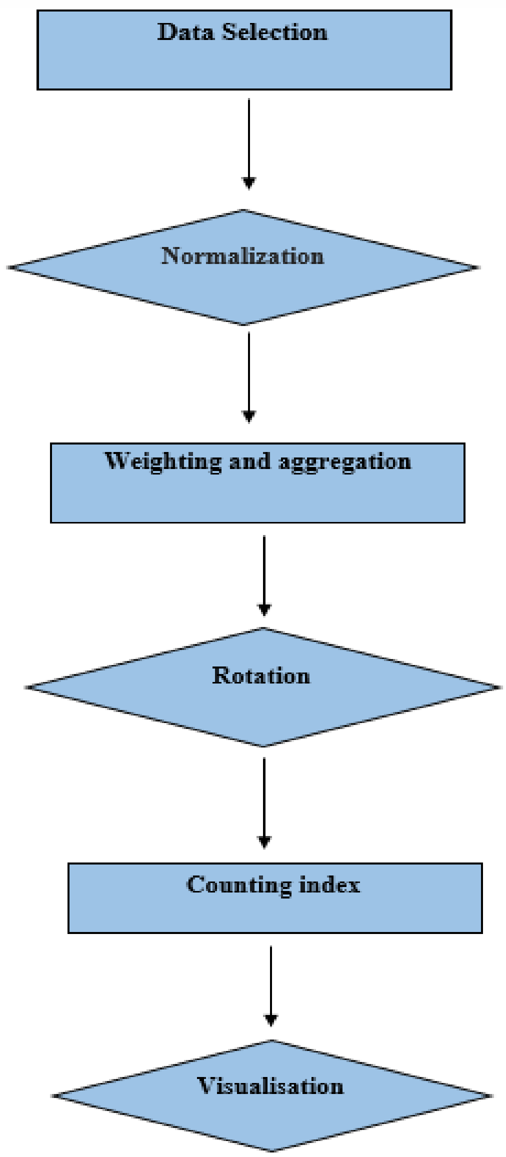
To test the hypothesis – that is, whether institutional characteristics in the EU mortgage markets are heterogeneous – firstly, factor analysis is employed by following the stages presented in Figure 4.2. At the end of the analysis, six indices are produced: the overall index and five sub-indices. The overall index is referred to as the Institutional Index. According to the classification of institutional features of the credit markets described in the previous section, the sub-indices are labelled financial sub-index, legal sub-index, transparency sub-index, openness sub-index and cultural sub-index.[82] Secondly, the robustness of the Institutional Index is checked using a different method (i.e. the scoring method). Finally, to ascertain whether these indices reflect reality, the relationship between institutional quality and the development of financial intermediation in the mortgage credit markets is investigated using the six indices (i.e. overall index and five sub-indices). Here, two methods are applied: linear regression (OLS) and graphical methods.

4.5.1. Factor Analysis and Results

Factor analysis is a technique that examines connections among numerous variables and analyses them in terms of their commonality. The indicators showing their commonality are called factors. The main goal is to determine the minimum number of common factors that will provide correlation between the original variables (Hair, et al., 2013).

[82]In fact, three sub-indices (financial, openness and legal) are constructed. In the case of the other sub-indices (transparency and cultural indices) developed by Transparency International and Hofstede, Minkov and Hostede (2010) respectively, they are normalised to make them comparable to other sub-indices because they have different measurement units.

Figure 4.2. Stages of Constructing an Index



Therefore, factor analysis is also referred to as a data reduction technique. According to Tucker and Lewis (1973), this technique can be very useful for investigating latent characteristics that explain essential connections between observed phenomena. In addition, this method is one of the most frequently used techniques in the literature in the preparation of composite indices (e.g. Henson and Roberts, 2006, OECD and JRC, 2008; Leiser and Groh, 2010, Mazziotta and Pareto, 2013; Konig and Rohr, 2013). A large sample size is also indicated because factor analysis is based on a correlation matrix of the variables involved, and correlations often require a large sample (Tabachnick and Fidell, 2014). In this respect, the number of observations in this study's data set is suitable for factor analysis.[83]

With factor analysis, a set of Q variables $X_1, X_2, \ldots, X_Q$ are identified in terms of a smaller number of m factors and the relationship between these variables emphasised. The model is given by:

$$
\begin{aligned}
X_1 &= \alpha_{11}F_1 + \alpha_{12}F_2 + \alpha_{13}F_3 + \cdots + \alpha_{1m}F_m + e_1 \qquad (1)\\
X_2 &= \alpha_{21}F_1 + \alpha_{22}F_2 + \alpha_{23}F_3 + \cdots + \alpha_{2m}F_m + e_2\\
&\vdots \\
X_Q &= \alpha_{Q1}F_1 + \alpha_{Q2}F_2 + \alpha_{Q3}F_{3m} + \cdots + \alpha_{Qm}F_m + e_Q
\end{aligned}
$$

Where i=1, 2,,,…,Q;Xi represents the observed (original) variables but standardized with zero mean and unit variance; $F_1, F_2, \ldots, Fm$ are m uncorrelated common factors, each with zero mean and unit variance; $\alpha_{i1}, \alpha_{i2}, \ldots, \alpha_{im}$ are represent the factor coefficients (i.e. loadings) concerning the original variable Xi; and e_i are error terms. The factor coefficients show the amount of contribution of the variable.

As earlier mentioned, having determined the institutional drivers (i.e. conceptualising the institutional features), construction of the index through factor analysis comprises six stages as shown in Figure 4.2: selecting the institutional variables; normalising them; weighting and aggregating; performing rotation; calculating the index; and visualising the results.

Data selection

The first stage is to select the variables and to check their suitability, after which it is possible to decide whether factor analysis can be applied using these variables. To do this, firstly the correlation matrix of the variables is checked.[84] A correlation matrix reveals the presence or absence of a relationship between the sets of variables. In order to apply factor analysis, the correlations between the variables must be strong, otherwise the variables may not share common factors. Appendix 4.3 shows correlations between the variables selected for the 28 EU countries; it indicates a strong relationship between them.

[83] There are 868 (28 × 31) observations in our sample.
[84] In this study, the Pearson method is applied to check the correlation matrix of the variables.

Subsequently, Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) test are applied. Both allow us to assess the overall suitability of the variables. The Bartlett's test indicates whether the correlation matrix is different from an identity matrix: if so, the factor model may be appropriate. For the factor model to be appropriate, the p-value in the Bartlett's test should be small (<0.05). The KMO assesses the partial correlations between the variables. The KMO statistics reveal the proportion of variance in our variables that could be caused by underlying factors. If the value is greater than 0.60, the variables share common factors (OECD and JRC, 2008). If not, the factor analysis may not yield meaningful results. The KMO statistic (0.776) and Bartlett's test results (Chi = 1514,080, p-value<0.00) support the overall suitability of the data set (see Appendix 4.4).

Finally, it is necessary to consider whether the underlying data structure is appropriate for describing a uni-dimensional construct and whether the groups of indicators identified provide a good interpretation of the result. The Cronbach's alpha coefficient is used to assess whether a dataset measures uni-dimensionality The Cronbach's alpha coefficient is used to assess whether a dataset measures uni-dimensionality and gives us a simple way to measure whether a score is internally consistent or reliable Theoratically, the coefficient is between zero and one and acceptable threshold for appropriate data structure is 0.70 (Lieser and Groh, 2011; Konig and Rohr; 2013). As exhibited in Appendix 4.5, the estimation gives a Cronbach's alpha coefficient of 0.9667, which means that our dataset has relatively high internal consistency.

The results of these three analysis of index show that the five drivers' composition is robust statistically.

Normalization of variables

In the second stage, all data are normalised to make them comparable because the variables don't all use the same measurement. For this, the min-max method is used being one of the more common standardisation methods[85] (e.g. Nicoletti, Scarpetta and Boylaud, 2000; Lieser and Groh, 2011; Svirydzenka, 2016). The min-max method is a statistical method used to transform real data values into certain values between 0 and 1 or -1 and 1 using the equation:

[85] Other normalisation methods are standardisation (or z-scores), and indicisation (index number transformation or distance to a reference). For more information see OECD and JRC, 2008.

$$I_x = \frac{\mathrm{x} - x_{min}}{x_{max} - x_{min}}$$

Where x is the underlying data; $x_{min}$is the minimum value of data and x_{max} *is*the maximum value and I_x is the converted continuous 0-1 indicator. Thus, the variables have an identical range [0, 1] and are normalized through the process by subtracting the minimum value and dividing by the range of the variable values. It relates performance of a country on a variable to the global maximum and minimum across the countries.

Aggregation and weighting

The third stage of the analysis covers the selection of an aggregation and weighting procedure. This procedure is an important in constructing a composite index because it may have an impact on the final results and hence on country rankings. To avoid subjective bias, the variables should be weighted according to statistical relevance; thus, the informative value of the index can be maximised (see. OECD and JRC, 2008).

To calculate the weights, principal component analysis (PCA) is used. In this technique, numerous variables can be analysed simultaneously and explained in terms of common components. In this, the weights are determined only on statistical grounds thus avoiding subjective bias. The PCA process doesn't admit a predetermined structure for the data and orthogonal transformation is used to convert a set of the original correlated variables into a smaller set of variables. If those variables that have been transformed have little bearing on the variance, they can be extracted and play no part in the analysis. Because of this, PCA is also known as a data reduction technique. It is used here in a way similar to the studies of Noorbaksh (1998) and Nicoletti, Scarpetta and Boylaud, (2000), and the information received from our data set is assembled and used as much as possible.

According to the PCA results, four variables are to be extracted: two financial variables – loan to value (F_LTV) and availability of mortgage product (F_PRO) – and two legal variables – strength of auditing and reporting standards (L_AUD) and irregular payments and bribes (L_BRI). Thus, following this analysis the overall index will be constructed using 27 institutional variables.

Finally, the number of factors is determined by considering three criteria (OECD and JRC, 2008; Yong and Pearse, 2013). According to these criteria, those factors should be retained that: (i) individually contribute to an explanation of total variance by more than 10%; (ii) have associated eigenvalues greater than one; (ii) cumulatively contribute to an explanation of the overall variance by more than 60%. For this, two tools are used: calculation of eigenvalues and scree test. The first tool, eigenvalues, reflects the optimum number of extracted factors and it is expected that eigenvalues equal one or larger than one. The scree plot[86] displays the eigenvalues against all the factors and reveals how many factors are to be retained.

According to these criteria, there are four factors to be chosen, as shown in Table 4.1. More than 10% of the total variance individually and 82.44% of the total variance cumulatively are explained by these four factors. Each factor is described as a set of coefficients, referred to as factor loadings (or factor coefficients).

Table 4.1. Eigenvalues and Variances of Principal Components

Factor	Eigenvalues	Explained Variance (%)	Cumulative Variance (%)
Factor 1	15.65	61.22	61.22
Factor 2	10.76	10.76	71.98
Factor 3	1.41	5.53	77.51
Factor 4	1.26	4.93	82.44

Source: This table was produced from Appendix 4.7.

Each of the coefficients measures the linkage between the latent factor and the individual indicators. Factor I captures most of the variance in the original variables and explains 61.22% of their total variability. Factor V explains the smallest total variance in the variables (4.93%). As a result, four factors explain 82.44 % of total variability of the original variables.

Rotatation

The fourth step is rotation of the factor loadings. This is a standard step in factor analysis. Rotation of the factor loadings minimises the number of individual variables that have a high loading on the same factor. Thus, because with rotation it can change the factor loadings, this provides a better interpretation. For this purpose, the varimax rotation method is used, the most common rotation option in factor analysis.

In spite of the rotation, the variables are also loaded on two factors (Factors I and II) (see Appendix 4.8). After rotation, again, 82.44% of total variability of the original variables is

[86] A scree plot, as proposed by Catell (1966), always displays a downward curve. It shows the number of factors on the *x*-axisand the eigenvalues on the *y*-axis. Those factors are selected that have associated eigenvalues greater than one.

explained by four factors. Thus, it is observed that the number of factors does not change. In thıs case, as a result, the factor coefficients that were indicated before rotating are used to construct the composite indices (i.e. the Institutional Index and sub-indices).

Table 4.2 shows the factor loadings ($\alpha_1, \alpha_2.\alpha_3, \alpha_4$ and α_5).[87] Factor loadings are the coefficients that represent the correlation between each underlying variable and the factor. Uniqueness (e_1) shows the part that is unexplained by these factors. In Table 4.2, the factors are listed in order of how much variation they explain. It is seen that a large part of the institutional features is represented by the first factor (Factor I). Factor I captures most of the variance in all the legal variables as well as in market transparency. This factor also explains a large part of the change in the financial variables, with the exception of a few variables such as soundness of banks (F_BAN) and mortgage equity withdrawal (F_MEV). The factor with the highest loading is referred to as 'the general causal factor', 'composite' or the 'dimension'.

Among the institutional variables, the variable with the strongest association with Factor I is efficiency of legal framework, with respect to settling disputes as well as challenging regulations (L_EFF and L_EFR), with a factor loading of 0.9666 for L_EFF and 0.9600 for L_EFR.In other words, Factor I explains 96.66% of the change in legal efficiency of the markets in settling disputes (L_EFF) and 96% of the change in legal efficiency in challenging regulations (L_EFR). This legal variable is followed by property rights (L_PROP) and transparency of the market (TRNS) with 95.61% and 95.20% respectively.

The majority of the change in the variables that are included in financial and openness drivers is also explained by Factor I. In the financial driver, affordability of financial services (F_AFF) has the strongest relationship with Factor I, which explains 89.57% of the change in its variability. In the openness driver, burden of customs procedures (O_BUR) has the strongest relationship with Factor I of all the openness variables, with a factor loading of 0.8741.

When other factors are examined, it is seen that some variables have their strongest association with Factor II, such as soundness of banks (F_BAN), with a factor loading of 0.8531, while for some it is Factor III, such as mortgage equity withdrawal (F_MEV), with a factor loading of 0.495.

[87]The change in each variable is explained by the factors that are calculated using the following formula: $Var\ X_i = 1 = \alpha_1^2\ Var\ (F_1) + \alpha_2^2\ Var\ (F_2) + \alpha_3^2\ Var\ (F_3) + \alpha_4^2\ Var\ (F_4) + \alpha_5^2\ Var\ (F_5) + e_1$

Table 4.2. Factor Loadings and Weighting

CODE	Factor 1	Factor 2	Factor 3	Factor 4	Uniqueness
Financial Driver					
F_AVA	0.8853	0.3057	-0.0059	-0.0194	0.1224
F_AFF	0.8957	0.234	-0.0556	-0.0715	0.1348
F_LOC	0.8518	0.3357	0.0307	-0.0509	0.1583
F_ACC	0.6592	0.5901	0.1751	0.1729	0.1567
F_RIS	0.8494	0.3622	0.0827	0.1242	0.125
F_BAN	0.3755	0.8531	0.1408	0.0529	0.1086
F_SEC	0.8731	0.1698	0.1458	-0.0242	0.1871
F_CRE	-0.1745	-0.0481	-0.5794	0.4932	0.3882
F_MEV	0.3756	-0.1869	0.495	0.2191	0.531
Legal driver					
L_PRO	0.9561	-0.0776	-0.0275	-0.1183	0.0651
L_INV	0.9265	-0.24	-0.0913	0.0635	0.0716
L_JUD	0.9379	-0.1885	-0.0388	-0.1076	0.0718
L_EFF	0.9666	-0.0264	0.0601	-0.0557	0.0582
L_EFR	0.96	-0.0612	0.0398	0.0003	0.073
L_ENF	-0.5544	-0.5266	0.2444	-0.2566	0.2897
L_RIG	0.9265	-0.24	-0.0913	0.0635	0.0716
Openness driver					
O_INV	0.689	0.2151	-0.2272	-0.2986	0.3382
O_XT	0.8226	-0.1662	-0.0473	0.18	0.2611
O_XC	0.3328	-0.3498	0.1421	0.398	0.5883
O_MT	0.8393	-0.1831	0.0854	0.2125	0.2095
O_BUS	0.4377	0.0419	-0.6184	-0.2961	0.3367
O_REA	-0.5329	0.4222	0.1469	-0.3785	0.3729
O_REC	-0.6892	0.3055	0.2784	0.2472	0.293
O_BAR	0.6942	-0.3023	0.0898	0.039	0.417
O_BUR	0.8741	-0.1686	0.0511	-0.0087	0.2049
Transparency					
TRNS	0.952	-0.1325	-0.027	0.0066	0.0754
Cultural driver					
C_IND	0.6023	-0.3692	0.304	-0.4363	0.2182
Explained variance (%)	61.22	10.76	5.53	4.93	17.56

Source: Own calculations.

Note that: The bold areas shows the highest numbers of each variable across the four components. F_AVA: Availability of financial services, F_AFF: Affordability of financial service, F_LOC: Financing through local equity, F_ACC: Ease of access to loans, F_RIS: Venture capital availability, F_BAN: Soundness of bank, F_SEC: Regulation of securities exchanges, F_CRE: Getting credit- depth of credit information, F_MEV: Mortgage equity withdrawal, L_PROP: Property rights, L_JUD: Judicial independence, L_EFF: Efficiency of legal framework in setting disputes, L_EFR: Efficiency of legal framework in challenging regulations, L_RIG: Getting Credit- Strength of legal rights, L_ENF: Enforcing Contracts, O_INV: Investment freedom, O_XT: Trading cross borders – time to export, O_XC: Trading cross borders – cost of export, O_MT: Trading cross borders - time to import, O_BUS: Starting a business – number of procedures, O_REA: Cost of real estate, O_REC: Recovery rate of insolvency, O_BAR: Prevalence of trade barriers, O_BUR: Burden of customs procedures, TRAN: Corruption perceptions index, C_IND: Habits and customs.

Some variables have a relationship with more than one factor. That is, a change in a variable is explained by all four factors, such as the cultural variable (C_IND): 36.28% of the change in this cultural variable is explained by Factor I, while 13.63%, 9.24% and 19% of change are explained by Factors II, III and IV respectively. Further examples could be cited.

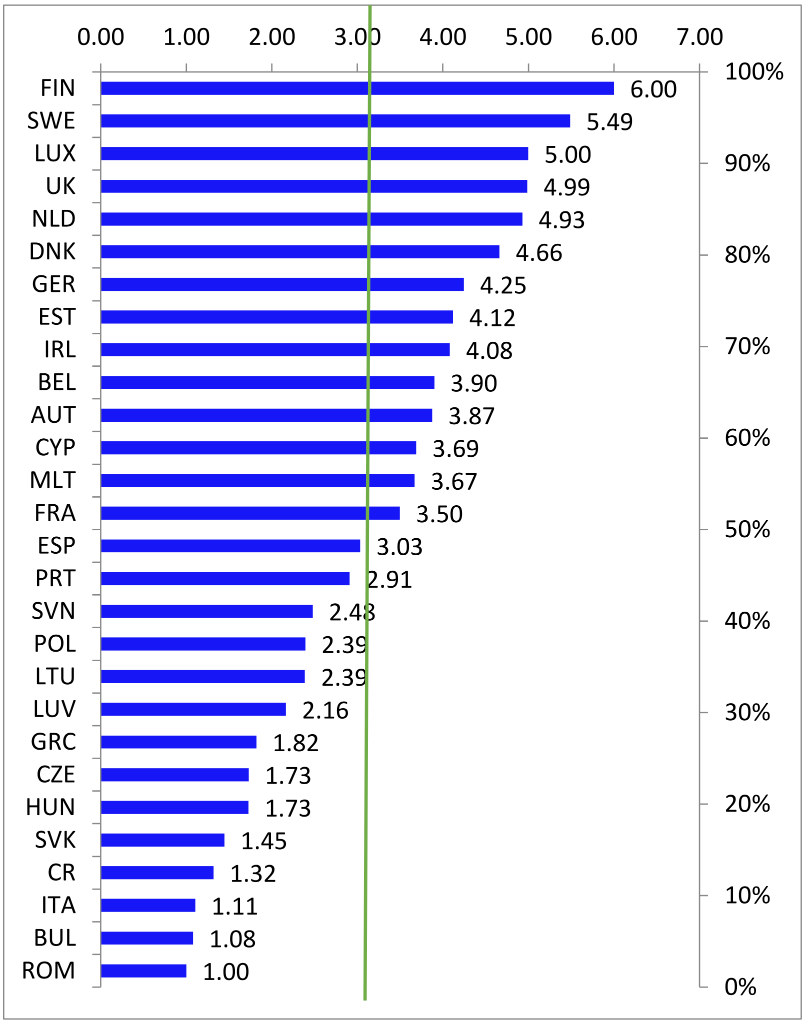
In conclusion, the variables retained after factor extraction are correlated with four factors and these factors explain 82.44% of the total variance in 27 variables. These results show that the legal driver and transparency driver have stronger relationships with Factor I than do the financial, openness and cultural drivers. Except for enforcement of contracts (L_ENF), all variables under the legal driver have the strongest association with Factor I among all variables in the analysis. Following the results, it can be suggested that the quality of the institutional environment in the credit markets is largely determined by legal drivers. These results are consistent with previous empirical studies, which highlighted the importance of legal features for the financial markets (e.g. La Porta et al., 1998; Kwok and Tadesse, 2006; Qian and Strahan, 2007).

Constructing index and its visulation

The final stage of the factor analysis is to construct a composite index and to visualise the results. As aforementioned, this process is based on weighting according to the proportion of variance explained by the factor in each variable, and each factor is weighted by considering its contribution to the portion of the explained variance in the data set.[88]Following this process, the overall index is produced. Developed and labelled the Institutional Index. This index shows the quality of the institutional environment of the mortgage credit markets of the EU member countries. The results show that, within the EU-28, the mean of overall index is 3.169182, the standard deviation is 1.470902 and the mean of sub-indices index ranges from 3.199653 to 3.693591 (see Appendix 4.9). The overall index (the Institutional Index) range are between -1.33336 to 1.204393 and then it is rescaled between one and six. Overall country rankings with respect to the Institutional Index are reported in Figure 4.3. In the Institutional Index, the highest number indicates the mortgage credit markets with the highest institutional quality, and the lowest number the markets with the weakest institutional quality.

[88] The formula used to construct an index is followed:
gen fend=(variance proportion/total explained variance)*estimated factor score. For overall index developed in this chapter, it is _= (0.6122/0.8244)*F1+(0.1076/0.8244)*F2+(0.0553/0.8244)*F3+(0.0493/0.8244)*F4
Where F1, F2, F3 and F4 are estimated factor scores.

Figure 4.3. Institutional Index



Source: Own calculations.
(*) Green line shows average of EU. It is 3.16.
Note: AUT: Austria, BEL: Belgium, BUL: Bulgaria, CR: Croatia, CYP: Cyprus, DNK: Denmark, ESP: Spain, EST: Estonia, FIN: Finland, FRA: France, GER: Germany, GRC: Greece, HUN: Hungary, IRL: Ireland, ITA: Italy, LTU: Lithuania, LUV: Latvia, LUX: Luxembourg, MLT: Malta, NLD: Netherland, POL: Poland, PRT: Portugal, ROM: Romania, SVK: Slovakia, SVN: Slovenia, SWE: Sweden, UK: United Kingdom.

Then, by following the same stages, the sub-indices are produced according to the five dimensions of the institutional environment in the credit markets: financial, legal, openness, transparency and cultural sub-indices. Like the Institutional Index, these sub-indices are rescaled between one and six for comparability. Descriptive statistics of them are shown in Appendix 4.9. Country rankings of these sub-indices are displayed in Figures 4.4 – 4.5.

The Institutional Index (i.e. overall index), as shown in Figure 4.3 reveals country rankings and index points for all 28 EU member countries. The Institutional Index reveals that nearly half of the EU countries are at above the EU-28 average while half of them are at below. In addition, the numbers reveal a large difference between those credit markets with the highest quality and those with the lowest.

Northern European countries and the UK are at the top of the Institutional Index and take the lead with respect to the institutional environment of their credit markets. It shows that all the Central and Eastern European countries are below the index average of the EU-28 countries, with the exception of Estonia. This case exists for the Southern European countries. Finland ranks highest in the Institutional Index. That is, its mortgage credit markets have the highest institutional quality of all EU countries. Romania is at the bottom of the ranking having the credit market with lowest institutional quality.

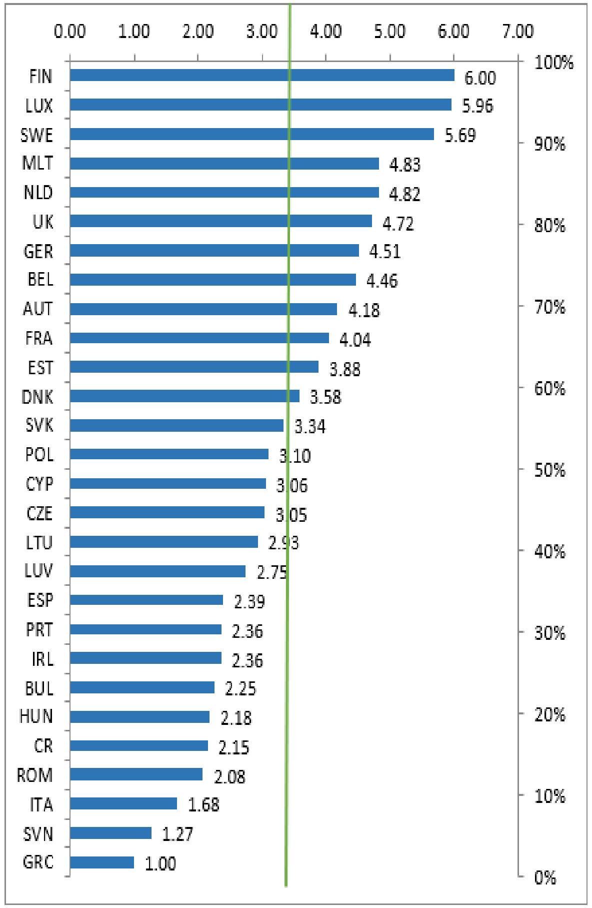
In the Institutional Index, all the former members of the EU[89] are also above the EU-28 average with a few exceptions, such as those countries on the periphery (i.e. Greece, Italy, Portugal and Spain), which have lower positions in the ranking. The case of Italy, among the most advanced countries in the EU as well as the world, is interesting.[90] In the Institutional Index, Italy is lowest in ranking among the EU's most advanced countries. That is, among these it has credit markets with the weakest institutional quality. A similar situation is evident in the sub-indices (see Figures 4.4 – 4.5). In this case, one suggestion can b**e** that Italy does not have the high-quality financial infrastructure and well-functioning legal system of the other developed economies of the EU. In addition, its credit markets are less open and less transparent than other developed EU members. In addition, according to the results of cultural sub-index, Italian individuals display less indulgent behaviour than their European peers.

[89] By former members we are referring to the countries that joined the EU before 2004. They are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the UK.

[90] Moreover, Italy is a member of the Group of Seven (G7), which consists of the most developed countries of the world. They are: Canada, France, Germany, Italy, Japan, the UK and the US, four of which are from the EU (France, Germany, Italy and the UK). According to the IMF (2017), G7 countries represent 58% of global net wealth and are the largest advanced economies in the world.

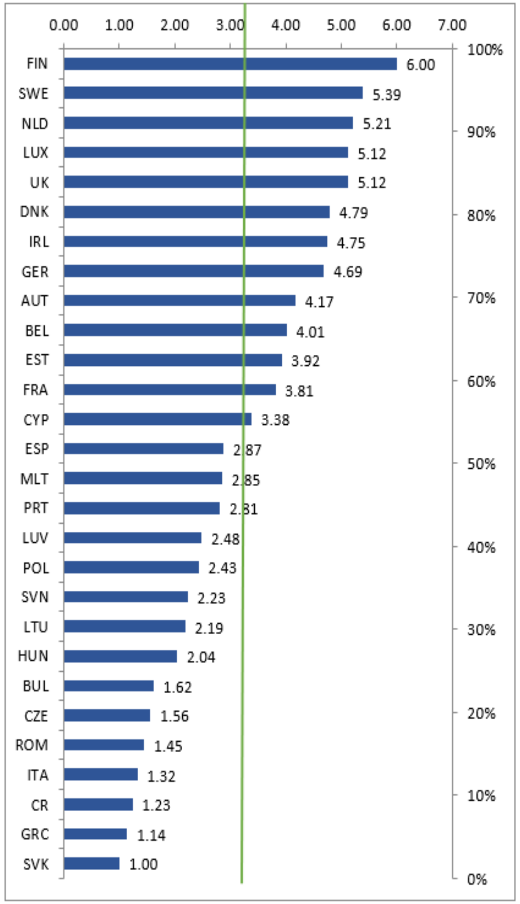
Figure 4.4. Sub-Indices (I)

Financial Sub-Index



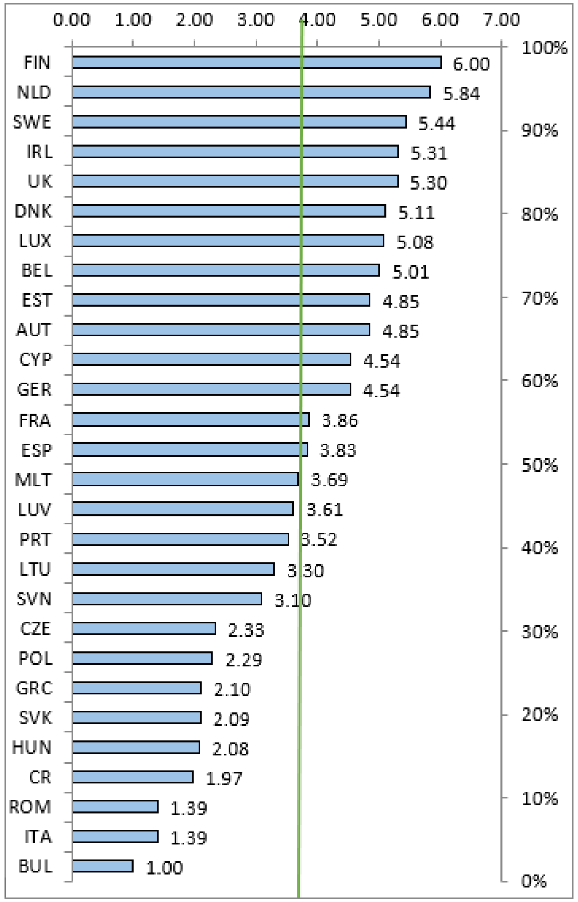
(*)Average of the EU is 3.37.

Legal Sub-Index



(*) Average of the EU is 3.19.

Openness Sub-Index

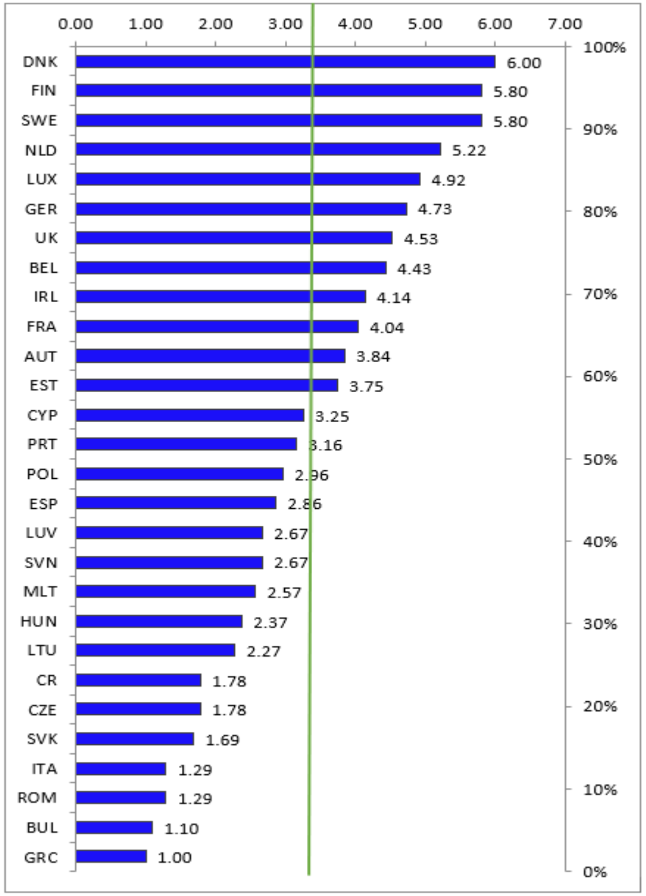


(*) Average of the EU is 3.69.

Note that: Green line shows average of EU. AUT: Austria, BEL: Belgium, BUL: Bulgaria, CR: Croatia, CYP: Cyprus, DNK: Denmark, ESP: Spain, EST: Estonia, FIN: Finland, FRA: France, GER: Germany, GRC: Greece, HUN: Hungary, IRL: Ireland, ITA: Italy, LTU: Lithuania, LUV: Latvia, LUX: Luxembourg, MLT: Malta, NLD: Netherland, POL: Poland, PRT:: Romania, SVK: Slovakia, SVN: Slovenia, SWE: Sweden, UK: United Kingdom.

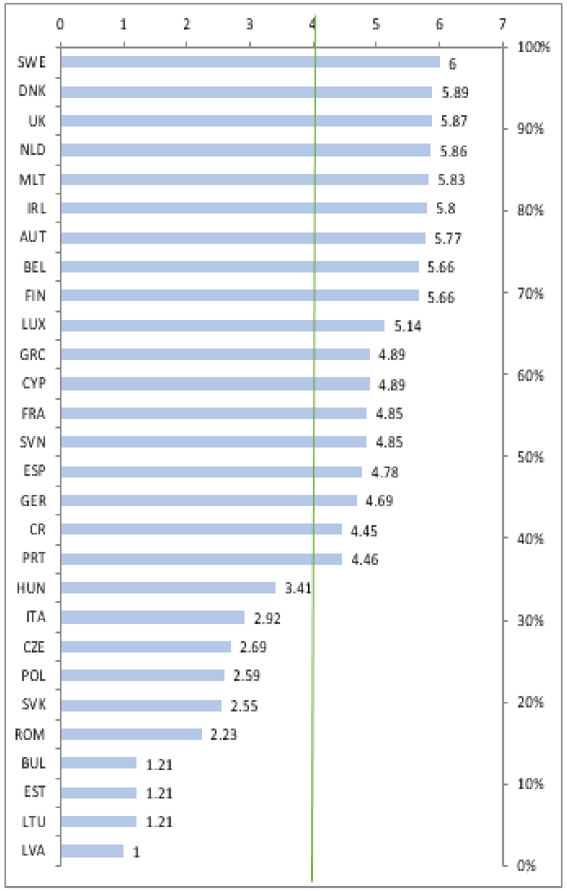
Figure 4.5. Sub-Indices (II)

Transparency Sub-Index



(*) Average of the EU is 3.28.

Cultural Sub-Index



(*) Average of the EU is 4.15.

Note that: Green line shows average of EU. AUT: Austria, BEL: Belgium, BUL: Bulgaria, CR: Croatia, CYP: Cyprus, DNK: Denmark, ESP: Spain, EST: Estonia, FIN: Finland, FRA: France, GER: Germany, GRC: Greece, HUN: Hungary, IRL: Ireland, ITA: Italy, LTU: Lithuania, LUV: Latvia, LUX: Luxembourg, MLT: Malta, NLD: Netherland, POL: Poland, PRT: Portugal, ROM: Romania, SVK: Slovakia, SVN: Slovenia, SWE: Sweden, UK: United Kingdom.

A similar case can be seen with France, albeit at a higher position than Italy. Although France is at the EU average, it finds itself lower in the Institutional Index than most other developed EU members along with Italy. This might partly be explained by the origins of its law system, based on French civil law. These results concur with the findings of La Porta et al. (1998), who examined legal rules covering protection of creditors and corporate shareholders, enforcement of law and the origin of law by classifying countries according to legal origins. They found that French civil law countries (i.e. France, Greece, Italy, Portugal and Spain) are weaker with respect to governance of these legal issues compared to countries with English origin law (i.e. a common law), Scandinavian civil law or German civil law origin.

The position of the EU countries in the Institutional Index is largely replicated across the sub-indices. The countries above the EU average in the financial sub-index largely retain similar positions in the other sub-indices (see Figures 4.4–4.5). The countries at the top of the legal sub-index show higher quality relating to legal environment than do the others. That is, they have well-functioning legal systems. The opposite is true for the countries at the bottom. Again, Northern European countries have higher numbers in the sub-indices and are above the EU average, while Southern, Central and Eastern European countries have lower numbers except for Estonia and are below the EU average.

For example, high numbers in the openness sub-index as well in the transparency sub-index are attained by the countries that have credit markets with higher degrees of openness and are more transparent (e.g. Finland and Sweden). For those with low numbers, the opposite is true (e.g. Bulgaria and Greece). These results mostly reflect the results of the cultural sub-index with a few exceptions (e.g. Finland and Ireland). Both Finland and Ireland are above the EU-28 average in the cultural sub-index, but Finland has a lower position here than in all the other indices. It is the opposite case for Ireland, which has a higher position here than in the other indices. According to by Hofstede, Minkov and Hostede (2010)'s definition, the cultural dimension of this sub-index is related to a person's ability to consider the future consequences of actions in the present. That is, a person can have either an indulgent or a restrained nature, according to cultural background. Individuals with indulgent behaviour like to receive immediate gratification, whereas those with low indulgence will forego immediate gratification for the benefit of their future advancement. The results of the cultural index show that a person from Ireland is more likely to display indulgent behaviour than someone from Finland.

Like in the Institutional Index, the sub-indices confirm that there is a large discrepancy between those countries with highest and those with lowest institutional quality with regard to their mortgage credit markets. The cultural sub-index differs from the other sub-indices in that the discrepancies between EU markets is smaller. For example, the transparency sub-index reveals larger differences than the cultural index, with Denmark, which has the highest index number (i.e. 6) having the most transparent mortgage markets and Greece, with the index lowest number (i.e. 1). In the cultural sub-index, however, Sweden comes top with 6 (the most indulgent individuals), and Latvia bottom with 1 (the most restrained culture). The cultural index numbers also indicate that the EU countries have more in common with each other culturally than they do with regard to other institutional characteristics.

In summary, the results of the Institutional Index and the sub-indices demonstrate that the EU mortgage markets still remain diverse. In other words, these markets are heterogeneous with regard to institutional environment and thereby prove the hypothesis of this essay. These findings also confirm the results of previous studies that have constructed an index for mortgage markets (e.g. Wyman, 2003, 2006; London Economics, 2005; IMF, 2008) although their indices cover fewer institutional features than the Institutional Index, with their results largely overlapping those of our index.

4.5.2. Scoring Method

In this section, the robustness of the Institutional Index is checked. For this purpose, a different method (scoring) is applied using the same institutional variables.[91] The second overall index is constructed following the approach of Şener's (2016) approach. According to the literature review, this method will here be applied to mortgage markets – or indeed other real estate markets – for the first time.

The scoring method is technically acquired from the average of the variables. In this method, the related value of a country (X_k)[92] is compared with the threshold value calculated with Equation (2) given below;

$$T_1 = \overline{X_{28}} - \alpha * \sigma(X_{28}) \tag{2}$$

[91]The European Commission uses this technique to create a benchmark for assessing whether candidate countries fulfil the Copenhagen criteria. The Copenhagen criteria are the eligibility criteria for joining the EU.
[92] X_k is the value of every EU country's each variable in the data.

Where $\overline{X_{28}}$ and $\sigma(X_{28})$ are the arithmetic average and the standard deviation, respectively, of each variable for all EU member countries; α is a convergence constant; T_1 represents threshold. Taking heterogeneity among the markets, a threshold of ± 0.5 standard deviations[93] from the average is set as the threshold of institutional quality; hence the convergence constant is assumed to be equal to ±0.5 for all variables.[94]

In the scoring method, while a country is evaluated with respect to its institutional environment, the value of each variable is compared to the threshold value of (T_1).If the value is above the threshold, the institutional quality of the mortgage markets is viewed as being relatively good and given a score of *one*; otherwise they are seen as being weak and given a score of *zero.* In the next stage, an index is constructed with the total of the success scores of the related variables per country. Equation 3 is:

$$I_i = \sum_{k=1}^{n} X_k \qquad (3)$$

In Equation 3, I_i, represents the index obtained by adding all the success scores (0 or 1) in the *n* indicator of a country; the positions of the countries are determined according to the limit for the mortgage markets with high institutional quality. In the final stage, the new overall index is calculated.[95] After producing the index, the scores obtained for all the countries are then rescaled from one to six like the Institutional Index. This index is called the Score Index.

