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A Historical Sketch of Macroeconometrics

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Models are to be used, not believed.

Henry Theil (1924-2000)

The paper describes the evolutionary history of Macroeconometrics over the last one hundred years. Three main approaches are distinguished, their underlying principles are discussed and the weakness of each principle is considered. The paper also shows the current developments in the field and indicates the directions of the research currently undertaken.

1. Introduction

The interest in Macroeconometrics is growing from day to day with more articles and books being written on the subject. Numerous courses are taught on it, a constant flow of researchers is coming into the field and even conferences are now devoted to Macroeconometrics. The reason for such growth of interest is related to the increasing popularity of dynamic stochastic general equilibrium (DSGE) models which provided a good framework for data analysis for economic policy purposes. The increase of popularity is also supported by the development of computers and simulation algorithm (Fernandez-Villaverde et al, 2009). Considering an exponential growth of interest in the subject it is worthwhile to make a journey to the past when only an early sprout appeared and then slowly return back to the present observing the whole evolutionary development.

The rest of the paper is organized as follows. The second section describes early works which were at the cradle of Macroeconometrics. In the third section the contribution of Jan Tinbergen to the rejuvenation of Macroeconometrics is presented. The exhibition of the work of the Cowles commission and its approach is provided in the fourth section. The fifth section explains the reasons for the failure of the Cowles Commission approach. The following three sections describe the principles of the new approaches (the LSE, the VAR and the VECM) which appeared as a response to the failure. Finally

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the last section concludes and provides some remarks on the direction of the development of Macroeconomics.

2. Early sprouts

Before starting writing this paper, I thought that the history of Macroeconometrics started from the 1950s but it was very surprising to discover that actually the discipline has a much longer history, dating back to the 1870s and associated with the name of William Stanley Jevons (1835-1882). He was the first economist who studied business cycles combining both theory and statistical data. Jevons was a noted economist of his time specializing in economic policy issues. However his work, attempting to find a casual link between sunspot cycles and business cycles, was ridiculed by the profession of that time. Looking at the dates of the financial crises in the 19th century he concluded that the length of an average cycle was about 10.8 years when a sunspot cycle was about 11.1 years. Inspired by the finding he wrote that mean values being so close to each other could, with probability, indicate a casual link between these periodic phenomena.

To explain the gap between the average cycle lengths he introduced the idea that the sunspot theory together with a psychological phenomenon could produce such an average length of business cycles. Some attempts were also made to find the casual relationship between sunspot cycles and output and prices in agriculture. Although many of his contemporaries did not recognize his works in the field he had a few successors. The most well-known were John Mills and Adamson from Manchester. Adamson was the only one who criticized him on valid grounds. In his letter to Jevons he disputed the reasonableness of assigning 'crises' to some dates and noted that it seemed unrealistic to assume cycles to be of the same length during the whole period of the investigation. In Adamson's opinion, the length of cycles should grow as the country developed and he also doubted the existence of the link between sunspot cycles and price cycles in agriculture. Although Jevons' idea to link the sunspot cycles with business ones is bizarre, he made a step forward in the development of econometrics by relying on uniform distribution which lies in the origin of a general theory (Morgan, 1992).

Later, using more advanced statistical tools, Henry Ludwell Moore (1869-1958) developed the alternative business cycle theory but his ideas were even more bizarre

than that of Jevons'. First, he found a casual relationship between weather cycles and business cycles. The work was criticized by Philip Wright, who in his article showed the relationship between weather cycles and business cycles breaks when only relevant for agriculture rainfall was considered. In his second work published in 1923 Moore showed the causal link between the planet Venus' movements and business cycles. Here he argued about the existence of the eight year business cycles as Venus comes between the earth and the sun every 8 years. This work surpassed the previous one by considering an exogenous cause (the Venus movement) not alone but combined with economic and social factors. He also extended his work by studying several countries, not just Great Britain as before (Colander and Landreth, 1994). Despite all these improvements the work did not get much praise. In Morgan's (1992) opinion there are three reasons why the works of Jevons and Moore did not become popular with the profession. First, their idea about the existence of some exogenous factor outside the economy that affected economies did not receive approval from other economists and the frequency methods they used were found to be unsuitable for econometric purposes. Second, there were alternative business cycle theories which were much simpler for students to comprehend. One such alternative theory was by Wesley Clair Mitchell (1874-1948). In contrast to Jevons and Moore, he used theories to interpret empirical observation (Colander and Landreth, 1994). Finally, economists of the 1920s and 1930s preferred description to explanation in statistical works. Their idea to build models using statistical relationships found in data was only revitalized in the late 1930s by Jan Tinbergen (1903-1994), a Nobel Prize winning economist.

