Journal of Econometrics 183 (2014) 1–4

Contents lists available at ScienceDirect

Journal of Econometrics

journal homepage: www.elsevier.com/locate/jeconom

Editorial

Introduction to *internally consistent modeling, aggregation, inference, and policy*

James J. Heckman [a], Apostolos Serletis [b,*]

[a] Department of Economics, University of Chicago, 1126 East 59th Street, Chicago, IL 60637, United States

[b] Department of Economics, University of Calgary, Calgary, Alberta T2N 1N4, Canada

ARTICLE INFO

Article history:
Available online 5 July 2014

JEL classification:
C43
D12
E51

Keywords:
Monetary aggregation
Flexible functional forms
Barnett critique

ABSTRACT

This special issue of the *Journal of Econometrics* honors William A. Barnett's exceptional contributions to unifying economic theory with rigorous statistical inference to interpret economic data and inform public policy. It is devoted to papers that advance microeconometrics, macroeconometrics, and financial econometrics to build models to interpret evidence.

This special issue of the *Journal of Econometrics* honors William A. Barnett's contributions in the fields of economic theory and econometrics. William Barnett is an eminent scientist and an outstanding econometrician and macroeconomist. He is the leading figure in the study of monetary and financial aggregation using the index number and aggregation theory. In his seminal *Journal of Econometrics* paper in 1980, "Economic monetary aggregates: an application of index number and aggregation theory", produced while he was on the staff of the Federal Reserve Board's elite Special Studies Section, he fired the first volley arguing that official simple-sum monetary aggregates, constructed by the Federal Reserve, produce an internal inconsistency between the implicit aggregation theory and the theory relevant to the models and policy within which the resulting data are nested and used. That incoherence has been called the Barnett Critique, with emphasis on the resulting inference and policy errors and the induced appearances of function instability.

Barnett (1980) applied economic aggregation and index number theory to construct monetary aggregates consistent with Diewert's (1976) class of superlative quantity index numbers. Barnett's monetary aggregates are Törnqvist–Theil discrete time Divisia quantity indices, named after Francois Divisia, who first proposed the continuous time index in 1925 for aggregating over goods; Barnett (1980) proved how the formula could be extended to include monetary assets. Barnett has also extended the field of index number theory to include risk in Barnett (1995), Barnett et al. (1997), and Barnett and Wu (2005), using weaker assumptions in each successive derivation. He extended the index number theory to multilateral international financial aggregation in Barnett (2007), for multicountry economic unions. Moreover, Barnett and Choi (2008) identified a generalized superlative index number class, including some indexes that cannot be found by Diewert's (1976) approach which requires algebraic representation of the aggregator function.

Thirty years later, the Federal Reserve Board and many other central banks around the world continue officially to produce and supply low quality monetary statistics, inconsistent with the relevant aggregation and index-number theory. This practice misleads central banks, as well as financial firms, mortgage lenders, and mortgage borrowers, regarding the levels of systemic risk in the economy and also misleads economists regarding the appearance of instability of policy-relevant functions in the economy. These data deficiencies exist despite the fact that dozens of central banks throughout the world produce Divisia monetary aggregates for internal use, often available only to the central bank's highest ranking officials. Noteworthy exceptions include the Bank of England, the Federal Reserve Bank of St. Louis, the National Bank of Poland, the Bank of Israel, and the International Monetary Fund, which advocate and provide Divisia monetary aggregate data to the public. The European Central Bank's Governing Council also uses the Divisia monetary aggregates, but on a confidential basis, without making the data available to the public. The Bank of Japan produces Divisia monetary aggregates, but only for internal use. As an indication of the level of international acceptance of Barnett's approach among

* Corresponding editor. Tel.: +1 403 220 4092; fax: +1 403 282 5262.
E-mail address: Serletis@ucalgary.ca (A. Serletis).
URL: http://econ.ucalgary.ca/profiles/apostolos-serletis (A. Serletis).

http://dx.doi.org/10.1016/j.jeconom.2014.06.005
0304-4076/

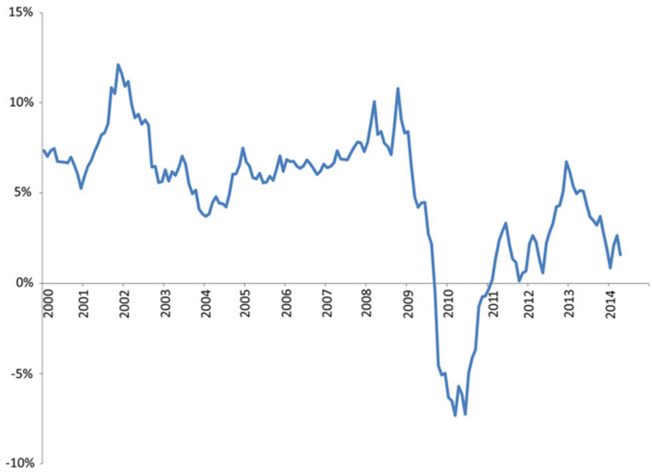

Fig. 1. Divisia M4+, year-over-year percentage growth rate (January, 2000–April, 2014).

sophisticated economists, see the International Monetary Fund's official data document, *Monetary and Financial Statistics: Compilation Guide*, 2008, pp. 183–184.