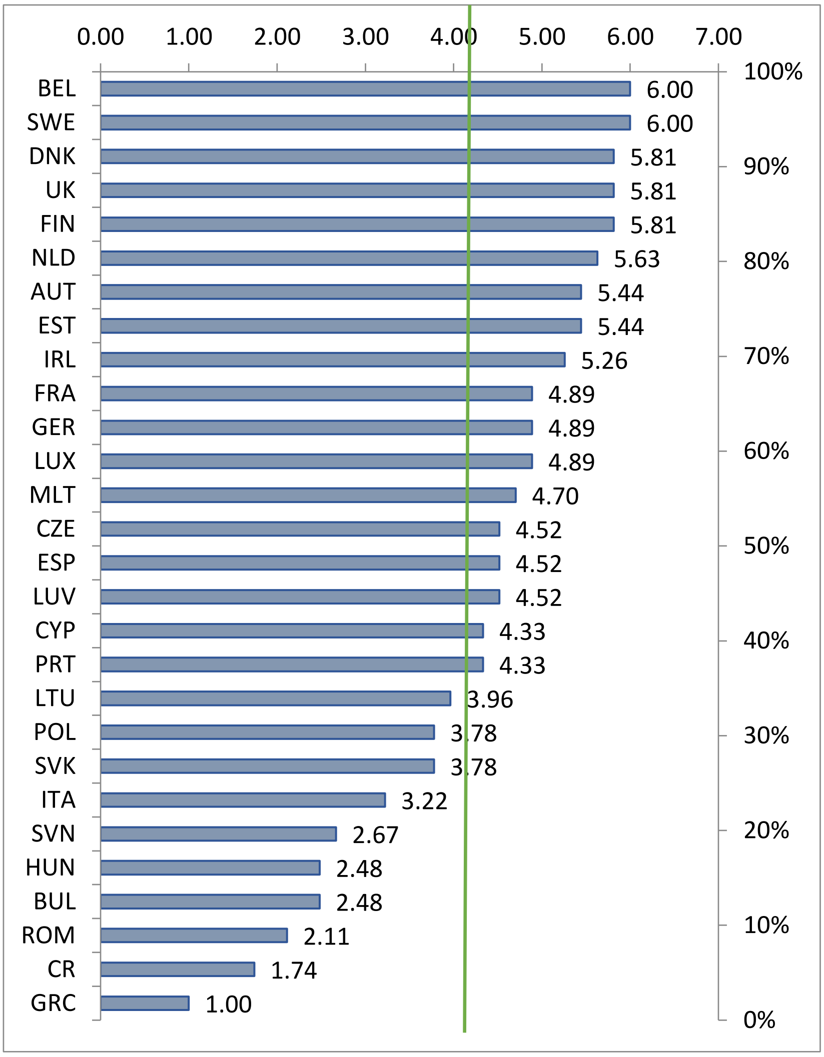
Figure 4.6 displays the rankings in the Score Index. As in the Institutional Index, in the Score Index the highest number indicates those mortgage markets with the highest institutional quality, while the lowest number indicates those with the weakest. These results confirm the robustness of the Institutional Index, although there are some minor differences in countries' rankings. Again, in the Score Index, Northern European countries are above the EU-28 average, while Southern, Central and Eastern European countries are below. This means that Northern countries with a higher score (i.e. higher institutional quality) have a more developed mortgage markets, but this is opposite for the others.

Moreover, the findings clearly reveal the differentiation between Northern and Southern European countries as well as between Northern and Eastern Europe. Again, the results of the

[93] Here, the same threshold as the European Commission is taken into account.
[94]In those indicators in which a decrease in value means an improvement, the negative value of the convergence constant has been used.
[95] The Stata formulation is as follows: sum enabling trade gen b27=1 if enabling trade >r – 0.5*r (sd). *r* and *sd* denote mean and standard deviation respectively.

Score Index reveal also a large discrepancy between the credit markets with the highest institutional quality and those with the lowest.

Figure 4.6. Score Index



(*) Green line shows average of EU (28).
Note: AUT: Austria, BEL: Belgium, BUL: Bulgaria, CR: Croatia, CYP: Cyprus, DNK: Denmark, ESP: Spain, EST: Estonia, FIN: Finland, FRA: France, GER: Germany, GRC: Greece, HUN: Hungary, IRL: Ireland, ITA: Italy, LTU: Lithuania, LUV: Latvia, LUX: Luxembourg, MLT: Malta, NLD: Netherland, POL: Poland, PRT: Portugal, ROM: Romania, SVK: Slovakia, SVN: Slovenia, SWE: Sweden, UK: United Kingdom.

4.6. Institutional Quality and Financial intermediaries

Having constructed the Institutional Index and the sub-indices, it needs to be ascertained whether they present a sound benchmark for the institutional quality of mortgage markets and whether they represent reality. For this purpose, in this section the relationship between the development of financial intermediation and institutional quality is investigated using the indices developed as an indicator of the institutional quality of the mortgage markets.

4.6.1. Financial Intermediaries

The financial systems play a role in shaping the development of the economy. The financial system consists of financial intermediaries and financial markets as well as their interaction. In financial markets, people needing funds borrow it both directly and indirectly. Indirect finance refers to the activities of financial intermediaries. Financial intermediaries are organisations that enable the funds to be channelled between borrowers and lenders (Mishkin and Eakins, 2016). There are many intermediaries in the financial sector:[96] depository institutions (e.g. commercial banks, savings banks and building societies), mortgage banks and mortgage brokers etc.

The financial intermediation theory suggests that financial intermediation contributes to an increase in efficiency in the functioning of financial markets by improving resource allocation and decreasing the constraints of liquidity (e.g. Scholtens and Van Wensween, 2000; Gorton and Winton, 2003). In a financial system since financial intermediaries provide two main economic services (liquidity provision and monitoring). In addition, they play a key role in the markets as they mitigate problems (e.g. transaction costs, risk sharing and information costs) in the financial markets that can prevent people accessing loans (Mishkin and Eakins, 2016). Moreover, there is substantial evidence on the role of the financial intermediaries in an economy: existing empirical literature reveals the significant positive effect of intermediaries on the economy in many aspects, such as economic growth, total factor productivity and transmission of monetary policy to the economy, among others (e.g. Levine, Loayza and Beck, 2000; Hao, 2006; Yao, 2011; Bastidon, 2014; Obradovic and Grbic, 2015; Grbic, 2016).

Financial intermediaries are important for a financial system since they provide two main economic services: liquidity provision and monitoring. In addition, they play a key role as they mitigate problems (e.g. transaction costs, risk sharing and information costs) in financial markets that can prevent people accessing loans (Mishkin and Eakins, 2016).

On the other hand, as earlier mentioned, since institutional characteristics influence the allocation of resources and determine the rules of game in the markets, institutional quality can affect all parts of an economy with respect to many aspects, such as the financial sector and its

[96]Financial intermediaries can be classified in many ways, based on the nature of the services they provide depository institutions, contractual savings institutions or investment intermediaries. In addition, they are categorised according to the financing of their activities into brokerage or qualitative asset transformation. For moreinformation, see Greenbaum and Thaker, 2007.

components (i.e. financial intermediaries and financial markets). In fact, many studies show that institutions contribute to an improvement in the efficiency of financial sector and support financial development (Levine, Loayza and Beck, 2000; Mishkin, 2009, Chin and Ito, 2007). According to Alonso and Garcimartin (2013), there is a virtuous circle between financial development and the quality of institutions. That is, financial development supports the markets with high institutional quality and also high institutional quality fosters financial development. If the financial sector has a high-quality institutional environment, it may be suggested that financial intermediaries will be intrinsically more developed because of robust enforcement of the law and good protection of the rights of all market participants in the financial sector.

Thus, financial intermediation with high institutional quality enables a well-functioning mortgage finance system in the economy. In other words, if the financial sector in a country has high institutional quality, that country will have more developed financial intermediaries as well as more advanced mortgage credit markets. There is a positive correlation between institutional quality and the development of financial intermediation. As such, in examining the relationship between the development of financial intermediation and the Institutional Index as well as the sub-indices, it is expected that a positive relationship between them will be found.

4.6.2. Measuring the Development of Financial Intermediation

In order to test the relationship of the development of financial intermediation with both the Institutional Index and the sub-indices, it should first be decided which measurements will be used for the development of financial intermediation. The literature reveals no single measure for this.

The World Bank has developed a data set behind the most comprehensive database to measure the development of the financial sector, which it does from two perspectives: financial intermediaries and financial markets (see Chiack et al., 2012). This database uses several measures for four characteristics of financial intermediaries: financial depth, financial efficiency, financial access and financial stability. Financial depth captures the size of financial intermediation relative to the economy. The key measures of depth are private sector credit to GDP, financial institutions' assets to GDP, M2 to GDP, deposits to GDP and gross value-added of the financial sector to GDP. Financial efficiency indicates the cost of intermediating credit and the ability of financial intermediaries to access information at low cost and to supply financial services at low cost and with sustainable income. The key measures are net interest margin, lending-deposits spread, non-interest income to total income and overhead costs (percentage of total assets). Financial access shows the degree to which financial services can be used by companies and households. The key measures are accounts per thousand adults (commercial banks), branches per 100,000 adults (commercial banks), percentage of people with a bank account, and percentage of firms with a line of credit. Financial stability indicates the frequency of system-wide episodes that causes system failures in the financial sector, such as financial crisis, large asset price bust and bank panics. The key measures for stability are Z-score, capital adequacy ratios, asset quality ratios and liquidity ratios.

In the empirical literature, most studies attempt to measure the development of financial intermediaries in terms of their depth or their efficiency or both. The most widely used measurements of depth of financial intermediation are the ratio of private credit to GDP and/or the ratio of liquid liabilities to GDP (e.g. McKinnon, 1973; King and Levine, 1993; Fry, 1995; Levine, Loayza and Beck, 2000, Beck, 2007; Rohter, 2001; Fink, Haiss and Vuksic, 2006; Allen et al., 2013). To measure efficiency of financial intermediation, interest rate spreads and net interest margin are two indicators commonly considered (e.g.Rohter, 2001; Demirgüç-Kunt, Laeven. and Levine, 2004; Beck, Lundberg. and Majnoni, 2006).

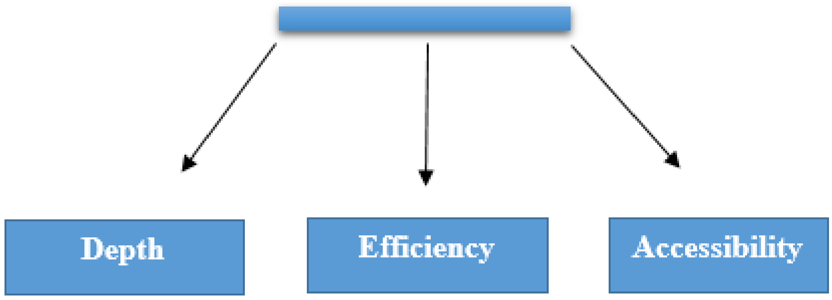
In this study, three measurements are taken into account according to data availability. Since this study focuses on the mortgage credit markets, the total mortgage loan to GDP ratio is used instead of total private credit/GDP, while owner-occupiers with a mortgage or home loan (percentage of population) is used instead of the percentage of firms with a line of credit which shows firms using bank loans to finance working capital. The latter ratio indicates the share of individuals in a population who take out a loan to purchase their own homes. The third is net interest margin.

4.6.3. Methodology and Data Definition

In order to ascertain whether the indices produced represent reality as well as a good benchmark for mortgage credit markets, the relationship between the development of financial intermediaries and institutional quality is examined. For this, two methods are used: the ordinary least squares (OLS) method and graphical display. The OLS is one of the techniqes used for estimation of linear regression model and estimates the unknown parameters in a linear regression model by minimising the difference between observed dependent values and estimated values.

Financial intermediaries are considered as an indicator of the development of the mortgage credit markets. To select the indicators of the development of financial intermediaries, the approach of the World Bank (2017) is followed and three dimensions of financial intermediaries are considered. They are: depth, efficiency and accessibility of financial intermediaries (Figure 4.7) and as aforementioned, three measurements are taken into account bearing in mind data availability in all EU countries. These are total mortgage loan to GDP ratio, as an indicator of depth, the percentage of owner occupied with housing credit in population, as an indicator of accessibility, and net interest margin, as an indicator of efficiency.

Figure 4.7. Indicators of the Development of Fınancial Intermediaries



The ratio of mortgage loan to GDP indicates the financial resources that are provided to the households by depository intermediaries (e.g. commercial banks, savings banks, etc.). A higher ratio shows a higher amount of financial resources going to the households who want to have own home in an economy.Net interest margin is an indicator of the efficiency of financial intermediaries and shows the difference between interest revenue earned and interest that they pay. In those credit markets with more efficient financial intermediation, net interest margin is lower than those with less efficient financial intermediation. The percentage in a population of owner-occupied housing bought with credit in a population is an indicator of the accessibility of financial services for home buyers, provided by financial intermediaries, and shows the proportion of households who borrow, via mortgage or home loan, to buy. A higher ratio indicates a higher number of households accessing credit to buy their own home.

In the analysis, our indices constructed are considered as a measurement for institutional quality of the mortgage markets. These indices cover the Institutional Index, which is considered an indicator of the total institutional environment and five sub-indices: the financial sub-index for financial institutional features of the credit markets, the legal sub-index for legal institutional features, the openness sub-index for the degree of financial liberalization in the markets, the transparency index for indicators of corruption, and the cultural index for informal institutions.

Examining the development of financial intermediation and the quality of the institutional environment in the mortgage markets comprises two stages. In the first, this relationship is estimated by applying the OLS technique. In the second, the relationship between the development of financial intermediation and institutional quality is illustrated using a graphical method.

The linear regression model uses three equations: the depth equation, accessibility equation and efficiency equation. They show the association between the institutional quality of the mortgage credit markets and the development of these markets with three dimensions of financial intermediation.

Equation 1 represents the association between the depth of financial intermediation and the quality of the institutional environment, and Equations 2 and 3 show the relationship between the development of financial intermediation and institutional quality with regard to the accessibility of financial intermediation and its efficiency respectively. Each equation consists of two variables: a variable for the development of financial intermediation and a variable for the quality of institutional environment. In each equation, the development indicators of financial intermediation are included as dependent variables and the indicators of the quality of the institutional environment are the independent variables. The equations used are as follows:

$$Depth_t = \alpha_0 + \alpha_1\, Institution_{t-1} \qquad (1)$$

$$Accessibility_t = \delta_0 + \delta_1\, Institution_{t-1} \qquad (2)$$

$$Efficiency_t = \beta_0 + \beta_1\, Institution_{t-1} \qquad (3)$$

Where $Depth_t$ is the ratio of mortgage credit to GDP at time *t* as an indicator of the depth of financial intermediation in the mortgage credit markets; $Accessibility_t$ is the percentage of owner-occupied housing in a population bought with credit as an indicator of the accessibility of financial services for home buyers provided by financial intermediaries at time t ; $Efficency_t$is the net interest margin at time *t* as an indicator of the efficiency of financial intermediation; $Institution$ are the indices produced as an indicator of the institutional features at time *t-1*; and U_1 and U_2 are the error terms. The development variables of financial intermediation are included in the model as real terms. They also put in the model in their logarithmic form except net interest margin. The development variables belong to 2015 and the institutional variables cover 2014 to avoid causality.

The data regarding the development of financial intermediaries is collected from the World Bank, the Statistical Office of the European Communities (Eurostat) and the European Mortgage Federation (EMF). The institutional variables are the indices produced in this essay. The data list is displayed in Appendix 4.11.

In the first stage of analysis, the estimation of the model comprises three steps. In the first steps, the three indicators of the development of financial intermediation are regressed against the Institutional Index. In the second step, we extend our analysis by taking into consideration the five sub-indices. The estimation of each of the three equations is repeated by adding each of the sub-indices to the equations. In the last step, three development indicators of financial intermediation are regressed against each of the institutional variables separately, which are used to construct. The model is then re-estimated. Thus, it is possible to capture both total and separate effects of institutional features on the development of financial intermediaries. In the second stage of the analysis, the relationship between the development of financial intermediation and the Institutional Index is presented using a graphical method.

At the end of the analyses, it is expected that the institutional quality of the credit markets will be positively associated with the both mortgage credit to GDP ratio and the number of home buyers borrowing mortgage credit, while there will be a negative relationship between institutional features and net interest margin. In other words, the expectation is that institutional quality has a positive relationship with both the depth and accessibility of the financial intermediaries while having a negative relationship with efficiency of financial intermediation. Thus, an improvement in the quality of the institutional environment increases the depth and accessibility of the mortgage credit market as well as its efficiency that is the development of these markets.

4.6.4. Empirical Analysis and Findings

Linear Regression Analysis

The estimation results of the linear regression model are summarised in Tables 4.3–4.5. Table 4.3 reports the estimation results of the relationship between the quality of the institutional environment and the depth of financial intermediation for 28 member countries of the EU; Table 4.4 presents the estimation results of the relationship between institutional environment and accessibility of financial services for home buyers, while Table 4.5 presents the estimation results of the association between the efficiency of financial intermediation and the institutional environment.

The estimation results illustrated in Table 4.3 are as expected. There is a positive relationship between the depth of financial intermediation (i.e. the ratio of mortgage credit to GDP) and both the Institutional Index and the five sub-indices. Changes in institutional environment have an effect on the depth of financial intermediation in the same way. That is, the results show that there is a positive relationship between depth of financial intermediation and the quality of institutional environment.

Table 4.3. Institutional Quality vs. Depth of Financial Intermediation

	Dependent variable: Mortgage Debt/GDP (%)		
	Coefficients	P value	R-squared
Institutional index (Overall index)	12.78787	0.000	0.3992
Financial sub-index	9.76364	0.001	0.3058
Legal sub- index	11.52574	0.000	0.5233
Openness sub-index	12.19496	0.000	0.5637
Transparency sub-index	18.59263	0.000	0.5811
Cultural sub-index	33.66465	0.000	0.5394

Note that: Sample size is 28. Statistical significance is at the levels of 95 percent.

According to the estimation results, each additional improvement in the quality of the institutional environment contributes to deepening of financial intermediation by 12.7878% and hence increases the supply of mortgage credit. The estimation coefficient of the development variable is statistically significant. A 1% increase in institutional quality with respect to financial, legal, openness, transparency and cultural features of the mortgage credit markets increases the depth of financial intermediation by 9.7636%, 11.5257%, 12.1949%, 18.5926% and 33.6646% respectively. Their estimated coefficients are also statistically significant. The largest effect of the institutional environment comes from its cultural dimension while the smallest effect is from the financial dimension.

The estimation results for the cultural dimension of the institutional environment show that, in the EU, informal institutional characteristics (e.g. customs and habits) are more important than any others for decision-making in EU households with regard to owning one’s own home and borrowing in order to buy it. This result is consistent with the findings of Musso Neri and

Stracca (2011). Although average income per capita is higher in the US than the Eurozone,[97] they found that European households tend to hold more property (in particular in the form of primary residence) than the US households and hence that housing wealth (as a share of GDP) is higher in the Eurozone than in the US.

The estimation results for the relationship between institutional environment and accessibility of financial intermediation are similar to the results with regard to depth. Table 4.4 displays that the percentage of owner occupied with housing credit in population has a positive relationship with all the indices. A 1% increase in overall institutional quality of the credit markets makes mortgage credit to households easier by 9.5538%. An improvement in the legal environment and the openness of credit markets affects the accessibility of financial services to the same extent. A 1% change in cultural features and transparency of the credit market causes a positive change in accessibility by 22.3177% and 14.4982% respectively.

Table 4.4. Institutional Quality vs. Accessibility of Financial Intermediation

	Dependent variable: % of owner occupied with loan in population		
	Coefficients	P value	R-squared
Institutional index (Overall index)	9.55387	0.000	0.7084
Financial sub-index	8.183799	0.000	0.4584
Legal sub- index	9.118371	0.000	0.6988
Openness sub-index	9.043437	0.000	0.6614
Transparency sub-Index	14.49824	0.000	0.7540
Cultural sub- Index	22.31772	0.000	0.5058

Note that: Sample size is 28. Statistical significance is at the levels of 95 percent.

Table 4.5 shows the test results of the relationship between efficiency of financial intermediation and quality of institutional environment. The coefficients of all the institutional variables are as expected: they have a negative sign and are statistically significant. These results reveal a negative relationship between net interest margin and institutional quality. This means that higher institutional quality prevents excessive profit margins for financial intermediaries in the mortgage credit markets. A 1% increase in the institutional quality of credit markets decreases net interest margin by between 0.8149% and 0.3473%. Among the institutional dimensions, culture accounts for most of the variance in the efficiency of the markets, followed by transparency. Thus, it can be argued that an improvement in the

[97] Per capita income was €32,900 and €42.500 in the Eurozone and the US as of GDP (PPP) (https://www.ecb.europa.eu/mopo/eaec/html/index.en.html (14.10.2017).

institutional environment creates a more competitive credit market environment and decreases the profit margins of financial intermediaries as well as increasing the affordability of credit for home buyers.

Table 4.5. Institutional Quality vs. Efficiency of Financial Intermediation

	Dependent variable: Net Interest Margin (%)		
	Coefficients	P value	R-squared
Institutional index (Overall index)	-.4186008	0.000	0.2017
Financial sub-index	-.3473969	0.001	0.2664
Legal sub- index	-.3980012	0.000	0.4293
Openness sub-index	-.3919145	0.000	0.4006
Transparency sub-index	-.6040519	0.000	0.4221
Cultural sub-index	-.8149072	0.007	0.2175

Note that: Sample size is 28. Statistical significance is at the levels of 95 percent.

The results of the first two steps of the regression analysis – testing the relationship between the institutional environment (both overall and the five dimensions) and the development of financial intermediation – indicate that an improvement in institutional quality makes a bigger contribution to the depth and accessibility of financial intermediation than does their efficiency in the mortgage markets. In this case, one suggestion is that institutional quality has an indirect impact on financial intermediaries' efficiency and a direct effect on their depth and accessibility. Another suggestion may be that the efficiency of mortgage markets is influenced by other factors, such as economic conditions, management decisions and deposit insurance etc.[98]

In the last step of the first stage of the analysis, the development indicators of financial intermediation are regressed against each of the institutional variables that were used to construct the indices. Table 4.6 shows the estimation results for the relationship between depth of financial intermediation and each of the 27 institutional variables. The sign of the coefficients of all the institutional variables are as expected expect for accessing credit (F_CRE), enforcing contracts (L_ENF) and starting business-number of procedures (O_BUS). All estimated coefficients are statistically significant – apart from a few, such as for accessing credit (F_CRE), strength of banks (F_BAN), enforcing contracts (L_ENF), cost of real estate (O_REA) and recovery rate of insolvency (O_REC). The estimations show that culture (C_IND) explains

[98] For more information for the determinants of the efficiency of the credit markets see Staikouras and Wood, 2007; Carbo-Valverde and Fernández, 2007; Gonzalez, 2009.

most of the changes in the development of financial intermediation. A 1% change in the habits and customs of the country increases the development of financial intermediation by 33.7646%.

Transparency of markets (TRNS) follows after culture. Other institutional features that affect the development of financial intermediation are most of the legal variables, such as efficiency of legal framework (L_EFF), changing regulations (L_EFR), judicial independence (L_JUD) and property rights (L_PROP). Two variables under the openness driver follow the legal variables (trading across borders, O_MT and O_XT, relating time to export and import). These variables in turn are followed by two variables under the financial driver (affordability of financial services - F_AFF and availability of financial services - F_AVA).

These estimation results indicate that informal institutional features (e.g. habits and traditions), transparency and legal features of the credit markets play more important role in increasing the depth of financial intermediation than the others. In this case, one suggestion can be that policy makers, in pursuit of more developed mortgage markets, should consider prioritising the cultural, legal and transparency features of the institutional environment.

Similar results also emerge for the relationship between institutional variables and the accessibility and efficiency of financial intermediation, as illustrated in Tables 4.7 and 4.8. The test results of the relationship between the institutional environment and the accessibility of financial intermediation show that two of the financial features are the most important, i.e. affordability (F_AFF) and availability of financial services (F_AVA), This shows that as expected, both affordability and availability are more important for home buyers, who need to borrow from the credit markets.

Table 4.6. Institutional Features vs. Depth of Financial Intermediation

	Dependent variable: Mortgage Debt/GDP (%)		
	Coefficients	**P value**	**R-squared**
Financial sub-index	**9.763643**	**0.001**	**0.3058**
F_AVA	13.38196	0.003	0.3010
F_AFF	15.85411	0.000	0.4225
F_LOC	12.75313	0.004	0.2734
F_ACC	8.065261	0.086	0.1094
F_RIS	12.28702	0.006	0.2538
F_BAN	1.032947	0.831	0.0018
F_SEC	14.0298	0.001	0.3309
F_CRE	-1.961604	0.684	0.0065
F_MEV	.0097648	0.001	0.2229
Legal sub- index	**11.52574**	**0.000**	**0.5233**
L_PROP	16.96465	0.000	0.4838
L_IRR	16.5217	0.000	0.4589
L_JUD	17.31449	0.000	0.504
L_EFF	17.46559	0.000	0.5128
L_EFR	17.34514	0.000	0.5058
L_ENF	-5.309309	0.266	0.0474
L_RIG	6.5217	0.000	0.4589
Openness sub-index	**12.19496**	**0.000**	**0.5637**
O_INV	8.961016	0.054	0.1350
O_XT	16.44692	0.000	0.4547
O_XC	6.928595	0.143	0.0807
O_MT	17.70099	0.000	0.5267
O_BUS	2.029423	0.674	0.0069
O_REA	-10.7741	0.019	0.1951
O_REC	-16.24615	0.000	0.4437
O_BAR	15.217	0.000	0.3893
O_BUR	14.61052	0.001	0.3589
Transparency sub-index			
TRAN	18.59263	0.000	0.5811
Cultural sub-index			
C_IND	33.66465	0.000	0.5394

Note that: Sample size is 28. Statistical significance is at the levels of 95 percent. F_AVA: Availability of financial services, F_AFF: Affordability of financial service, F_LOC: Financing through local equity, F_ACC: Ease of access to loans, F_RIS: Venture capital availability, F_BAN: Soundness of bank, F_SEC: Regulation of securities exchanges, F_CRE: Getting credit- depth of credit information, F_MEV: Mortgage equity withdrawal, L_PROP: Property rights, L_JUD: Judicial independence, L_EFF: Efficiency of legal framework in setting disputes, L_EFR: Efficiency of legal framework in challenging regulations, L_RIG: Getting Credit- Strength of legal rights, L_ENF: Enforcing Contracts, O_INV: Investment freedom, O_XT: Trading cross borders – time to export, O_XC: Trading cross borders – cost of export, O_MT: Trading cross borders - time to import, O_BUS: Starting a business – number of procedures, O_REA: Cost of real estate, O_REC: Recovery rate of insolvency, O_BAR: Prevalence of trade barriers, O_BUR: Burden of customs procedures, TRAN: Corruption perceptions index, C_IND: Habits and customs.

Table 4.7. Institutional Features vs. Accessibility of Financial Intermediation

	Dependent variable: % of owner occupied with loan in population		
	Coefficients	**P value**	**R-squared**
Financial sub-index	**8.183799**	**0.000**	**0.4584**
F_AVA	10.60687	0.000	0.4036
F_AFF	12.50546	0.000	0.5610
F_LOC	10.79787	0.000	0.4182
F_ACC	7.474423	0.008	0.2004
F_RIS	10.58944	0.000	0.4022
F_BAN	3.277169	0.221	0.0385
F_SEC	12.2806	0.000	0.5410
F_CRE	-.510342	0.874	0.8742
F_MEV	12.61667	0.035	0.1450
Legal sub- index	**9.118371**	**0.000**	**0.6988**
L_PROP	13.28574	0.000	0.6331
L_IRR	13.55733	0.000	0.6593
L_JUD	13.66888	0.000	0.6702
L_EFF	13.37741	0.000	0.6419
L_EFR	13.1414	0.000	0.6195
L_ENF	-5.679491	0.007	0.1157
L_RIG	13.55733	0.000	0.6593
Openness sub-index	**9.043437**	**0.000**	**0.6614**
O_INV	9.108636	0.000	0.2976
O_XT	10.1884	0.000	0.3724
O_XC	4.248241	0.227	0.0647
O_MT	10.5526	0.000	0.3994
O_BUS	6.246692	0.014	0.1400
O_REA	-7.75847	0.005	0.2159
O_REC	-12.40158	0.000	0.5517
O_BAR	11.60776	0.000	0.4833
O_BUR	13.11001	0.000	0.6165
Transparency sub-index			
TRAN	14.49824	0.000	0.7540
Cultural sub-index			
C_IND	22.31772	0.000	0.5058

Note that: Sample size is 28. Statistical significance is at the levels of 95 percent. F_AVA: Availability of financial services, F_AFF: Affordability of financial service, F_LOC: Financing through local equity, F_ACC: Ease of access to loans, F_RIS: Venture capital availability, F_BAN: Soundness of bank, F_SEC: Regulation of securities exchanges, F_CRE: Getting credit- depth of credit information, F_MEV: Mortgage equity withdrawal, L_PROP: Property rights, L_JUD: Judicial independence, L_EFF: Efficiency of legal framework in setting disputes, L_EFR: Efficiency of legal framework in challenging regulations, L_RIG: Getting Credit- Strength of legal rights, L_ENF: Enforcing Contracts, O_INV: Investment freedom, O_XT: Trading cross borders – time to export, O_XC: Trading cross borders – cost of export, O_MT: Trading cross borders - time to import, O_BUS: Starting a business – number of procedures, O_REA: Cost of real estate, O_REC: Recovery rate of insolvency, O_BAR: Prevalence of trade barriers, O_BUR: Burden of customs procedures, TRAN: Corruption perceptions index, C_IND: Habits and customs.

Table 4.8. Institutional Variables vs. Efficiency of Financial Intermediation

	Dependent variable: Net Interest Margin (%)		
	Coefficients	**P value**	**R-squared**
Financial sub-index	**-.3473969**	**0.001**	**0.2664**
F_AVA	-.6050132	0.000	0.4234
F_AFF	-.576922	0.000	0.3850
F_LOC	-.5710091	0.000	0.3850
F_ACC	-.2079297	0.185	0.0500
F_RIS	-.3533981	0.028	0.1445
F_BAN	-.1074895	0.411	0.0134
F_SEC	-.5485257	0.000	0.3309
F_CRE	.0132055	0.927	0.0002
F_MEV	.4079167	0.272	0.0489
Legal sub- index	**-.3980012**	**0.000**	**0.4293**
L_PROP	-.6826527	0.000	0.5390
L_IRR	-.605321	0.000	0.4238
L_JUD	-.6108326	0.000	0.4316
L_EFF	-.5448057	0.000	0.3433
L_EFR	-.5917294	0.000	0.73087
L_ENF	-.1274647	0.233	0.0188
L_RIG	-.605321	0.000	0.4238
Openness sub-index	**-.3919145**	**0.000**	**0.4006**
O_INV	-.4106547	0.003	0.1951
O_XT	-.5391215	0.005	0.1350
O_XC	-.1607452	0.400	0.0299
O_MT	-.5602943	0.003	0.3631
O_BUS	-.2414311	0.093	0.0674
O_REA	-.3053319	0.110	0.1078
O_REC	-.5419822	0.000	0.3398
O_BAR	-.4275452	0.006	0.2114
O_BUR	-.4563309	0.001	0.2409
Transparency sub-index			
TRAN	-.6040519	0.000	0.4221
Cultural sub-index			
C_IND	-.8149072	0.007	0.2175

Note that: Sample size is 28. Statistical significance is at the levels of 95 percent. F_AVA: Availability of financial services, F_AFF: Affordability of financial service, F_LOC: Financing through local equity, F_ACC: Ease of access to loans, F_RIS: Venture capital availability, F_BAN: Soundness of bank, F_SEC: Regulation of securities exchanges, F_CRE: Getting credit- depth of credit information, F_MEV: Mortgage equity withdrawal, L_PROP: Property rights, L_JUD: Judicial independence, L_EFF: Efficiency of legal framework in setting disputes, L_EFR: Efficiency of legal framework in challenging regulations, L_RIG: Getting Credit- Strength of legal rights, L_ENF: Enforcing Contracts, O_INV: Investment freedom, O_XT: Trading cross borders – time to export, O_XC: Trading cross borders – cost of export, O_MT: Trading cross borders - time to import, O_BUS: Starting a business – number of procedures, O_REA: Cost of real estate, O_REC: Recovery rate of insolvency, O_BAR: Prevalence of trade barriers, O_BUR: Burden of customs procedures, TRAN: Corruption perceptions index, C_IND: Habits and customs.

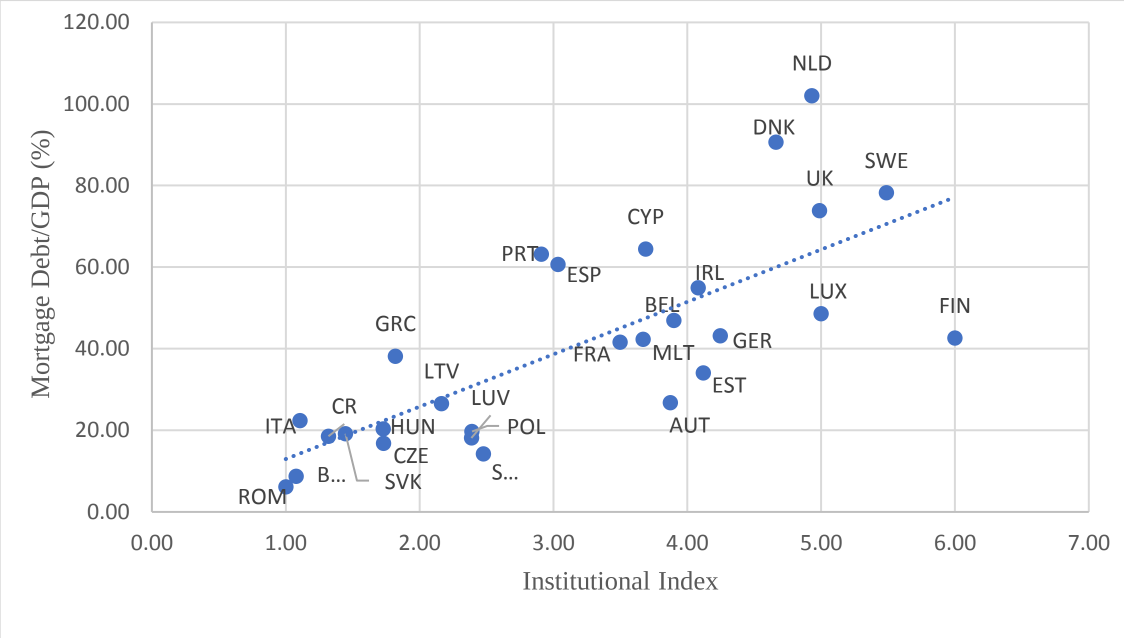
In summary, all estimation results indicate that institutional quality contributes to the development of financial intermediation in the mortgage markets and hence, the development of these markets. These findings also show that informal (i.e. cultural characteristics) and formal institutional characteristics (i.e. legal) together with transparency features contribute more than other institutional features to the development of financial intermediation and thus, the development of the mortgage credit markets. In addition, institutional features have a larger impact on the deepening of financial intermediation than either its efficiency or accessibility. An interesting point is that informal institutional characteristics (i.e. cultural features) have the largest impact on the development of financial intermediation in the EU mortgage markets. This result confirms the significance of cultural factors for the credit markets. It is also consistent with previous studies (e.g. Aggarwal and Goodell, 201; Asraf et al., 2017) In conclusion, it can be argued that an increase in institutional quality means greater credit supply and greater access to financial services for home buyers, a decrease in high profit margins in the credit markets, and the creation of well-functioning mortgage markets.

Graphical Analysis

Following the regression analysis, the relationship between the development of financial intermediation and the institutional environment is illustrated using a graphical method which considers the overall quality of the institutional environment (i.e. the Institutional Index). Figure 4.8 presents the depth of financial intermediation against the institutional quality of the mortgage markets. In other words, this figure displays the relationship between the mortgage credit/GDP ratio and the Institutional Index. As expected, there is a positive relationship between the Institutional Index and the depth of financial intermediation over the countries. Thus, an improvement in the quality of the institutional environment contributes to the development of financial intermediation. Higher institutional quality increases the deepening of financial intermediation and hence, creates more developed credit markets.

Figure 4.8 shows that the mortgage credit/GDP ratio is high in those countries with high-institutional-quality mortgage markets, such as the Netherlands, Sweden and the UK. This also indicates that such countries have more developed financial intermediation than the others.

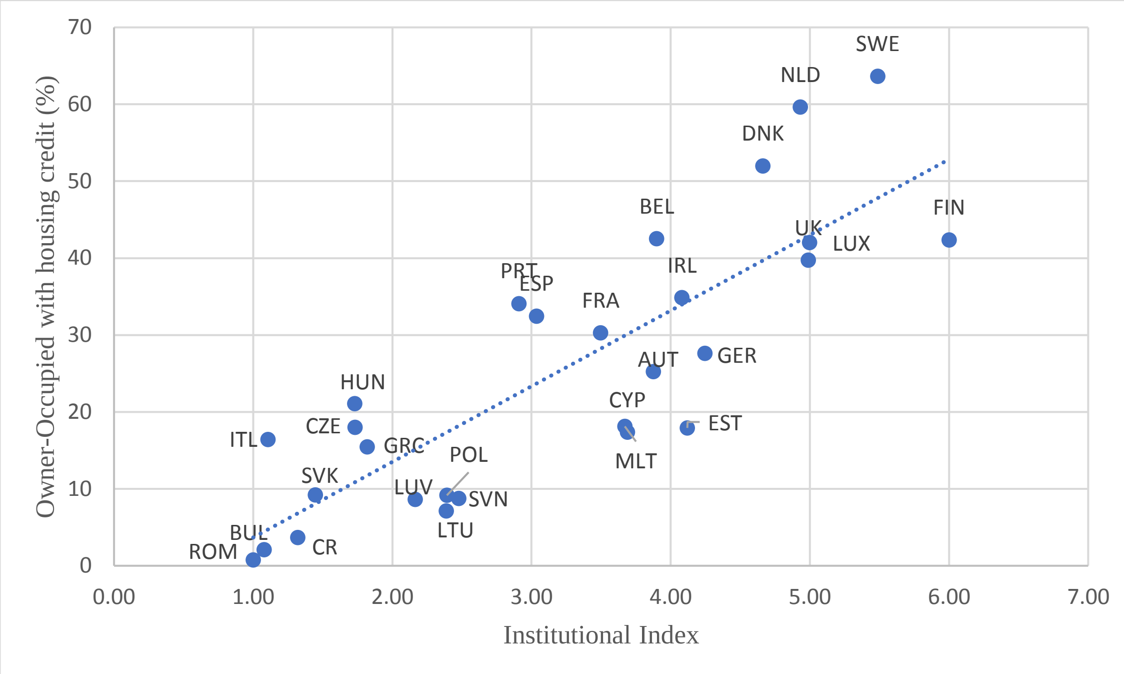
Figure 4.8. Institutional Index vs. Depth of Financial Intermediation



Source: Author's calculations and EMF, 2016 (for outstanding mortgage credit/GDP-%).
Note that: AUT: Austria, BEL: Belgium, BUL: Bulgaria, CR: Croatia, CYP: Cyprus, DNK: Denmark, ESP: Spain, EST: Estonia, FIN: Finland, FRA: France, GER: Germany, GRC: Greece, HUN: Hungary, IRL: Ireland, ITA: Italy, LTU: Lithuania, LUV: Latvia, LUX: Luxembourg, MLT: Malta, NLD: Netherland, POL: Poland, PRT: Portugal, ROM: Romania, SVK: Slovakia, SVN: Slovenia, SWE: Sweden, UK: United Kingdom.

As expected, there is a positive relationship between the Institutional Index and the depth of financial intermediation over the countries. Thus, an improvement in the quality of the institutional environment contributes to the development of financial intermediation. Higher institutional quality increases the deepening of financial intermediation and hence, creates more developed credit markets. Similar results emerge for accessibility of financial intermediaries, as illustrated in Figure 4.9. There is a positive correlation between the Institutional Index and the share of individuals in the population borrowing to buy their own house (i.e. accessibility of financial services). Thus, improvement in institutional quality positively influences accessibility of financial services in the credit markets. This figure shows that take-up of housing loans is higher in the markets with higher institutional quality. The proportion of owner-occupied housing with a loan is high in Northern European countries, such as the Netherlands, Denmark and Finland, while this ratio is low in Central and Eastern European countries as well as in Southern countries, such as Hungary, Romania and Italy.