3. Renaissance in Macroeconometrics

Jan Tinbergen was one of the founders of the field which is now called Macroeconometrics. It was Tinbergen who first thought of economies as a system of equations that determine relationship among economic variables and estimated parameters of these equations. In 1936 he presented such a system for the Dutch economy and started to use it for policy and planning purposes. After a while he was invited to Geneva by the League of Nations to test the theories of business cycle empirically. By 1938 Tinbergen and his team had built a macro econometric model consisting of 48 equations and estimated it for the USA. Although many achievements have been attained since then, the model still looks sophisticated both on theoretical and

statistical grounds. Besides being amazing it was criticized by another think tank of economics - John Maynard Keynes (1883-1946). Keynes argued that Tinbergen's methods would fail to prevent numerical correlation from being misinterpreted as causations. This problem still remains unresolved. Tinbergen in his turn argued that policy decisions could not be made based only on qualitative assumptions and the role of numerical values of parameters is indebted. Tinbergen was a policy oriented person and this interest can be found in all his subsequent works (Tobin, 1997). Macroeconometrics received further development after World War II at the Cowles Commission when Jacob Marschak (1898-1977) created an exceptional team of econometricians.

4. The Cowles Commission approach

The Cowles Commission involved the best econometricians of the 20th century and was established by Alfred Cowles (1891-1984) in Colorado Springs in 1932. Alfred Cowles was an investment advisor in Colorado Springs. After the crash of the stock market in 1929 he realized that he did not understand how economies work and stopped publishing his advisory bulletin. He focused on doing research on stock market and forecasting. Later Harold Davis, a mathematician and his friend introduced him to Irving Fisher (1867-1947), president of the Econometric Society. Davis and Fischer suggested Cowles found an econometric organization and a journal. Cowles agreed to sponsor the project. Later in 1939 the commission moved to Chicago and finally in 1955 to Yale where it exists up to know. Such econometricians as Jacob Marschak (1898-1977), Abraham Wald (1902-1950), Trygve Haavelmo (1911-1999), Tjalling Koopmans (1910-1985) worked there (Crist, 1994). Most of the tests and quantity results we use in applied econometric research were obtained under the commission. The commission made a noted contribution to the field of Macroeconometrics by developing its own approach in the area which is called the Cowles Commission approach. The approach aims at estimating a dynamic simultaneous equation system and is comprised of three stages: specification and identification of the theoretical model, estimation of the parameters of the model and their judgment, and simulation of policy effects. The philosophy of the Cowles commission is to determine the effect of exogenous (policy) variables on macroeconomic indicators in order to know which value to assign to the policy variables to attain the required values of macroeconomic

indicators (Favero, 2001). The work on simultaneous equations started in the 1930s. Since then they have focused on three directions: estimating forecasting accuracy of simultaneous equation models, analyzing small sample properties and developing methodology for non linear simultaneous equations. The resume of the first and the third directions was made by Ray C. Fair. In 1984 he published a book “Specification, Estimation and Analysis of Macroeconometric Models” which covers methodology, macroeconomic theory, specification of econometric models, estimation techniques, optimal control issues, rational expectation models and computational issues. The book was further extended and published 10 years later under the name “Testing Macroeconometric Models”. On small sample properties area a considerable contribution was made by Joseph Kadane who, during his two-year stay with the Cowles, developed and completed his doctoral thesis- a new analytical procedure to analyze small sample properties of estimators. The development led to obtaining perceptive results regarding small sample properties alternative simultaneous equation estimators (Malinvaud, 1988).

5. The failure of the Cowles Commission approach

Until the mid 1970s all models used were based on the approach of the Cowles Commission. However, after considerable structural changes appeared in the global economy (oil shocks, the collapse of the Bretton Woods system), this type of macro models produced false forecasts and forced economists to make changes constantly (Epstein, 1989). It became clear that these models did not justify themselves anymore. The conclusion was supported by the Lucas Critique, which argued that it was not realistic to forecast the effect of changes in economic variables on the economy just based on highly aggregated historical data. The reason for this argument was the following: parameters were not structural, which means that they would change as the economic conjuncture of the market changed. Any policy recommendation suggested relying on such models is a far cry from being truthful. In Lucas’ opinion to get reliable estimates for policy recommendation less aggregated data should be used to reflect the factors driving human behavior. Knowing the probable reaction of individuals, the macroeconomic impact of a policy change can be easily predicted². As a reaction to the

² http://en.wikipedia.org/wiki/Lucas_critique

failure of the Cowles Commission approach several new approaches appeared: the LSE (London School of Economics) approach, the VAR (vector autoregression) approach and VECM (vector error correction model) approach.

