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Editorial

Recent Developments in Macro-Econometric Modeling: Theory and Applications

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Developments in macro-econometrics have been evolving since the aftermath of the Second World War. Essentially, macro-econometrics benefited from the development of mathematical, statistical, and econometric tools. Such a research programme has attained a meaningful success as the methods of macro-econometrics have been used widely over about half a century now to check the implications of economic theories, to model macroeconomic relationships, to forecast business cycles, and to help policymakers to make appropriate decisions.

However, despite this progress, important methodological and interpretative questions in macro-econometrics remain (Stock 2001). Additionally, the recent global financial crisis of 2008–2009 and the subsequent deep and long economic recession signaled the end of the "great moderation" (early 1990s–2007) and suggested some limitations of the widely employed and by then dominant macro-econometric framework. One of these deficiencies was that current macroeconomic models have failed to predict this huge economic downturn, perhaps because they did not take into account indicators of contagion, systemic risk, and the financial cycle, or the inter-connectedness of asset markets, in particular housing, with the macro-economy. It seems that something was going wrong, and accordingly, several new lines of research have pointed to the importance of measurement errors in macroeconomic and financial variables (Barnett 2012). Furthermore, it appears that monetary rules and macroeconomic models were misspecified, and the pre-crisis generation of dynamic stochastic general equilibrium (DSGE) models had ignored many features of the real world, which should have been incorporated in the structure (e.g., banks and financial sector, heterogeneities, imperfect information, etc.) and behavioral assumptions (e.g., expectation formation and learning, rational inattention, forms of bounded rationality, etc.) of these models. Consequently, a growing recent research agenda has evolved in order to tackle these shortcomings (Del Negro and Schorfheide (2011); and Schorfheide (2013); among many others).

When we were approached to act as guest editors for this Special Issue in late November 2015, we were largely motivated by the above doubts and thoughts, and we did not hesitate to list such concerns in the call for papers. We did not expect then that the outcome of the call would be as good in quality and as diverse and fundamental in coverage as we are glad to see it now, in April 2018, when we have just completed the Special Issue. We are very much indebted for this positive outcome to the colleagues who submitted their papers and to the referees who provided thoughtful and constructive feedback even within the tight deadlines this journal seeks to impose, often in less than a month and almost always in less than two months. The authors, in turn, have implemented revisions that addressed all essential comments and suggestions of the referees. Observing this prompt, collegial and constructive reviewing process as guest editors was a particular pleasure for us. In our tasks and efforts, we were helped immediately and very efficiently by the Editor-in-Chief Marc Paolella,

the assistant editors Michele Cardani, Jocelyn Dong, Lu Liao, Tina Tian, Melanie Yuan, and Vera Zhu, and our website editor Nadja Petrovic, without whose devotion this Special Issue would not have been produced in such a smooth and well-managed manner.

This Special Issue aims to focus on new developments in macroeconomic modeling and macro-econometric techniques that have been introduced to extend the recent framework of macro-econometrics, itself challenged along various dimensions after the experience with the global financial crisis. Accordingly, this Special Issue collects eight articles that propose theoretical, methodological or empirical contributions to research in macro-econometrics. To nicely put this collection of recent advances into a broader historical perspective, we include as a ninth paper (in fact, opening this issue), a reprinted interview with one of the leading theorists of macroeconomic dynamics and macro-econometricians of his generation. Our Special Issue thus provides, we are confident, a concise but authoritative update on current developments in macro-econometric modeling, estimation and forecasting, which itself is embedded more generally within the context of the aspirations and challenges of the related research agenda over the past half a century or so.

As just mentioned, we decided to open the Special Issue by reprinting the **interview of Apostolos Serletis with William Barnett**, with their kind agreement and permission. This interview provides a wonderful frame and perspective regarding the development of macroeconomic dynamics and macro-econometrics through the career of a brilliant scientist, not just an economist or econometrician, William Barnett, since the time he worked as a systems development engineer at Rocketdyne Division of North American Aviation in Los Angeles in the 1960s until the present day. Reading Barnett's fascinating account of his own research path is not only so enjoyable, but is also very insightful and revealing about the ambitions and disappointments with macro-econometrics, and with social science too, in a broader context. But it also synthesises many of the achievements—as well as illusions—in macro-dynamics and macro-eocnometrics Barnett has witnessed, and pondered on, along the road.