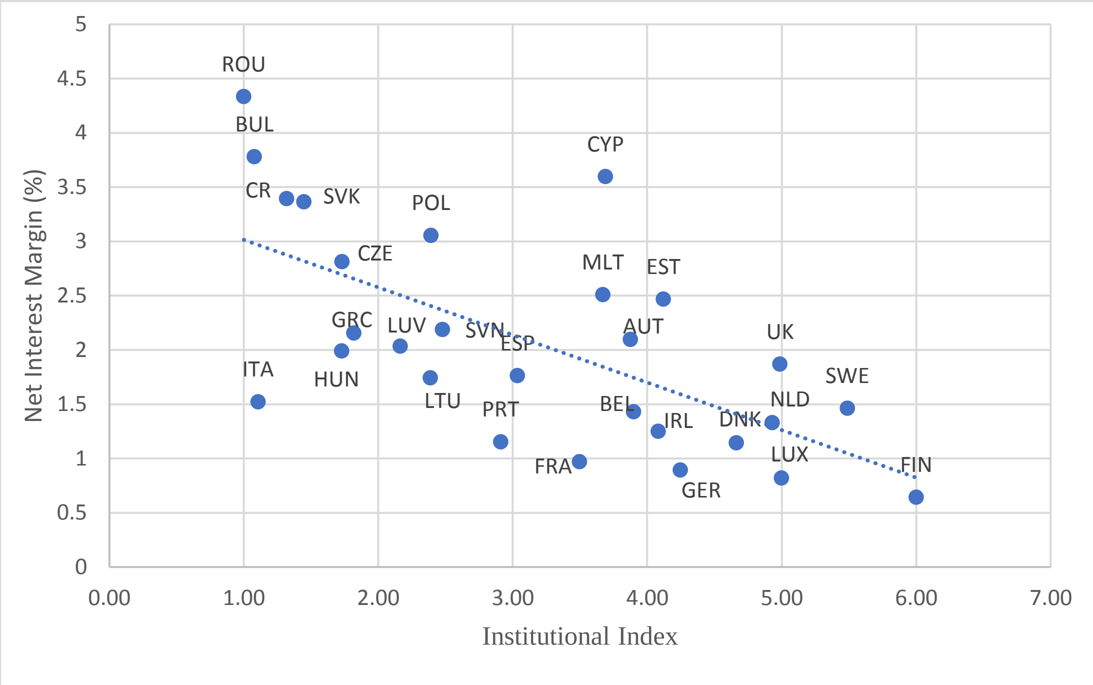
Figure 4.9. Institutional Index vs. Accessibility of Financial Intermediation



Source: Author's calculations and Eurostat databank (for % of owner occupied housing with loan in population).
Note that: AUT: Austria, BEL: Belgium, BUL: Bulgaria, CR: Croatia, CYP: Cyprus, DNK: Denmark, ESP: Spain, EST: Estonia, FIN: Finland, FRA: France, GER: Germany, GRC: Greece, HUN: Hungary, IRL: Ireland, ITA: Italy, LTU: Lithuania, LUV: Latvia, LUX: Luxembourg, MLT: Malta, NLD: Netherland, POL: Poland, PRT: Portugal, ROM: Romania, SVK: Slovakia, SVN: Slovenia, SWE: Sweden, UK: United Kingdom.

Figure 4.10 shows that the relationship of the efficiency of the credit markets with the quality of the institutional environment is negative. That is, there is a negative relationship between the net interest margin and the Institutional Index. In other words, the net interest margin (i.e. profit margin) decreases when institutional quality increases in the markets. One of the reasons for this is that a good institutional structure contributes to a competitive environment among financial intermediaries and, thus, greater competition increases the efficiency of the markets and removes opportunities for excess profit for financial intermediaries. As shown in Figure 4.10, net interest margin is low in countries with high institutional quality (e.g. Finland, Sweden and the UK), while countries with weak institutional quality have a high net interest margin (e.g. Bulgaria and Romania). Thus, financial intermediaries' net interest revenue as a share of their average interest-bearing assets is low in the markets with high institutional quality. The opposite is true for countries with weak institutional quality.

Figure 4.10. Institutional Index vs. Efficiency of Financial Intermediation



Source: Author's calculations and the World Bank databank (for net interest margin).
Note that: AUT: Austria, BEL: Belgium, BUL: Bulgaria, CR: Croatia, CYP: Cyprus, DNK: Denmark, ESP: Spain, EST: Estonia, FIN: Finland, FRA: France, GER: Germany, GRC: Greece, HUN: Hungary, IRL: Ireland, ITA: Italy, LTU: Lithuania, LUV: Latvia, LUX: Luxembourg, MLT: Malta, NLD: Netherland, POL: Poland, PRT: Portugal, ROM: Romania, SVK: Slovakia, SVN: Slovenia, SWE: Sweden, UK: United Kingdom.

Thus, the results of the graphical method confirm the estimation results of the regression analysis. The results of both methods show that an increase in institutional quality supports an increase in the development of financial intermediation by increasing both depth and accessibility of financial intermediation and by decreasing the profit margins of intermediaries.

It can be concluded that, if a country can improve the quality of its institutional environment, it can create more developed financial intermediation in the credit markets, as well as a well-functioning mortgage finance system. Since the most developed markets are those having the highest competitiveness environment, none of the financial intermediaries will have a privileged position in estimating market prices and thus enjoy only normal profit opportunities, which will mean lower transaction costs and lower mortgage interest rates in the markets.

Moreover, these findings confirm the institutional theory that proposes that the institutional environment can significantly influence the performance of the economy (North, 1993; Willamson, 2000). The results of the study are also in line with previous studies on the role of institutions in the development of the financial sector (e.g. Tobin, 1984; Mishkin, 2016). In addition, the findings of this study are consistent with previous studies on the effect of cultural institutions on financial sector development (e.g. Aggarwal and Goodell, 2010; Asraf et al., 2017); with previous studies on the role of the legal framework in the financial sector (e.g. La Porta et al., 1998, 2013; Beck, Demirgüç-Kunt and Levine, 2001; Djankov, McLiesh and Shleifer, 2007; Asraf, 2017); with previous studies on the effect of transparency in the markets. (Auerbach and Siddiki, 2004; Blackburna, 2006); and with previous studies on the effect of levels of openness on the financial sector (e.g. Baltagi, Demetriades and Law, 2009; Alzer and Dadasov, 2013); Consequently, it can be argued that our indices represent reality and that they may be used as a benchmark for institutional quality in the mortgage credit markets.

The results from the graphical method also show that financial intermediation in the EU credit markets has a heterogeneous appearance with regard to its institutional characteristics. Some countries (e.g. Finland and Sweden) achieve the top position in all figures that describe the relationship between the development of financial intermediaries and the Institutional Index. Some maintain a consistently low position, such as Central and Eastern countries. These results also align with the results of the factor analysis. One suggestion might be that institutional quality can be taken as one of the indicators of the development of financial intermediation and/or that the development of financial intermediation may be taken as one of the indicators of the institutional environment. In addition, these findings are consistent with those of previous studies on integration of the EU mortgage markets (e.g. Wyman, 2003; London School, 2005). From these findings, it might also be argued that the mortgage markets of the EU member countries still remain diverse and that these markets have not integrated fully although many attempts have realised for more integrated the EU mortgage markets since almost three decades.

4.7. Conclusion

The aim of this study was to measure the institutional features of the mortgage credit markets and to create a benchmark for these markets. To achieve this goal, an overall index, namely the Institutional Index and sub-indices were constructed using factor analysis. These indices show the features of the institutional environment of the mortgage markets in relation to different institutional dimensions, such as legal, openness, transparency, cultural and financial. All indices are rescaled between one and six (the upper limit) to make a comparison. A high index number indicates the country has a credit market with high institutional quality as well as a more developed financial intermmediation in the mortgage markets.

The index numbers show that the Northern European countries (e.g. Finland and Sweden) rank most highly with the Institutional Index. This shows that the institutional quality of their credit markets is higher than for other EU countries. In contrast, the periphery countries (e.g. Greece and Italy) and Central and Eastern European countries (e.g. Bulgaria and Romania), have below EU average institutional quality. These results indicate that the ranking position of individual countries in the sub-indices is largely similar to the Institutional Index. The Northern European countries rank most highly with any of the indices.

The findings also indicate the EU mortgage markets are heterogeneous. This could be the result of a combination of other factors such as economic structure, type of housing finance system with institutional differences. These results are similar to earlier studies of EU mortgage markets (e.g. Wyman, 2003; London Economics, 2005) though they included significantly fewer institutional features.

The further analysis indicates that the indices developed reflect mortgage market features. The results from the OLS model are generally as expected with the indices appearing to fairly accurately describe mortgage market development showing a positive relationship between institutional features and financial intermediation in mortgage markets. This suggests that both formal and informal institutional features can have a positive role in the development of financial intermediation. Countries which have strong financial intermediation and a high quality institutional environment have well developed mortgage markets with respect to the depth, accessibility and efficiency of the financial intermediaries. These results are in agreement with various earlier empirical studies which looked at the financial sector and institutions (e.g. Beck, et al., 2003; Djankov, McLiesh and Shleifer, 2007; Qian and Strahan, 2007; Aggarwal and Goodwell, 2010).

CHAPTER FIVE

HOUSE PRICES AND CURRENT ACCOUNT IMBALANCES: CREDIT CHANNEL AND INSTITUTIONS[99]

Abstract

This chapter examines the relationship of house price cycles and current account imbalances as well as the role of the credit channel and institutions in this relationship. Although most countries that have experienced house price boom in the same period have similar trends in interest rates, credit supply and current account imbalances, cross-country differences of house price volatility exist. The final effects of these developments also change from country to country significantly. Therefore, we argue that institutional features of an economy may contribute to this cross-sectional variation. We consider 14 European Union member countries and use a simultaneous equations model with three-stage least squares estimation. The findings show the existence of a strong and positive relationship between house price cycles and current account imbalances as well as of an impact on this relationship of the institutional characteristics through credit channel. In addition, the estimations results indicate the role of the institutions in the magnitude of this relationship. These results are robust to several different model specifications.

5.1. Introduction

With the latest wave of financial liberalisation started in the 1980s, many countries mitigated or removed the obstacles in capital movements and then, capital movements have gained further momentum due to advanced technology and the capital has become globalized. Thus, the international capital movements have reached one sixth of the world income of the same year.[100]As a result of the financial liberalisation, economies are increasingly integrated into international financial markets and the mutual dependency between economies has increased.

Financial liberalisation has presented some advantages for domestic markets, such as increasing foreign capital inflows, reducing the cost of capital, raising credit availability for borrowers, mitigating information asymmetry, decreasing adverse selection and moral hazard and creating more competitiveness environment in the domestic financial markets (Chin and Ito, 2006; Eichengreen, Gullapalli and Panizza, 2011; Broner and Ventura, 2016). However, in spite of these advantages, financial liberalisation has also raised some issues such as an unprecedented increase in current account imbalances starting with the 1990s. When the current account

[99] I would like to thank participants of the ERES, the AsRES and the EBES Annual Conferences in the 2018 for their comments.

[100]As of 2007, the international capital movements were 11.8 trillion dollars and the GDP (PPP) of the world was 65,4 trillion dollars (see IMF, 2008).

becomes unbalanced; in other words when there is a deficit or a surplus in the current balance, it is seen as an economic problem and it is called ‘current account imbalance’.

On the other hand, there has been a large increase in asset prices, especially house prices within the same time period: “…never before had real house prices raised so fast, for so long, and in so several countries at the same time” (Crowe, Dell’Ariccia and Igan, 2014). From 2000 to 2007, many economies experienced a house price boom, commonly defined as a period in which an asset’s price exceeds its fundamental value, i.e. overvaluation of their prices (Xiong, 2013; Zhu and Milcheva, 2016). In this period house prices rose 50% in real terms in the median advanced economy while they were up by almost 30% in the median developing country (Igan and Loungani, 2012).

Thus, the current account imbalances and house price boom-bust cycles have become the defining characteristics of the period before the recent global crisis (i.e. the 2007-2008 crisis). This situation has led many researchers to question whether there is a correlation between house prices and current account imbalances mainly within a specific country.

Most member countries of the European Union (EU) have experienced both house price boom and current account imbalances in the same period (Figure 5.1). A main reason was that monetary expansion and hence credit supply increased in the EU domestic markets due to an increase in the degree of financial liberalisation. Thus, interest rates declined and credit affordability of households increased. These developments in the mortgage credit markets reflected in housing markets as increase in house prices with an increase in housing demand as well. And, albeit similar in trends, but they show different features. For example, the volatility of prices changed from country to country in the EU, while the level of imbalances is significantly different country by country. Between 2000 and 2007, while Netherland’s and Sweden’s current account surplus to GDP went up from 1.8% and 4% in 2000 to 6% and 8.2% respectively in 2007, current account deficit to GDP ratio of Spain and Ireland reached -4.4% and 0.6% in 2000 to -9,6% and -6.5% respectively in 2007 (IMF, 2017). In the same period, real house prices went up 95% in Spain, 65.7% in Sweden and about 60% in Ireland (OECD, 2018). Additionally, their final effects on the economy have varied to a significant degree. Some of the countries having both house price boom and current account imbalances faced deep crisis (e.g. Spain), some did not (e.g. Sweden). In addition, although some of them experienced a crisis, they could mitigate its effects and recover in a shorter time than others (e.g. the UK).

In other words, although with financial liberalisation, developments in the economy show similar trends in many EU countries, these developments have had distinct characteristics as well as different outputs. The institutional features of the economy can contribute to this differentiation. Some institutional features relate to accessibility of credit information, enforcing contracts, protection of investors, regulation quality and government effectiveness etc. According to North (1990, 3), ’Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction.’ Regardless of which theoretical approach (e.g. conflict institutionalism, behavioural institutionalism, and structure-agency institutionalism)[101] is taken, institutions influence the economy and generate the differences among countries by affecting the distribution of resources and economic performance (North, 1994; Ball, Lizieri and MacGregor, 1998; Acemoğlu, Johnson and Robinson, 2005).

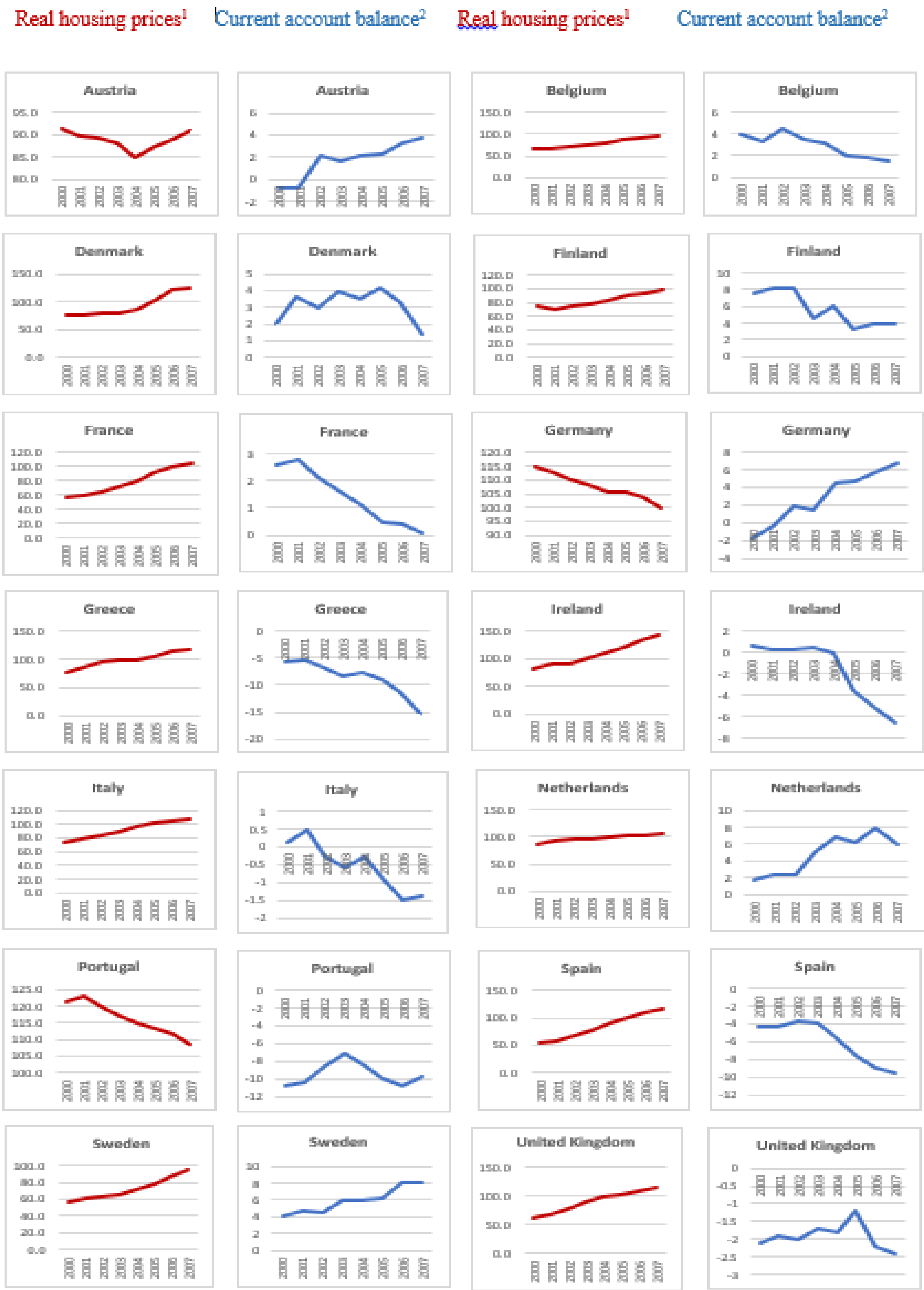
So far, a gap concerning the correlation between house price movements and current account imbalances exits in the literature. Very few studies examined the relationship between house prices and current account imbalances by following the financial liberalisation approach (e.g. only Favilukis et al., 2012). There is no study on the effect of institutional features on the relationship between house price cycles and current account imbalances among the studies focused on both dynamics.

Thus, two hypotheses are tested in this study. The first is that there is a relationship between house price cycles and current account imbalances largely via monetary expansion increased by financial liberalisation. The second is that the institutions play a role in the relationship between house price and current account dynamics by affecting to what extent monetary expansion will influence domestic credit markets and may have a potential to differ the relationship between house price cycles and current account imbalances. The research questions addressed are the following:

- Is there the relationship between house price movements and current account imbalances?
- Do the institutions play a role in this relationship?

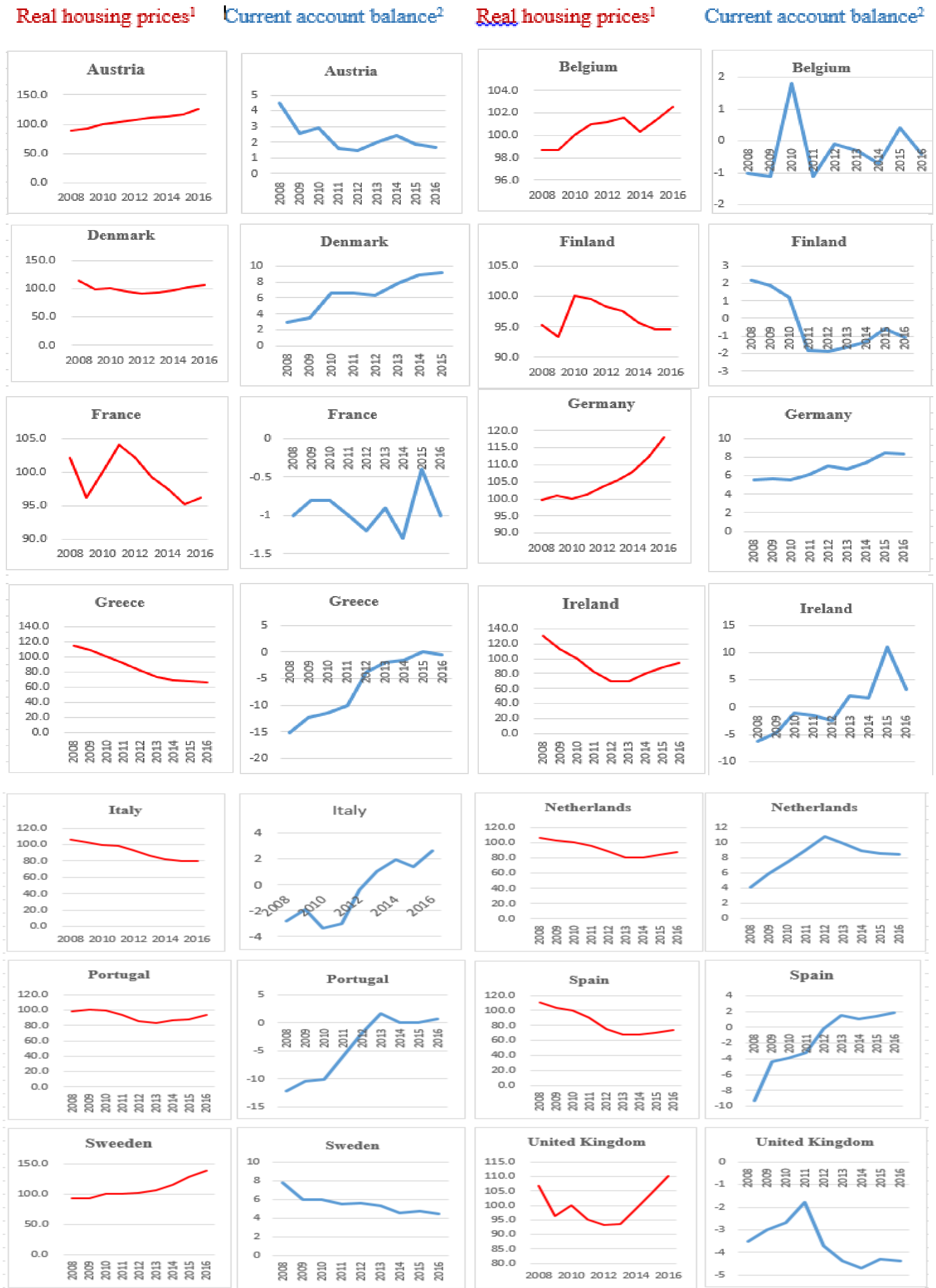
[101]For more information see. Chapter 2 (Literature review), sub-title is `Mortgage markets and institutions`.

Figure 5.1. Current Account Imbalances vs. House Price Cycles (2000-2007)



Source: IMF (2017) and OECD (2018).
(1)2010=100
(2) As a percentage of GDP

Figure 5.2. Current Account Imbalances vs. Housing Price Cycles (2008-2016)



Source: IMF (2017) and OECD (2018).
(1)2010=100
(2) As a percentage of GDP

To test these hypotheses, a simultaneous equation model and the three-stage least squares (3SLS) technique are employed. The estimation results confirm the validity of our hypotheses. They show that there is a strong and positive relationship between house prices and current account imbalances. In addition, the findings indicate that the institutional features cause the differentiation of the relationship between house prices and current account imbalances. The institutional features of mortgage markets as well as governance features in a country can influence the degree of monetary expansion and thus, the amount credit supply in domestic markets by affecting both accessibility of domestic institutions to the international markets and the amount of foreign capital coming into the country. Thus, in turn, it can affect the volatility of house prices.

The contribution of our study to the literature is to assess the role played by house price dynamics in current account imbalances through a financial liberalisation approach; to test this relationship by using the different model specifications as well as different technique. We also evaluate the effect of the institutional features on the relationship between house prices and current account dynamics and identify credit as the main channel through which house prices may affect current account imbalances.

The paper is structured as follows: section 5.2 introduces the literature review and section 5.3 presents the explanation of theoretical framework. Section 5.4 and 5.5 respectively cover methodology and data description. Section 5.6 discusses the main findings of the empirical analysis while section 5.7 draws the main conclusions.

5.2. Literature Review

The current literature explains the relationship between house prices and current account imbalances by using different theoretical approaches; savings glut, banking glut, demand shock and financial liberalisation.

The global savings glut hypothesis explains the reason behind house prices movements with increasing savings level in Asian countries and oil exporting countries. According to this approach, saving levels in developing and emerging countries increased in the aftermath of the 1997-1998 Asian financial crisis, and a rise in oil prices increased the revenue of oil exporting countries (e.g. Bernanke 2005; Aizenman and Jinjarak, 2009; Tillmann, 2013, Sa and Wieladek, 2015). As a result, the current accounts of these countries have been in surplus. However, since the financial markets of these countries were not deep enough, and the volume of their secure investment instruments was not big enough to supply for this demand, this ‘surplus’ was invested in developed economies (e.g. the US). The foreign capital coming into these countries brought down interest rates in domestic markets, which then led to more loans being made available. An increase in loan availability for housing increased the demand for housing. The result had been rapid house price movements (i.e. house price boom). This approach explains the reason behind the house price bust with increase in interest rates in domestic markets due to foreign capital leaving the country.

The global banking glut hypothesis is another theoretical approach that analyzes the relationship between house prices and current account imbalances and shows that foreign capital flows stemming from various sources affected the credit terms in the US (e.g. Shin, 2011, 2012; Punzi and Kakuo, 2015). During the period preceding the global financial crisis, foreign banks made serious investments in long-term US. assets, but many of these assets were bought by European banks instead of China or oil exporting countries.[102] Therefore, contrary to the argument posed by savings glut, a predominant inflow of funds by European banks provided grounds for a decline in interest rates and a relaxation of credit standards in the US financial markets. According to Shin (2011), who first claimed the ‘global banking glut’ approach (i.e. cross border lending), the great role played by European banks invalidates the global savings glut which falls short of explaining current account imbalances not only in the US, but also in other countries (e.g. Germany, Ireland and Spain).[103] His findings indicate that with the introduction of the bank capital requirements in Basel II Accord in the Eurozone and the use of a common currency (euro), cross- border transactions have grown in the number and the amount of loans lent by surplus countries’ to the banking sector of the deficit countries. A similar situation exists in the U.S. As a matter of fact, Bertaut et al. (2012)’s study also confirms the Banking Glut’s argument.[104]

On the other hand, Justiniano, Primiceri and Tambalotti (2014) and Punzi and Kauko (2015) have analyzed savings glut together with banking glut testing their impact on markets. Using

[102] The sum of U.S. assets held by foreigners was 7.8 trillion dollars in 2006 while it was as high as 9.8 trillion dollars in 2007. Of this number, European banks bought 3.2 trillion in 2006 and 4.2 trillion dollars in 2007 China on the other hand bought 699 billion dollars and 922 billion dollars worth assets respectively within the same time frame (see Bario and Disyatat, 2011).

[103] In 2000, while Ireland’s ratio of current deficit/GDP was -0, 4%, and that of Spain was -4%; by the end of 2007 the ratio for Ireland became -5, 3% and -10% for Spain. Within the same time frame the current account /GDP ratio in Germany was -1.7% and 6.9% respectively (see. EC, 2011a).

[104] The findings of Bertaut at al. (2012) show that European investors looking for a higher return bought personal assets rather than U.S. treasury securities and by way of reducing the yield of U.S. assets they affected the credit conditions.

different methods, they reached similar conclusions showing that the volatility of house prices can be explained with capital that flows in through banking rather than securities issuance. In addition, some studies show that a savings glut has not taken place before the global financial crisis (i.e. the 2007-2008 crisis) (e.g. Chin and Ito, 2007; Taylor, 2008; Jinjarak, and Sheffrin, 2011).

A third approach explains correlation between house prices movements and the dynamics of current account imbalances through domestic demand shocks (e.g. Gete, 2010; Laibson and Mollerstrom, 2010; Ferrero, 2015; Arestis and Gonzales-Martinez, 2016). A demand shock happens when the total demand in an economy increases (or decreases) suddenly and impacts on the economies total spending levels and the price of goods. As a result, an increase in total spending in domestic markets triggers an increase in the price of goods, especially non-tradable goods, such as housing. According to the demand shock approach, an increase in domestic demand causes an increase in house prices and capital inflows while a house price bust happens due to a decline in domestic demand. In other words, the main drivers behind the house price boom and the deterioration of the current account balance are domestic factors (credit and preference shocks), with monetary factors only playing a minor role.

A fourth approach argues the reason behind house price cycles is financial liberalisation and thus, explains the relationship between the two dynamics using financial liberalisation approach (e.g. Favilukis et al., 2013), which suggests that financial liberalisation provides an opportunity to reach funds in international markets made easily and in a less costly way. This reflects on domestic markets as an increase in monetary expansion and a decrease in interest rates. Thus, these developments cause home buyers to obtain less costly mortgage loans and more easily and then housing demand and the borrowing of mortgage loans increase. The result is an increase in house prices driven by a constrained housing supply that cannot concurrently meet. The findings of Favilukis et al. (2013) have indicated that financial liberalisation represents the key factor driving house price movements instead of foreign capital inflows.

A great number of studies conclude that an increase in house prices cause an increase in current account deficits. Also, it is observed that a large number of previous studies have used savings glut, banking glut and demand shock rather than financial liberalisation approach while explaining the relationship between these two dynamics. In fact, if the degree of financial openness of economies had not increased to that extent especially since the beginning of 1990s, and if capital had not globalized to such a level, neither savings glut nor banking glut nor demand shock could have happened to such an extent, and then these two imbalances might not have concurrently reached to such a high level in many countries. Thus, financial liberalisation is one of the main reasons for monetary expansion and then increasing relationship between house price and current account dynamics that simultaneously occurred and led to the significant problems in many economies in the world. Therefore, in this study, financial liberalisation approach is followed while investigating the relationship between house price and current account dynamics.

5.3. Theoretical Framework

In the 2000s, several countries simultaneously experienced the two types of economic problems–current account imbalances and house price boom-bust cycles on the other. Considering how strong an impact just one of these economic problems can have on a country's economy; the effect of having both events occurring at the same time could be devastating. Since there is a strong relationship between house prices and credit supply,[105] the credit channel may have played an important role in transferring the change in house prices to the macroeconomy, such as the external dimension of the economy (e.g. current account balance). We expect that the impacts of house price increases caused by increasing credit supply on current account balance will depend on the magnitude of house price increases and the strength of its effects in addition to other economic factors (e.g. economic vulnerability, institutional environment). In this section, first of all, the occurrence of current account imbalances in the economy is explained and then the effects of the price changes in housing markets on the current account balance are presented.

The 'current account balance' is important in being an indicator of a country's economic and financial credibility; its international solvency and the success of its government's economic policies as the sum of net exports of goods and services, the receipt or payment wages and interest earned on assets abroad (net primary income) and current payments for development aid and to international organizations (net secondary income) (IMF, 2008).When the current account becomes unbalanced; in other words when there is a deficit or a surplus in the current balance, it is called 'current account imbalance'. Current account deficit in an economy occurs when the total investment exceeds the total savings (I > S). This means that a country's economic activities are not financed by domestic savings. When this happens, the net financial assets decrease while net foreign capital inflows increase. Current account imbalances are a

[105] The findings of many studies show that there is a strong linkage of credit with house prices (e.g. Goodhart and Hoffmann, 2008; Anundsen and Jansen, 2013; Jorda, Schularick and Taylor, 2015).

cause for concern for policy makers for several reasons. Firstly, ‘imbalances’ reflect degradation in domestic markets (e.g. some economies may experience huge government deficit whereas others may witness an excessive private savings); secondly, some imbalances may be a reflection of some intentional distortions with a negative impact on trade partners (such as unfair trade practices or policies of foreign exchange); thirdly, economies with a high deficit and increased foreign liabilities may experience a sudden loss of trust and financial problems, leading to massive disruptions of the international monetary and financial systems (see IMF, 2014).

After 1980s economic systems started to shift towards a more deregulated system and current account imbalances manifest in many countries as ‘deficit’ rather than ‘surplus’. It is known that long-term current deficit and its financial management render an economy vulnerable to outside shocks and sometimes even leads to economic crisis. In the literature, it is generally accepted that a current account deficit become a threat when it exceeds 5% of the GDP (see Calvo and Rehinhart, 1999; IMF, 2000; Arrelona ve Mendoza, 2002). When there is a high and long-term deficit, its financing becomes increasingly difficult and its sustainability an impossible task. Countries in this situation usually experience what Calvo (1998) termed as ‘sudden stop’- a situation where a country’s access to international capital markets suddenly ends (i.e. the country can no longer reach external resources it needs and this situation usually ends in an economic crisis).

Recognition of the effects of current account imbalances on economies, particularly in countries with high current account deficits, have resulted in development of models which explain the role of balance payments in an economy. Most of them have been based on balance sheet analysis and targeted to understand how current account imbalances affect an economy as well as how other factors, such as microeconomic distortions cause crisis.[106]

Thus, the repercussions of external and domestic shocks can be analyzed through the models based on balance sheet models (general equilibrium models). While explaining the current imbalances here, among these models, Dornbusch Model which continues to dominate the

[106]After the European Exchange Rate Mechanism (ERM) crisis in the EU (1992) and Mexican crisis (994-1995), the models that recognized the role of current account imbalances (balance sheet mismatches), were developed. In these models, one of the fundamental weaknesses, which triggered crisis, could be an unsustainable current account deficit and they point out multiple equilibria in a economy (see Obstfeld and Rogoff, 1996; Cole and Kehoe, 1996). Then, the models based on balance sheet analysis explicitly have been developed after 1997-1998 Asian crisis. Moreover, they underline different factors, such as capital reversal, currency mismatches and microeconomic distortions etc. (see Dornbusch, Park and Claessens, 1980; IMF, 1999 and Rogoff, 2002).

policy field is used (Krugman and Obstfeld, 1994; Rogoff, 2002)**.** This Model is an extension of the Mundel-Fleming Model.[107] The basic features of Dornbusch Model showing the two-way relationship between production and the current account balance cover some assumptions such as the prices of currency are flexible; expectations for exchange rate change are rational (i.e. consistent); the prices of goods in the short run is sticky or slowly changing. Dornbusch (1980) argues that the volatility in the market is not only due to imperfect information or adjustment barriers and suggests that it is much more fundamental feature than that.

In Dornbusch model, when the monetary policy changes (e.g. in the case of an unanticipated constant increase in money supply in the domestic markets), prices will change with changing the amount of money. First, a new short run equilibrium will occur in the market and then financial markets will gradually reach to a new long run equilibrium. After this process, three markets (domestic money market, currency exchange market, and goods market) will come to a general equilibrium.

Figure 5.3 displays the Dornbusch Model with a two-way relationship between production and current account. The AE curve (*AE= Y- a (Y)*) shows the first relationship between total production (*Y*) and total expenditures (*A(Y)*), i.e. the net savings. Under the assumption of the total propensity to consumption being less than 1, the increase in income leads to higher net savings and the current account is defined as net savings. The XM curve, on the other hand, shows the current account, now defined as net exports. The XM curve represents the difference between imports and exports (*X-M*), i.e. the net exports. Imports are based on domestic demand while exports are based on foreign demand and both are dependent on the real foreign exchange rate. An increase in total income increases the total expenditures. Under a widely accepted assumption (Marshal-Lerner condition)[108] an appreciation in the real foreign exchange rate decreases imports and increases exports and hence impacts the current account balance. As a result, it causes a shift in the XM curve.

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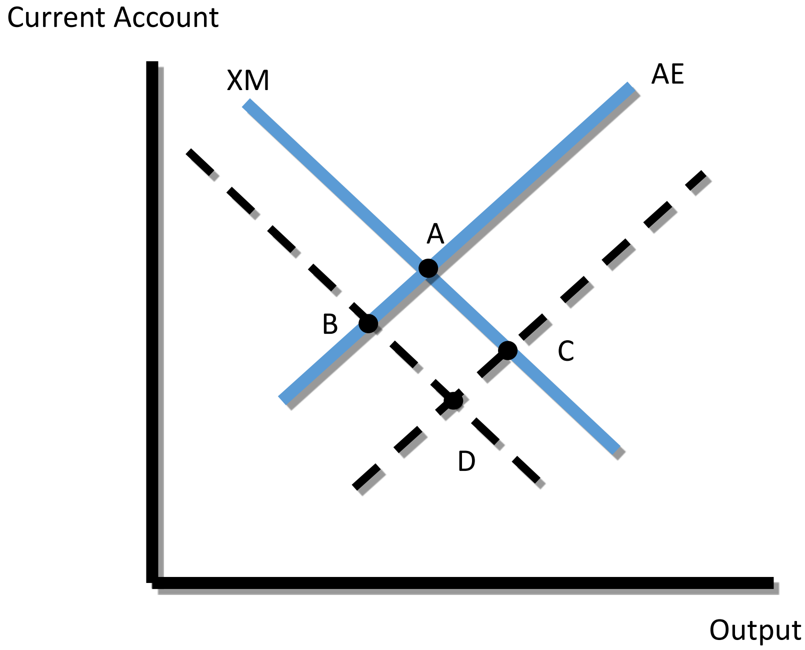
[107]The Mundell-Fleming Model defines the IS-LM general equilibrium model, which explains the general equilibrium in the economy under the assumption of closed economy, with the simultaneous equilibrium of the money and goods markets, and focuses on production and interest rates. The Mundell-Fleming Model describes the general equilibrium as a combination of both the goods and money markets and the external balance, and focuses on the production and interest rate as well as the fixed exchange rate (nominal exchange rate). Mundell –Fleming argued that in an open economy, it was impossible to maintain a fixed exchange rate, free capital movements and independent monetary policy (impossible trinity) all together.

[108]The Marshall-Lerner condition considers the impact of currency fluctuation on the balance of trade and refers to the condition that an exchange rate devaluation or depreciation will only cause a balance of the trade improvement if the absolute sum of the long-term export and import demand elasticities is greater than unit. If the domestic currency devalues, imports become more expensive and exports become cheaper due to the change in relative prices (see Krugman and Obstfeld, 1994).

Figure 5.3. Dornbusch Model



We can take point *A* to represent the state of equilibrium of an economy. If shock happens due to the external or internal reasons, it can change in this equilibrium point. A shock can occur for external reasons and the XM curve shifts. One reason could be a decrease in competitiveness that an increase in the price of exported goods would cause, e.g. due to an increase in the cost of labor. Thus, the XM curve would move down, and the equilibrium point would be *B*, with a drop in the foreign demand for domestic goods. A similar change would occur if there was excessive appreciation of the domestic currency.

Another shock is the increase in domestic demand in the economy, which would also change the equilibrium of the economy. A demand shock could originate domestically or externally. Thus, even though competitiveness of the economy may not change and hence the net export curve may not shift, the AE curve (savings curve) will shift downwards and equilibrium of the economy would be at point *C*.

External shocks can come from developments in international markets and cause monetary expansion in domestic markets, strengthening domestic demand even more via the credit channel. One of the reasons for this can be an increasing degree of financial openness, as in the pre-global financial crisis period. Financial liberalisation was initially discussed in 1970's. McKinnon (1973) and Shaw (1973) emphasized some of the detrimental effects of financial liberalisation (financial repression) and suggested some theoretical framework for policy makers. Liberalisation can be defined as the process of withdrawing the state from economic activities, not intervening in the markets, determining the prices of goods and services according to the supply and demand in the market and eliminating the barriers to international capital movements (see Fry, 1995; Obstfeld and Rogoff, 1996; Mishkin and Eakins, 2016). This theory suggests that financial liberalisation mitigates or removes government controls over financial markets and allows domestic financial markets to be more interconnected with international markets by increasing free movements of funds from countries with funds surplus to countries with insufficient funds and rising cross border activities of financial intermediaries. The effect of increasing financial liberalisation on domestic markets has been an increase in fund supply, an increase in efficient allocation of resources, a decline in interest rates, and an increase in credit demand as well as in the demand for goods. One of the consequences of these developments may be an increase in total consumption and total investment and a decrease in total savings in the economy. If the competitiveness of a country does not change (i.e. the net export curve remains as it is), the AE curve would shift and the equilibrium point in the economy would shift from *A* to *C* (see. Figure 5.3).