6. New approaches: the LSE approach

The history of the origin of what is now known as the LSE approach goes to 1963 when John Denis Sargan (1924-1996) presented his paper at Colston Society conference on National Economic planning at Bristol University. The paper was later named the “Colston Paper” and laid the conceptual foundations of the approach (Hendry, 2003). The LSE approach sees the reason of the Cowles Commission approach failure in the absence of a test to validate the credibility of the reduced form derived from the structural one. However, the philosophy of the LSE approach coincides with that of the Cowles Commission which assumes simulation and econometric policy evaluation. According to the LSE approach, a general dynamic reduced form model needs to be set first and then several diagnostic tests are applied to validate the reduced form of the model. The structural form is identified and estimated at the final stage. If the structural form is just identified, no validation is needed and if the structural form is overidentified, the validation is to be tested. Finally after the robustness of the model to Lucas Critique is checked, the effects of the various economic policies can be simulated. (Favero, 2001).

7. New approaches: the VAR approach

In his popular article “Macroeconomics and Reality” Sims (1980) also doubted the reliability of large scale macroeconomic models for policy recommendations indicating that the rareness of the cases when macroeconomic research was done within one model. Sims criticism was directed toward identification of the large macro models which in his view were inappropriate, claiming that identification for such a large scale model was incredible. His solution to the problem was an alternative approach to Macroeconometrics- VAR. By using VAR Sims showed that economically testable models with meaningful descriptive statistics could be obtained without solid theoretical foundations. The VAR philosophy is different from those of the Cowles Commission and the LSE approaches. It assumes providing information on how macroeconomic indicators respond to impulses of policy variables. Thus the focus of the VAR approach

is shocks. The prime step is to define the appropriate shocks and then to analyze the response of the system to shocks by looking at impulse responses and variance decompositions (Favero, 2001). However, many economists criticized VAR as being atheoretical. For example, Cooley and LeRoy (1985) argued that VARs were just refineries that digest the data and produce a summary of its dynamic properties. They are also difficult to understand and to interpret because of lack of theoretical foundations. To remove the atheoretical label from VAR, Sims (1986) and some other economists suggested a theoretical alternative to VAR, which Sims called identified VAR. It is now widely known as structural VAR (SVAR). SVAR focuses on imposing restrictions not on parameters, but on shocks to make the model reflect theory. Many economists argue in favor of SVAR because SVAR models do not suffer from overidentifications as large macroeconomic models and it is more theoretical in comparison with just VAR (Lutkepohl and Kratzig, 2004). The other “modification” of VAR model developed by Soren Johansen is vector error correction model (VECM). VECM can be defined as rescaled VAR model with identified parameters. In VECM having theoretical foundation, testing significance of coefficients and identification issues are crucial. Here, as in VAR models, variables are treated as endogenous but only theoretically relevant variables are employed (Rao, 2005). The VAR model is usually transformed to VECM when there are some cointegrating relationships among variables. Cointegrating relationship means that even if variables are unit root processes their linear combination does not exhibit a unit root behavior. VECMs are more desirable than differenced VAR models because differencing removes all information on long run relationships (Canova, 2007).

8. Conclusions

Today it can be stated confidently that there is no complete methodology. Macroeconometrics is in the ‘black box’ and it is of paramount importance to free it from there. Obviously an inadequate modeling strategy will not yield a valuable product, but one should also know that a simple adequate strategy will not be able to produce reasonable results if the approach it referred to was initially not well founded. Each approach has some insightful features which the others lack. Thus the solution can be an integration of the existent approaches (Pagan, 1987). One of the attempts to count previous shortcomings is the development of DSGE models. This type of models

analyzes how the economy changes over time, and takes into consideration the effect of random shocks on the economy. The DSGE models are constructed on microeconomic principles as suggested by the Lucas Critique.³ Another development which will ensure that reasonable models are developed is the development of non linear time series analysis which statistical foundations are still evolving. The other improvement has to be made in the sphere of asymptotic properties of small samples in time series (Johansen, 2009). These and the other advancements in the field will make modeling more coherent and increase the accuracy of its results which the previous approaches did not provide.

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³ http://en.wikipedia.org/wiki/Dynamic_stochastic_general_equilibrium

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