Filtering has a long tradition in macro-econometrics, at least since Beveridge and Nelson (1981) and Hodrick and Prescott (1981, 1997), and no matter the apparent dominance of the latter technique, albeit with very recent criticisms (Hamilton 2018) regarding some weaknesses of the Hodrick-Prescott filter, it seems that there is still scope for innovative work in this field. One such avenue of novel methodological research is demonstrated by **Luis J. Álvarez** in his article "**Business Cycle Estimation with High-Pass and Band-Pass Local Polynomial Regression**". He proposes a frequency domain analysis of the contrast filter obtained by the difference of a series and its long-run local polynomial regression (LPR) component and shows that it operates as a kind of high-pass filter. An alternative is also provided by the use of band-pass LPR methods that aims at isolating the cyclical component. Results are compared to standard high-pass and band-pass filters, which situates the paper within the literature, and the proposed new procedures are further illustrated using the US GDP series, demonstrating their applicability.

Wage formation is another "classical" theme in macro-econometrics since the seminal work of Phillips (1958) and its modern reinterpretation in DSGE models. **Ragnar Nymoen** focuses on the case of Norway in his contribution to our Special Issue entitled "**Between Institutions and Global Forces: Norwegian Wage Formation Since Industrialisation**". He reviews the development of labour market institutions in this country, showing how labour market regulation has been interacting with macroeconomic developments. Nymoen then attempts to evaluate dynamic econometric models of nominal and real wages that encompass single- and multi-equation methods using a new data set with historical time series of wages and prices, unemployment and labour productivity. He employs impulse indicator saturation to achieve robust estimation of focus parameters, and the breaks are interpreted in the light of the historical overview. A relatively high degree of constancy of the key parameters of the wage setting equation is documented, over a considerably longer historical time period than earlier studies have done. Such evidence is consistent with the view that the evolving system of collective labour market regulation over long periods has delivered a certain necessary level of coordination of wage and price setting. However, he also reports evidence that global forces have

been working too for a long time, linking in effect real wages to productivity trends in the same way as in countries with very different institutions and macroeconomic development.

In novel theoretical work entitled "**Endogeneity, Time-Varying Coefficients, and Incorrect vs. Correct Ways of Specifying the Error Terms of Econometric Models**", **P.A.V.B. Swamy**, **Jatinder S. Mehta** and **I-Lok Chang** challenge conventional econometric estimation from the viewpoint of omitted relevant regressors. They claim that using the net effect of all relevant regressors omitted from a model to form its error term is incorrect because the coefficients and error term of such a model are non-unique, and non-unique coefficients cannot possess consistent estimators. They show how uniqueness can be achieved if, instead, one uses what they term "sufficient sets" of (relevant) regressors omitted from each model to represent the error term. In this case, the unique coefficient on any non-constant regressor takes the form of the sum of a bias-free component and omitted-regressor biases. Measurement-error bias can also be incorporated into this sum. They finally demonstrate that, when following the procedures proposed, accurate estimation of bias-free components become possible.

A voluminous empirical approach in macro-econometrics, since Mankiw et al. (1992) at least, strives to explain cross-country differences in economic growth or development. In this Special Issue, **Dorian P. Owen** contributes to that theme with his article "**Evaluating Ingenious Instruments for Fundamental Determinants of Long-Run Economic Growth and Development**". The problem with the vast majority of this literature is that the determinants of cross-country differences in long-run development are characterised by the use of various instruments of "ingenious" nature. However, while "inventive" indeed, many of these instruments do not easily convince about their ability to provide a valid basis for causal inference. Owen's contribution consists in examining whether explicit consideration of the statistical adequacy of the underlying reduced form, which provides an embedding framework for the structural equations, can usefully complement economic theory as a basis for assessing instrument choice. He finds that diagnostic testing of the reduced forms in influential studies reveals evidence of model misspecification, with parameter non-constancy and spatial dependence of the residuals being almost ubiquitous. This feature, surprisingly not previously identified, potentially undermines the inferences drawn about the structural parameters, such as the quantitative and statistical significance of different fundamental determinants of long-run economic growth and development.