Moreover, financial liberalisation can enhance the shocks in the economy, such as the domestic shock via the real estate sector, especially housing sector which fulfils several functions as consumer and investment goods in the economy, has a privileged position in economy among other sectors.[109] Due to this, the large price cycles in this sector can create a significant effect on the macroeconomy via total consumption, savings and investment. In addition, large house price boom-bust cycles can come together with other economic issues (e.g. inflation, current account imbalances etc.). In this case, the clear consequence can be a deep crisis as is seen in the 2007-2008 financial crisis. Findings of previous studies showed that many countries were experiencing a house price boom before the latest global financial crisis (e.g. Agnello, and Schuknecht, 2011; Igan and Loungani 2012) and that the house price boom emerged almost simultaneously with both current account imbalances and credit boom in many countries in this

[109] The housing sector, is among the sectors that create a significant level of employment and added value. Furthermore, households' expenditures for the housing and other related with the housing are generally the highest share among their total expenditures and a big portion of an average household's wealth consists of housing investments (Meen, 2001; Nenji, Brooks and Ward, 2013).

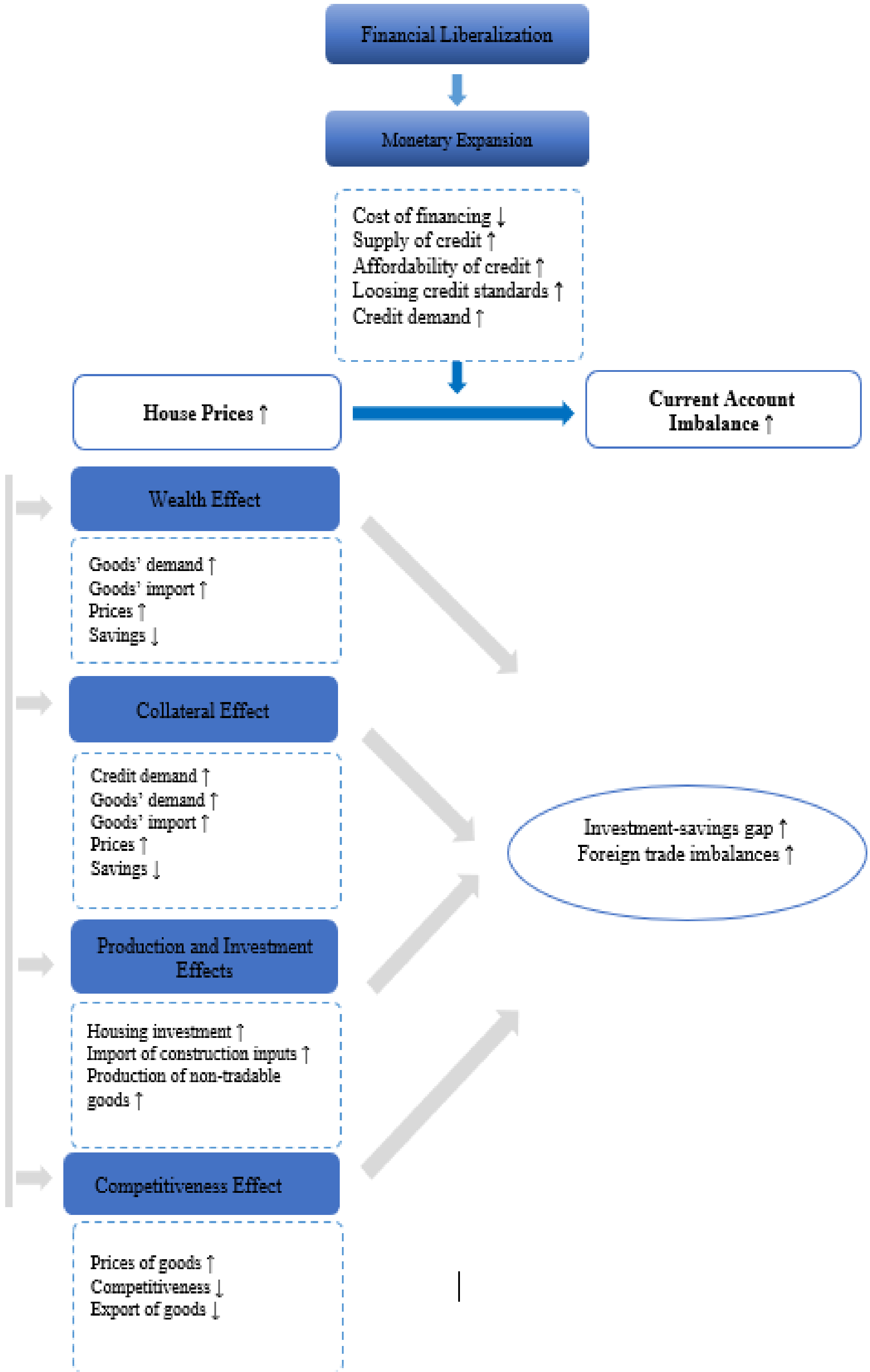
period (Reinhart and Rogoff, 2008; Mody, Sandri and Gürkaynak, 2012; Shambaugh, 2012, Aizenman and Jinjarak, 2014).

Consequently, the house price boom may cause the AE curve (savings curve) or the XM curve (net export curve) or both to shift downwards an in this case, the new equilibrium point would be at point *B* or *C* or *D* respectively. The new equilibrium point may be reached with high increase in current account deficits, depending on the strength of the effects caused by increasing house prices as well as other factors (e.g. the economic structure of the country, sensitivity to external developments) (see Figure 5.3).

Figure 5.4 provides a broad picture of the effects of increasing house prices on current account balances supported by increasing credit supply. With financial liberalization, monetary expansion and then credit supply have increased in domestic markets. In addition, especially since the 1990s, there has been an increase in credit payment alternatives and availability of new hybrid financial instruments as well as in the diversification of funding sources as discussed in the chapter three. These developments would cause a decline in interest rates, an increase in affordability of households, an increase in credit demand and an increase in house prices because of a mutual relationship between house prices and credit supply. According to the approach of financial accelerator mechanism, there is bidirectional relationship between credit and house prices (Bernanke and Gertler, 1995, Anundsen, and Jansen, 2013). This approach suggests that when monetary expansion occurs, it causes an increase in banks' credit supply by affecting the level of interest rates as well as that of the external finance premium (the credit channel of monetary policy transmission). The credit channel causes to change the size of lending in the economy by influencing both lending of overall depository institutions (e.g. banks) and the behaviour of households and firms, as well as the allocation of credit by using two mechanism: the bank lending channel and the balance sheet channel (i.e. the net worth channel). Both channels can play significant roles in housing markets by affecting the financial positions of both households and firms, which in turn affects investment and spending decisions. When credit supply increases, households prefer to buy durable goods (e.g. housing), while firms choose to invest or buy more inventory.[110] An increase in credit supply encourages

[110]In this study, firm behaviour will not be analysed in detail.

Figure 5.4. Relationship between House Prices and Current Account Imbalances



an increase in housing demand and hence inflates house prices because housing supply cannot meet this increase in housing demand concurrently. Increasing house prices also encourage firms to invest in housing and raises the value of collateral secured against credit. Thus, the borrowing capacity of both households and firms will rise.

Thus, these developments may affect current account balance in many ways: house price increases create a welfare and collateral effects which can transfer the change in house prices to current account balance by increasing in their expenditures and credit borrowing capacity of households. With increasing house prices, housing values increase, and this facilitates borrowing of households more due to the fact that the housing is considered to be an immovable good and has a secure collateral for lenders (Iacoviello, 2005; Muellbauer and Murphy, 2008). They will be able to increase their expenditures for consumer goods. An increase in consumption by encouraging households to bring forward domestically produced goods as well as imported goods. Previous studies confirm the effect of house prices on consumption (e.g. Miles, 1992; Campbella and Cocco, 2007; Glick and Lansing, 2010; Cho, 2011; Nenji, Brooks and Ward, 2013; Dong, Hui and ShengHua, 2017). For example, Nenji, Brooks and Ward (2013) demonstrate that a 10% increase in welfare stemming from the housing sector increases total consumption by 1.1%. On the other hand, increasing demand for consumer goods, in turn, pave the way for decreasing savings and broadening the saving-investment gap and then current account deficits. As a result, rising house prices would cause homeowners to feel safer, to save less, borrow more and spend more.

Furthermore, another way of transferring the change in house prices to the current account is housing investment. This can be in two ways. First, if the increase in housing construction costs is lower than the house price increases, constructing new housing is more profitable for home builders and they invest on housing more. Second, the collateral effect of housing can pave the way for new business investments because this effect of housing is not only created by the households but also by the home builders. The collateral value of the housing including the land gives home builders the opportunity to enhance their credit borrowing capacity and to finance their other investments. In fact, Bernanke and Gertler (1995) shows that firms` net assets used as collateral are important to increase their credit borrowing capacity. Increasing both housing and other business investments may also lead to an increase in the import of construction inputs. Additionally, the increased profitability of housing investments can also create a production-shifting effect and encourage to produce non-tradable goods (e.g. housing) by making them attractive to tradable goods producers (production effect) (Malliarapulos and Anastasatos, 2011)

On the other hand, since with increasing demand of consumer goods, their prices may go up, this may negatively influence an inflation and then, the competitiveness of the country in international markets (competitiveness effect) (Malliarapulos and Anastasatos, 2011; Wyplosz, 2012). The result is a drop in exportation of such a country. If increasing prices simultaneously come with foreign exchange appreciation, this negative effect also may be stronger (Wyplosz, 2012; Soukiazis, Artunes and Kostakis, 2018). Consequently, a large increase in house price may cause to shift the equilibrium point in the economy and the new equilibrium point may be reached with high increase in current account deficits.

In summary, permanent monetary expansion in domestic markets can cause credit channel to strengthen the wealth and collateral effects of housing as well as its other effects (e.g. investment and production effects). Thus, with support of credit channel, developments in housing sector can create a strong shock on total consumption and investment and hence on total production and inflation in the economy. The consequences of all the effects stemming from a house price increases are an increase in the investment-savings gap and in foreign trade deficits, and hence, a deterioration in current account balances (i.e. an increase in current account imbalances). However, these effects on the current account balance will depend on the strength of the effects caused by changes in house prices as well as in monetary expansion .

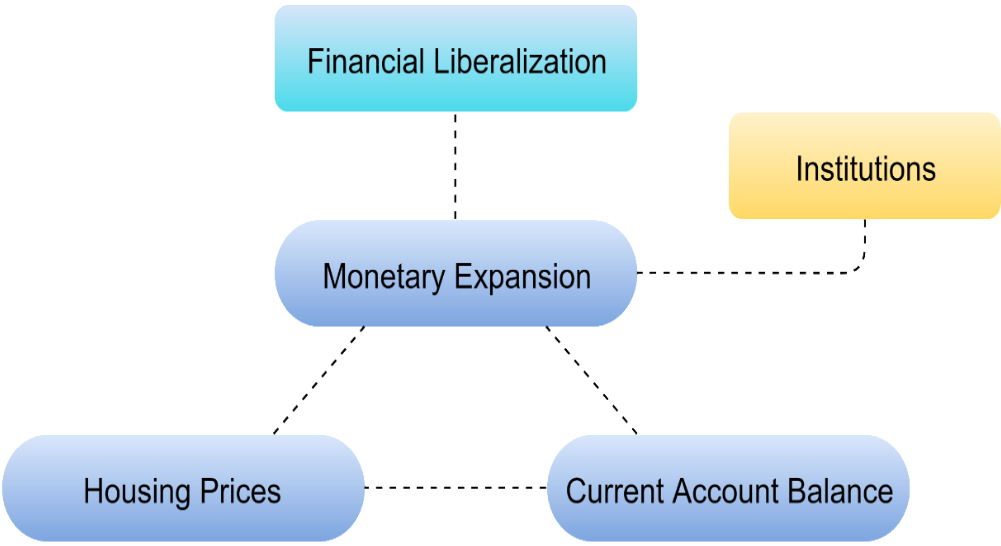
5.4. Methodology

The aim of this study is to examine whether there is a relationship between house prices andcurrent account imbalances and whether institutions play a role in this relationship. According to the theory, it is excepted that with financial liberalisation, while credit supply increases in domestic credit markets interest rates and profit margin of financial intermediaries decrease and then credit affordability increases.

While testing the relationship between house price and current account dynamics, it is assummed that a relationship between house prices and current account imbalances is created largely via monetary expansion in the mortgage credit markets, which is itself created by financial liberalisation. Secondly, it is believed that there is the role of the institutional characteristics in this relationship. Figure 5.5 exhibits these testable arguments.

The analysis covers 14 EU countries[111] and the period between 1990 and 2016. To test the long term relationship between house prices and current account imbalances, a simultaneous equations model with panel data is used given the potentially endogenous nature of house prices and current account imbalances. While examining the relationship mentioned, credit channel is added to the model because this channel has played an important role for transmitting the developments in housing markets in the macroeconomy (see Bernanke and Gertler, 1995; Muellbauer and Murphy, 2007; Iacoviello and Minnetti, 2008; Taltavull de La Paz and White, 2012). It can change the size of lending in the economy by influencing overall credit supply as well as the allocation of credits.

Figure 5.5. House Prices and Current Account Balance: Institutions



Thus, our model consists of three equations: house price, credit and current account balance equations. In simultaneous equations model, every equation must be suitable a ceteris paribus, for causal interpretation in the system of equations to be considered. That is, each equation in the system is interpreted supposing that other conditions are constant. The most important point with regard to the use of simultaneous equations model is that, as only the outcomes in equilibrium are observed (Wooldridge, 2016).

According to this model's assumptions, some exogenous variables are also added to the system to guarantee identification. If there are some exogenous variables that exist in the first equation, some of them do not exist in the second (or third) equations. According to the other assumption

[111] Austria, Belgium, Denmark, Germany, Greece, Finland, France, Ireland, Italy, Netherland, Portugal, Spain, Sweden and the United Kingdom. Data availability has limited the number of the EU countries considered.

of the model, exogenous variables are not correlated with error terms. In addition, if endogenous variables included in our model as exogenous variable are considered, they must be presented their lagged values or first difference (Kennedy, 2008; Wooldridge, 2016). These enable us to differentiate between three structural equations.

We employ the three-stage least squares (3SLS) technique in the model. The 3SLS is a logical extension of 2SLS, but it is a more developed version of the 2SLS and it is accepted that it yields a better estimation (Kennedy, 2008; Brooks, 2008). Analyzing the link between the sales of a large firm and advertising budget and the cash amount, Heck (1977) showed that 3SLS estimators are more efficient than 2SLS estimators. Moreover, the selection of this technique is supported by Belsley (1988) and Faggian and McCann (2009) who concluded that 3SLS techniques produce a more consistent and efficient estimation and then it is better for statistical inference than 2SLS procedures.

The empirical analysis comprises two stages: The first stage is to examine the relationship between house prices and current account imbalances.The second stage is to investigate the role of the institutions in this relationship. [112]

In the first stage, the first step is the estimation of the model according to the different periods. For this, three sample periods are used: whole period (1995-2016), pre-crisis period (2000-2007) and post-crisis period (2008-2016). Thus, it is possible to compare the results before and after the recent global financial crisis. The second step is the estimation of the model by grouping the sample countries according to their current account balance/GDP ratio. In grouping, we set the value regarded as the threat threshold for economic stability accepted by the European Commission (EC) (see EC, 2012).[113] This is -4%.[114] That is, if current account deficit/GDP ratio of a country exceeds -4%, the EC considers to be a threat to the economy. It is counted based on three-year backward moving average of the current account balance in

[112] In this study, the house price effects on current account balance is focused , examining the relationship between house prices and current account balance, and the examination of the effect of monetary movements (e.g. foreign capital inflows or credit supply) on current account imbalances was excluded.

[113] In fact, in the literature, it is generally accepted that current account deficit becomes a threat when it exceeds 5% of the GDP (e.g. Calvo, 1998, Calvo ve Rehinhart, 1999; IMF, 2000; Arrelona ve Mendoza, 2002). Yet, since in this study, all the countries that are considered are the member countries of the EU, the threat threshold accepted by the EC is taken into account (i.e. -4%).

[114] After sovereign debt crisis in Eurozone, European Commission (EC) has introduced "Macroeconomic Imbalances Procedure Scoreboard" and determined the two thresholds for current account imbalances since 2011 When current account deficit/GDP ratio exceeds -4% as well as +6%, EC has considered to be a threat to the economy. European Commission has considered to be a threat to the economy. The aim of the scoreboard is to filter countries that warrant in-depth studies in order to determine whether the potential imbalances identified in the early-warning system are benign or problematic (see EC, 2012).

percent of GDP.[115] According to this threshold, countries are divided into two groups as those with a proportion equal to the threshold and sub-threshold value and those with a proportion higher than the threshold value (see Appendix 5.1). The first group consists of 10 countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Sweden and United Kingdom and the second group covers four countries: Greece, Ireland, Portugal and Spain.

In this stage of the analysis, it is expected that there is a negative relationship between current account balance and both house prices and credit size in our simultaneous equations model while credit size should show a positive relation with financial liberalisation as well as house prices.

In the last stage of the analysis, the role of institutions in the relationship between house prices and current account imbalances is tested because institutions can effect the extent to which foreign capital will enter domestic markets after financial liberalisation as well as which way it will be used after entering**.** It is assumed that with financial liberalisation, if a country has more stable and market-friendly institutions, it can attract more foreign capital in the domestic markets, and increase the accessibility of funds with lower cost into the international markets and hence, increase monetary expansion in domestic markets and credit supply. Thus, since the effect of institutions on the relationship between house prices and current account imbalances transmits to this relationship via the credit channel, the institutional variables are included in credit equation of our benchmark model covering the period between 1990 and 2016.

In addition, these capital inflows can be used more efficiently due to the higher quality of the institutional environment. To this end, the institutional characteristics of both credit markets and governance are considered. Firstly, our simultaneous equations model is again estimated through the classification of countries according to institutional quality of their credit markets. Secondly, the features of governance assumed to affect the extent to which foreign capital are attracted after financial liberalisation are incorporated into the analysis. For this aim, the institutional features related to the governance of a country are given due consideration by following previous studies on financial liberalisation as well as capital account openness (e.g.

[115] Here, it is considered one criterion (i.e. the deficit threshold) because high current account deficit increases the crisis risk in the economy. While grouping the countries according to the deficit criterion, the arithmetic mean of the countries' current account balance /GDP ratio for the period 2005-2007 is taken into account in the calculation of the deficit threshold value.

Bekaert, Harvey and Lundblad, 2005; Klein and Olivei, 2008; Okada, 2013; Reinhardt, Ricci and Tressel, 2013). We add governance variables to the model separately and with averages.

To classify the countries according to the institutional quality of their credit markets, we use the Institutional Index[116] which shows institutional quality of credit markets of EU member countries. In the Institutional Index, a higher score points out that these countries have a more advanced institutional environment (i.e. high institutional quality) and more efficiently run credit markets. The other institutional variables indicate a country's governance's quality. They consist of six indices: regulation quality, the rule of law, government effectiveness, control of corruption, voice and accountability and their average. These governance indices are developed by Kaufmann, Kraay and Masttruzzi (2010).

In this stage, firstly, countries are grouped in relation to the quality of their institutional environment and our simultaneous equations model is re-estimated. For this aim, sample countries are divided into two groups according to their position in the Institutional index: the countries with a high institutional quality (i.e. the EU average or above) and countries with a weak institutional quality (i.e. below the EU average). In the sample, 10 countries have a high institutional quality: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Netherlands, Sweden and the UK. Four countries of the sample have a weak institutional quality: Greece, Italy, Portugal and Spain (see Appendix 5.2). Secondly, six governance variables are included in the benchmark model and the estimation of the model is repeated.

The governance indicators can affect the amount of foreign capital inflows in domestic markets as a result of financial liberalisation. Previous studies show that even if the liberalisation level of an economy is high enough, the country may not be attractive for foreign capital if, for example, the regulation quality is weak. A weak governance structure also can negatively affect

[116] This index was developed as a composite index in the fourth chapter of the thesis by using factor analysis. The Institutional Index, which is numbered from 1 to 6, defines the multidimensional phenomenon and covers 31 institutional features categorising within five sub-groups: financial drivers, legal drivers, openness drivers, transparency drivers and cultural drivers. Financial drivers cover the variables relating to the institutional features of the development of the financial sector, such as access to financial services, soundness of the banks, availability of financial services and credit information. The specific features of the mortgage markets (e.g. mortgage equity withdrawal, availability of mortgage products and loan to value ratio) are also included in this category. Legal drivers consist of formal institutions and their enforcement in the markets (e.g. property rights, protection of investors and efficiency of legal framework). Openness includes the variables that relate to the opening-up of the markets to abroad (e.g. investment freedom, presence of trade barriers, burden of customs procedures). Cultural drivers refer to customs and habits, and transparency driver includes the level of corruption in the country. While selecting the institutional variables, the following factors need to be taken into account: (i) the variables are within the field of public authority; (ii) they are influenced by the market process; (iii) they are calculated using a similar method; (iv) they are available in all the EU countries.

the cost of obtaining funds from international markets by domestic financial institutions (e.g. Bekaert, Harvey and Lundblad, 2005; Baltagi, Demetriades and Law, 2009; Klein and Olivei 2008; Reinhardth, Ricci and Tressel, 2013). Therefore, as the monetary expansion which is expected to increase in domestic markets with liberalisation has not reached the required level, these effects can be observed on the size of credit lending and the cost of financing. To examine their roles, the benchmark model is re-estimated by adding the governance variables that are separately handled as exogenous variables in the credit equation of the model as well as their average. Thus, it becomes possible to infer as to whether different institutional features may differentiate the relationship between house prices and current account imbalances.

To our best knowledge, this is the first study that investigates the role of the institutions in the relationship between the house prices and current account imbalances. In addition, it is the second study that explains this relationship through a financial liberalisation approach (after Favilukis et al., (2012). Nonetheless, it is different from their study in some respects although the study is built on the same theoretical framework because the credit channel is included a different financial liberalisation indicator -Chin and Ito's (2006) financial openness index- is employed and institutional variables are also added for both the credit markets and governance indicators. Finally, we also improve the estimation procedure using a simultaneous equation model and 3SLS technique.

5.5. Model Specification

As aforementioned, we reveal our proposition by examining a model with three equations. They are house price, credit and current account balance equations. While investigating the relationship between house prices and current account imbalances, it is assumed that other variables remain constant under the assumptions of the simultaneous equations model. The equations of our model which aim to estimate the long-term relations are given below.

House price equation

In the house price equation, our cross-country approach is based on the housing demand-supply theory. The neo-classical framework suggests that house prices are determined by the interaction of supply and demand for housing. House prices can be counted from the reduced form equilibrium function derived from demand and supply functions. The advantage of this approach is that it enables us to predict fundamental values in the market directly and to compare them with the values observed in the market (Clark and Coggin, 2011). The literature review shows that there is a consensus on the variables affecting house prices. There are price determinants on the demand side of housing, such as household income, credit availability, interest rates and demographic factors while land costs, construction costs, existing house stocks, residential construction, housing depreciation, transaction costs, credit availability and financing cost exist on the supply side (see Meen, 2001; Wolswijk, 2006; Ball, Meen and Nygaard, 2010; Agnello and Schuknecht, 2011; Caldera and Johansson, 2013; Bahmani-Oskooee and Ghodsi, 2018). In the existing literature, income, interest rates, credit supply and housing supply are the most explaining house prices (see Meen, 2001; Iacoviello and Minetti, 2003; Himmelberg, Mayer and Sinai,2005; Bahmani-Oskooee and Ghodsi, 2018).

Thus, the house price equation of our model is established through the supply-demand approach and it covers macro-economic variables in the existing literature that are the most explaining house prices, such as income, interest rates, housing supply and credit size in the economy. Due to avoiding multicollinearity problem, we put the term spread instead of the long-term interest rates. Here, house price index for house prices, private credit to GDP ratio for the size of credit lent by banks and other financial institutions, the change in total output size for the measurement of income variable (i.e. economic growth rate), term spread for interest rate variable and residential construction to GDP for housing supply are considered. Equation (1) shows the long-run linkage between house prices, economic growth rate, term spread, outstanding private credit to GDP and residential construction to GDP.[117]

$$hprice_t = \alpha_1 gdpgrowth_{t-1} + \alpha_2 credit_{t-1} + \alpha_3 dfint_{t-1} + \alpha_4 resconstgdp_{t-1} + U_1 \quad (1)$$

Where real house prices (*hprice*) are positively related to the economic growth (*gdpgrowt*h), the volume of credit (*credit*) and residential construction (*resconstgdp*) while house prices have a negative relationship with term spread (*dfint*).

It is expected that increasing term spread, that is an indicator for increasing the cost of credit, will affect the affordability of house buyers negatively, as well as both housing demand and house prices. In contrast, an increase in household income can cause an increase in housing demand and then house prices. Increasing house prices can trigger the borrowing of more housing credit by households while encouraging housing construction.

Credit Equation

[117]Data availibility as long time series have affected the selection of supply indicator.

The credit equation showing the determinants of the credit size in domestic markets is the second equation in our simultaneous equations model.

In the empirical literature, the standard credit model is widely used to investigate credit size as well as financial development in the financial markets. Standard specification of the model explains the long-term movements of credit and encompasses the extent of economic activity and financing cost. Our credit model is built upon the standard model by following the work of Bernanke and Gertler (1995) and Calza, Gartner and Sousa (2003). In addition, house price variable is included in the credit equation as Hofmann (2004). In the standard credit model, it is assumed that credit supply is mostly determined by demand. Thus, credit supply depends on financing cost of lenders and economic activity.

However, our model differs from previous studies because two more variables are added to the standard model. To test our hypothesis the degree of an economy’s financial liberalization (or the degree of financial openness) and current account variables are also included. The degree of financial openness, an indicator of the extent to which capital controls in an economy are reduced or removed, is important for both foreign capital inflows and the accessibility of domestic institutions to international financial markets. It is expected that the increasing openness that paves the way for an increase in funds in international markets will be able to increase the accessibility of domestic financial institutions to these markets with lower cost and more easily and thus, their dependence on domestic sources will decrease. Therefore, the effects of financial liberalisation on domestic credit markets decrease interest rates, loosen credit standards, and increase the credit supply.

Finally, a current account balance variable is also added to the credit equation because the credit size can be affected by current account imbalances and openness of financial accounts serves as a buffer stock to stabilise the current account balance in the economy (Chinn and Prasad, 2003). Thus, our credit equation shows the long-term relationship of the credit size with the economic growth rate, financing cost, house prices, the financial liberalisation degree and current account balance. Here, private credit to GDP ratio for the credit size (*credit*), the change in total output size for the measurement of economic growth rate (i.e. economic activity), short-term interest rates for the cost of financing for lenders, the financial liberalisation index for financial openness degree and current account balance to GDP ratio for current account imbalances are considered. The financial liberalisation index is developed by Chin-Ito (2006). The credit equation of the simultaneous equations model is:

$$credit_t = \alpha_1 gdpgrowth_{t-1} + \alpha_2 hprice_{t-1} + \alpha_3 sint_{t-1} + \alpha_3 kaopen_{t-1} + \alpha_4 curacc_{t-1} + U_2 \tag{2}$$

Where the size of credit lending in the economy proxied by private credit to GDP ratio (*credit*) is positively related to the economic growth (*gdpgrowth*), house prices (*hprice*) and financial openness (*kapoen*) while it is negatively related to short term interest rates (*sint*) and current account imbalances (*curacc*).

Current account balance equation

The third equation of the model is a current account balance equation which includes the determinants of the current account variation in the economy. The literature review points out that there is no single theoretical model to explain the determinants of the current account balance. By following previous studies, the estimation strategy of the determinants of current account balance is built upon an intertemporal current account model[118] that shows its determinants in the long term as well as medium term (e.g. Chinn and Prasad, 2003; Gruber and Kamin, 2007, 2009; Ca' Zorzi, Chudik and Dieppe, 2012; Gossé and Serranito, 2014). According to this intertemporal approach, international funds are under free capital mobility and, directed to locations where higher returns are offered. Free capital mobility serves to maximize the resource utilization, which is based on the optimization of individual consumption and investment. Thus, the financial account serves as a buffer stock. We follow the intertemporal approach because our sample covers developed countries[119] and adapt the specification proposed by Chinn and Prasad (2003), following previous studies (e.g. Chin and Ito, 2008; Gruber and Kamin, 2007, 2009; Ca' Zorzi, Chudik and Dieppe, 2012; Cheung, Furceri and Rusticelli, 2013; Dbyka, 2017).

A difference with Chinn and Prasad (2003) is the inclusion of private credit to GDP ratio instead of money supply (M2) to GDP ratio as an indicator of financial development as well as

[118] Other models are commonly based on the 'portfolio approach' and 'development approach'. According to the portfolio approach, the growth of foreign assets held by a country and the scope of this portfolio will have an impact on current account balance by creating two effects on it (i.e. portfolio growth effect and portfolio rebalancing effect) (see Ventura, 2001; Kraay and Ventura, 2000) The stages of development approach less developed countries generally need more external source on the way to shifting to a more developed category and, therefore, import more foreign capital, causing such countries to have a larger current deficit. On the other hand, when they reach a more developed stage, they start to have a current surplus and close their deficits (see Chinn and Prasad, 2003; Ca' Zorzi, Chudik and Dieppe, 2012).

[119] Empirical studies confirm the intertemporal approach for developed countries and show that financial account serves to finance current account (see Fry, 1995; Wong and Caranza, 1999; Sarisoy-Guerin, 2003; Yan and Yang, 2012).

the size of credit supply in the economy, following previous studies, such as Chinn and Ito (2008), Yan and Yang (2012), Cheung, Furceri and Rusticelli (2013) and Dbyka (2017). Another difference is that house prices are added to the current account balance model like Ban (2018) in order to test our hypotheses. In contrast to all previous studies with regard to current account balance model specification, our model includes only the strongest explanatory variables of current account balance.[120] They are economic growth, population growth, government fiscal balance and the financial development. The current account equation is:

$$curacc_t = \alpha_1 gdpgrowth_{t-1} + \alpha_2 fiscalbalance_{t-1} + \alpha_3 propgrowth_{t-1} + \alpha_4\, credit_{t-1} + \alpha_5 hprice_{t-1} + U_3 \qquad (3)$$

Where the long-term relationship linking current account (*curacc*) is positively related to economic growth (*gdpgrowth*) and government fiscal balance (*fiscalbalance*) while negatively related to population growth rate (*popgrowth*), financial development (*credit*) and house prices (*hprice*).

While examining the relationship between house prices and current account imbalances (i.e. the first stage of the analysis), our simultaneous equations model consists of three endogenous and 12 exogenous variables. In the second stage of the empirical analysis, more institutional indicators are incorporated as exogenous variables.[121] Endogenous variables are house prices, credit size and current account balance and others are treated as exogenous. All variables included in the model are in real terms deflated by the consumer price index (2010=100) and all exogenous variables are lagged by one year. In addition, the level variables (i.e. house prices) are considered with their logarithmic form.

As aforementioned, our first testable hypothesis is that there is a relationship between house prices and current account imbalances, and this is largely due to the monetary expansion that the financial openness increases. If this hypothesis is correct, one of our expectations is that there is a positive relationship between credit size and both house prices and financial openness.

[120] In fact, we also applied panel regression method by considering all determinants of current account balance in the literature. They are relative income, relative income squared, economic growth, population growth rate, government fiscal balance, net foreign assets, financial development, oil balance and foreign exchange rate. The estimation results are consistent with those of previous studies in related to the signs of the estimated coefficients and their significance statistically (see Appendix 5.14). Then, a few were chosen as the determinants of current account balance: the growth rate, government fiscal balance, population growth and financial development. They are the strongest explanatory variables of current account balance.

[121]The institutional variables cover seven variables: Instıtutional Index, regulation quality, the rule of law, government effectiveness, control of corruption, voice and accountability and the average of the governance variables.

An increasing degree of financial openness will make it easier for domestic institutions to access financial markets and facilitate foreign capital inflows. As a result, monetary expansion can increase in domestic markets and then, financing cost decreases. With low interest rates the affordability of borrowers can increase. Such a situation can trigger demand for housing and therefore, push house prices upwards while increasing house prices lead to more borrowing by home buyers.

Another expectation is a positive relationship between current account imbalances and house prices. In other words, it is expected that there is a negative relationship between house prices and current account balance. Increasing house prices may lead to current imbalances in five channels: the welfare channel, collateral channel, the production channel, the competitiveness channel and the investment channel as explained earlier (see Figure 5.4).

5.6. Data Description

In the empirical analysis for the period between 1990 and 2016 (yearly), the main data resources are: the World Bank, the International Monetary Fund (IMF), the European Central Bank (ECB), the Statistical Office of the European Union (Eurostat) and the Organization for Economic Co-operation and Development (OECD), Chin and Ito (2006) and Kaufmann, Kraay and Masttruzzi (2010). Both the list of yearly panel dataset with their notation and their sources are included in Appendix 5.3. All variables are included in the model as endogenous variable or exogenous variable during the estimation of the model except for consumer price index. Consumer price index (2010=100) is used for converting the variables at nominal values to real values. The descriptions of the variables in the model are reported below.

House prices: House price is one of three endogenous variables in the model. House price index (2010=100) is used to represent house prices. This index is produced by the OECD and shows the change in annual house prices. Increasing house prices are expected to cause house buyers to borrow more loan and to deteriorate the current account balance. Therefore, house prices will have positive relationship with credit size and negative relationship with the current account balance is expected. The sign of coefficient of house price variable is expected to be positive in the credit equation and negative in the current account balance equation.

Current account balance: The second endogenous variable is current account balance in the model. The ratio of current account balance to GDP is taken as an indicator of this variable. It is the measurement for the balance of trade, net primary income and srcondary income. While current surplus shows that net assets of a country are more than its liabilities, current deficit points out that net liabilities are more than its net assets. If the testable hypothesis is correct, it is expected that current account balance has negative relationship with both house prices and credit size (i.e. financial development).

Credit size: The model`s third endogenous variable is the size of credit lent to the private sector (i.e. households and companies). This indicator is also widely accepted in the relevant literature as the measure of the financial development of an economy. (King and Levine, 1993b; Beck, 2007; Yao, 2011). Financial development is one of the determinants of the current account balance because it has a potential effect on determining saving-investment balance apart from conventional macroeconomic ones. Thus, the share in GDP of the credit to the private sector by deposit money banks and other financial institutions is taken into account as indicator of both credit size and the financial development variables. The expected the sign of this variable are positive and negative in the house price and current account equations respectively.

Financial liberalisation (financial openness): Financial liberalisation is one of the factors with a potential effect on the determination of investment-saving balance in an economy because it affects the supply of funds in domestic financial markets. It indicates the extent to which a country is open to financial cross-border transactions (e.g. foreign capital inflows and outflows). Since the increasing degree of financial openness can facilitate the accessibility of domestic financial institutions to international markets and increasing foreign capital inflows, it is expected to pave the way for an increase in fund supply and hence, credit supply in domestic markets.

The measurement of financial openness considered is the financial liberalisation index produced by Chinn-Ito (2006), which ranges from 1 to 0. The higher the value shows the higher financial openness of a country. It is based on codifying according to restrictions on cross-border financial transactions reported by the IMF in its Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). It is expected that the coefficient of this variable will be positive in the credit equation.

Interest rates: Our simultaneous equations model covers both short term interest rates and term spread. The term spread in the house price equation is the indicator of borrowing cost for individuals, who want to buy own housing by taking out a loan from financial intermediaries while short-term interest rate in the credit equation indicates cost of obtaining funds for financial intermediaries. Short-term interest rate in the credit equation is the indicator of the cost of financing of the lenders (e.g. banks) and covers the interest rates through which short-term borrowings (overnight, 1–12 months) between financial institutions are realized in the markets or the rates through which short-term government securities are issued or traded in the financial markets. The term spread is the difference between long- and short-term interest rates. Long term interest rates show 10-year government bond interest rates.

It is expected that when the cost of obtaining funds for financial intermediaries decreases (increases), short and long term interest rates will decrease (increase) and then, affordability of credit as well as credit demand will increase (decrease). Therefore, there is an inverse relationship between interest rates and both house prices and credit supply. The signs of coefficients of both term spread and short-term interest rate variables are excepted to be negative in the house price and credit equations.

Housing supply: In the model, the share of actual housing construction in GDP is taken as the indicator of housing supply. Actual housing construction (not sales) is part of gross fixed capital formation. As increasing house prices can encourage housing investment, there is a positive relationship between house prices and housing construction. Thus, the expected sign is positive.

Economic growth: One of the determinants of three endogenous variables of the model (i.e. house price, current account and credit) is economic growth. It shows the change in the amount of goods and services produced at a given time in the economy. It is also an indicator for the change in total income as well as in economic activity in a country. More production may increase the volume of export and improve current account balance. It also creates an increase in the income in the future and paves the way for increased consumption on the part of households. Thus, economic growth is included in three equations of the model. The expected signs of the coefficient of economic growth variable is positive in both house price and credit equations, but in the current account balance equation, its sign can change in related with the sources of economic growth. If with the economic growth, an increase in export of goods is larger than an increase in import, we expect it improves trade balance and positively affects current account balance in the future. In this case, the expected sign of the coefficient of this variable is positive in the current account equation, otherwise negative.

Fiscal balance: Gross government budget balance to GDP ratio is taken as the measurement of financial balance. Decreasing budget deficit of public sector and hence, improving financial balance affect current account balance positively. Otherwise, it will be opposite. The expected sign of the variable is positive.

Demographic factor: Another factor determining current account balance is the demographic change in a country. Demographic factor, i.e. population, affects the difference between investment and savings in the economy. It is expected that an increase in population rises consumption and decreases savings. Then, population has a negative relationship with current account balance. The expected sign is negative.

Institutional Index: It shows the institutional features of the credit markets**.** This index was constructed in chapter four. The expected sign is positive.

Regulation quality: It reflects a government's ability to establish strong policies and to make regulations encouraging private sectors, and to put them into force. The expected sign is positive.

Rule of law: It shows the trust in the quality of legal arrangements and the society's perception of them with regard to their obedience. The expected sign is positive.

Control of corruption: It expresses social perceptions of how the public power acts in the case of profits gained in different forms of corruption. The expected sign is positive.

Government effectiveness: It measures the society's perceptions of the quality of public and civil services and of the government's reputation for framing and implementing policies. The expected sign is positive.

Voice and accountability: It reveals the society's perceptions of such issues as the freedom of individuals' representatives to participate in elections, freedom of speech and the existence of free media. The expected sign is positive.

Institutional average: It shows an arithmetic average of the five governance indicators (i.e. regulation quality, rule of law, control of corruption, government effectiveness and voice and accountability). The expected sign is positive.

5.7. Initial Assessments

Appendix 5.4 presents descriptive statistics for the yearly dataset that includes three endogenous variables (i.e. house price, credit and current account balance) and the exogenous variables of the model except for consumer price index.

Before testing the simultaneous equations model, whether there is multicollinearity between exogenous variables and whether the variables are stationary are checked in order to make better estimation. For controlling multicollinearity of the model, we look at the correlation matrix, Variance Inflation Factors (VIF) and the multicollinearity (or collinearity) diagnostic. In the correlation matrix, typical correlation values cited as evidence of multicollinearity ranges from 0.6 to its above (Fitzpatrick et al., 2001; Wooldridge, 2016). Appendices 5.5 and 5.6 show that the correlations among the variables of our dataset are largely sıgnificant statistically at the 5% level and that the highest correlation between any of independent variables in the yearly dataset is 0.5484. Then, multicollinearity is tested by using the VIF and the multicollinearity diagnostic. If a VIF is greater than 5 and a tolerancestatistics less than 0.1 indicates that there is multicollinearity problem (Heigberger and Holland, 2015). In the multicollinearity diagnostic test, if the values of indices are larger than 15, this shows the possibility of collinearity problem. The results of all tests indicate that there is no multicollinearity problem among the regressors of our model as illustrated in Appendices from 5.7 to 5.9.

5.8. Empirical Analysis and Main Findings

5.8.1. The Relationship between house prices and current account imbalances

The first stage of the empirical analysis covers the investigation of the relationship between house prices and current account imbalances. Firstly, the relationship between the two variables are tested in three different periods. Thereafter, it is examined by grouping the countries in accordance with their current imbalance level. Estimation results of both can be seen in Table 5.1 and Table 5.2 respectively. In these tables, Panels A, B and C include the house price, credit and current account balance equations respectively.

In Table 5.1, Model 1 covers the whole period (1990-2016). This model is a benchmar model of the analysis. Model 2 and Model 3 refer to the pre-crisis (2000-2007) and post-crisis (2008-2016) periods respectively. Test results confirm a relationship between house prices and current account dynamics largely through monetary expansion and then increasing credit supply that financial openness causes. In Model 1, the signs of the coefficients of all variables are as expected. They are also statistically significant except for two variables, that is, short-term interest rates (*sint*) and economic growth (*gdpgrowth*) in Panel B and Panel C respectively.