The second volley in the Barnett critique was fired in Barnett et al. (1984), replicating prior studies which had found "puzzles" in monetary economics and which presented evidence of functional instability in the economy's financial sector. They found that all puzzles and appearances of instability disappeared, when the simple-sum monetary aggregates were replaced by Divisia monetary aggregates. The same conclusion has been found repeatedly in subsequent research by economists throughout the world. More recently, Barnett documents the relevancy of the Barnett Critique in understanding the sources of the risk misperceptions that led to the global financial crisis and Great Recession. In Barnett and Chauvet (2011a) and his 2012 MIT Press book, *Getting it wrong: How faulty monetary statistics undermine the Fed, the financial system, and the economy*, he argues that economic agents, under the misperception that the business cycle had permanently ended during the Great Moderation, displayed an incorrect assessment of systemic risk and significantly increased their leverage and risk-taking activities. This led to the credit-driven, asset-price bubble in the U.S. housing market, with prices departing significantly from fundamental values. When the bubble burst, it brought down much of the financial system and not only led to an economic downturn in the United States, but also to a global recession.

During 2011, as the implications of his new book became known, Barnett was appointed Director, Center for Financial Stability, in New York City. He manages a program building on his research in monetary and financial aggregation. The program he directs can be found at http://www.centerforfinancialstability.org/amfm.php, along with an online library linking to Divisia monetary aggregate data and studies for over 40 countries throughout the world. The CFS Divisia monetary aggregates, documented in detail by Barnett et al. (2013), are currently the best measures of the money supply. They indicate that policy was more expansionary than indicated by the official simple-sum monetary aggregates during the asset bubbles and more contractionary than indicated by interest rates, following the financial crisis leading into the Great Recession. For example, as can be seen in Fig. 1, Divisia M4 is currently growing at a low rate, historically inconsistent with healthy economic recovery.

Barnett has also made fundamental contributions to the associated field of flexible-functional-form modeling. The earliest modern consumer-demand-system model, having a provable local approximation property and rigorous connection with internally consistent aggregation over goods and prices, was Theil and Barten's Rotterdam model, which used Divisia and Frisch indexes to aggregate over goods quantities and prices. The model was derived directly from the relevant first-order conditions. That model was not vulnerable to the Barnett critique. But the model's link to aggregation over consumers was questionable, since the available theory conditioned on an unreasonable assumption, implying that the model collapsed to Cobb–Douglas. Barnett (1979a) proved that the model's aggregation over consumers could be accomplished under remarkably weak assumptions, but with the addition of a remainder term, having properties that he explored. Barnett (1979b) further derived and applied the model's test for blockwise weak separability, which is the necessary condition for quantity aggregation, and he derived the remainder term after aggregation over consumers.

At that time, there also was a problem with the available econometric theory. The relevant class of models for most of this literature is the closed form nonlinear systems of equations, but proofs of the asymptotic properties of the maximum likelihood estimator, under regularity conditions relevant to nonlinear demand systems, did not exist. The available proofs assumed linear structure or independent and identically distributed endogenous variables. Those assumptions are not relevant to nonlinear regression systems. Barnett (1976) was the first to prove the asymptotic normality and efficiency of the MLE for that class of models, paving the ground for future research in the field.

Flexible functional forms, providing second-order local approximations, have most commonly been derived from second-order Taylor series approximations. Global regularity, including monotonicity and curvature, cannot be imposed on those available models without causing them to collapse to highly restrictive special cases. Barnett (1983) proposed the use of the second-order Laurent series and identified a parsimonious special case, called Minflex Laurent, which retains the flexibility property. He applied the new modeling approach to estimate the demand for money in a manner consistent with aggregation-theoretic monetary aggregation. Barnett and Lee (1985) proved that the second-order Laurent series and its Minflex parsimonious special case have better economic properties, over a very large region, than the second-order Taylor series flexible functional forms. This research on consumer demand motivated subsequent research on production by Diewert and Wales (1987), resulting in their generalized Barnett production model.

In his insightful analysis, Gallant (1981) introduced the concept of asymptotic global flexibility, using semiparametric estimation converging globally to unknown functions. In this approach, the order of the approximation is linked to the sample size, and the sample size is permitted to go to infinity. Gallant used the Fourier series for that purpose. But the Fourier series basis functions span the neoclassical function space from outside that space, since the basis functions are periodic and therefore not neoclassically regular. As a result, when the series expansion is truncated by the finite sample size, the model usually violates neoclassical regularity conditions. Barnett et al. (1991) proved that the Müntz–Szatz series expansion can be used for seminonparametric inference, while keeping the basis functions inside the neoclassical function space. The resulting model is called the asymptotically ideal model (AIM) and continues to be a state-of-the-art approach motivating sophisticated research.

Some of Barnett's most forward-looking research remains beyond the state of the art of mainstream applied research to this day. Barnett (1977a) produced the only currently known globally regular blockwise-weakly-separable demand system. Aggregation is recursive within the utility tree, thereby assuring internal consistency between the aggregate data and the model within which the data are used. Barnett (1977b) also derived and proved identification of the structural form consistent with the household production function approach and showed how it can be specified with