A notorious theme in time-series modeling and forecasting concerns inflation. While there are many theory-based as well as agnostic, statistical models of inflation dynamics, inflation has systematically been found very hard to forecast (Stock and Watson 2007; Faust and Wright 2013). Some of the literature has defended disaggregation methods as producing better inflation forecasts relative to aggregate inflation methods. Along these lines goes the experience with forecasting Euro Area (EA) and United States (US) inflation by *The Bulletin of EU & US Inflation and Macroeconomic Analysis (BIAM)*, a monthly publication that has been reporting real-time analysis and forecasts for inflation and other macroeconomic aggregates for the EA, the US and Spain since 1994. **Antoni Espasa and Eva Senra** discuss the design of such inflation disaggregation schemes in their article "**Twenty-Two Years of Inflation Assessment and Forecasting Experience at the Bulletin of EU & US Inflation and Macroeconomic Analysis**". Based on the accumulated rich experience at BIAM, they conclude that those schemes would be useful if they were formulated according to economic, institutional and statistical criteria aiming to select a set of components with very different statistical properties for which valid single-equation models could be built. They show that BIAM real-time EA inflation forecasts compare successfully with the consensus from the *ECB Survey of Professional Forecasters*, one and two years ahead.

Seasonal adjustment of monthly and quarterly time series has been a long-debated issue in macro-econometrics too. In our Special Issue **Alain Hecq, Sean Telg and Lenard Lieb** contribute to this particular research area with their article "**Do Seasonal Adjustments Induce Noncausal Dynamics in Inflation Rates?**". They study the effect of seasonal adjustment filters on the identification of mixed causal/non-causal autoregressive models. Relying on Monte Carlo simulations, they conclude that

standard seasonal filters induce spurious autoregressive dynamics on white noise series, a phenomenon already documented in the literature. Using a symmetric argument, they show that those filters also generate a spurious non-causal component in the seasonally adjusted series, but preserve the existence of causal and non-causal relationships. Their key result has important implications for modeling economic time series driven by expectation relationships, which they illustrate employing inflation data on the G7 countries.

In line with the challenge of measuring unobservable expectations economic agents hold, and modify, regarding various key macro-variables, it is sufficient to recall that modeling expectations has challenged macroeconomic theory and macro-econometric work since the rational expectations revolution (Muth 1961) and its even earlier alternative, and evolving in parallel paradigm, of various forms of adaptive expectations (following the early work of Cagan (1956)) and learning. In our Special Issue **Francesca Rondina** contributes to this topic in her article " **Estimating Unobservable Inflation Expectations in the New Keynesian Phillips Curve**". She relies on an econometric model and Bayesian estimation to reverse engineer the path of inflation expectations implied by the New Keynesian Phillips Curve and the data. She reports that the estimated expectations roughly track the patterns of a number of common measures of expected inflation available from surveys or computed from financial data. In particular, they exhibit the strongest correlation with the inflation forecasts of the respondents in the University of Michigan Survey of Consumers. The estimated model also shows evidence of the anchoring of long-run inflation expectations to a value that is in the range of the target inflation rate, a finding of direct relevance to monetary policymaking.

The last paper in the Special Issue addresses the related and very topical research area of forecasting inflation uncertainty in advanced economies. In their contribution "**Forecasting Inflation Uncertainty in the G7 countries**", **Mawuli Segnon**, **Stelios Bekiros** and **Bernd Wilfling** introduce a new model, based on the combination of ARFIMA models and Markov-switching multifractal processes, as an alternative to STARFIMA-GARCH models to improve the forecasts of inflation uncertainty. The authors provide the statistical properties of the model and examine maximum likelihood estimators and optimal forecasting through Monte Carlo simulations. The forecast accuracy comparison is based on both the Equal Predictive Ability (EPA) test of Diebold and Mariano (1995) and the Superior Predictive Ability (SPA) test of Hansen (2005), itself building on the Reality Check (RC) framework of White (2000). The novelty of the paper consists in developing a model that allows for multiple characteristics of inflation uncertainty, namely, clustering and nonlinear effects, dual long-memory and asymmetries in inflation rates.

We very much hope to provide to the readers, colleagues and PhD students, an update to macro-econometrics along the several covered fields in our Special Issue as well as a deeper perspective on the interactions of macro-theory and macro-modeling with macro-econometrics, statistics and computation. We very much hope too that our Special Issue will stimulate further research and novel insights.

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