Table 5.1. Estimation Results According to the Different Periods

		Whole Period (1995-2016)	Pre-crisis period (2000-2007)	Post-crisis period (2008-2016)
		Model 1	Model 2	Model 3
Panel A: House Price	$gdpgrowth_{t-1}$	.24081***	.20073**	.3428981***
		(0.000)	(0.000)	(0.000)
	$credit_{t-1}$	.00180***	.00290**	..00028
		(0.000)	(0.000)	(0.281)
	$dfint_{t-1}$	-.01600***	-.02138	-.00836**
		(0.001)	(0.465)	(0.023)
	$resconsgdp_{t-1}$	.05695 ***	.04259***	.02757***
		(0.002)	(0.000)	(0.000)
	cons	.01553 ***	.02090***	.00755***
		(0.000)	(0.000)	(0.000)
	Chi2	950.38	168.61	360.23
	R-sq	0.7703	0.5740	0.7566
	P-value	0.000	0.000	0.000
Panel B: Credit Market	$gdpgrowth_{t-1}$	2.39022***	1.644473	3.27164
		(0.025)	(0.373)	(0.322)
	sin_{t-1}	-.4830444	2.473167	4.807147
		(0.694)	(0.341)	(0.105)
	$kapoen_{t-1}$	1.359688***	2.781354***	-.4496101
		(0.010)	(0.004)	(0.765)
	$hprice_{t-1}$	15.27255***	37.87644***	21.12862
		(0.004)	(0.006)	(0.417)
	$curacc_{t-1}$	-1.516155***	-.3924501	-.8315471
		(0.000)	(0.574)	(0.207)
	cons	-.6002376	-3.161595**	1.435312
		(0.305)	(0.019)	(0.393)
	Chi2	50.04	22.92	12.01
	R-sq	0.0848	0.1134	0.0826
	P-value	0.000	0.000	0.000
Panel C: Current Account Balance	$gdpgrowth_{t-1}$	.069925	.2623605	.0620749
		(0.483)	(0.165)	(0.676)
	$popgrowth_{t-1}$	-.0274237 ***	-.0338655***	-.0109795
		(0.000)	(0.000)	(0.152)
	$fiscalbalance_{t-1}$	.5118198***	.8828793***	.5832803***
		(0.000)	(0.000)	(0.000)
	$credit_{t-1}$	-.0174857**	-.0131674	.0111032
		(0.014)	(0.255)	(0.290)
	$hprice_{t-1}$	-4.736719***	-7.72205***	-5.903229***
		(0.000)	(0.000)	(0.001)
	cons	.2787317 ***	.4397837***	.2886616 ***
		(0.000)	(0.000)	(0.000)
	Chi2	163.61	185.85	57.33
	R-sq	0.3635	0.6031	0.3343
	P-value	0.000	0.000	0.000
	Observations	277	112	111

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively.

In Panel A of Model 1, house prices have a positive relationship with income, the size of credit and housing construction, yet a negative relationship with term spread. The predictive results are statistically significant. A 1% increase in housing investment, income and credit demand causes to increase in house prices by 0.5695%, 0.2408% and 0.0018%, respectively. A 1% decline in credit interest rates rises house prices by 0.016%. The income and housing construction variables account for most of the variance in the house price equation based upon the supply-demand approach. The same results are true for the pre-crisis (Model 2) and the post-crisis (Model 3). However, although the direction of the relationship between house prices and credit size in the post-crisis period (Model 3) is as expected, it is not statistically significant. This also exists for the expected impact of the interest rate variable on the house prices in the pre-crisis period (in Panel A of Model 2).

In Panel B, Model 1 shows that a 1% increase in the economic growth, financial openness and house prices would lead to an increase in credit size (i.e. the share of credit size lent by deposit taking banks and other financial institutions in GDP) by 2.3902%, 1.3596% and 15.2725% respectively.That is, these variables have a positive relationship with the credit supply, which has a negative relationship with the financing cost. A 1% drop in short-term interest rates positively influences the size of loans lent by financial intermediaries, leading to an increase of 0.483%. On the other hand, the predictive results indicate that among the determinants of credit volume, the effect of change in house prices on credit size is much greater than the other variables. This finding is consistent with previous studies (e.g. Goodhart and Hofmann, 2008 and Jordà, Schularick and Taylor, 2015) and it shows that there is a strong relationship between house prices and credit supply and it.

Nevertheless, in Panel B of Model 2 and Model 3, the anticipated impact of the short term interest rates over credit size seems to have disappeared. This may be stemmed from a disconnection from some fundamentals driving the housing demand and supply if house price increase or decrease occurs significantly. In our analysis covering the Eurozone countries excepting three (Denmark, Sweden and the UK), one of the reasons for this case may be the ECB's zero lower bound monetary policy during the time of sovereign debt crisis, because these countries are subject to a common monetary policy rather than national one.[122] In fact, this is

[122] The EU comprises two groups of countries with respect to phase of economic integration: Eurozone and non-Eurozone. Eurozone countries belong to the economic and monetary union area of the EU, whereas non-Eurozone countries are yet to fulfil the required criteria (e.g. Hungary and Poland) or choose to remain outside (e.g. Denmark, Sweden and the UK). Eurozone countries cannot implement their own monetary policy. The monetary policy in the Eurozone is determined by the European Central Bank. That is, the countries in the Eurozone are subject to a common monetary policy (for more information see ECB, 2011.

also possibly valid for the expected impact of financial liberalisation on the credit size in the post-crisis period (the Panel B of Model 3).

In Panel C, Model 1 shows expected the signs of coefficients. The government fiscal balance and economic growth have the improving effect on the current account balance while population growth has a negative impact on it. The effect of government fiscal balance is also greater than that of population growth and economic growth. In addition, the estimation results are statistically significant except for economic growth. On the other hand, the sign of the coefficient of the credit size variable, which is regarded as the indicator of financial development, is negative and statistically significant. In this case, it can be argued that the developed financial sector can negatively affect the investment-savings balance by reducing precautionary savings in the developed economies of the EU. This result is consistent with previous studies covering developed countries (e.g. Chin and Ito, 2008; Gruber and Kamin, 2007). Furthermore, the Model 3 shows that the relationships of financial development and population growth with current account balance are not significant statistically though their coefficients are as expected. Additionally, while the improvement impact of fiscal balance on the current account balance does not change in a shorter period – i.e. 2000-2007 and 2008-2016- there is negative relationship between economic growth and current account balance (see the Panel C of both Model 2 and Model 3).

The estimation results of the benchmark model (i.e. Model 1) show a strong and significant relationship between the three endogenous variables (i.e. house price, current account balance and credits size). A 1% increase in real house prices leads to a deterioration in the current account balance by 4.7367% while a 1% increase in the house prices affects the credit size positively and leads to an increase in the credit size by 15.2725%. In the Panel B. Model 1, a 1% increase in the credit supply affects house prices positively, but causes a deterioration in the current account balance by 1.5161%. The case similarly exists for the financial development variable (i.e. private credit to GDP ratio) in Panel C. In addition, our results indicate that the impact of increasing credit supply on house prices is far greater than its impact on current account balance.

Overall, increasing house prices causes an increase in current account imbalances. Additionally, there is a positive relationship between credit supply and house prices as well as financial openness. Moreover, Model 2 shows that the relationship between endogenous variables is stronger in the pre-crisis period when a 1% increase in the house prices has affected the amount of credit supply and a deterioration of current account balance much more by about 70% and

63% respectively (see the Panel B and C). Model 3 shows the signs of these three endogenous variables' coefficients remain consistent with other periods (i.e. the whole and pre-crisis period). Hence, both house prices and credit size have a detrimental impact on current account balance.[123] The relationship between house prices and current balance still remains negative and statistically significant in the post-crisis period in the Panel C, but the relationship between credit size and current account balance is not significant statistically in the pre-crisis period.

Table 5.2 covers the estimation results of the second step of the first stage of the empirical analysis and shows the results having grouped countries by their current account imbalance levels. Model 4 includes the estimation results for countries having current account imbalances within or below the threshold (-4%) whereas Model 5 includes those over -4%, namely Greece, Ireland, Portugal and Spain.

The results of both Model 4 and Model 5 are largely similar to each other in respect to the signs of the variables and their significance. There is negative and significant relationship between house prices and current account balances in both group while financial openness has a positive effect on the size of credit supply in domestic markets. However, the impact of financial openness on credit markets is more powerful in countries over the treat threshold (i.e. Model 5, Panel B) than in the other group. A 1% increase in the financial openness increases the credit supply in the countries over the threat threshold 1.7997% whereas it is by 1.1159% in the other group in Panel B. That is, the financial openness increases credit supply in the countries 60% more than it does in the countries with current account imbalances within or below the threshold (-4%). One of the reasons may be differences between the countries relating to economic structure, sensitivity to external developments and the institutional environment of the credit markets. For example, the sovereign debt crises have proved that the economies over the threat threshold (e.g, Greece and Spain) have more vulnerable than others.

This reflects the relationship between house prices and the current account balance in the Panel C. The group which has more credit supply also has higher current account imbalances. Thus, the findings show that despite the group within or below the threshold (i.e. Model 4), increasing house prices have a less negative impact on current account balance than that of the group with the group exceeding the threat threshold (Model 5). A 1% increase in house prices negatively

[123] In credit and current account equations (i.e. Panels B and C), the indicator for crediy supply and financial development are the same because (i.e. private credit to GDP ratio is also the indicator for financial development (see the World Bank).

Table 5.2. Estimation Results for Different Levels of Current Account Imbalances (CAB)

		Countries with CAB ≤-4%	Countries with CAB >-4%
		Model 4	**Model 5**
Panel A: House Prices	$gdpgrowh_{t-1}$	.2721257***	.1951428***
		(0.000)	(0.000)
	$credit_{t-1}$	.0022852***	-.0016841
		(0.000)	(0.144)
	$dint_{t-1}$	-.0372744***	-.0081933
		(0.000)	(0.397)
	$construc_{t-1}$	.0845371***	.0539401***
		(0.000)	(0.000)
	constant	.0110849***	.0243722***
		(0.000)	(0.000)
	Chi2	751.44	296.36
	R-sq	0.7775	0.7925
	P-value	0.000	0.000
Panel B: Credit Market	$gdpgrowh_{t-1}$	3.975991***	.8774271
		(0.009)	(0.481)
	sin_{t-1}	.6898727	1.002504
		(0.687)	(0.522)
	$kapoen_{t-1}$	1.115983	1.799714***
		(0.273)	(0.002)
	$hprice_{t-1}$	55.46009***	21.82826**
		(0.000)	(0.017)
	$curacc_{t-1}$	-.856073	-1.68815***
		(0.253)	(0.007)
	constant	-1.517726	.639817
		(0.191)	(0.235)
	Chi2	34.98	51.56
	R-sq	0.0779	0.3628
	P-value	0.000	0.000
Panel C: Current Account Balance	$gdpgrowth_{t-1}$	-.0028638	.6214987***
		(0.978)	(0.000)
	$popgrowth_{t-1}$	-.0280173***	.0049445
		(0.000)	(0.503)
	$fiscalbalance_{t-1}$	.3510933***	-.0761886
		(0.000)	(0.460)
	$credit_{t-1}$	-.0034741	-.0299036*
		(0.574)	(0.089)
	$hprice_{t-1}$	-1.082726	-8.890898***
		(0.170)	(0.000)
	constant	-1.662017**	.3997811***
		(0.024)	(0.000)
	Chi2	50.09	63.59
	R-sq	0.2116	0.4275
	P-value	0.000	0.000
	Observations	200	77

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The estimation results cover the whole period. Model 4 covers Austria, Belgium, Denmark, Germany, Finland, France, Italy, the Netherlands, Sweden and the UK. Model 5 includes Greece, Ireland, Portugal and Spain.

affects the current account balance in the countries not exceeding the threat threshold by -1.0827% in the Panel C of Model 4, while the other group has more negative effects, reaching more than eight folds (which is; -8.8908%).

From this, it can be concluded that financial openness has similar effects on the domestic markets of both group in the Panel B. That is, rising financial liberalisation causes an increase in monetary expansion in the domestic markets and hence, an increase in credit supply, but differences in their current account balance /GDP ratio segregate the outputs created by the expansion of the credit supply on the economy. Another similarity between the two group countries is that the relationship between interest rates and credit size is not as expected and being insignificant statistically. One of the reasons for this may be exceptional circumstances of the sample period, such as the existence of house price boom-bust, credit boom-bust and current account imbalances with together.

When compared to the other group, countries not exceeding the threat threshold (Model 4) have a stronger relationship between house prices and credit supply than the other group in the Panel B. In this group, a 1% change in prices has an impact on the credit volume about three times as much as in the countries which are above the threat threshold (55.4601%). However, in countries not exceeding the treat threshold, the change in house price and its deterioration effect on the current balance are less than they are in the other group (Model 5). Thus, Panel C in Model 4 indicates that although in the group with current account deficits within or below -4%, there is a stronger relationship between house prices and the credit supply, house price increases lead to less deterioration on current account balance. However, the opposite is true in the case of Model 5. In this case, one suggestion can be that the distictions between the countries relating to their institutional environment (e.g. enforcement of law, protection of investors, cultural factors) may produce different results in the economy in addition to the economic features.

One of the conclusions reached can be that the estimation results of the simultaneous equations model confirm the first hypothesis largely and indicate that there is an association between the three endogenous variables (i.e. house prices, credit size and current account imbalances). Another conclusion is that there is a positive and strong relationship between current account imbalances and house prices and that the relationship of house prices with current account balance seems to be much stronger than credit’s relation to current account balance. Again, there is a positive and strong relationship between credit supply and house price. In addition, the relationship of house prices with credit supply is stronger than its relation to current account balance.

In this case, it can be argued that monetary expansion and then a decrease in interest rates and an increase in credit supply in domestic markets strengthen the relationship between house prices and current account balance. Since with monetary expansion, an increase in affordability of households and credit demand support the upward movement of house prices, it also increases the possibility of preparing the ground for strengthening the deterioration impact on the current account balance of house prices through the effects of increasing house prices (e.g. welfare effect, collateral effect, investment effect etc.). The estimation results also confirm that these effects of house price increases can be detrimental to the current account balance by adversely affecting both investment-savings balance and foreign trade balance from these channels created by house prices. Increase in demand of consumption goods, reduction in the savings, increase in import of both consumer goods and construction inputs and increase in production of non-tradable goods (e.g. housing). Additionally, the findings show that house price increases are much more detrimental to the current balance than that of increasing credit supply on the current account balance (see Panel C). Therefore, we suggest that the indirect effect created by credit supply on the current account balance through house prices is more than its direct effect. In this case, one suggestion is that the indirect effect of credit supply on the current account balance can stem from a causal relationship between house prices and monetary expansion via the credit channel.

In addition, the findings are in line with previous studies on the relationship between house prices and credit size (e.g. Gerlach and Peng, 2005; Gimeno and Martínez-Carrascal, 2010). Again, they are consistent with the findings of the empirical literature on the current account balance determinants (e.g. Chinn and Prasad, 2003; Ca' Zorzi, Chudik and Dieppe, 2012; Cheung, Davide and Rusticelli, 2013) and of house prices (e.g. Meen, 2001; Agnello and Schuknecht, 2011) as well as of credit size (e.g. Kutlukaya and Erol, 2016; Nobili and Zollino, 2017).

Concluding, according to the estimation results, there is ceteris paribus, a negative correlation between house prices and current account balances and ever-growing monetary expansion created by financial openness in domestic markets may have a strengthening effect regarding this relationship. In other words, with the increased financial openness, both increasing accessibility of domestic financial intermediaries to cheaper funds in international markets and increasing foreign capital inflows cause monetary expansion in the domestic credit markets strengthen the upward movement of house prices and its relationship with the current account imbalances in member countries of the EU.

5.8.2. Role of Institutions in the Relationship between House Prices and Current Account Imbalances

The second part of the empirical analysis tests the second hypothesis: that is, whether the institutional features affect the relationship between house prices and current account imbalances. As discussed in the introduction section, institutions influence economic performance by determining the rules of the game in the economy. Thus, with financial liberalization, the institutional environment has an impact on the extent to which foreign capital will enter domestic markets as well as on their allocation way after entering. If a country has a high quality institutional environment, it is expected that such an environment can provide more foreign capital inflows for the domestic markets, more effectively to direct them and also to either mitigate or remove the negative effects of monetary expansion on the economy, such as very high house price fluctuations caused by increasing credit supply and the disruptive effects of these fluctuations over the current account balance.

To test our hypothesis and thus to capture the the role of institutional environment on the relationship between house price and current account dynamics, the institutional features are added to our benchmark model that covers the whole period. To this end, the institutional characteristics of credit markets (e.g. accessibility of financial services, credit information, affordability of credit, property rights, investor protection etc.) are taken into consideration, as well as institutional characteristics as to the governance of a country (e.g. regulation quality, rule of law, effectiveness of government etc.), which play a role in attracting foreign capital and in obtaining cheap and easy funding from international financial markets, and them in domestic markets in efficient way in domestic markets.

We firstly include the Institutional Index as an indicator of the institutional characteristics of credit markets and the EU countries are grouped according to their position in the Institutional Index. There are the two group countries: countries with credit markets having high institutional quality (i.e. ones at the EU average of the Institutional Index and above) and countries with credit markets having weak institutional quality (i.e. ones at below the EU average) (see Appendix 5.2). Then, the benchmark model is estimated again by using a 3SLS technique.

Table 5.3 presents the test results of the simultaneous equations model considering the Institutional Index. Model 6 shows the results for the countries having the credit markets with high institutional quality (e.g. Finland, Sweden and the UK) whereas Model 7 shows the estimates for the ones having the credit markets with weak institutional quality, such as Greece

Table 5.3. Estimation Results for Institutional Quality

		Countries with high institutional quality (≥ EU average)	Countries with weak institutional quality (< EU average)
		Model 6	**Model 7**
Panel A: House Prices	gdpgrowh$_{t-1}$	.2964785***	.2352483***
		(0.000)	(0.000)
	credit$_{t-1}$	.0023046***	-.0012449
		(0.000)	(0.211)
	dfint$_{t-1}$	-.0513049***	-.0062876
		(0.000)	(0.459)
	construc$_{t-1}$	.0606551***	.0391997***
		(0.000)	(0.002)
	constant	.0100781***	.0202454***
		(0.000)	(0.000)
	Chi2	805.82	290.20
	R-sq	0.7914	0.7819
	P-value	0.000	0.000
Panel B: Credit Market	gdpgrowh$_{t-1}$	2.996546**	1.25071
		(0.038)	(0.383)
	sin$_{t-1}$	.9378309	.3977595
		(0.598)	(0.784)
	kapoen$_{t-1}$	1.124182	1.03291*
		(0.260)	(0.052)
	hprice$_{t-1}$	45.54554 ***	43.30938***
		(0.000)	(0.052)
	curacc $_{t-1}$	-1.90552***	-4.749406***
		(0.008)	(0.000)
	constant	-1.306245	1.578237***
		(0.247)	(0.003)
	Chi2	43.49	84.03
	R-sq	0.1017	0.3556
	P-value	0.000	0.000
Panel C: Current Account Balance	gdpgrowth $_{t-1}$	.0576365	-.1802958
		(0.467)	(0.334)
	popgrowth $_{t-1}$	-.0340855***	-.0189459*
		(0.000)	(0.062)
	fiscalbalance$_{t-1}$	.2792797***	.2214842
		(0.000)	(0.146)
	credit $_{t-1}$	-.0127378**	-.0814089***
		(0.038)	(0.089)
	hprice$_{t-1}$	-1.364755*	-4.75541***
		(0.055)	(0.001)
	constant	.1282958***	.2961753***
		(0.024)	(0.000)
	Chi2	98.63	62.86
	R-sq	0.3049	0.3351
	P-value	0.000	0.000
	Observations	199	78

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The estimation results cover the whole period. Model 4 covers Austria, Belgium, Denmark, Germany, Finland, France, Ireland, the Netherlands, Sweden and the UK. Model 5 includes Greece, Italy, Portugal and Spain.

and Portugal. Higher institutional quality is also taken as an indicator for development of credit markets.

The estimation results of the Model 6 and Model 7 covering the institutional features of the credit markets support the second hypothesis. That is, the institutional features of credit markets have an impact on both lending of financial institutions (e.g. banks) and the behaviour of households and firms through the credit channel, which use two mechanism: the bank lending channel and the balance sheet channel (i.e. the net worth channel). Then, they have the role in the relationship between house prices and current account imbalances. These both channels can play significant roles in housing markets because they influence the financial positions of both households and firms, which in turn affects investment and spending decisions. For example, when credit supply increases and then, the financing cost decreases, households prefer to buy durable goods, such as housing, while firms choose to invest more real estate.

These findings are also largely consistent with new institutional economics approach. This theory focuses on formal institutions (e.g. rules, laws, constitutions) and informal institutions (e.g. habits and customs, norms of behaviour) and their enforcement in economy (North, 1990, 1994),[124] suggesting that the institutions determine the rules of the game and influence the allocation of resources in economy and thus, can produce different outputs in the economies (e.g. differences relating to economic development among countries) (North, 1990; Willamson, 2000; Acemoğlu, Johnson and Robinson, 2005).

According to the estimation results, there is a negative relationship between house prices and current account imbalances, but increasing the institutional quality weakens this relationship. In Model 6 including countries with credit markets where have a high institutional quality, a 1% increase in house prices causes an increase in current imbalances by 1.3647% (see Panel C). This increase is also approximately four times smaller than in Model 7 including the countries with weak institutional quality, which has 4.7554% for the coefficient of house prices.

This means that a high institutional quality affects functioning of the credit markets in a positive way and decreases the magnitude of the relationship of house prices with current account balance, even if in the markets with high institutional quality, the relationship between house prices and credit is stronger than the credit markets with weak institutional environment. In other words, in such credit markets, market participants (lenders, borrowers, fund suppliers) can easily have access to information and rules and regulations are applied more efficiently and investors are

[124] North is one of the pioneers of this approach and combines the Coasian view of transaction costs with ideology of behavioral economics.

better protected, and thus the negative impact of house price increases on the current account balance is less than the other group.

In addition, the findings also show that the institutional characteristics of credit markets can differentiate the effects of the increased credit supply on housing markets and then on the economy, but the change in house prices in the credit markets with high institutional quality is much less detrimental to the current account balance than in the credit markets with weak institutional quality (see Panel C in Models 6 and 7). Therefore, one suggestion is that the institutional environment with a high quality creates well-functioning credit markets and then can mitigate the negative effects on the economy of the volatility of house prices, which is caused by monetary expansion with increasing the degree of financial openness.

The estimation results indicate that both groups have some common features. One of them is that in both groups, the financial openness has a positive effect on the size of credit supply in domestic markets as expected (Panel B in Models 6 and 7), but its positive effect is stronger in the countries with high institutional quality than the other group. Another common feature is that the house prices have a significant effect on determining the size of the credit, yet the effect of house prices is weaker in the countries with low institutional quality than that of the other group. Nevertheless, in the countries with high institutional quality, house price increases have less detrimental effect on the current account balance than the countries with low institutional quality. Therefore, it can be argued that with financial liberalization, the institutional environment with a high quality contributes to strengthen the relationship of credit supply with house prices much more in the economy and to decrease the impact of variation of house prices on current account balance.

From these findings, we conclude that the institutional characteristics of credit markets influence the relationship between credit markets and housing markets and then, the magnitude of the relationship between house prices and current account imbalances. Additionally, a high quality institutional environment in the credit markets may reduce the strength of the relationship between house prices and current account balance and smooth the negative effects of increasing house prices on current account balance as well as those of financial liberalization.

In this stage of the empirical analysis, the second step is the inclusion in the model of institutional variables related to the governance of a country. Governance entails the traditions and legislations that are used to ensure law and order is maintained in a society (Aidt, Dutta and Sena, 2008; Kaufmann, Kraay and Masttruzzi, 2010). This definition incorporates the mechanisms that are used to enable governments to create and implement logical and fair principles that foster socio-economic development and encourages in public sector. Governance covers the institutions by which authority is exercised in a country**.** This compromises the process by which governments are chosen, monitored and replaced; the capacity of the government to effectively determine and introduce sound policies; and the respect of citizens and the state for the institutions that govern social and economic interactions among them. Governance features included in the model are regulation quality (*iregqual*), control of corruption (*icorrup*), voice and accountability (*iaccount*), government effectiveness (*igoveff*), and law of order (*irulelaw*). They are separately integrated into the model with their lagged (one year) values and logarithmic form. In addition, the model is re-estimated by adding the average of these variables (*iaverage*) to our model.

In a financially open economy, it is expected that an increase in the quality of governance brings more foreign capital from international markets more cheaply and easily (Schmukler, 2008; Klein and Olivei, 2008; Mishkin, 2009; Okada, 2013). Additionally, the quality of governance may affect the relationship between house prices and current account imbalances by smoothing the effects of monetary expansion and hence, increased credit supply. For this reason, governance variables are added to the credit equation of our benchmark model (i.e. Panel B).

Table 5.4 presents the estimation results after governance variables are included in the model and all models are re-estimations of our benchmark model.[125] Model 8 includes the estimation results after adding the regulation quality variable to the model while Model 9 includes the government effectiveness variable. Models 10, 11, 12 and 13 show the estimation results with other governance variables -control of corruption, accountability, rule of law and an average of these governance variables respectively. The signs of the coefficients of all the governance variables are as expected except for the rule of law (Model 12) and they are also statistically significant. These results show that the governance features affect the amount of monetary expansion and hence, the amount of credit supply positively. The findings also prove our hypothesis, i.e. the institutions can influence the relationship between house prices and current account imbalances.

[125]Because the governance variables are available from 1996, the estimation results cover the period between 1996 and 2016 instead of between 1990-2016. In addition, 1997, 1999 and 2000 years are not included due to the lack of data.

Table 5.4. Estimation Results for Features of Governance

		Model 8	**Model 9**	**Model 10**	**Model 11**	**Model 12**	**Model 13**
Panel A: Housing Price	gdpgrowh$_{t-1}$	.26370***	.26417***	.26403***	.26443***	.26861***	.26477***
		0.000	0.000	0.000	0.000	0.000	0.000
	credit$_{t-1}$	.00129***	.00137***	.00136***	.00142***	.00161***	.00146***
		0.000	0.000	0.000	0.000	0.000	0.000
	dfint$_{t-1}$	-.01667***	-.01678***	-.01668***	-.01674***	-.01707***	-.01688***
		0.002	0.001	0.002	0.002	0.001	0.001
	resconsgdp$_{t-1}$	.04691***	.04679***	.04681***	.04673***	.04639***	.04669***
		0.000	0.000	0.000	0.000	0.000	0.000
	cons	.01419***	.01407***	.01409***	.01399***	.01336***	.01391***
		0.000	0.000	0.000	0.000	0.000	0.000
	Chi2	877.72	878.30	878.17	879.02	891.57	879.75
	R-sq	0.7703	0.574	0.7566	0.7703	0.7566	0.7566
	P-value	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: Credit Market	gdpgrowh$_{t-1}$	1.72637	3.24621**	2.86093**	15.27255*	4.51323***	3.21745**
		0.190	0.013	0.028	0.066	0.001	0.024
	sin$_{t-1}$	1.27722	2.34061	1.97594	2.17356	- 3.18608*	2.25120
		0.432	0.156	0.229	0.196	0.058	0.193
	hprice$_{t-1}$	1.40185	13.86035	11.10756	9.49248	26.33793***	15.25923
		0.889	0.162	0.261	0.378	0.008	0.159
	curacc $_{t-1}$	-2.94363***	-2.56025***	-2.60404***	-2.38176***	-1.03627*	-2.06598***
		0.000	0.000	0.000	0.000	0.066	0.001
	kapoen$_{t-1}$	1.05083	1.78626**	1.71349***	1.78259***	2.28219	1.87949***
		0.114	0.017	0.009	0.008	0.001	0.006
	iregqual $_{t-1}$	1.56507***					
		0.000					
	igoveff $_{t-1}$		.91184***				
			0.001				
	icorrup $_{t-1}$			.81596***			
				0.000			
	iaccount $_{t-1}$				1.10252***		
					0.005		
	irulelaw $_{t-1}$					-.02547	
						0.441	
	iaverage $_{t-1}$						.51576*
							0.073
	cons	-5.51054***	-2.75323**	-2.28487**	-3.61133**	1.18869***	-1.03428
		0.000	0.023	0.014	0.037	0.005	0.419
	Chi2	64.06	50.00	54.77	45.63	41.08	41.04
	R-sq	0.1964	0.1397	0.1595	0.1252	0.0914	0.1045
	P-value	0.000	0.000	0.000	0.000	0.000	0.000
Panel C: Current Account Balance	gdpgrowth $_{t-1}$	.03521	.03645	.03359	.03746	.04817	.03829
		0.765	0.757	0.774	0.750	0.681	0.745
	popgrowth $_{t-1}$	-.02622***	-.02646***	-.02642***	-.02647***	-.02651***	-.02663***
		0.000	0.000	0.000	0.000	0.000	0.000
	fiscalbalance$_{t-1}$	.61237***	.61115***	.61121***	.61139***	.61059***	.61125***
		0.000	0.000	0.000	0.000	0.000	0.000
	credit $_{t-1}$	-.00912	-.01125	-.01044	-.01067	-.01137	-.01089
		0.259	0.163	0.196	0.160	0.157	0.177
	hprice$_{t-1}$	-4.80059***	-4.78716***	-4.80014***	-4.78392***	-4.84625***	-4.77615***
		0.000	0.000	0.001	0.000	0.001	0.001
	cons	.27459***	.27641***	.27607***	.27564***	.27921***	.27561***
		0.000	0.000	0.000	0.000	0.000	0.000
	Chi2	136.97	138.66	138.10	138.14	141.27	138.43
	R-sq	0.3836	0.3816	0.3824	0.3821	0.3869	0.3819
	P-value	0.000	0.000	0.000	0.000	0.000	0.000
	Observations	222	222	222	222	222	222

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The estimation results cover the whole period.

In Model 8, regulation quality variable proves to be the most important variable among the governance variables to influence the credit supply (Panel B). A 1% quality improvement in regulations increases credit supply 1.565% (see Panel B). Moreover, the improvement in regulation quality also weakens the relationship between credit size and house prices. In this case, it can be argued that higher regulation quality smooths the effect of financial liberalisation on the credit supply as well as on the relationship between credit supply and house prices. In Panel B of Model 8, a 1% change in both house prices and degree of financial liberalisation has an impact on the credit size by 1.4018% and 1.0508 % respectively. At the same time, though the sign of house price variable is positive, it is not statistically significant.

While the strong and negative relationship between current account imbalances and house prices continues, the improvement in regulation quality affects this relationship, not significantly. The findings of Model 8 are also confirmed by other models with all governance variables affect credit size positively and significantly except for rule of law (i.e. Model 12). When rule of law is added to the model, there is no expected relationship between the credit size and rule of law. This means that in our sample covering 14 EU countries, economic agents do not have confident that the rules are followed in society. The finding is in line with previous studies (e.g. Chin and Ito, 2008; Gruber and Kamin, 2007; Yan and Yang, 2012). Yet, one of the reasons for such a result may be features of their law system because the countries in our sample have different law systems. For example, Portugal, Spain and Italy have the French origin civil law and Sweden and Austria have Scandinavian and German origin civil law respectively while Ireland and the UK have Common law. In fact, La Porta et al. (1998) show that origin of the law system affects the development of the financial sector. When the average of these institutional variables is added in Model 13, similar estimates are obtained.

Considering the effect of governance variables on the relationship between house price and current account dynamics, we find that a 1% change in governance variables indirectly have an impact on this relationship between 4.77615% and 4.84625% (see Panel C)**.** Additionally, when we compare these estimation results with those of the benchmark model, the results of the models having governance variables clearly show that the features of governance structure of the economy have an impact on the relationship of house prices with current account balance.

In summary, the findings show that institutional characteristics can influence the size of the relationship between house price and current account dynamics. For example, if the credit markets have a weak institutional quality, the relationship between both dynamics is stronger than other countries. A high institutional quality environment decreases the detrimental effect of increasing house prices on the current account balance. The impact of improvement in governance structure can also be seen on this relationship. In the credit markets having a good institutional quality, financial liberalisation is laying the groundwork for increasing credit supply even more than in the countries with weaker institutional environment.

5.9. Robustness Check

In this section, a series of further robustness tests of the benchmark model (i.e. Model 1) are presented. The model under various alternatives is re-estimated. First, we place different variables in the benchmark model instead of two variables that are exogenous (financial liberalisation index) and endogenous (credit size). They are domestic credits (*domescredit*) and issues of debt securities (*intdebt*). Domestic credits show all credits lent to the private sector by all participants in the financial sector (i.e. monetary authorities, deposit money banks, finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies).[126] Issues of debt securities covers the amount of both outstanding public and private debt securities and long term bonds and notes and money market instruments placed on international markets.

Firstly, we include the real domestic credits (*domescredit*) in all three panels as an alternative for credit size (*credit*). It is added to the model as both endogenous variable in Panel B and exogenous variable in Panels A and C and then the model is re-estimated.

Secondly, we add issues of debt securities to our model replacing the financial liberalisation index because after financial liberalization, it is expected that that domestic institutions will gain access to international markets easily and thus, monetary expansion and credit supply will increase in domestic markets. One way to obtain funds from international markets is that debt securities (*intdebt*) are issued by both public and private sectors. Thus, we add this variable to Panel B as an exogenous variable and repeat our model's prediction.

Finally, we include these two variables (issues of debt securities and domestic credits) together in the model and the model is re-estimated. In Table 5.5 the estimation results of these models show that a negative linkage between current account balance and house prices as well as

[126] As noted earlier, credit size carries the credits lent o the private sector by only by deposit money banks that accept transferable deposits.

Table 5.5. Estimation Results for Robustness Check

		Model 14	Model 15	Model 16
Panel A: House Price	$gdpgrowh_{t-1}$	.26747***	.24040***	.26743***
		(0.000)	(0.000)	(0.000)
	$credit_{t-1}$		.00172***	
			(0.000)	
	$domescredit_{t-1}$	.00128***		.00128***
		(0.000)		(0.000)
	$dfint_{t-1}$	-.01715***	-.01601***	-.01723***
		(0.000)	(0.002)	(0.000)
	$resconsgdp_{t-1}$	.04279***	.05702***	.04285***
		(0.000)	(0.000)	(0.000)
	cons	.01404***	.01564***	.01404***
		(0.000)	(0.000)	(0.000)
	Chi2	982.80	948.65	983.00
	R-sq	0.8094	0.7709	0.8094
	P-value	0.000	0.000	0.000
Panel B: Credit Market	$gdpgrowh_{t-1}$	2.9860**	1.7371	2.3991*
		(0.033)	(0.117)	(0.099)
	sin_{t-1}	3.9925**	-1.8917*	3.68107**
		(0.021)	(0.090)	(0.033)
	$kapoen_{t-1}$	1.1859		
		(0.116)		
	$intdebt_{t-1}$		.05131	.11086
			(0.351)	(0.127)
	$hprice_{t-1}$	24.70411***	23.60359***	27.42078***
		(0.010)	(0.002)	(0.004)
	$curacc_{t-1}$	-.46233	-1.4041***	-1.1567***
		(0.578)	(0.001)	(0.008)
	cons	-3.161595**	.51029	.35735
		(0.019)	(0.154)	(0.428)
	Chi2	43.60	39.48	40.32
	R-sq	0.1166	0.0754	40.32
	P-value	0.000	0.000	0.000
Panel C: Current Account Balance	$gdpgrowth_{t-1}$	.05581	.07308	.05333
		(0.570)	(0.464)	(0.589)
	$popgrowth_{t-1}$	-.01813***	.07308***	-.01836***
		(0.001)	(0.000)	(0.001)
	$fiscalbalance_{t-1}$	.64191**	.51288***	.64539***
		(0.041	(0.000)	(0.000)
	$credit_{t-1}$		-.01465**	
			(0.045)	
	$domescredit_{t-1}$	-.01979**		-.01499*
		(0.014)		(0.290)
	$hprice_{t-1}$	-5.7015***	-4.7389***	-5.903229***
		(0.000)	(0.000)	(0.064)
	cons	.32346***	.27589***	.32278***
		(0.000)	(0.000)	(0.000)
	Chi2	165.29	160.95	162.28
	R-sq	0.4066	0.3660	162.28
	P-value	0.000	0.000	0.000
	Observations	229	277	229

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. All models cover the whole period.

between these two variables and credit supply and that there is a positive relationship between house prices and credit supply. Both variables are added to the model with their one year lagged values when they are included as exogenous variable, but not as endogenous variable. Domestic credits included in the model are in real terms deflated by the consumer price index (2010=100).

Table 5.5 displays the estimation results of Model 15, covering domestic credits, Model 16, including the international securities issuances and Model 17, including both variables. These results confirm the robustness of previous findings. In all three models, there is a negative and

strong correlation between house prices and the current account balance, and the estimated coefficients of these two variables are statistically significant. The house prices in all three models are the main determinant of credit size and the change in house prices affects credit supply positively.

After these tests, additional robustness checks are performed. For this purpose, firstly, models using lagged values without their logarithmic form are estimated by considering their both real and nominal terms. Secondly, if the endogenous variables are as exogenous variable in the equations of the model, models using their first difference are estimated, by also considering the variables both in nominal and real values.

Table 5.6 exhibits the estimates with nominal values. In the first three columns of this table, Models 17-A, 17-B and 17-C show estimates of variables with lagged values whereas in the last three columns in this table, i.e. Models 18-A, 18-B and 18-C include the results of the alternative model specification which covers the estimation results of first differences of the variables.

Table 5.7 includes the estimates of the same alternative specifications as for Table 5.6, but in real terms. In the first three columns, Models 19-A, 19-B and 19-C show estimates of variables with lagged values whereas in the last three columns, Models 20-A, 20-B and 20-C include the results in first difference.

In all alternatives, we find confirmation for a negative relation between the house prices and the current account balance in Panel C. A similar situation holds true for both house prices and financial liberalisation in relation to credit size (see Panel B). As expected, while house prices and credit size affect each other in positively, the relationship between the financial liberalisation and the credit volume also has a positive sign in both.

Table 5.6. Estimation Results for Robustness Check (at nominal terms)

		Lagged Values (1)			First Difference (2)		
		Model 17-A	**Model 17-B**	**Model 17-C**	**Model 18-A**	**Model 18-B**	**Model 18-C**
Panel A: House Prices	$gdpgrowth_{t-1}$	.00177***	.00174***	.00173***	-.00015***	-.0001519***	-8E-05
		(0.000)	(0.000)	(0.000)	(0.003)	(0.010)	(0.262)
	$credit_{t-1}$	.22091***	.22213***	.19713***	.49296***	.5910618***	.90677***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	$dfint_{t-1}$	.22091**	-1.03824**		-.97101***	-1.064295***	
		(0.040)	(0.015)		(0.000)	(0.000)	
	$sint_{t-1}$			-.81510***			-1.01510***
				(0.001)			(0.001)
	$construc_{t-1}$	3.56169***	3.53592***	3.91493***	-.26042	-.3370027*	-.08811
		(0.000)	(0.000)	(0.000)	(0.166)	(0.055)	(0.726)
	constant	-9.41234	-7.31479	1.24912	12.67293***	13.19823	6.92965**
		(0.129)	(0.247)	(0.167)	(0.000)	(0.000)	(0.031)
	Chi2	719.30	722.02	752.81	77.01	86.07	197.33
	R-sq	0.6667	0.6669	0.6860	-0.1759	-0.3589	-1.2605
	P-value	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: Credit Market	$gdpgrowth_{t-1}$	.00074	.00050	.00049	.00009	.00013	.00007
		(0.107)	(0.270)	(0.286)	(0.269)	(0.125)	(0.329)
	$lint_{t-1}$		1.50881			1.28169***	
			(0.160)			(0.003)	
	$sint_{t-1}$	-.52933		.32398	.53501*		1.12767***
		(0.634)		(0.780)	(0.053)		(0.002)
	$kapoen_{t-1}$	73.96943*	85.18746**	76.35717*	9.14351	.42673	1.36674
		(0.098)	(0.044)	(0.091)	(0.324)	(0.950)	(0.863)
	$hprice_{t-1}$	1.05863***	1.09323***	1.01220***	.03229	.02250	1.06668***
		(0.000)	(0.000)	(0.000)	(0.196)	(0.440)	(0.000)
	$curacc_{t-1}$	.17881	.2684	.09359	-4.59347**	-7.96216***	-.23227
		(0.740)	(0.618)	(0.864)	(0.044)	(0.000)	(0.865)
	constant	-34.03783	-64.40828	-43.00375	-8.07688	-10.28947	-8.14580
		(0.474)	(0.133)	(0.361)	(0.419)	(0.241)	(0.420)
	Chi2	156.60	159.59	145.31	48.54	42.29	231.95
	R-sq	0.2419	0.2429	0.2485	-0.2751	-1.2719	-0.2124
	P-value	0.000	0.000	0.000	0.000	0.000	0.000
Panel C: Current Account Balance	$gdpgrowth_{t-1}$	-.30443***	-.30340***	-.28082***	.06142*	.00369	-.14710**
		(0.005)	(0.005)	(0.010)	(0.098)	(0.921)	(0.004)
	$popgrowth_{t-1}$	-3.09721***	-3.09491***	-3.08402***	-.15869	-.03702	-.10173
		(0.000)	(0.000)	(0.000)	(0.324)	(0.790)	(0.601)
	$fiscalbalance_{t-1}$	.59325***	.59319***	.47900	-.00930	.01668	.00851
		(0.000)	(0.000)	(0.000)	(0.793)	(0.632)	(0.841)
	$credit_{t-1}$	-.00657	.00697	.00720	-.05250*	-.05295*	-.04135
		(0.434)	(0.375)	(0.360)	(0.060)	(0.060)	(0.177)
	$hprice_{t-1}$	-.00656	-.00724	-.00689	-.08800**	-.16245***	.00118
		(0.600)	(0.563)	(0.583)	(0.027)	(0.000)	(0.984)
	constant	4.02077***	3.99205***	3.93455***	.56608	.65611	.49557**
		(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.027)
	Chi2	104.91	104.91	107.42	85.07	91.11	43.70
	R-sq	0.2530	0.2530	0.2545	0.1297	0.0463	0.1198
	P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	Observations	277	277	277	277	277	277

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. Estimation results cover the whole period.

(1) All exogenous variables have lagged values.

(2) All endogenous variables have first difference even if they are exogenous variables.

Table 5.7. Estimation Results for Robustness Check (at real terms)

		Lagged Values (1)			First Difference (2)		
		Model 19-A	**Model 19-B**	**Model 19-C**	**Model 20-A**	**Model 20-B**	**Model 20-C**
Panel A: House Prices	$gdpgrowh_{t-1}$	.00098 ***	.00097***	.00140 ***	.00019**	.00013	.00014*
		(0.000)	(0.000)	(0.000)	(0.013)	(0.183)	(0.084)
	$credit_{t-1}$	.20534***	.20530***	.19392***	.76672 ***	.82085***	.80961***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	$dint_{t-1}$	-2.39849**	-1.03824**		.03350	-.18947	
		(0.040)	(0.015)		(0.664)	(0.359)	
	$sint_{t-1}$			-2.0001***			-.22145
				(0.000)			(0.190)
	$construc_{t-1}$	3.33366***	3.34386***	3.85999***	.00604	.01653	.01461
		(0.000)	(0.000)	(0.000)	(0.936)	(0.833)	(0.846)
	constant	.2651921	.2735616	.04173	-.05807**	-.02542	-.03086
		(0.003)	(0.003)	(0.556)	(0.049)	(0.559)	(0.347)
	Chi2	326.56	329.34	319.37	152.26	327.26	165.99
	R-sq	0.4815	0.4818	0.4779	-1.0782	-1.2399	-1.1962
	P-value	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: Credit Market	$gdpgrowh_{t-1}$	1.74e-10	2.11e-10	2.30e-10	.00016*	.00012	.00011
		(0.387)	(0.296)	(0.255)	(0.091)	(0.323)	(0.298)
	$lint_{t-1}$		1.45884*			.30249	
			(0.160)			(0.247)	
	$sint_{t-1}$	.68536		.96278	.13623		.40583*
		(0.389)		(0.293)	(0.222)		(0.052)
	$kapoen_{t-1}$	1.06749**	1.05854**	1.03632 **	.07658	.02159	.06309
		(0.034)	(0.023)	(0.040)	(0.158)	(0.551)	(0.231)
	$hprice_{t-1}$	.73472***	.80493***	.72365***	1.16641***	1.18976***	1.19591***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	$curacc_{t-1}$	-.00854*	-.00641	-.00766*	-.00321*	-.00145	-.00239
		(0.055)	(0.169)	(0.086)	(0.069)	(0.247)	(0.141)
	constant	-.66721	-.78029	-.64281	-.03461	-.00603	.00624
		(0.197)	(0.107)	(0.216)	(0.614)	(0.927)	(0.922)
	Chi2	83.63	86.15	76.42	220.51	348.27	275.57
	R-sq	0.2419	0.1109	0.1197	-0.3066	-0.3177	-0.3315
	P-value	0.117	0.000	0.000	0.000	0.000	0.000
Panel C: Current Account Balance	$gdpgrowth_{t-1}$	-.409637***	.40923***	-.39482***	.33321***	.29977***	.31183***
		(0.000)	(0.000)	(0.010)	(0.001)	(0.006)	(0.003)
	$popgrowth_{t-1}$	-.02041***	-.02041***	-.02172***	.00267	.00221	.00232
		(0.001)	(0.001)	(0.000)	(0.481)	(0.617)	(0.574)
	$fiscalbalance_{t-1}$	.61453 ***	.61475 ***	.61976***	.37232***	.37988***	.37747***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	$credit_{t-1}$	-.00194	-.00166	-.00281	-.00324	.02643	-.00225
		(0.798)	(0.826)	(0.712)	(0.965)	(0.754)	(0.976)
	$hprice_{t-1}$	-.07123***	-.07151***	-.06377***	-.94235***	-.93249***	-.91898***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	constant	.10717***	.10711***	.10189***	.01629***	.01722***	.01677 ***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	Chi2	138.14	138.26	136.22	68.95	59.29	65.48
	R-sq	0.3499	0.3501	0.3460	-7.7375	-7.6266	-7.3259
	P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	Observations	277	277	277	277	277	277

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. Estimation results cover the whole period.
(1) All exogenous variables have lagged values.
(2) All endogenous variables have first difference even if they are exogenous variables.

5.10. Conclusion

The aim of this study is to examine the relationship between house prices and current account imbalances by following the financial liberalisation approach and to investigate whether the institutional environment plays a role in this relationship. For this purpose, the simultaneous equations model was used by employing the 3SLS estimation procedure. The model was built with three equations (i.e. house price, credit supply and current account balance) considering the 14 EU countries for 1990-2016. While testing this relationship, the countries were grouped according to different periods (e.g. pre-crisis and post crisis periods) as well as their current account imbalance level.

The results showed that credit supply and house prices have a strong and positive relationship. That there is a strong and negative relationship between house prices and current account balance; this relationship is strengthened by increased credit supply. The house prices and current account imbalances relationship is stronger in the pre-crisis period than in post-crisis period for all samples. In addition, the relationship between house price and current account imbalances is stronger in the group of the countries with current account imbalances above the threat threshold of -4% (e.g. Greece and Spain) than in the group of the countries with current account imbalances equal to or below the threat threshold (e.g. Finland and the United Kingdom).

The house price and current account relationship is affected by institutional characteristics, especially the institutional environment in the credit markets. Countries having the credit markets with higher institutional quality have a weaker relationship between house prices and current account imbalances (e.g. Finland and the Netherlands). It is observed that governance features of a country have an impact on monetary expansion in the domestic markets and then on the size of credit supply. They affect the relationship between credit supply and house prices and credit supply rather than the relationship of house prices with current account balance. In addition, a good governance structures can positively affect credit supply and this in turn has a positive effect on the relationship between credit supply and financial liberalisation. The governance characteristic which has greatest impact on this relationship is improvement in regulatory quality. Other features such as government effectiveness, control of corruption have less effect on it. Regulation quality also strongly mitigates the effect of financial liberalisation on credit supply.

CHAPTER SIX
CONCLUSION

6.1. Introduction

This research mainly examines the relationship between credit supply and house prices and their effects on the macroeconomy because developments in the triadic relationship of credit–housing–economy can have serious consequences for the whole economy and may trigger a crisis, even globally.

The research was initially motivated by the recent global financial crisis which had such a damaging impact on so many economies.[127] In spite of prompt and coordinated efforts by most central banks and preventative measures worth trillions of dollars (liquidity injections, security packages and financial incentives), the deepening of the crisis could not be prevented. It is widely recognised that the developments in both mortgage and housing markets lay at the heart of this global crisis (Glindro et al., 2011; Crowe, Dell'Ariccia and Igan, 2012; Xiong, 2013). As earlier mentioned, a house is almost invariably a household's most expensive commodity, and so most households need to borrow from the mortgage markets. This situation creates a close relationship in many economies between mortgage credit and housing markets in many economies. Moreover, since the 1990s the relationship between these two markets has strengthened, thereby affecting the economy more strongly than before, with increasing dependency of domestic financial markets on international markets as a result of financial liberalisation along with advances in technology.

The latest global crisis has increased the importance of investigating the relationship between credit, housing and the economy. This research consists of three essays that focus on this triadic relationship in the context of the EU, one of the most important global actors economically, being the world's second largest economy (Eurostat; IMF). Thus, using a quantitative research

[127] The IMF's (2010) study put cumulative loss at already 25 percent of GDP by end-2009, for advanced countries that experienced a systemic crisis. In addition, there was a cost of governments' intervention in order to prevent the contagion effects of crisis. Both the costs of direct fiscal intervention (such as charging operations-from the sale of assets taken into public ownership etc.) and the cost of indirect intervention (through guarantees) are very huge. For example, advanced G-20 economies committed to making an average of 25 percent of GDP available for support operations.

methodology, the aim is to make a contribution to the literature by examining this relationship from various angles (e.g. current account imbalances and the institutional environment).

This chapter is structured as follows: Section 6.2 presents a summary of the findings and their implications; Section 6.3 argues the contribution of this research to the literature as well as summarising it; and Sections 6.4 and 6.5, respectively, discuss the limitations of the research and make suggestions for further research.

6.2. Research Findings and Implications

6.2.1. Private Credit and House Prices from a European Perspective

The first empirical essay, Chapter 3, examines the relationship between private credit supply and house prices in the EU in the different perspectives (e.g. monetary policy, house price boom and credit boom). The empirical analysis, which follows a vector autoregressive (VAR) approach, explores whether there is a dynamic relationship between credit supply and house prices at both a cross-country and a country level by grouping the countries. These groups were determined according to monetary policy (Eurozone and non-Eurozone), sovereign debt crisis experience (the GIIPS group), whether they experienced a house price boom and credit boom simultaneously before the global financial crisis (the GIIS group) and the main reason for the sovereign debt crisis (the IS group).[128]

The cross-country results show differences in terms of both size and direction of this relationship as well as the existence of causality in the lag order one. The results indicate a dynamic relationship between credit supply and house prices for all cross-country samples, but with differing magnitudes. Comparing the different samples, house price proves to be strongly influential on credit supply in the IS group (Ireland and Spain). In addition, there is a causal relationship between credit supply and house prices in all groups in one quarter lag – with the exception of the two sub-groups GIIPS and GIIS – although there are differences in the direction of the relationship among the samples.The sample as a whole demonstrates a two-way causal relationship, while both the Eurozone and non-Eurozone sub-groups show one-way causality. However, the direction of causality in the Eurozone is from house price to credit,

[128]In the empirical analysis, the Eurozone countries comprise Austria, Belgium, Germany, Greece, Finland, France, Ireland, Italy, the Netherlands, Portugal and Spain; non-Eurozone countries comprise Denmark, Sweden and the UK; the GIIPS group comprises Greece, Ireland, Italy, Portugal and Spain; the GIIS group is the GIIPS group minus Portugal; and the IS group comprises Ireland and Spain.

while the opposite is true in the non-Eurozone. Thus, it can be concluded that monetary policy affects the size and direction of the relationship between credit supply and house prices.

Among the sub-groups of the Eurozone – i.e. sharing a monetary policy – there are differences in both the size of the relationship as well as the causality. For example, the IS group has a one-way causality between credit supply and house prices in the lag order one, while there is no causality in the GIIPS and GIIS groups in the same period: that is, in this group credit supply and house prices move independently. One of the reasons can be some differences between the countries included in these sub-groups relating to their economic structure and institutional environment etc.

The direction of causality can be taken to indicate how strongly credit supply affects house prices, or vice versa. Given that there is one-way causality between credit supply and house prices in the Eurozone group and that its direction is from house price to credit supply, it can be concluded that the housing markets, not the credit markets, are decisive in the relationship. In this case, contrary to expectations, monetary policy alone may have a weak impact on housing markets. As such, it is important to consider both credit policies and housing market policies together[129] because in the Eurozone, credit markets are governed by policy from a supranational authority (the European Central Bank [ECB]) while housing markets are governed by national policy. This highlights the need for close coordination between the ECB and national authorities in order to achieve the objectives of financial and economic stability.

The situation of the non-Eurozone group, the causality of which goes from credit to house prices, is quite the reverse. The unilateral relationship shows that the credit market is more important than the housing market in the relationship between credit supply and house prices. Thus, it can be argued that, in non-Eurozone countries, monetary policy can mitigate or even eliminate the likelihood of financial and economic instability resulting from this relationship more effectively than in the Eurozone group.

Theoretical explanation of the direction of the causality for the Eurozone and non-Eurozone could differ. The life-cycle approach offers a better way of explaining the relationship between credit and house prices in the Eurozone, whereas in the non-Eurozone the monetarist approach is a better fit. In the Eurozone, the wealth and collateral effects on the private sector (i.e. households and firms) of rising house prices are an increase in credit demand and hence the supply of credit. In the non-Eurozone, due to increased credit affordability through monetary

[129] Housing polices include: investment in social housing, rent controls, and support for alternative types of rental housing (such as co-ops).

expansion, housing demand and consequently credit demand increases and causes an upward movement of house prices. On the other hand, the results of the first essay partly confirm the theory. The theory suggests that credit and house prices mutual reinforcing, i.e. there is a two way causality between them at cross-country level. However, the findings show that the sub-samples of the EU have a one way causality between them, except for the whole sample.

The results at country level are similar to the cross-country results. In the five GIIPS countries of the Eurozone (i.e. Greece, Ireland, Italy, Portugal and Spain), there is a positive relationship between credit supply and house prices, but the size and direction of this relationship, as well as the outputs, change from country to country in the lag order one. The effect on credit of a change in house prices is, among these countries, largest in Italy, followed by Spain. In Italy, there is a two-way causality between credit and house prices, which is a one-way in Spain, whereas there is no causality in Greece or Ireland in the same period. While in Italy and Spain the causality starts in the lag order one, in Greece and Ireland it starts in the lag orders three and four respectively. So, despite a common monetary policy, not only do the size and direction of the relationship vary from country to country, but so does the length of time of interaction

Thus, these results confirm the hypotheses of this essay: there is a relationship between credit supply and house prices in the EU; Monetary policy makes a difference in this relationship in the EU when it is determined in two different way (national and non-national levels – i.e common monetary policy; and this relationship differs at both cross-country and country level, even under a common monetary policy.In this case, one conclusion that may drawn is that a different monetary policy affects the direction and strength of causality between house prices and credit. Another is that like non-Eurozone if the monetary policy is determined independently, i.e. nationally, it can be changed according to their changing economic conditions and used in an efficient way. Thus, with the monetary policy it is possible to create more impact on this relationship. In the case of common monetary policy, this cannot be done by individual country in the Eurozone. The single monetary policy therefore may produce different outputs for individual countries in the Eurozone because of some differences among the countries relating to institutional environment, economic structure and development level of mortgage markets etc. For example, the origin of the law system can create differences between the countries with respect to the relationship of credit with house prices. Indeed, the findings of La Porta et al. (1998) show that origin of the law system (e.g. French or Scandinavian or German origin civil law or Common Law) affects the development of the financial sector and hence of housing finance system, such as Ireland and Spain, which have

Common Law and French Law orgin civil law respectively. In addition, the countries' law system can have the same origin law system, but the level of the enformencement of law may be different as seen in Portugal, Spain and Italy, that have the French origin civil law. The Institutional Index produced in the chapter 4 confirms this. The index scores show that France has a higher position than Italy (see Figure 4.3). Again, although countries have the liberal order, the liberalisation degree of their economies changes country to country as in the EU member countries (see Appendix 4.10) and this may influence the amount of foreign capital inflows and then credit supply in the domestic markets.

Again, religion issues and cultural features of the society (e.g. customs and traditions) can also make a difference relating to the relationship between credit and house prices by affecting the degree of risk taking, transaction costs and the structure of financial system (i.e.whether bank-based or market-based), along with political and economic factors. Stulz and Williamson (2003) have showed that Catholic countries have dramatically weaker creditor rights than other countries while Kwok and Tadesse (2006) found that countries with lower uncertainty avoidance have more of a tendency towards a market-based system than countries with higher uncertainty avoidance. Licht, Goldschmidt and Schwartz (2007) indicated that countries with a more individualistic culture might be less corrupt and thereby incur lower transaction costs through market participation. The EU's case proves them.

Looking at the EU countries, it can be seen that some have financial markets with a market-based structure (e.g. Belgium and the Netherlands), while some have a bank-based system (e.g. Ireland and Italy), even though all have an advanced financial sector (Bijlsma and Zwart, 2013). This situation is naturally reflected in the configuration of mortgage markets. In countries with market-based financial sector, funds for mortgage credits are created to a much greater degree from issues of the securities than in those with bank-based financial markets. Moreover, the types of contracts (fixed-rate or variable-rate) that predominate might be affected by cultural factors (e.g. risk avoidance). Variable-rate contracts have dominated new loans in Ireland, while fixed-rate contracts have been the norm in the Netherlands (ECB, 2009). Culture may also be one of the factors influencing house buyers' preferences with regard to duration of mortgage loan: for example, although the mortgage system in a country may well allow loans over a longer term (e.g. 40 years), a majority of home buyers might still choose a shorter duration (e.g. 20–25 years) (e.g. Luxembourg).

The findings of the sample as a whole concur, to some extent, with those of a previous cross-country study (Goodhart and Hofmann, 2008),[130] which shows a two-way causality between credit and house prices. However, since the literature review revealed no study focusing on the Eurozone versus the non-Eurozone, or on the GIIPS or its sub-groups, it was not possible to make any further comparisons.

When comparing the findings of previous studies at individual-country level, some overlap can be seen. For example, our results were similar to those of Brissimis and Vlassopoulos (2009), who focused on Greece, which has a causality going from house prices to credit. However, in contrast, Gimeno and Martínez-Carrascal (2010) found that in Spain the causality is from credit to house prices, the opposite of this study's finding. An overall similarity to all country-level studies reviewed is the existence of a relationship between credit and house prices. Differences arise about causality: whether it exists and, if so, whether it is unilateral or bilateral and whether its direction is from credit to house prices or vice versa. These differences may be strongly affected by the time period covered, the scope of the variables and the data used for the analysis.

Following on from these findings, we suggest that besides the monetary policy, other factors might play a role in the interaction between credit and house prices and hence account for the differences between countries; these include the existence of causality and its direction, economic structure, type of housing finance system, a sensitivity of the external development and institutional environment. Also it is possible that, in the Eurozone under the current conditions, where the causality goes from house prices to credit supply, monetary policy alone cannot achieve good governance of the relationship between credit and house prices and assure the stability of both markets at the Eurozone and country level. In fact, the common monetary policy may increase the risk of instability in both the credit and housing markets in some Eurozone member countries, as seen in the case of the GIIPS countries, because it produces different effects than those targeted. The consequences of the monetary policy pursued by the ECB in the pre-crisis period (1999–2007) proved this, producing a tight monetary policy effect in Northern European countries but a loose effect in Southern European countries (Gros and Baldwin, 2010; Shambaugh, 2012). As a consequence, in the latter countries (e.g. Italy and Spain) the inflation rate was above the EU average in this period and real interest rates were

[130] Goodhart and Hofmann (2008) considered 17 industrialised countries of the OECD, so their sample is slightly different from ours. However, the majority of their sample consists of the same EU countries as in our sample, with the exception of Austria, Greece and Portugal. With this level of crossover, it is reasonable to assert that the results can be meaningfully compared.

below the EU average.[131] Monetary policy is considered to be one of the reasons for the GIIPS crisis (Buzaglo, 2011; Wyplosz, 2012; De Grauwe, 2012). These factors indicate that the ECB, the main purpose of which is to ensure price stability in the Eurozone, is not entirely successful in achieving its goal across all Eurozone countries (see, for example, periphery countries). Thus, it is argued that greater institutional and economic convergence is desirable and would lead to greater stability through a common monetary policy in the Eurozone countries. In the Eurozone, the differences at cross-country and country level may also be taken as an indication of the level of integration of both the mortgage markets and housing markets. We conclude that these EU markets have not fully converged. This aligns with previous studies on the integration of the mortgage markets (Wyman, 2003; Neuteboom, 2008; Aalbers, 2009; Andión, Mashide-Sanfiz and Penebad, 2010).

These results have policy implications at individual country level as well as at EU level. First, a consideration of the direction of causality may contribute to more efficient macro and micro policies on credit and housing markets. This is particularly important in the Eurozone, where credit markets are governed by common monetary policy and housing markets by national policy, implying the need for close coordination between the ECB and national authorities. In contrast, non-Eurozone countries have autonomy over both markets. Second, in aiming to manage the relationship between credit and house prices, policy-makers should also be aware of differences between countries with regard to other factors (e.g. economic structure, institutional environment) besides monetary policy. Finally, in order to achieve deeper integration of the EU mortgage markets, policy-makers should take into account the interaction between credit and house prices not only at country level but also at EU level and among its sub-groups.This would also support more deepening of rhe economic integration across the EU.

6.2.2. Measuring the Insitutional Features of European Mortgage Markets

Following on from the first essay, the second essay, Chapter 4, focuses on the institutional features of the EU mortgage credit markets. A benchmark was created for the institutional features of these markets using factor analysis. The Institutional Index was produced along with sub-indices representing the five dimensions of the institutional environment. These indices show the quality of the institutional environment of the mortgage markets with regard to

[131] In 2007, while EU average was 2.2%, the inflation rate was 3% in Greece, %2.8 in Spain and 2.9% in Ireland, and Portugal (EC, 2011a).

different institutional dimensions (i.e. legal, openness, financial, transparency and cultural). For a robustness check, alternative methods were used: scoring, linear regression model and graphical. First, the robustness of the Institutional Index was checked using the scoring method. Second, using the indices produced, the relationship between financial intermediation and institutional features was examined with the expectation that the institutional environment positively affects the development of financial intermediaries in the mortgage markets. For this, the ordinary least squares (OLS) technique and a graphical method were applied. The results of the regression analysis prove the robustness of the Institutional Index and its sub-indices and indicate that the indices accurately describe reality and thus can be used as benchmarks for the quality of mortgage markets.

According to the Institutional Index scores, the countries in or above the EU (28) average (e.g. Northern European countries) have credit markets with a higher affordability of credit, easier access to financial services and credit information, etc. In addition, their credit markets are more liberalised and have greater transparency, while enjoying higher efficiency with regard to legal framework, stronger property and legal rights, etc. Such countries (e.g. Finland, Sweden, the Netherlands and the UK) are also more relaxed with less restraint on habits and customs. As expected, these countries have mortgage markets with a higher-quality institutional environment.

The results of the analysis also prove the hypothesis of this essay. They provide empirical evidence that the institutional characteristics in the mortgage markets of EU member countries are heterogeneous and that the institutional environment creates differences among their mortgage markets. In addition, these findings show that financial intermediation in those countries with a high-quality institutional environment is more developed with respect to depth, accessibility and efficiency of the financial intermediaries. The findings of this essay also indicate differentiation between Northern and Southern European countries as well as Central and Eastern European countries. Northern European countries (e.g. Finland and Sweden) are at the top of the ranking in all the indices while the periphery countries (e.g. Greece and Italy) and Central and Eastern European countries (e.g. Poland and Romania) are below the EU average. In other words, Northern European countries have credit markets with a more efficient legal framework, easier access to financial services and credit information, are more liberalised and endure less restraint on customs, etc. Thus, the Institutional Index numbers show a large discrepancy among EU mortgage markets relating to their institutional environment: these markets still remain diverse. A further, expected, result is that institutional quality contributes to the development of financial intermediation in the mortgage markets and thus the development of financial systems. In conclusion, it is argued that our indices may be taken as indicators of the quality of the institutional environment in EU countries as well as the development stage of mortgage markets.

These results are in line with previous studies that constructed indices for mortgage markets (Wyman, 2003: London Economics, 2005; IMF, 2008), although these studies considered only a few institutional features of EU mortgage markets. We also find our results being consistent with previous studies examining the role of the institutional environment on the financial sector (La Porta et al., 1998; Beck et al., 2003; Kwok and Tadesse, 2006; Aggarwal and Goodell, 2010; Ashraf, 2017).

Furthermore, the Institutional Index scores can be taken as indicators of the integration of EU mortgage markets. It seems that these markets still exhibit significant heterogeneity and that the integration of EU mortgage markets is improving only slowly despite the European Commission's attempts to harmonise them since the late 1980s. As such, these results concur with those of previous studies on the integration of EU mortgage markets (EC, 2007; Dübel, 2008; Aalbers, 2009, 2010; Martins, Martins and Stevenson, 2015). Some institutional features (e.g. customs) take longer than others (e.g. regulations) to change, but all can be affected over time. One suggestion is that better convergence of institutional environments, in addition to addressing other issues (e.g. language barriers and market entry costs), may contribute to greater harmonisation of the mortgage markets. If so, convergence of credit markets will improve the convergence of EU housing markets by shaping preferences of economic agents (e.g. households, financial intermediaries). Furthermore, greater convergence may support higher efficiency of the ECB monetary policy in the Eurozone markets and, thus, greater financial stability.

The positions of the countries in the Institutional Index and sub-indices can also help to explain differences between the Eurozone countries as far as the relationship between credit supply and house prices is concerned, with regard to the size and direction of the relationship, as well as its timing. Our results indicate that the institutional features of the credit markets might be a reason for the differentiation between the countries in the Eurozone and that rapid harmonisation of the institutional environment could contribute to reducing the differentiation.

At the same time, these results highlight some interesting anomalies, specifically with regard to Italy and Estonia. With respect to institutional quality, despite Italy being one of the most advanced economies of the EU its mortgage market comes bottom in the institutional ranking. Among Central and Eastern European countries, only Estonia is above the EU average, but still has a less developed economy than that of Italy. It seems that having an advanced economy does not necessarily mean a well-developed mortgage credit market. Another interesting point is the case of countries (e.g. Greece and Italy) that have high owner-occupancy rates and less developed mortgage credit markets. These countries' occupancy rates are above the EU average (70.1%), but the institutional quality of their credit markets is below the EU average.[132] In contrast, Germany demonstrates the reverse, i.e. a high-quality institutional environment and a low owner-occupancy rate.[133] The situation in Greece and Italy might be explained by cultural factors (e.g. traditions) or social aspects (e.g. close family relationships), while Germany's position might largely be explained by its highly developed rental sector.

The findings of the second essay also have implications for policy-makers at both country and EU level, who are advised to pay much more attention to the institutional environment if they are to succeed in achieving more developed and better-functioning mortgage credit markets, as well as more improved integration of these markets among EU members.

6.2.3. House Prices and Current Account Imbalances; Credit Channel and Institutions

The third essay, Chapter 5, empirically researches the relationship between house prices and current account imbalances by following the financial liberalisation approach and considers the role of the institutions in this relationship. For this purpose, asimultaneous equations model was used employing a three-stage least squares (3SLS) estimation technique. In the first stage of the empirical analysis, different time periods were considered to look for differences between pre- and post-crisis periods and the simultaneous equations model was estimated; the countries were then classified according to their current account imbalances and the model was re-estimated. In the second stage, to investigate the role of the institutional environment in the relationship between house prices and current account imbalances, the institutional features of both the credit markets and governance structures were included in the model, and the model was tested.

[132] Occupancy rates of Italy and Greece were 74% and 73% , respectively, in 2016. The percentages in the population of owner-occupants with a home loan, which is an indicator of mortgage market accessibility, were 14.8% for Greece and 16.8% for Italy in 2016. Their mortgage debts as a share of GDP, which is an indicator of the deepening of these markets, were 34.2% for Greece and 22.3% for Italy in 2016 (Eurostat, 2017: EMF, 2017).

[133] Germany's occupancy rate was 51.7% in 2016. The indicators of the development of mortgage markets were above the EU average. For example, the mortgage debt to GDP ratio was 42.3% in 2016 while owner-occupants with a home loan relative to population was 26.2% (Eurostat and EMF, 2017).

The findings of the empirical analysis can be distilled into four main points. First, credit supply has a positive and strong relationship with house prices as well as with financial liberalisation; second, there is a positive and significant relationship between house prices and current account imbalances, and an increasing credit supply strengthens this relationship; third, the relationship between these two dynamics is stronger in the pre-crisis period than in the post-crisis period for countries with current account imbalances both above and below the threat threshold (i.e. -4%). However, the relationship is much stronger in countries above the threshold (e.g. Ireland and Spain) than those below (e.g. the Netherlands and the UK); fourth, institutional characteristics can affect the size of the relationship between house prices and current account dynamics and reduce the strength of this relationship. The institutional quality of the credit markets affects the relationship of house prices with current account balance much more than that of governance features. Governance features have more impact on the credit supply. For example, in those countries having credit markets with higher institutional quality, the relationship between house prices and current account dynamics is weaker. The same is true for governance features: an improvement in governance structure positively affects the relationship between credit supply and financial liberalisation, and thus the magnitude of credit supply. In addition, the impact on credit supply of goverenance features via financial liberalization is larger than that of the institutional features of credit markets. Moreover, improvements in regulatory quality have a much greater impact than other governance characteristics and can mitigate the effect of financial liberalisation on credit supply much more effectively.

These results have proved the hypotheses of this essay: that increasing house prices impair current account balances via the credit channel that transmits developments in house prices to the economy. Generally, credit supply has been increased by a process of financial liberalisation, and increased credit supply strengthens the link between house prices and current account dynamics. These results also confirm that institutional features can affect this relationship and thus result in different outcomes for different countries because of different environment to respect with governance, legal and cultural features of the economy and their enforcement even if they argued the existence of different reasons behind on increasing house prices.

Our conclusions are in line with Favilukis et al., (2012), who followed the financial liberalisation approach, as well as with previous studies that followed different approaches (i.e. banking glut, savings glut and demand shock) (Shin, 2001; Sa and Wieladek, 2015; Ferrero, 2015), all of which demonstrated the existence of a strong relationship between house prices and current account imbalances.

These findings can be also seen as evidence of the importance of the institutional environment in addition to other factors (e.g. economic structure and external developments) that affect the triadic relationship (credit–house price–macroeconomy).

This view is supported by the rankings of EU countries in the Institutional Index and sub-indices, revealing significant heterogeneity in the institutional characteristics of EU credit markets (e.g. availability of financial services, efficiency of legal framework, level of corruption, etc.), and by the variation in governance features among EU countries (e.g. regulation quality, effectiveness of government and control of corruption).

These findings of Chapter 5 support those from the previous two. They indicate: the significance of the relationship between the credit and housing markets for the stability of both the financial sector and the economy; the importance for the economy of the credit channel in transmitting developments in the housing markets; and the importance of the institutional environment in managing this relationship.

The findings of the third essay have important policy implications at both EU and individual-country level. If policy-makers were more aware of the link between house prices and current account dynamics, they could do more to reduce the risk of instability in the economy over the long term. In determining macroeconomic policies, specifically in the context of addressing large current account imbalances with a view to stabilising the economy, they are advised to account for the interaction between credit and housing markets. For the Eurozone countries, the ECB's monetary policy strategy, which since 1999 has been set as a common policy for Eurozone members, is particularly important as it might be having a different impact depending on the individual economy, as evidenced by the sovereign debt crises. Policy-makers are also advised to pay more attention to the institutional environment to obtain better outputs while managing their economy's resources. This particular issue is more significant for EU countries, with the EU being a regional economic bloc having a goal of achieving economic union among its member states.

6.3. Summary and Contribution

In summary, we have found a relationship between credit supply and house prices, with differences within the EU, at cross-country and country level, relating to the size and direction of this relationship; and we also have found differences among EU mortgage markets relating to the quality of the institutional environment. Furthermore, we have shown that there is a dynamic relationship between house prices and the external balance of the economy (i.e. current account balance) and that credit supply strengthens this relationship, again with differences across the EU with respect to both pre- and post-global crisis periods and the level of current account imbalances.

A common thread through all the essays presented here is the presence of significant heterogeneity in the triadic relationship (credit–housing–economy) in the EU. Clearly, one of the reasons for this is the variation in institutional characteristics among EU member states.

This research makes a contribution to the existing literature. The first essay's aim was to examine the dynamic relationship between credit supply and house prices: although there are numerous studies in this field, most are at country level (e.g. Gerlach and Peng, 2005; Oikarinen, 2009; Öhman and Yazdanfar, 2018) with only three cross-country studies (Collyns and Sendhadji, 2005; Goodhart and Hofmann, 2008; Jordà, Schularick and Taylor, 2015). Thus, neither direction nor size of this interaction at cross-country level has yet been fully examined. In addition, neither of the cross-country studies focused on the interaction between credit and house prices in the EU alone, which is in a regional bloc at an advanced stage of economic integration. Nor are there any studies on this relationship that consider Eurozone and non-Eurozone countries separately, which have different monetary policy. Also, with regard to the EU, the particular case of the GIIPS countries, which experienced a sovereign debt crisis, has not been investigated at a cross-country level. Thus, the contribution of the first essay lies in its examination of the relationship between credit supply and house prices at both cross-country and country level in the EU, from different perspectives (e.g. monetary policy, house price boom and credit boom) and its investigation of the direction and size of this relationship. Second, it considers the effect of monetary policy on this relationship and compares sub-groups within the EU, as well as individual countries. In doing so, it reveals the importance of the direction of causality between credit and house prices in governing their relationship with a view to implementing more efficient micro and macro policies in the economy.

As a follow up on the final findings of the first essay, the second essay aims to focus on measuring the institutional features of the mortgage credit markets. A literature review reveals a vast amount of studies emphasising the significance of institutional characteristics (e.g. Malpezzi, 1989; Maclennan, Muellbauer and Stephens, 1998; Calza, Moncelli and Stracca, 2013; Martins, Martins and Stevenson (2015), yet very few actually measure them by selecting particular features (e.g. Wyman, 2003; London Economics, 2005), and no previous attempt was found to create a benchmark for the institutional quality of mortgagemarkets. Therefore, the second essay's contribution is to produce an Institutional Index, which represents multiple dimensions of the institutional features of EU mortgage markets; to create a benchmark for their institutional quality; and to examine the relationship between institutional quality and the development of financial intermediation.

The third essay investigates the relationship between current account imbalances and the house price boom–bust cycles that became the defining characteristics of the period leading up to the recent global financial crisis. The existing literature shows a large number of studies on this relationship using a savings glut, banking glut and demand shock approach rather than a financial liberalisation approach. In fact, if the degree of economies' financial openness had not reached such a high level, especially since the beginning of 1990s, and if capital had not globalised to the extent it did, neither the savings glut and banking glut nor the demand shock would have materialised to the same extent, and we might not have seen these twin economic problems concurrently reaching such high levels in many countries. Thus, financial liberalisation can be seen as one of the main reasons for monetary expansion and the simultaneous strengthened relationship between house prices and current account dynamics that led to such significant problems in many economies throughout the world. However, based on the literature review, only one study thus far has followed a financial liberalisation approach to examine the relationship between house price movements and current account imbalances (Favilukis et al., 2012). There is thus a gap in the literature concerning the correlation between house price movements and current account imbalances. In addition, there is no study on the effect of institutional features on the relationship between house prices and current account imbalances. Therefore, the third essay follows a financial liberalisation approach to assess the relationship between house prices in current account imbalances through the credit channel and to investigate the role played by the institutions in this relationship. It tests the relationship between house prices and current account imbalances using different model specifications as well as different techniques, and explores the role of institutional features in the relationship between house prices and current account imbalances.

6.4. Limitations of the Research

The main limitations of this research concern data availability: a) the length of data could ideally have been greater, and b) the desired number of variables were not available in all EU countries. First, lack of data prevented the exploration of the relationship between credit supply and house prices for all

EU members. The same is true for the examination of the relationship between house prices and current account imbalances. Thus, the triadic relationship could not be assessed for all EU members. Second, different classifications in the first and fifth esays (Chapters 3 and 5) could not be tested. For example, it was not possible to compare new EU members with old ones.[134]

Third, in Chapter 4, which focused on the institutional features of mortgage markets, had we been able to construct an Institutional Index and its sub-indices in a longer time period. This could have enabled us to see whether; there has been an improvement in EU countries' institutional environment since the establishment of the EU as well as of the Eurozone; the extent to which the EU polices have convergenced the institutional environment between member countries; and the extent to which, these policies have achieved convergence between member countries relating to the development of financial intermediation.

Fourth, a lack of data for several variables limited the model specification for our empirical analysis (e.g. selection of proxy variables in Chapter 3). This was also an obstacle in checking the robustness of our estimation results for the benchmark models. Finally, criteria for measuring the institutional features of credit markets are lacking because there is no consensus in the literature regarding the key criteria for institutional quality.

6.5. Future research

Much remains to be done to extend and improve this work. A possible future area of study would be to investigate the optimum type of monetary policy to coordinate Eurozone mortgage markets with national housing market policies. One could explore how other factors, such as institutional features, economic structure and differences in housing finance systems, affect the interaction between credit supply and house prices, in order to identify appropriate and efficient macroeconomic policies in the credit and housing markets.

This study has shown how rising housing prices can affect current account balances through wealth effect, collateral effect, investment effect, competitiveness effect and production effect. However, it is crucial to determine which of these effects has the most detrimental impact on current account balance. In doing so, policy-makers will be empowered to take measures to mitigate or obviate those risks that may lead to housing issues in the economy. In addition, the results of this research indicate that increasing credit supply strengthens the relationship between house prices and

[134] New EU members are those that joined on 1 May 2004 or later. They are: Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia.

current account imbalances. From this findings, one possible future work would be to examine the effect of the causality between house prices and monetary expansion on the relationship of house prices with current account imbalances.

Moreover, it might be fruitful to investigate the impacts of monetary expansion on current account imbalances, as these effects were not included in this study. Based on literature review, we are yet to see a full examination of the effects of increasing monetary expansion on current account balance. In this scope, also one could examine whether there is a causal relationship between current account imbalances and monetary expansion

In addition, it is important to examine why foreign capital inflows are directed towards a country's housing sector, in order to control the risks that may arise in that housing sector. Finally, there is a need for more detailed research into the reasons behind the slower integration of mortgage markets relative to product markets.

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APPENDICES

Chapter Three

Appendix 3.1. Data Description and Source

CODE	VARIABLES	DATA DECRIPTION AND SOURCE
cip	Consumer price index (2010=100) (%)	Definition: Consumer price index (CPI) is defined as the change in the prices of a basket of goods and services that are typically purchased by specific groups of households. Source: The Organization for Economic Co-operation and Development (OECD)
credit	Private Credit/ GDP (%)	Definition: It shows that total bank lending to private sector is divided by the GDP. Total credit is in terms of billions of US dollar. It covers total *credit to* the non-financial sectors (households and non-financial corporations excluding general government lent by deposit money banks and other financial institutions Source: Bank for International Settlements (BIS)
dfint	Term spread (%)	Definition: Term spread is also called interest rate spread. It measures the difference between long term and short term interest rates. It is calculated by author. Source: The Organization for Economic Co-operation and Development (OECD)
gdp	Economic activity and total income (as of current billions of the US dollar)	Definition: Gross domestic product (GDP) is total of all the final goods and services produced as monetary value within the borders of a country in a specific period. GDP shows the size of economic activity as well as of total income earned in an economy in a specific period. Source: Bank for International Settlements (BIS)
hprice	Nominal house price index (%) (2010=100)	Definition: House price index measures the price changes of residential housing. Source: The Organization for Economic Co-operation and Development (OECD)
lint	Long- term interest rates (%)	Definition: Nominal long-term interest rates are long term government bond yields and are calculated as monthly averages (non seasonally adjusted data). They refer to central government bond yields on the secondary market, gross of tax, with a residual maturity of around 10 years. Source: The Organization for Economic Co-operation and Development (OECD)
sint	Short-term interest rates (%)	Definition: *Short-term interest rates are* rates on money markets for different maturities (overnight, 1–12 months. Source: The Organization for Economic Co-operation and Development (OECD)

Appendix 3.2. Descriptive Statistics

Code	Sample	Mean	Standard Deviation	Minimum	Maximum
hprice	1050	91.07219	21.13372	38.4	158.8
credit	1050	99.49153	31.96031	35.8	199.5
gdp	1050	946921.1	1004578	88021.75	4030455
dfint	1050	1.781952	2.341615	-4.7	18.71
sint	1050	2.12E+00	1.844475	-0.77	10.8

Note that: *hprice:* housing prices, *credit:* private credit/GDP,*dfint*: term spread, *gdp:* economic activity, *sint*: short-term interest rates.

Appendix 3.3. Correlation Matrix

	Hprice	credit	gdp	dfint	sint
hprice	1.0000				
credit	0.3319*	1.0000			
gdp	0.1962*	0.1426*	1.0000		
dfint	-0.0979*	-0.1202*	-0.1456*	1.0000	
sint	-0.3823*	-0.0924*	-0.0685*	-0.3771*	1.0000

Note that: Asterisk denotes statistical significance at the 0.05 level. *hprice:* house prices, *credit:* private credit/GDP, *dfint*: term spread, *gdp:* economic activity, *sint*: short-term interest rates.

Appendix 3.4. Correlation Matrix

	$dlnrlhprice_{t-1}$	$dlnrlcredit_{t-1}$	dlnrlgdp	drdfint	drsint
$dlnrhprice_{t-1}$	1.0000				
$dlnrcredit_{t-1}$	0.2331*	1.0000			
dlnrgdp	0.1903*	0.0334*	1.0000		
drdfint	-0.0678*	0.0072*	-0.0133	1.0000	
drsint	0.1001*	0.0930*	0.1089*	-0.1468*	1.0000

Note that: Asterisk denotes statistical significance at the 0.05 level. $dlnhprice_{t-1}$: first difference real house prices with logarithmic transformation, $dlnrcredit_{t-1}$: first difference credit with logarithmic transformation,*dfint:*first difference term spread, *dlnrgdp:* first difference economic activity with logarithmic transformation, *drdfint*: first

Appendix 3.5. Multicollinearity and Diagnostic Tests for Private Credit Equation

Appendix 3.5/A: Coefficients for Private Credit Equation (a)

	Unstandardized coefficients		Standardized Coefficients			95% Confidence interval for Beta		Collinearity Statistics	
	Beta	Standard Error	Beta	**t-statistics**	**P-value**	Lower bound	Upper bound	Tolerance	VIF (b)
constant	61.085	4.856		12.58	0.000				
gdp	6.858E-6	3.60E-06	0.216	7.456	0.000	0.000	0.000	0.961	1.040
hprice	0.525	0.047	0.347	11.117	0.000	0.432	0.617	0.825	1.212
sint	-1.235	0.532	0.071	-2.323	0.020	-2.278	-0.192	0.854	1.171

(a) Dependent variable is private credit (i.e. credit).
(b) VIF is variance inflation factor.
(c) *credit:* private credit/GDP, *gdp*: economic activity, *hprice*: house prices, *sint*: short-term interest rates.

Appendix 3.5/B: Collinearity Diagnostics for Private Credit Equation (a)

				Variance Proportions		
Dimension	**Eigenvalue**	**Condition Index**	**Constant**	**gdp**	**hprice**	**sint**
1	3.179	1.000	0.00	0.03	0	0.02
2	0.508	2.502	0.00	0.49	0	0.35
3	0.294	3.288	0.02	0.47	0.04	0.37
4	0.118	4.803	0.06	0.01	0.96	0.26

(b) Dependent variable is current supply (i.e.credit).

Appendix 3.6. Multicollinearity and Diagnostic Tests for House Price Equation

Appendix 3.6/A: Coefficients for House Price Equation (a)

	Unstandardized coefficients		Standardized Coefficients			95% Confidence interval for Beta		Collinearity Statistics	
	Beta	Standard Error	Beta	t-statistics	P-value	Lower bound	Upper bound	Tolerance	VIF (b)
constant	77.177	2.215		34.841	0.000	72.831	81.524		
gdp	3.595E-6	0.000	0.171	6.442	0.000	0.000	0.000	0.939	1.064
credit	0.241	0.017	0.364	14.028	0.000	0.207	0.275	0.980	1.021
dfint	-3.494	0.242	-0.380	-14.465	0.000	-3.968	-3.020	0.959	1.043

(a) Dependent variable is house price (i.e. hprice).
(b) VIF is variance inflation factor.
(c) *hprice:* house prices, *credit:* private credit/GDP, *gdp:* economic activity, *difint*: term spread.

Appendix 3.6 /B: Collinearity Diagnostics for House Price Equation (a)

			Variance Proportions			
Dimension	**Eigenvalue**	**Condition Index**	**Constant**	**gdp**	**credit**	**lint**
1	3.273	1.000	0.01	0.03	0.01	0.02
2	0.510	2.534	0.00	0.71	0.01	0.09
3	0.178	4.289	0.02	0.12	0.18	0.75
4	0.139	5.193	0.07	0.14	0.81	0.14

(b) Dependent variable is house price (i.e.hprice).

Appendix 3.7. Estimation Results for Cross-country Level (No Fixed Effects)

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		Whole Sample	Eurozone	Non-Eurozone	GIIPS	GIIS	IS
Panel A: Private Credit	$dlncredit_{t-1}$	-.01124	-.02258*	.02389***	-.06231**	-.07064**	-.05122
		(0.343)	(0.063)	(0.000)	(0.015)	(0.053)	(0.107)
	$dlnrhprice_{t-1}$	.08687**	.08240**	.11715	.14600	.17736	.20129**
		(0.043)	(0.038)	(0.341)	(0.135)	(0.151)	(0.062)
	dlnrgdp	.98727***	.98065***	1.00698 ***	.97418***	.96517***	.97923***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	drsint	-.53745	-.10937	-1.36291	-.95047	.96517	-2.16510
		(0.359)	(0.861)	(0.130)	(0.419)	(0.147)	(0.111)
	drdfint	-.27588	-.17572	-.36955	-.97356	-1.59030	-.92987
		(0.532)	(0.675)	(0.516)	(0.250)	(0.168)	(0.223)
Panel B: House Price	$dlnrhprice_{t-1}$	-.35897***	-.39778***	-.03011	-.17164**	-.12859	-.11663
		(0.000)	(0.000)	(0.576)	(0.040)	(0.176)	(0.250)
	$dlncredit_{t-1}$	.02194***	.01168	.05590***	.00077	.00500	.01651
		(0.005)	(0.232)	(0.008)	(0.968)	(0.840)	(0.595)
	dlnrgdp	.02670***	.02140**	.05721***	.01926	.01191	.04067***
		(0.001)	(0.038)	(0.002)	(0.325)	(0.621)	(0.353)
	drsint	-.45190	-.44354	-.87341	-1.5921*	-1.98101**	-3.21479***
		(0.158)	(0.363)	(0.212)	(0.095)	(0.068)	(0.010)
	drdfint	-.27211*	-.36511	-.01563	-.967285	-1.28197*	-1.11021
		(0.077)	(0.298)	(0,975)	(0.122)	(0.091)	(0.178)

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The variables are transformed in logarithms except for short term interest rates and term spread. Also, all variables with their first difference at real terms. The lag order is one for all samples. *dlnrlhprice*: house prices, *dlncredit*: private credit, *dlnrgdp*: economic activity (and total income); *dlrsint*: short- term interest rates; *drdfint*: term spread.

Appendix 3.8. Estimation Results of Individual Countries

		Model 7	Model 8	Model 9	Model 10	Model 11
		Greece	**Ireland**	**Italy**	**Portugal**	**Spain**
panel A: Private Credit	$dlnrcredit_{t-1}$	.7171922*	.6142489***	.4971709	.8157334**	.7860041***
		(0.057)	(0.000)	(0.307)	(0.015)	(0.008)
	$dlnrhprice_{t-1}$	.4296974	.3230662	1.312778**	.075235	.7936545***
		(0.225)	(0.120)	(0.011)	(0.858)	(0.004)
	$dlnrgdp_{t-1}$	.6301786	.5007992**	-.5712269	.8196364	.8423665***
		(0.105)	(0.012)	(0.247)	(0.023)	(0.006)
	$drsint_{t-1}$	-0.5512004	1.231219	1.32744	.075235	1.372763
		(0.633)	(0.543)	(0.483)	(0.540)	(0.494)
	$drdfint_{t-1}$	-.5526653	3.074431***	3.122372*	-.0345742	3.347631**
		(0.180)	(0.004)	(0.055)	(0.971)	(0.045)
	constant	.004572	.0082692	.0035365	.0031	.0032043
		(0.606)	(0.245)	(0.583)	(0.629)	(0.588
Panel B: House Price	$dlnrcredit_{t-1}$	.1526065	.0150148	.0092231*	-.0673832	.0491899
		(0.137)	(0.825)	(0.067)	(0.370)	(0.520)
	$dlnrhprice_{t-1}$	538119***	.6317447 ***	.8572058***	.6275453***	.8347969 ***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	$dlnrgdp_{t-1}$	-.0872816	.0271406	-.0875845*	.0039005	-.0421553
		(0.410)	(0.761)	(0.082)	(0.961)	(0.597)
	$drsint_{t-1}$	-.607551*	.64557	.3603655	-.0830031	-.7573982
		(0.053)	(0.475)	(0.363)	(0.824)	(0.144)
	$drdfint_{t-1}$	-.047452	-.3056249	-.1620197	-.1600239	-.4911003
		(0.673)	(0.527)	(0.329)	(0.453)	(0.254)
	constant	-.0041771*	.0022582	-.0004544	.0000437	.0003035
		(0.084)	(0.478)	(0.489)	(0.976)	(0.843)
Panel C: Economic Activity	$dlnrcredit_{t-1}$	.1540676	-.0708915	.4277413	.0786369	.2093274
		(0.680)	(0.547)	(0.378)	(0.809)	(0.482)
	$dlnrhprice_{t-1}$	.3730023	.0880363*	.8857365	.1243382	.5890054**
		(0.288)	(0.085)	(0.086)	(0.760)	(0.033)
	$dlnrgdp_{t-1}$	-.1326919	.0880363	-.469794	-.0701508	-.2784007
		(0.734)	(0.606)	(0.340)	(0.841)	(0.371)
	$drsint_{t-1}$	-0.0057335	-.3017107	1.147825	-1.26991	1.207197
		(0.996)	(0.306)	(0.544)	(0.432)	(0.550)
	$drdfint_{t-1}$	-.1462397	1.975441**	2.978314*	-.0977419	3.221643*
		(0.163)	(0.033)	(0.067)	(0.916)	(0.055)
	constant	-.0003165	.0115142*	-.0008383	.0029933	.0030964
		(0.971)	(0.058)	(0.896)	(0.629)	(0.603)

Panel D: Short Term Interest Rates	$dlnrcredit_{t-1}$	-.0670993**	.0118001	-.0233567	.0029452	-.0140036
		(0.045)	(0.135)	(0.485)	(0.862)	(0.486)
	$dlnrhprice_{t-1}$	.0178183	.0179082*	.0500929	.0018	.0272473
		(0.572)	(0.096)	(0.159)	(0.947)	(0.145)
	$dlnrgdp_{t-1}$	.0779418**	-.0122108	.0230696	.0005309	.0139859
		(0.024)	(0.237)	(0.496)	(0.982)	(0.505)
	$drsint_{t-1}$	.4609381***	.6399643***	.6284983***	.5672854***	.8161317 ***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	$drdfint_{t-1}$	-.0024498	.1309279**	.127467	.0798789	.336415***
		(0.947)	(0.019)	(0.254)	(0.193)	(0.003)
	constant	.0000389	-.0001689	-.0000748	-.0002042	-.0000912
		(0.961)	(0.646)	(0.865)	(0.620)	(0.821)
Panel E: Term Spread	$dlnrcredit_{t-1}$	.1548383*	-.0054815	.0319462	.0314146	.0455132
		(0.083)	(0.754)	(0.449)	(0.419)	(0.000)
	$dlnrhprice_{t-1}$	.0650097	-.0152086	.0083157	-.0059568	-.0365916
		(0.439)	(0.524)	(0.853)	(0.902)	(0.130)
	$dlnrgdp_{t-1}$	-.2575661***	.0100189	-.0448752	-.0487101	-.0483504*
		(0.005)	(0.662)	(0.294)	(0.243)	(0.075)
	$drsint_{t-1}$	0.2953479	-.3766421	-.3937405**	.0231222	-.61461
		(0.280)	(0.105)	(0.016)	(0.288)	(0.000)
	$drdfint_{t-1}$	.4602753***	.205247	.0431783	.4802145***	-.0719218
		(0.000)	(0.099)	(0.759)	(0.000)	(0.624)
	constant	-.0008772	-.0003958	-.0004268	-.0001398	-.0005111
		(0.676)	(0.627)	(0.444)	(0.850)	(0.326)
	Observations	73	73	73	73	73

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The VAR model does not control variables. The variables are transformed in logarithms except for short term interest rates and term spread. Also, all variables with their first difference at real terms. The lag order is one for all samples. *dlnrlhprice*: house prices, *dlncredit*: private credit, *dlnrgdp*: economic activity (and total income); *dlrsint*: short- term interest rates; drdfint: term spread

Appendix 3.9. Eigenvalue Stability Tests for Cross-country Level

	Eigenvalue		Modulus
	Real	Imaginary	
Whole Period	-.36437 -.00584	0 0	-.36437 -.00584
Eurozone	-.40033 -.02004	0 0	-.40033 -.02004
Non-Eurozone	-.08842 .082203	0 0	-.08842 .082203
GIIPS	-.17267 -.06129	0 0	-.17267 -.06129
GIIS	-.14117 -.05807	0 0	-.14117 -.05807
IS	-.15022 -.01764	0 0	-.15022 -.01764

Note that: Stability tests results show that in all periods and all samples, all the eigenvalues lie inside the unit circle.

Appendix 3.10. Eigenvalue Stability Tests for the Individual Countries

	Eigenvalue		
	Real	**Imaginary**	**Modulus**
Greece	.629997	0	.629997
	.0811588	0	.0811588
Ireland	.7646075	0	.7646075
	.5031297	0	.5031297
Italy	.9712181	0	.9712181
	-.0234117	0	-.0234117
Portugal	.6382936	0	.6382936
	.91957	0	.91957
Spain	.8893694	0	.8893694
	.444076	0	.444076

Note that: For all countries, all the eigenvalues lie inside the unit circle.

Appendix 3.11. The Results of Granger Causality Test for Individual Countries

		Credit Equation		Housing Price Equation		Relationship	Direction
	Excluded	dlnrhprice	All	dlnrcredi	All		
Greece	Lag order: 3	5.1361**	6.891	0.158	2.568	One way	HP → CRE
Ireland	Lag order: 4	4.1077 **	15.91***	0.201	12.265*	One way	HP → CRE
Portugal	Lag order:7	3.2937*	6.774	11.189***	14.093***	Two way	HP ↔ CRE (1)

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively.HP: housing price, CRE: private credit.
(1)The effect of housing prices on credit is stronger than that of credit on housing price.

Appendix 3.12. Results of Overidentifying Restriction Tests for Cross-country

Whole Sample	Hansen's J chi2(16) = 64.908783 (p = 0.000)
Eurozone	Hansen's J chi2(16) = 59.058715 (p = 0.000)
None-Eurozone	Hansen's J chi2(16) = 25.543589 (p = 0.061)
GIIPS	Hansen's J chi2(16) = 28.114278 (p = 0.031)
GIIS	Hansen's J chi2(16) = 28.317259 (p = 0.029)
IS	Hansen's J chi2(16) = 21.048652 (p = 0.017)

Note that: There is no overidentification.

Appendix 3.13. Hausman Endogeneity Test

	Coefficients			
	(b) eqn3sls	(B) agncid	(b-B) Difference	sgrt (diag(V_b - V_B)) S.E.
dlnrealcredit				
dlnrealhprice$_{t-1}$	0.2443295	0.1528494	0.0914801	0.0819607
cons	0.0064162	0.0025019	0.0039143	0.0016672
dlnrealhprice				
dlnrealcredit$_{t-1}$	0.1193859	0.0522707	0.0671152	0.0287929
cons	0.004057	0.0039595	0.0000975	0.0001255

b : consistent under H_o and H_a obtained from Reg3

B : inconsistent H_a, efficient under H_o obtained from Reg3

Test: H_o : difference in coefficients not systematic

chi2 (4) : (b-B)` [(V_b - V_B)^ (-1)} (b - B)

: 27.60

Prob >ch2 : 0.0000

(V_b - V_B is not positive definite)

Note that: *dlnrcredit:* private credit; *dlnrhprice*: housing prices.

Appendices-Chapter Four

Appendix 4.1. Data Description and Source for Index Constructing

CODE	INDICATORS	DATA DECRIPTION AND SOURCE
Financial Drivers		
F_AVA	Availability of financial services	It is based on question “to what extent does the financial sector provide the products and services that meet the needs of businesses?” [1 = not at all; 7 = to a great extent] Source: The Global Competitiveness Report (World Economic Forum)
F_AFF	Affordability of financial services	It is based on question “to what extent does the financial sector provide the products and services that meet the n to what extent does the cost of financial services (e.g., insurance, loans, trade finance) impede business activity?” [1 = impedes business to a great extent; 7 = not at all] Source: The Global Competitiveness Report (World Economic Forum)
F_LOC	Financing through local equity	It is based on question “to what extent can companies raise money by issuing shares and/or bonds on the capital market?” [1 = not at all; 7 = to a great extent] Source: The Global Competitiveness Report (World Economic Forum)
F_ACC	Ease of access to loans	It is based on question “how easy is it for businesses to obtain a bank loan?” [1 = extremely difficult; 7 = extremely easy] Source: The Global Competitiveness Report (World Economic Forum)
F_RIS	Venture capital availability	It is based on question “how easy is it for start-up entrepreneurs with innovative but risky projects to obtain equity funding?” [1 = extremely difficult; 7 = extremely easy] Source: The Global Competitiveness Report (World Economic Forum)
F_BAN	Soundness of bank	It is based on question “how do you assess the soundness of banks?” [1 = extremely low—banks may require recapitalization; 7 = extremely high—banks are generally healthy with sound balance sheets Source: The Global Competitiveness Report (World Economic Forum)
F_SEC	Regulation of securities exchanges	It is based on question “to what extent do regulators ensure the stability of the financial market?” [1 = not at all; 7 = to a great extent] Source: The Global Competitiveness Report (World Economic Forum)

F_CRE	Getting credit- depth of credit information	It measures rules and practices affecting the coverage, scope and accessibility of credit information available through either a public credit registry or a private credit bureau. Source: Doing Business (World Bank)
F_MEV	Mortgage equity withdrawal	It shows whether there is opportunity in the mortgage markets that homeowners have to liquidate home equity, either with the acquisition of new debt or as part of a housing transaction. [0 = nonexistent; 1 = existent] Source: EMF (2016), ECB (2009)
F_PRO	Availability of mortgage products	It shows the variety of mortgage product available to the borrower in a mortgage market. [0 = less availability (one type); 1 = more availability (more than one type] Source: EMF (2016), ECB (2009)
F_LTV	Loan to value ratio (average)	It is the ratio of a loan to the value of a housing purchased Source: EMF (2016)
Legal Drivers		
L_PROP	Property rights	It is based on question "to what extent do regulators ensure the stability of the financial market?" [1 = not protected by law; 7 = well protected by law] Source: The Global Competitiveness Report (World Economic Forum)
L_IRR	Irregular payments and bribes	"It is based on question "how common is it for firms to make undocumented extra payments or bribes connected with (a) imports and exports; (b) public utilities; (c) annual tax payments; (d) awarding of public contracts and licenses; (e) obtaining favorable judicial decisions?" 1:very common; 7: never occurs] Source: The Global Competitiveness Report (World Economic Forum)
L_JUD	Judicial impendence	It is based on question "how independent is the judicial system from influences of the government, individuals, or companies?" [1 = not independent at all; 7 = entirely independent]] Source: The Global Competitiveness Report (World Economic Forum)
L_EFF	Efficiency of legal framework in setting disputes	It is based on question "to "how efficient are the legal and judicial systems for companies in settling disputes?" [1 = extremely inefficient; 7 = extremely efficient] Source: The Global Competitiveness Report (World Economic Forum)

L_EFR	Efficiency of legal framework in challenging regulations	It is based on question "how easy is it for private businesses to challenge government actions and/or regulations through the legal system?" [1 = extremely difficult; 7 = extremely easy] Source: The Global Competitiveness Report (World Economic Forum)
L_INV	Protecting Investors	It examines powers of shareholders to challenge the transaction Source: Doing Business (World Bank)
L_RIG	Getting Credit- Strength of legal rights	It measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders. Source: Doing Business (World Bank)
L_ENF	Enforcing Contracts	It covers time, cost and number of procedures. Source: Doing Business (World Bank)
L_AUD	Strength of Auditing and reporting standards	It is based on question "how strong are financial auditing and reporting standards?" [1 = extremely weak; 7 = extremely strong] Source: The Global Competitiveness Report (World Economic Forum)
Openness Driver		
O_INV	Investment freedom	It shows degree of current account liberalization and current account liberalization. It evaluates a variety of regulatory restrictions that are imposed on investment (e.g. Foreign investment, foreign land ownership). [0 = not freedom; 100 = the highest freedom] Source: Heritage Foundation
O_XT	Trading cross borders – time to export	It is based on question "What makes up the time and cost to export a trade partner?" (Domestic transport +border, compliance documentary compliance). Source: Doing Business (World Bank)
O_XC	Trading cross borders – cost of export	It is based on question "What makes up the time and cost to export a trade partner? (domestic transport +border compliance + documentary compliance) " Source: Doing Business (World Bank)
O_MT	Trading cross borders - time to import	It is based on question "What makes up he time and cost to import from a trade partner?" (time of documentary compliance + border compliance (hours) Source: Doing Business (World Bank)

O_BUS	Starting a business – number of procedures	It is based on question "What is the number of procedures to get a local limited liability company up and running?" Source: Doing Business (World Bank)
O_REA	Cost of real estate (%)	It is based on question "What are the time, cost and number of procedures to comply with formalities to build a real estate?" Source: Doing Business (World Bank)
O_REC	Recovery rate of insolvency	The recovery rate is recorded as cents on the dollar recovered by secured creditors through judicial reorganization, liquidation or debt enforcement (foreclosure or receivership) proceedings. Source: Doing Business (World Bank)
O_BAR	Prevalence of trade barriers	"It is based on question "what extent do non-tariff barriers (e.g., health and product standards, technical and labeling requirements, etc.) limit the ability of imported goods to compete in the domestic market?" [1 = strongly limit; 7 = do not limit at all] Source: The Global Competitiveness Report (World Economic Forum)
O_BUR	Burden of customs procedures	It is based on question "how efficient are customs procedures (related to the entry and exit of merchandise)? "[1 = extremely inefficient; 7 = extremely efficient] Source:The Global Competitiveness Report (World Economic Forum)
Transparency Driver		
TRNS	Corruption perceptions index	It is annually ranks countries "by their perceived levels of corruption, as determined by expert assessments and opinion surveys. (0= highly corrupt; 100 = very clean). Source: Transparency International
Cultural Driver		
C_IND	Indulgence (habits and customs)	It is defined as the extent to which people try to control their desires and impulses, based on the way they were raised**.** (0= strong restraint; under 50: restraint; over 50: more indulgent; 100 = Extremely indulgent). Source: Hofstede, G. Minkov, G. and Hostede, G.J. (2010), *Cultures and Organizations: Software of the Mind*. Revised and Expanded 3rd Edition. McGraw-Hill (https://geert-hofstede.com)

(*) All data belongs to 2014 year while cultural factors belong to 2010.

Appendix 4.2. Descriptive Statistics

Code	Sample	Mean	Standard Deviation	Minimum	Maximum
F_AVA	28	4.576615	0.709302	3.465613	5.991829
F_AFF	28	5.025243	0.726435	3.7712	6.147955
F_LOC	28	3.476908	0.77571	2.1595	4.829143
F_ACC	28	2.810484	0.765401	1.56991	4.228075
F_RIS	28	2.796596	0.671729	1.704493	4.303874
F_BAN	28	4.711251	1.106071	2.29418	6.494812
F_SEC	28	4.562418	0.741453	3.374724	6.236159
F_CRE	28	18.28571	30.98159	0	100
F_MEV	28	0.5714286	0.5039526	0	1
F_PRO	28	1.50	16.75325	0	1
F_LTV	28	25.15714	5.1101	50	100
L_PRO	28	4.907486	0.895186	3.537991	6.378975
L_IRR	28	4.966587	0.965765	3.391719	6.646954
L_JUD	28	4.584506	1.278847	2.336054	6.593963
L_EFF	28	3.889834	1.174511	2.330196	6.072338
L_EFR	28	3.725773	1.087749	2.244997	5.861499
L_INV	28	6.785714	1.474654	3	9
L_RIG	28	5.75	2.397916	2	10
L_ENF	28	576.0357	297.3449	300	1580
L_AUD	28	69.82143	19.36406	30	90
L_COR	28	63.28571	15.41249	40	91
O_INV	28	80.53571	10.30456	55	95
O_XT	28	11.57143	4.003966	6	19
O_MT	28	10.64286	4.347961	5	19
O_BUS	28	32.35714	5.306979	21	43
O_REA	28	10.25	4.667659	3.5	22
O_REC	28	62.1	21.08023	30.5	90.2
O_BAR	28	4.695188	0.399077	3.751671	5.434608
O_BUR	28	4.770806	0.595002	3.345826	6.148005
O_XC	28	1042.143	273.883	600	1525
C_IND	28	44.39286	19.9617	13	78

Note that: F_AVA: Availability of financial services, F_AFF: Affordability of financial service, F_LOC: Financing through local equity, F_ACC: Ease of access to loans, F_RIS: Venture capital availability, F_BAN: Soundness of bank, F_SEC: Regulation of securities exchanges, F_CRE: Getting credit- depth of credit information, F_MEV: Mortgage equity withdrawal, F_PRO: Availability of mortgage products, F_LTV: loan to value, L_PROP: Property rights , L_BRI: Irregular payments and bribes, L_JUD: Judicial independence, L_EFF: Efficiency of legal framework in setting disputes, L_EFR: Efficiency of legal framework in challenging regulations, L_INV: Protecting Investors, L_RIG: Getting Credit- Strength of legal rights, L_ENF: Enforcing Contracts, L_AUD: Strength of Auditing and reporting standards, O_INV: Investment freedom, O_XT: Trading cross borders – time to export, O_XC: Trading cross borders – cost of export, O_MT: Trading cross borders - time to import, O_BUS: Starting a business – number of procedures, O_REA: Cost of real estate, O_REC: Recovery rate of insolvency, O_BAR: Prevalence of trade barriers, O_BUR: Burden of customs procedures, TRAN: Corruption perceptions index, C_IND: Habits and customs.

Appendix 4.3. Correlation Matrix

	F AVA	F AFF	F LOC	F ACC	F RIS	F BAN	F SEC	F CRE	F MEV	F PRO	F LTV	L PROP	L IRR	L INV	L JUD	L EFF	L EFR	L ENF	I AUD	L RIG	TRNS	O XT	O XC	O MT	O BUS	O REA	O REC	O BAR	O BUR	O INV	C IND
F AVA	1																														
F AFF	0.938	1																													
F LOC	0.839	0.832	1																												
F ACC	0.760	0.654	0.7566	1																											
F RIS	0.856	0.808	0.850	0.883	1																										
F BAN	0.566	0.549	0.604	0.760	0.590	1																									
F SEC	0.816	0.821	0.827	0.689	0.758	0.548	1																								
F CRE	-0.136	-0.068	-0.184	-0.117	-0.132	-0.132	-0.238	1																							
F MEV	0.255	0.255	0.212	0.248	0.340	0.065	0.309	-0.175	1																						
F PRO	0.712	0.700	0.723	0.419	0.594	0.331	0.694	-0.093	0.392	1																					
F LTV	0.301	0.492	0.355	0.205	0.306	0.079	0.415	0.050	0.0321	-0.256	1																				
L PRO	0.844	0.851	0.845	0.563	0.761	0.284	0.800	-0.158	0.330	0.361	0.381	1																			
L IRR	0.7053	0.7298	0.7033	0.4589	0.6948	0.1344	0.7643	-0.0872	0.4271	0.0331	0.411	0.8883	1																		
L INV	0.705	0.730	0.703	0.459	0.695	0.134	0.764	-0.087	0.427	0.795	0.236	0.8883		1																	
L JUD	0.722	0.768	0.771	0.471	0.696	0.202	0.823	-0.224	0.299	0.671	0.308	0.927	0.9264	0.926	1																
L EFF	0.814	0.831	0.838	0.630	0.829	0.316	0.806	-0.281	0.355	0.799	0.416	0.927	0.8972	0.897	0.931	1															
L EFR	0.820	0.828	0.827	0.615	0.846	0.280	0.775	-0.193	0.368	0.852	0.373	0.940	0.9113	0.911	0.914	0.972	1														
L ENF	-0.603	-0.606	-0.579	-0.617	-0.606	-0.626	-0.501	-0.089	-0.100	-0.405	-0.527	-0.431	-0.4481	-0.448	-0.387	-0.530	-0.471	1													
L AUD	0.802	0.781	0.671	0.371	0.608	0.320	0.703	-0.320	0.219	0.571	0.298	0.726	0.674	0.820	0.614	0.891	0.711	0.2043	1												
L RIG	0.705	0.730	0.703	0.459	0.695	0.134	0.764	-0.087	0.427	0.598	0.143	0.888	0.788	0.880	0.926	0.897	0.911	-0.448	0.688	1											
TRNS	0.777	0.800	0.752	0.551	0.722	0.264	0.833	-0.165	0.384	0.703	0.364	0.888	0.9538	0.954	0.924	0.912	0.893	-0.510	0.721	0.9538	1										
O XT	0.725	0.677	0.590	0.429	0.639	0.088	0.579	-0.131	0.296	0.621	0.078	0.780	0.7601	0.781	0.784	0.814	0.818	-0.492	0.821	0.7808	0.786	1									
O XC	0.137	0.195	0.156	0.015	0.162	-0.032	0.371	-0.039	0.205	0.151	-0.073	0.251	0.7808	0.374	0.401	0.294	0.292	-0.031	0.905	0.3739	0.3736	0.328	1								
O MT	0.740	0.693	0.630	0.469	0.676	0.107	0.596	-0.155	0.377	0.577	0.279	0.801	0.3739	0.786	0.783	0.829	0.846	-0.431	-0.394	0.7858	0.802	0.9653	0.375	1							
O BUS	0.400	0.392	0.355	0.205	0.363	0.069	0.353	0.051	-0.156	0.331	0.077	0.438	0.7858	0.460	0.459	0.383	0.378	-0.301	0.810	0.460	0.413	0.288	-0.050	0.174	1						
O REA	-0.330	-0.279	-0.364	-0.245	-0.357	0.183	-0.382	-0.145	-0.236	-0.317	0.189	-0.521	0.46	-0.612	-0.542	-0.532	-0.521	0.159	0.738	-0.612	-0.581	-0.547	-0.436	-0.571	-0.252	1					
O REC	-0.518	-0.654	-0.501	-0.195	-0.393	-0.017	-0.473	-0.056	-0.199	-0.303	-0.011	-0.720	-0.6124	-0.706	-0.726	-0.674	-0.669	0.248	0.802	-0.706	-0.737	-0.512	-0.179	-0.513	-0.441	0.411	1				
O BAR	0.598	0.658	0.382	0.280	0.505	0.069	0.648	0.009	0.348	0.527	0.077	0.682	-0.7055	0.649	0.656	0.593	0.652	-0.135	0.698	0.649	0.635	0.576	0.425	0.590	0.251	-0.367	-0.485	1			
O BUR	0.682	0.762	0.622	0.455	0.683	0.249	0.779	-0.167	0.434	0.653	0.214	0.813	0.6487	0.855	0.834	0.830	0.822	-0.416	0.693	0.855	0.845	0.638	0.453	0.657	0.396	-0.470	-0.647	0.806	1		
O INV	0.668	0.681	0.595	0.384	0.572	0.416	0.587	-0.267	0.046	0.471	0.402	0.659	0.8552	0.574	0.663	0.647	0.588	-0.501	0.720	0.574	0.633	0.578	0.122	0.549	0.535	-0.157	-0.449	0.404	0.598	1	
C IND	0.453	0.501	0.455	0.251	0.362	-0.093	0.529	-0.340	0.329	0.307	0.243	0.671	0.5735	0.553	0.626	0.629	0.597	0.041	0.597	0.553	0.620	0.425	0.075	0.489	0.130	-0.336	-0.629	0.556	0.574	0.268	1

Note that: F_AVA: Availability of financial services, F_AFF: Affordability of financial service, F_LOC: Financing through local equity, F_ACC: Ease of access to loans, F_RIS: Venture capital availability, F_BAN: Soundness of bank, F_SEC: Regulation of securities exchanges, F_CRE: Getting credit- depth of credit information, F_MEV: Mortgage equity withdrawal, F_PRO: Availability of mortgage products, F_LTV: loan to value, L_PROP: Property rights , L_BRI: Irregular payments and bribes, L_JUD: Judicial independence, L_EFF: Efficiency of legal framework in setting disputes, L_EFR: Efficiency of legal framework in challenging regulations, L_INV: Protecting Investors, L_RIG: Getting Credit- Strength of legal rights, L_ENF: Enforcing Contracts, L_AUD: Strength of Auditing and reporting standards, O_INV: Investment freedom, O_XT: Trading cross borders – time to export, O_XC: Trading cross borders – cost of export, O_MT: Trading cross borders - time to import, O_BUS: Starting a business – number of procedures, O_REA: Cost of real estate, O_REC: Recovery rate of insolvency, O_BAR: Prevalence of trade barriers, O_BUR: Burden of customs procedures, TRAN: Corruption perceptions index, C_IND: Habits and customs.

Appendix 4.4. Kaiser-Meyer-Olkin`s (KMO) Test and Bartlett test of sphericity

Barlett`s test of sphericity	
Chi-square	= 1514.080
Degrees of freedom	= 351
p-value	= 0.000
H0	= 0.000
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	= 0.776

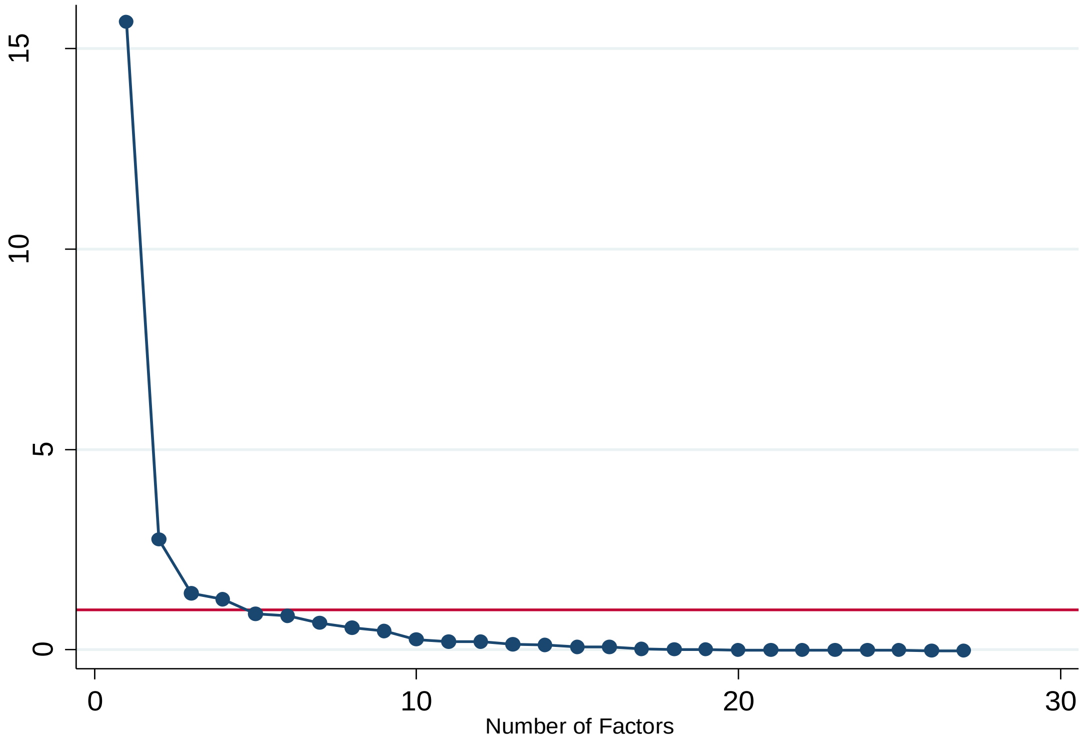
Source: Author’s calculations.

Appendix 4.5. Cronbach's Alpha Reliability Test

Average interitem covariance:	.4900849
Number of items in the scale:	27
Scale reliability coefficient:	0.9667

Source: Author's calculations.

Appendix 4.6. Scree Plot of Eigenvalues



Source: Author’s calculations.

Appendix 4.7. Eigenvalues and Variances of Principal Components

Factor	Eigenvalues	Difference	Explained Variance (%)	Cumulative Variance (%)
Factor1	15.6487	12.89912	0.6122	0.6122
Factor2	27.4958	1.3358	0.1076	0.7198
Factor3	14.1377	0.15405	0.0553	0.7751
Factor4	12.5972	0.35847	0.0493	0.8244
Factor5	0.90125	0.04373	0.0353	0.8596
Factor6	0.85753	0.19322	0.0335	0.8932
Factor7	0.66431	0.10578	0.026	0.9192
Factor8	0.55853	0.08617	0.0219	0.941
Factor9	0.47237	0.22158	0.0185	0.9595
Factor10	0.25078	0.0372	0.0098	0.9693
:	:	:	:	:
:	:	:	:	:
Factor27	-0.02941	.	-0.0012	1

Note that: LR test: independent vs. saturated: chi2(351) = 1514.080 . Prob>chi2 = 0.0000

Appendix 4.8. Eigenvalues and Sums of Squared Loadings

Factors	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	Variance (%)	Cumulative Variance (%)	Total	Variance (%)	Cumulative Variance (%)	Total	Variance (%)	Cumulative Variance (%)
Factor 1	15.65	61.22	61.22	15.65	61.22	61.22	14.64	57.33	57.33
Factor 2	2.75	10.76	71.98	2.75	10.76	71.98	2.97	12.65	69.98
Factor 3	1.41	5.53	77.51	1.41	5.53	77.51	2.77	6.82	76.8
Factor 4	1.26	4.93	82.44	1.26	4.93	82.44	1.59	5.64	82.44
Factor 5	0.90	3.53	85.96						
Factor 6	0.86	3.35	89.32						
Factor 7	0.66	2.6	91.92						
Factor 8	0.56	2.19	94.1						

Source: Author's calculations.

Note that: Extraction method is Principal Component. Rotation method is varimax.

Appendix 4.9. Descriptive Statistics of Indices

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
The Institutional Index (the Overall Index)	28	3.169182	1.470902	1	6
Financial Sub-index	28	3.379053	1.381391	1	6
Legal Sub-index	28	3.199653	1.530757	1	6
Openness Sub-index	28	3.693591	1.501527	1	6
Cultural Index	28	3.481342	1.501527	1	6
Transparency Index	28	3.207512	1.396413	1	6

Note that: Cultural sub- index and transparency sub-index were produced by Hofstede, Minkov and Hostede (2010 (2010) and Transparency International respectively. For comparability, they are rescaled it from one to six in this study.

Appendix 4.10. Numbers of Overall Index and Sub-Indices

	Overall Index		Financial sub-index		Legal sub-index		Openness sub-index		Transparency sub-Index (*)		Cultural sub-index (*)
Finland	6.00	Finland	6.00	Finland	6.00	Finland	6.00	Denmark	6.00	Sweden	6.00
Sweden	5.49	Luxembourg	5.96	Sweden	5.39	Netherlands	5.84	Finland	5.80	Denmark	5.89
Luxembourg	5.00	Sweden	5.69	Netherlands	5.21	Sweden	5.44	Sweden	5.80	United Kingdom	5.87
United Kingdom	4.99	Malta	4.83	Luxembourg	5.12	Ireland	5.31	Netherlands	5.22	Netherlands	5.86
Netherlands	4.93	Netherlands	4.82	United Kingdom	5.12	United Kingdom	5.30	Luxembourg	4.92	Malta	5.83
Denmark	4.66	United Kingdom	4.72	Denmark	4.79	Denmark	5.11	Germany	4.73	Ireland	5.80
Germany	4.25	Germany	4.51	Ireland	4.75	Luxembourg	5.08	United Kingdom	4.53	Austria	5.77
Estonia	4.12	Belgium	4.46	Germany	4.69	Belgium	5.01	Belgium	4.43	Belgium	5.66
Ireland	4.08	Austria	4.18	Austria	4.17	Estonia	4.85	Ireland	4.14	Finland	5.66
Belgium	3.90	France	4.04	Belgium	4.01	Austria	4.85	France	4.04	Luxembourg	5.14
Austria	3.87	Estonia	3.88	Estonia	3.92	Cyprus	4.54	Austria	3.84	Greece	4.89
Cyprus	3.69	Denmark	3.58	France	3.81	Germany	4.54	Estonia	3.75	Cyprus	4.89
Malta	3.67	Slovakia	3.34	Cyprus	3.38	France	3.86	Cyprus	3.25	France	4.85
France	3.50	Poland	3.10	Spain	2.87	Spain	3.83	Portugal	3.16	Slovenia	4.85
Spain	3.03	Cyprus	3.06	Malta	2.85	Malta	3.69	Poland	2.96	Spain	4.78
Portugal	2.91	Czech Republic	3.05	Portugal	2.81	Lithuania	3.61	Spain	2.86	Germany	4.69
Slovenia	2.48	Latvia	2.93	Lithuania	2.48	Portugal	3.52	Lithuania	2.67	Croatia	4.45
Poland	2.39	Lithuania	2.75	Poland	2.43	Latvia	3.30	Slovenia	2.67	Portugal	4.46
Lithuania	2.39	Spain	2.39	Slovenia	2.23	Slovenia	3.10	Malta	2.57	Hungary	3.41
Latvia	2.16	Portugal	2.36	Latvia	2.19	Czech Republic	2.33	Hungary	2.37	Italy	2.92

Greece	1.82	Ireland	2.36	Hungary	2.04	Poland	2.29	Latvia	2.27	Czech Republic	2.69
Czech Republic	1.73	Bulgaria	2.25	Bulgaria	1.62	Greece	2.10	Croatia	1.78	Poland	2.59
Hungary	1.73	Hungary	2.18	Czech Republic	1.56	Slovakia	2.09	Czech Republic	1.78	Slovakia	2.55
Slovakia	1.45	Croatia	2.15	Romania	1.45	Hungary	2.08	Slovakia	1.69	Romania	2.23
Croatia	1.32	Romania	2.08	Italy	1.32	Croatia	1.97	Italy	1.29	Bulgaria	1.21
Italy	1.11	Italy	1.68	Croatia	1.23	Romania	1.39	Romania	1.29	Estonia	1.21
Bulgaria	1.08	Slovenia	1.27	Greece	1.14	Italy	1.39	Bulgaria	1.10	Lithuania	1.21
Romania	1.00	Greece	1.00	Slovakia	1.00	Bulgaria	1.00	Greece	1.00	Latvia	1.00
EU (28) Average	**3.16**	**EU (28) Average**	**3.37**	**EU (28) Average**	**3.19**	**EU (28) Average**	**3.69**	**EU (28) Average**	**3.28**	**EU (28) Average**	**4.15**

(*) These indices that were constructed by Transparency International and Hofstede, Minkov and Hostede (2010) are rescaled from one to six. In the cultural index, the index numbers for Cyprus (officially the Republic of Cyprus) shows those of Cypriot Republic, which became the member of the EU in 2004. In fact, their cultural (indulgence) index does not have the index numbers for Cyprus. In fact, Hofstede, Minkov and Hostede (2010)'s cultural (indulgence) index does not have the index numbers for Cyprus. Cyprus' index number covers the insex number of Greece because it is culturally Greek (see Kyritsi and Christofis, 2018).

Appendix 4.11. Data Description and Source

Outstanding Mortgage Loan/ GDP (%)	It is the ratioof a country's total mortgage loan to its gross domestic product (GDP). Source: European Mortgage Federation (EMF)
Net Interest Margin (%)	It is an accounting value of bank's net interest revenue as a share of its average interest bearing (total earning) assets. Source: The World Bank
Owner occupied with mortgage or home loan (% of population)	It is the number of borrowers to get housing credits from financial intermediaries acting in the mortgage markets in order to buy own house. Source: Eurostat
Overall index (Institutional Index)	It shows the level of institutional quality. Source: Own calculations
Financial sub-index	It shows the level of institutional quality in respect to financial environment. Source: Own calculations
Legal sub-index	It shows the level of institutional quality in respect to legal environment. Source: Own calculations
Opennes sub-index	It shows the degree of openness in the economy. Source: Own calculations
Corruption sub- index	It is annually rankscountries "by their perceived levels of corruption, as determined by expert assessments and opinion surveys. (0= highly corrupt; 6 = very clean). Source: Transparency International
Cultural sub-index	It is defined *as*the extent to which people try to control their desires and impulses, based on the way they were raised**.** (0= strong restraint; under 3= restraint; over 3=more indulgent; 6= Extremely indulgent). Source: Hofstede, Minkov and Hostede (2010)

Appendices-Chapter Five

Appendix 5.1. Classification of the countries according to Current Account Balance (CAB) (as of % of GDP)

	Current Account Balance/GDP (%)
Group-I (The indicative threshold: equal to the threshold (-4%) and below	
Sweden	7.5
Netherlands	6,7
Germany	5.7
Finland	3.5
Austria	3.1
Denmark	3.0
Belgium	2.0
France	-0.1
Italy	-0.9
United Kingdom	-3.0
GROUP-II (The indicative threshold: the threshold (-4%) above	
Ireland	-5.1
Spain	-8.7
Portugal	-10.1
Greece	-11.8

Source: EC (2018), http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tipsbp10&plugin=1 (07.01.2018)
(*) 3-year backward moving average for 2005-2007.

Appendix 5.2. Classification of the countries according to their position in Institutional Index

	Index Score
Group-I (the countries with high institutional quality)	
Finland	6.00
Sweden	5.49
United Kingdom	4.99
Netherlands	4.93
Denmark	4.66
Germany	4.25
Ireland	4.08
Belgium	3.90
Austria	3.87
France	3.50
Group-II (the countries with weak institutional quality)	
Spain	3.03
Portugal	2.91
Greece	1.82
Italy	1.11

Source: Author’s calculations. The EU (28) average is 3.17.

Appendix 5.3. Data Description and Source

CODE	VARIABLES	DATA DEFINITION AND SOURCE
credit	Size of credit supply	Definition: Private credit by deposit money banks and other financial institutions to GDP ratio (%). It shows both sıze of credit lent and the level of financial development. It shows the size of credit supply as well as tle development level of financial sector. Source: The World Bank, World Development Indicators
cpi	Consumer price index (2010=100)	Definition: consumer price index (CPI) is defined as the change in the prices of a basket of goods and services that are typically purchased by specific groups of households. Source: OECD
curacc	Current Account balance (% of GDP)	Definition: Current account balance is the sum of net exports of goods and services, net primary income, and net secondary income. Source: International Monetary Fund (IMF)
dfint	Term spread (%)	Definition: Term spread is also called interest rate spread. It measures the difference between long term and short term interest rates. It is calculated by author. Source: Eurostat
domescredit	Domestic credits (% of GDP)	Definition: Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises. The financial corporations includemonetary authorities, deposit money banks, finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies) and deposit money banks, as well as other financial corporations. Source: The World Bank
fiscalbalance	General government fiscal balance (% of GDP)	Definition: General government deficit is defined as the fiscal position of government after accounting for capital expenditures. General government net lending is calculated as: gross savings plus net capital transfers (receivable minus payable) minus gross capital formation, followed by the subtraction of acquisitions minus disposals of non-produced, non-financial assets. Source: Eurostat

gdpgrowth	GDP growth rate (annual %)	Definition: Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Source: The World Bank, World Development Indicators
hprice	Nominal house price index (2010=100)	Definition: Nominal house price index measure the prices of residential real estates over time. Nominal house prices are deflated by CPI index ın 2010 Source: OECD
intdebt	Outstanding International debt securities (% of GDP)	Definition: It covers the amount of both outstanding public and private debt securities and consistent of long-term bonds and notes and money market instruments placed on international markets. Source: The World Bank.
iaccount	Voice and Accountability	Definition: It reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Source: Kaufmann, Kraay. and Masttruzzi (2010).
iregqual	Regulation quality	Definition: It reflects a government’s ability to establish strong policies and to make regulations encouraging private sectors, and to put them into force. Source: Kaufmann, Kraay. and Masttruzzi (2010).
igoveff	Government Effectiveness	Definition: It reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Source: Kaufmann, Kraay. and Masttruzzi (2010).
irulelaw	Rule of Law	Definition: it reflects the trust in the quality of legal arrangements and the society’s perception of them with regard to their obedience. Source: Kaufmann, Kraay. and Masttruzzi (2010).

icorrup	Control of corruption	Definition: it expresses social perceptions of how the public power acts in the case of profits gained in different forms of corruption. The expected sign is positive. Source: Kaufmann, Kraay. and Masttruzzi (2010).
iaverage	Average of the governance indices	Definition: it shows an average of governance variables (regulation quality, rule of law, control of corruption, government effectiveness and accountability). Source: Kaufmann, Kraay. and Masttruzzi (2010).
inst	Instıtutıonal Index	Definition: it reflects the institutional features of the credit markets, such as credit affordability, protection of investor, accessibility of financial services, enforcing contracts. Source: It was produced by author.
kapoen	Financial liberalization index	Definition: Financial liberalization index is a de jure of financial openness. It is also called the Chin-Ito index that is an index measuring country's degree of capital account openness. It is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Source: Chinn and Ito (2006). '
popgrowth	Annual growth rate of population (%)	Definition: Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Source: The World Bank, World Development Indicators
resconstgdp	Size of Residential Construction (% of GDP)	Definition: A building should be regarded as residential building when more than half of the floor area is used for dwelling. Source: OECD
sint	Short term interest rates (%)	Definition: Short-term interest rates are *rates on* money markets for different maturities (overnight, 1–12 months). They are generally averages of daily rates, measured as a percentage. Source: Eurostat

Appendix 5.4. Descriptive Statistics

Code	Sample	Mean	Standard Deviation	Minimum	Maximu m
hprice	371	77.12884	27.80432	26.2	153.7
credit	363	92.25634	37.38045	27.15	212.9
curacc	378	0.4079365	4.494204	-15.2	10.9
domescredit	248	107.7983	34.32109	44.38062	201.2587
gdpgrowth	377	1.931947	2.904664	-9.132494	26.27606
resconstract	308	5.402922	2.064819	0.6	13.5
dfint	317	0.703413	0.786439	-.04106	0.345
sint	378	4.409788	4.306165	-0.5	24.6
kaopen	378	0.9444316	0.1469026	0.165697	1
fiscal	308	-2.782792	3.856809	-32.1	6.9
popgrowth	364	0.4624921	0.4646777	-1.853715	2.89096
iaccount	252	91.075	7.119764	68.08	1.92
icorrupt	252	88.57516	11.57955	52.61	100
igoveff	252	89.42647	9.321676	60.19	100
indebt	363	52.65193	44.61017	2.48	292.25
iregqual	252	89.34794	8.609567	59.13	100
irulelaw	251	66.68614	32.46134	1.92	100

Note that: Asterisk denotes statistical significance at the 0.05 level. *hprice*: housing price index, *credit:* credit size and financial development, *gdpgrowth*: economic growth, *resconstgdp*: residential construction/GDP; *kaopen*: financial liberalization index, *fiscal*: general government fiscal balance/GDP, *popgrowth*: population growth rate; *dfint*: term spread, *sint*: short term interest rates, *domescred*: domestic credit, *intdebt:* international debt securities, *iregual*: regulation quality, *igoveff*: government effectiveness, *icorrup*: control of corruption, iaccount: voice and accountability, *irulelaw:* rule of law.

Appendix 5.5. Correlation Matrix

	houseprice	credit	curacc	gdpgrowth	esconstgd	dfint	sint	kaopen	fiscal	popgrowth	domescred	intdebt	ipolstab	ireggual	irulelaw	icorrup	igoveff	iaccount
houseprice	1.0000																	
credit	0.5384*	1.0000																
curacc	-0.1118*	-0.0834	1.0000															
gdpgrowth	-0.2011*	-0.2909*	0.1683*	1.0000														
resconstgdp	0.1996*	-0.1459*	-0.4293*	0.1905*	1.0000													
lint	-0.6312*	-0.4045*	-0.2310*	-0.0881	0.0000	1.0000												
sint	-0.6326*	-0.4728*	-0.1623*	0.0676	0.2473*	0.8473*	1.0000											
kaopen	0.4002*	0.3770*	0.1406*	-0.0194	-0.1233*	-0.7203*	-0.7668*	1.0000										
fiscal	-0.0674	-0.1615*	0.4430*	0.3717*	0.1097*	-0.2948*	0.0455	0.1447*	1.0000									
popgrowth	0.2528*	0.0984*	-0.1113*	0.2302*	0.4893*	-0.1427*	0.0074	0.0393	0.2052*	1.0000								
domescred	0.2858*	0.9503*	-0.1521	-0.2200*	-0.0324	0.0164	-0.0096	0.1551*	-0.1158	0.1396*	1.0000							
intdebt	0.3286*	0.3682*	0.062	-0.1865	-0.2495*	-0.2547	-0.3794*	0.2324*	-0.3287	0.0869*	0.2610*	1.0000						
ipolstab	-0.0815	-0.2134*	0.4237*	0.2508*	-0.0781	-0.1330*	0.1917*	0.0987	0.4369*	0.0667	-0.1847*	-0.0595	1.0000					
ireggual	0.1638*	0.2311*	0.4635*	0.2397*	-0.0476	-0.4196*	0.0123	0.3343*	0.4060*	0.3526*	0.2011*	0.1736*	0.5688*	1.0000				
irulelaw	-0.0167	-0.1274*	0.5164*	0.0719	-0.0383	-0.3307*	-0.1252*	0.1531*	0.4689*	0.1063*	-0.099	-0.2017*	0.2893*	0.3759*	1.0000			
icorrup	0.0570	0.1510*	0.5044*	0.2426*	-0.0714	-0.4017*	0.0372	0.2385*	0.4278*	0.2596*	0.1646*	0.0968	0.5939*	0.8863*	0.3907*	1.0000		
igoveff	-0.022	0.0939	0.5724*	0.2297*	-0.1157*	-0.3847*	0.0145	0.2124*	0.4563*	0.2007*	0.1743*	0.0394	0.6095*	0.8574*	0.4120*	0.9439*	1.0000	
iaccount	0.1545*	0.1053	0.5246*	0.2324*	-0.0319	-0.4572*	0.0047	0.2611*	0.4582*	0.2891*	0.1146*	0.1061	0.6574*	0.8734*	0.3922*	0.9161*	0.8803*	1.0000

Note that: *hprice*: housing price index, *credit:* credit size and financial development , *gdpgrowth*: economic growth, *resconstgdp*: residential construction/GDP; *kaopen*: financial liberalization index, *fiscal*: general government fiscal balance/GDP, *popgrowth*: population growth rate; *dfint*: term spread, *sint*: short term interest rates, *domescred*: domestic credit, *intdebt:* international debt securities, *iregual*: regulation quality, *igoveff*: government effectiveness, *icorrup*: control of corruption, iaccount: voice and accountability, *irulelaw:* rule of law.

Appendix 5.6. Correlation Matrix

	rlnhouseprice	rcredit	rcuracc	rlnhouseprice$_{t-1}$	rcreditt-1	rcuracc$_{t-1}$	rgdpgrowth$_{t-1}$	rresconstgdp$_{t-1}$	rlint$_{t-1}$	rsint$_{t-1}$	lnkaopen$_{t-1}$	rfiscal$_{t-1}$	popgrowth$_{t-1}$	rdomescred$_{t-1}$	rintdebt$_{t-1}$	lnipolstab$_{t-1}$	lniregqual$_{t-1}$	lnirulelaw$_{t-1}$	lnicorrup$_{t-1}$	lnigoveff$_{t-1}$	lniaccount$_{t-1}$
rlnhouseprice	1.0000																				
rcredit	-0.0011	1.0000																			
rcuracc	-0.2964*	-0.1623*	1.0000																		
rlnhouseprice$_{t-1}$	0.9661*	0.0178	-0.3231*	1.0000																	
rcredit$_{t-1}$	-0.0430	0.9657*	-0.1235*	-0.0011	1.0000																
rcuracc $_{t-1}$	-0.2448*	-0.1791*	0.9386*	-0.2950*	-0.1623*	1.0000															
rgdpgrowth$_{t-1}$	0.3614*	-0.1449*	0.0144	0.2961*	-0.1965*	0.1166*	1.0000														
rresconstgdp$_{t-1}$	0.7207*	-0.0613	-0.5056*	0.7350*	-0.1216*	-0.4426*	0.3665*	1.0000													
rlint$_{t-1}$	0.6379*	-0.1955*	-0.1586*	0.6812*	-0.1376*	-0.2249*	0.1106*	0.3201*	1.0000												
rsint$_{t-1}$	0.7026*	-0.2039*	-0.1586*	0.4392*	-0.1583*	-0.2007*	0.1600*	0.4742*	0.9482*	1.0000											
lnkaopen$_{t-1}$	-0.5087*	0.1976*	0.1600*	-0.5487*	0.1432*	0.2090*	-0.1366*	-0.3410*	-0.8382*	-0.8549*	1.0000										
rfiscal$_{t-1}$	0.0507	0.0236	0.3974*	0.0017	-0.0539	0.4439*	0.2979*	0.0025	-0.3616*	-0.1439*	0.2845*	1.0000									
popgrowth$_{t-1}$	0.0438	0.1631*	-0.1811*	0.0261	0.1183*	-0.1399*	0.2014*	0.4268*	-0.0249	0.0250	0.0039	0.2048*	1.0000								
rdomescredt-1	-0.0991	0.9437*	-0.1069	-0.0442	0.9182*	-0.1506	-0.2338	-0.0902	-0.0505	-0.0589	0.1707*	-0.0920	0.1671*	1.0000							
rintdebt$_{t-1}$	-0.4828	0.1248*	0.1356*	-0.4490	0.1849*	0.0695	-0.2450*	-0.3700	-0.2938	-0.3556	0.2284*	-0.2382*	0.0869*	0.2610*	1.0000						
lnipolstab$_{t-1}$	0.2076*	-0.1844*	0.4086*	0.1773*	-0.1842*	0.4440*	0.2217*	-0.1081*	-0.3938*	-0.0602	0.3046*	0.4536*	0.0286	-0.1847*	-0.0518	1.0000					
lniregqual$_{t-1}$	0.0762	0.2721*	0.4342*	0.0774	0.2523*	0.4770*	0.2217*	-0.1081*	-0.3938*	-0.0602	0.3046*	0.4536*	0.3210*	0.2011*	0.1669*	0.5545*	1.0000				
lnirulelaw$_{t-1}$	-0.0726	-0.0877	0.5333*	-0.0924	-0.0856	0.4588*	0.0969	-0.0596	-0.3146*	-0.0938	0.2409*	0.4724*	0.2534*	-0.0990	-0.1028	0.2739*	0.5322*	1.0000			
lnicorrup$_{t-1}$	0.0683	0.1866*	0.4682*	0.0490	0.1815*	0.5034*	0.2421*	-0.0942	-0.3555*	-0.0009	0.2001*	0.4468*	0.2311*	0.1646*	0.0937	0.5811*	0.8799*	0.4783*	1.0000		
lnigoveff$_{t-1}$	0.0315	0.1266*	0.5328*	-0.0136	0.1279*	0.4715*	0.2225*	-0.1359*	-0.3177*	-0.0133	0.1656*	0.4679*	0.1736*	0.1036	0.0461	0.5929*	0.8487*	0.4797*	0.9390*	1.0000	
lniaccount$_{t-1}$	0.0855	0.1454*	0.4759*	0.0732	0.1224*	0.49228*	0.2192*	-0.0805	-0.4088*	-0.0415	0.2238*	0.4808*	0.2624*	0.1279*	0.1025	0.6447*	0.8741*	0.4919*	0.9149*	0.8735*	1.0000

Note that: *rlnhouseprice$_{t-1}$*: housing price index, *rcredit$_{t-1}$*: credit size and financial development , *rgdpgrowth$_{t-1}$*: economic growth, *rresconstgdp$_{t-1}$*: residential construction/GDP, *lnkaopen$_{t-1}$*: financial liberalization Index, *rdfint$_{t-}$*: term spread, *rsint$_{t-t-}$*: short term interest rates, r*fiscal$_{t-1}$:* general government fiscal balance/GDP, *popgrowth$_{t-1}$*:population growth rate, *rdomescredit$_{t-1}$:* domestic credit , *rintdebt$_{t-1}$*: *international* debt securities, *lniregual$_{t-1}$*: regulation quality, *lnigoveff$_{t-1}$*: government effectiveness, *lnicorrupt$_{t-1}$*: control of corruption,*lniaccount$_{t-1}$*iaccount: voice and accountability, *lnirulelaw$_{t-1}$:* rule of law.

Appendix 5.7. Multicollinearity and Diagonastic Tests for House Price Model

Appendix 5.7/A: Coefficients for Housing Price Model (a)

	Unstandardized coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
	Beta	Standard Error	Beta	t-statistics	P-value	Zero-order	partial	Part	Tolerance	VIF (b)
constant	8.237	7.955		1.035	0.301					
gdpgrowth	0.002	0.000	0.546	9.508	0.000	0.636	0.481	0.387	0.501	1.995
credit	0.135	0.029	0.211	4.739	0.000	0.429	0.263	0.193	0.835	1.198
dfint	-0.479	0.562	-0.046	-0.852	0.395	-0.459	-0.049	-0.035	0.570	1.755
rescontgdp	2.795	0.483	0.241	5.787	0.000	0.180	0.316	0.235	0.953	1.049

(a) Dependent variable is house price (hprice).
(b) VIF is variance inflation factor.

Appendix 5.7/B: Collinearity Diagnostics for House Price Model (a)

			Variance Proportions				
Dimension	Eigenvalue	Condition Index	Constant	gdpgrowth	credit	dfint	rescontgdp
1	4.538	1.000	0.00	0.00	0.00	0.00	0.01
2	0.246	3.293	0.00	0.02	0.06	0.31	0.00
3	0.140	4.69	0.00	0.00	0.17	0.05	0.64
4	0.165	4.753	0.03	0.19	0.76	0.00	0.15
5	0.111	5.717	0.97	0.78	0.00	0.64	0.21

(a) Dependent variable is house price (hprice).

Appendix 5.8. Multicollinearity and Diagonastic Tests for Credit Model

Appendix 5.8/A. Coefficients for Credit Model (a)

	Unstandardized coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
	Beta	Standard Error	Beta	t-statistics	P-value	Zero-order	partial	Part	Tolerance	VIF (b)
constant	26.745	17.989		1.487	0.138					
gdpgrowth	4.27E-12	0.000	0.105	2.261	0.024	0.242	0.118	0.1	0.909	1.1
sint	-1.398	0.686	-0.137	-2.037	0.042	-0.418	-0.106	-0.09	0.433	2.31
hprice	0.429	0.08	0.317	5.34	0.000	0.483	0.269	0.236	0.556	1.799
curacc	-0.637	0.387	-0.077	-1.645	0.101	-0.084	-0.086	-0.073	0.882	1.133
kaopen	36.637	15.112	0.135	2.424	0.016	0.326	0.126	0.107	0.629	1.589

(a) Dependent variable is private credit/GDP ratio (8credit).
(a) VIF is variance inflation factor.

Appendix 5.8/B. Collinearity Diagnostics for Credit Model (a)

				Variance proportions				
Dimension	Eigenvalue	Condition Index	Constant	gdpgrowth	sint	hprice	curacc	kaopen
1	4.029	1.000	0.00	0.02	0.01	0.00	0.00	0.00
2	1.015	1.992	0.00	0.00	0.00	0.00	0.84	0.00
3	0.581	2.633	0.00	0.37	0.15	0.00	0.04	0.00
4	0.329	3.501	0.00	0.59	0.15	0.04	0.00	0.00
5	0.204	4.131	0.02	0.01	0.19	0.84	0.12	0.1
6	0.105	5.057	0.98	0.00	0.5	0.12	0.00	0.9

(a) Dependent variable is credit

Appendix 5.9. Multicollinearity and Diagonastic Tests for Current Account Model

Appendix 5.9/A. Coefficients for Current Account Model (a)

	Unstandardized coefficients		**Standardized Coefficients**			**Correlations**			**Collinearity Statistics**	
	Beta	Standard Error	Beta	**t-statistics**	**P-value**	Zero-order	partial	Part	Tolerance	VIF (b)
constant	5.404	1.092		4.947	0.000					
gdpgrowth	-0.174	0.106	-0.099	-1.642	0.102	0.106	-0.094	-0.081	0.658	1.519
popgrowth	-1.961	0.532	-0.2	-3.685	0.000	-0.135	-0.208	-0.181	0.815	1.227
fiscalbalance	0.654	0.069	0.52	9.531	0.000	0.442	0.482	0.468	0.809	1.236
hprice	-0.035	0.011	-0.178	-3.094	0.002	-0.205	-0.176	-0.152	0.725	1.38
credit	0.01	0.007	0.076	1.349	0.178	-0.087	0.078	0.066	0.754	1.327

(a) Dependent variable is current account balance (curacc).
(b) VIF is variance inflation factor.

Appendix 5.9/B. Collinearity Diagnostics for Current Account Model (a)

			Variance Proportions					
Dimension	**Eigenvalue**	**Condition Index**	**Constant**	**gdpgrowth**	**popgrowth**	**fiscalbalance**	**hprice**	**credit**
1	4.112	1.000	0.00	0.01	0.02	0.01	0.00	0.01
2	1.022	2.006	0.00	0.19	0.05	0.22	0.00	0.00
3	0.458	2.996	0.00	0.39	0.48	0.11	0.00	0.00
4	0.311	3.636	0.01	0.07	0.4	0.63	0.02	0.04
5	0.167	4.017	0.07	0.06	0.00	0.00	0.21	0.94
6	0.129	5.026	0.91	0.28	0.05	0.03	0.76	0.02

(a) Dependent variable is current account balance (curacc).

Appendix 5.10. Pedroni Cointegration: Pedoroni Test Results

	Modified Phillips-Perron	Phillips-Perron	Augmented Dickey-Fuller	Cointegrated (Yes/No)
Housing Price Equation	4.3112***	2.8146**	3.0125***	Yes
Credit Equation	4.8269***	4.6842***	4.7546***	Yes
Current Account Equation	3.8097***	-1.5769**	-1.4533*	Yes

Note that: Signs (***), (**) and (*) represents significance level at 1, 5 and 10 percent respectively. Ho: No cointegration: Ha: All panels are cointegrated. We reject null hypothesis that is there is cointegration between the variables. The variables in housing price equation are housing prices, credit/GDP, GDP growth rate, term spread and residential construction/GDP. The variables in credit equation are credit/GDP, GDP growth rate, housing prices, short term interest rates, and financial liberalization index (kaopen). The variables in current account equation are GDP growth rate, government fiscal balance, population growth rate, credit/GDP and housing prices.

Appendix 5.11. Unit Root Test Results

	Levin-Lin-Chu		Im-Pearson-Shin W Statistic		Augmented Dickey-Fuller		Phillips-Perron	
	Level	First difference	Level	First difference	Level	First difference	Level	First difference
nhouseprice	2.25258	-2.74002***	4.08884	-1.85724**	19.9162	50.5238**	14.9111	42.4339**
credit	-2.84251**	-4.25429***	-0.92061	-4.67142***	43.2157	81.6784***	19.8928	81.1243***
curacc	-1.18283**	-12.5769***	-0.99609	-14.4726***	42.3951	237.621***	37.2732	287.86***
dfint	-3.20533**	-17.0058***	-0.0526	-14.1999***	29.8523	229.776***	31.5036	250.788***
sint	-5.38559***	-15.0072***	-1.73285	-13.57***	42.7638	220.126***	74.9904**	259.894***
gdpgrowth	-8.70807***		-9.11723***		145.479***		153.066***	
resconstgdp	-3.6613***	-4.44784***	-2.73974***	-5.59086***	65.9550***	90.3289***	24.4721**	88.6914***
fiscalbalance	-4.23839***		-5.6588***		93.3599***		84.0202***	
kapoen	13.4756	-6.65071***	-11.7101	-10.9841***	231.153	138.13***	56.8814	96.2093***
popgrowth	2.01055	-11.6662***	-2.97642	-13.5606***	83.3562	196.337***	60.6751	176.911***
irulelaw	7.33886	4.4864**	1.95512	-1.08253*	20.513	48.2808*	12.7435	39.7974*
iaccount	-0.95373	-12.348***	-1.09272	-9.96056***	41.7210	149.537***	43.5426	191.708***
icorrup	-1.54554	-11.1827***	-1.24459	-10.261***	50.4894	155.343***	35.0498	190.443***
igoveff	-3.53562**	-11.1077***	-1.44411*	-10.0016***	43.2598	151.449***	41.8473	210.281***
iregul	-0.50275	-10.0699***	-0.36394	-8.31484***	35.8837	128.648***	34.1389	175.275***

Note that: In Levin-Lin-Chu, Null: unit root (assumes common unit root process). In other three tests, Null: unit root (assumes individual unit root process)
In Augmented Dickey Fuller and Phillips-Peron, probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively.(***), (**) and (*) indicate that null hypothesis is rejected at the statistical significance levels of 1, 5 and 10 percent respectively.

Appendix 5.12. Hausman Endogeneity Test Results

	Coefficients			
	(b) eqn3sls	(B) agncid	(b-B) Difference	sgrt (diag(V_b - V_B)) S.E.
hprice				
$gdpgrowth_{t-1}$	0.2434743	0.2408051	0.0026692	0.005903
$credit_{t-1}$	0.0016828	0.0017919	-0.0001092	0.0000774
$dfint_{t-1}$	-0.0151256	-0.0160025	0.0008769	0.0014266
$resconsgdp_{t-1}$	0.0567557	0.0569518	-0.0001961	0.0019117
cons	0.0153124	0.0155263	-0.0002139	0.0006106
credit				
$gdpgrowth_{t-1}$	2.53355	2.39022	0.1433297	0.4434675
sin_{t-1}	-1.404351	-0.4830444	-0.9213061	0.31597
$hprice_{t-1}$	27.28708	22.36402	4.923063	3.651626
$curacc_{t-1}$	-1.098779	-1.516155	0.4173758	0.1711213
cons	0.5849863	-0.6002376	1.185224	
curacc				
$gdpgrowth_{t-1}$	0.0216589	0.069925	-0.0482662	0.0632996
$popgrowth_{t-1}$	-0.0276552	-0.0274237	-0.0002315	0.0023564
$fiscalbalance_{t-1}$	0.5149871	0.5118198	0.0031673	0.020105
$credit_{t-1}$	-0.0125811	-0.0174857	0.0049046	0.0021731
$hprice_{t-1}$	-5.096805	-4.736719	-0.3600854	0.2782986
cons	0.2894247	0.2787317	0.010693	0.0121211

b : consistent under H_o and H_a obtained from Reg3
B : inconsistent Ha, efficient under Ho obtained from Reg3
Test: Ho : difference in coeffients not systematic
chi2 : (b-B)` [(V_b - V_B)^ (-1)} (b - 3)
: 15.93
Prob >ch2 : 0.2528
(V_b - V_B is not positive definite)

Appendix 5.13. Akaike's information criterion and Bayesian information criterion

Model	Obs	ll (null)	ll(model)	df	AIC	BIC
	277		-3149.785	17	-3444.667	-3383.059

Note: Obs : number of observations is used in calculating BIC.

Appendix 5.14. Estimation Results for the Determinants of Current Account Balance

	Coefficients
Per capita income	.05295***
	(0.000)
Economic growth	-8.0036
	(0.397)
Fiscal balance	.58457***
	(0.000)
Population growth	-4.24114
	(0.000)
Oil balance/GDP	.54291***
	(0.000)
Net foreign assets/GDP	.01964***
	(0.004)
Trade openness	.01066*
	(0.051)
Financial development	0.00595
	(0.241)
Constant	-9.47238
	(0.000)
F-test (21, 270)	22.76
P-value	0.000
R-sq	0.6905
Observations	292

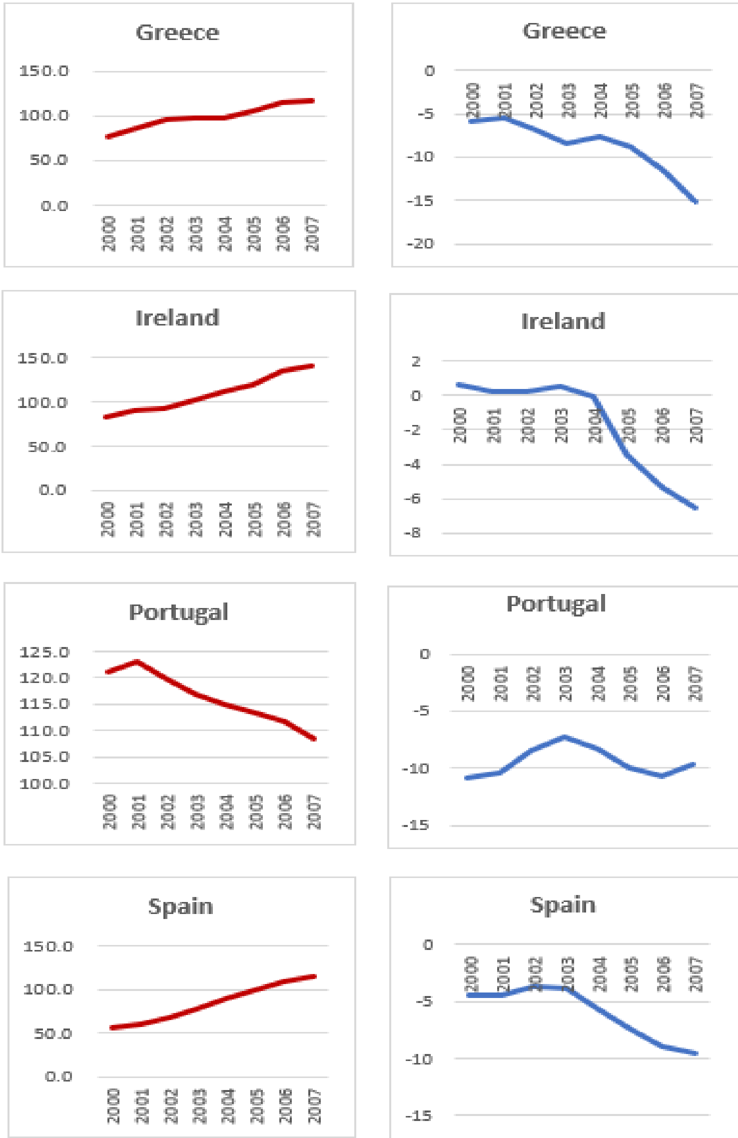
Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. As an estimation technique panel OLS time fixed effects is used following the work of Chinn and Prasad (2003) and Ca' Zorzi, Chudik and Dieppe (2012) on the determinants of current account balance. The model is based on intertemporal approach. Whole period (1990-2016) is considered.

Appendix 5. 15. Data List for the Determinants of Current Account Balance

VARIABLES	DATA SOURCE
Current Account balance (% of GDP)	International Monetary Fund
Consumer price index (2010=100)	OECD
Economic growth (%)	The World Bank
General government fiscal balance (% of GDP)	The World Bank
Financial development (private credit to GDP %)	The World Bank
Nominal oil balance (% of GDP)	The International Energy Agency
Net foreign assets (% of GDP)	Lane, and Milesi-Ferretti (2017).
Per capita income (US dollar)	The World Bank
Population growth (%)	The World Bank
Trade openness (export + import / GDP - %)	The World Bank

Appendix 5.16. The Countries with Current Account Imbalances over the Threat Threshold (>-4%)

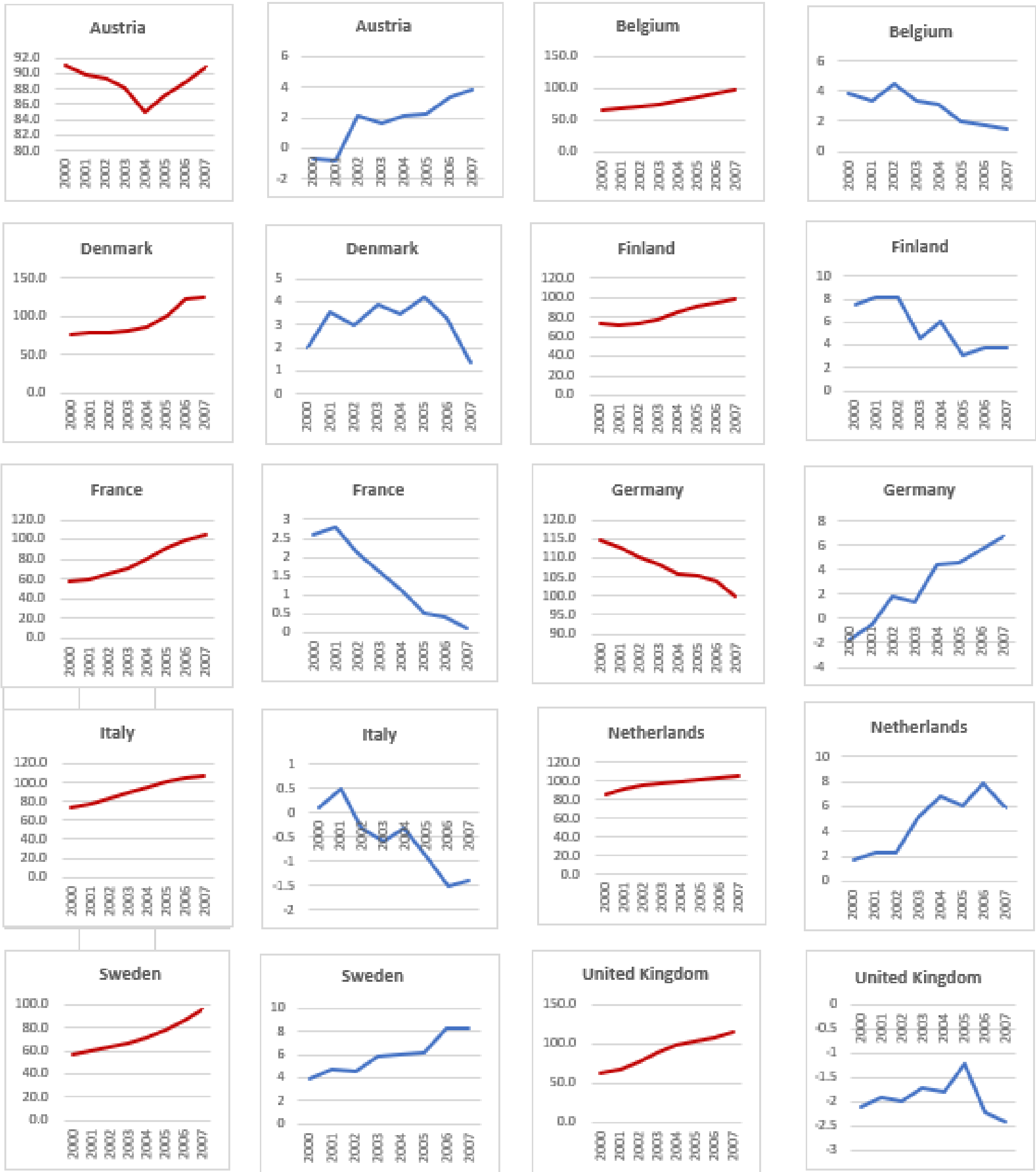
Real house prices[1] **Current account balance[2]**



Source: IMF (2017) and OECD (2018).
(1)2010=100
(2) As a percentage of GDP

Appendix 5.17. The Countries Having Current Account Imbalances with equal to or below the Threat Threshold (-4%)

Real house prices[1] | **Current account balance[2]** | **Real house prices[1]** | **Current account balance[2]**



Source: IMF (2017) and OECD (2018).
(1)2010=100
(2) As a percentage of GDP