Federal Reserve Bank of Minneapolis
Research Department Staff Report 77

February 1982

BEYOND DEMAND AND SUPPLY CURVES IN MACROECONOMICS

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ABSTRACT

This paper surveys recent issues in macroeconomics from the viewpoint of dynamic economic theory. The need to look beyond demand and supply curves and the insights that come from doing so are emphasized. Examples of issues in debt management and fiscal policy are analyzed.

Beyond Demand and Supply Curves in Macroeconomics

By Thomas J. Sargent

Research in the field of rational expectations and dynamic macroeconomics has a momentum or dynamics of its own. That dynamics stems from the internal logical structure of rational expectations as a modeling strategy, the questions that it invites researchers to face, and the standards that it imposes for acceptable answers to those questions.

Rational expectations research in macroeconomics was started by econometricians. It began as an effort to use optimizing economic theory to understand, interpret, and restrict the distributed lags that abounded in the decision rules of dynamic macroeconometric models of the 1950's and 1960's.[1] For a variety of reasons that effort was more painful and difficult than might be recognized today, and it led to conclusions more revolutionary and exciting than its researchers had anticipated or intended.[2] The final and most telling step of that research effort was the insight of Robert E. Lucas, Jr. and Edward Prescott that the content of optimizing dynamic economic theory was to deliver cross equation restrictions across the distributed lags in decision rules, on the one hand, and the equations for the motion of the variables that appear in agents' objective functions and which they care about predicting, on the other hand.[3] This meant that when one conducted a thought experiment involving a change in one of the exogenous laws of motion, some or all of the behavioral relations — decision rules — of the model would change. This fact called for a thoroughgoing change in the formal methods that macroeconomists had used to think about choosing desirable laws of motion for government policy variables. Neil Wallace and I [1975] tried to draw attention to this situation by constructing an example

economy in which the behavioral rules changed in such a drastic way with changes in the law of motion for the money supply that it frustrated any possibility for successful systematic countercyclical monetary policy.[4] The example was, as intended, a spectacular one in which taking account of the rational expectations restrictions across the monetary authority's feedback rule for money and the labor supply or Phillips curve had the effect of overturning the then widely accepted conclusion that Friedman's no-feedback k-percent rule for money supply growth could be dominated by a complicated money supply rule "feeding back on everything".

The insight that the coefficients in the distributed lags in behavioral equations are themselves functions of the parameters of the laws of motion for government policy variables and exogenous variables calls for new methods for formulating, identifying, estimating, and simulating econometric models;[5] new ways of computing optimal government policy rules for the government;[6] and even for new concepts and ways of talking about "policy problems" in armchairs and on backs of envelopes.[7]

Lucas and Prescott's insight about the cross-equation nature of the restrictions on behavioral relations drives the analyst toward explicitly formulating dynamic general equilibrium models at the level of objective functions, constraint sets and market clearing conditions or their counterparts.[8] Theoretical and econometric considerations conspire to force things in this direction. For if the presence of the cross equation restrictions implies that private decision rules change systematically with descriptions of the dynamic environment and of government rules, a successful theoretical analysis requires understanding the way in which optimizing agents make their decision rules depend on the dynamic environment in general, and government policy rules in particular. The econometric ideal of discovering

objects that are structural, in the sense that they are invariant with respect to the class of policy interventions to be analyzed, imposes that criterion for success.

The upshot is that the analyst's attention is directed beyond decision rules to the objective functions that agents are maximizing and the constraints that they are facing, and which lead them to choose the decision rules that they do. Since in general one agent's decision rule is another agent's constraint, a logical force is established toward the analysis of dynamic general equilibrium systems.[9] Because a central idea is to analyze things at a deeper level than demand and supply curves, this has led to reopening a host of longstanding issues in macroeconomics and monetary economics.

For monetary and macro economists, one of the most important classes of demand and supply schedules which rational expectations directs us to look beyond are those for government debts of various maturities and denominations — i.e. base money, and interest bearing bonds of various maturities.[10] To rational expectationists, the most natural first step is probably to attempt to copy finance theory, and to begin with the initial working hypothesis that the government is like a firm and that its debt is priced according to the same sorts of equilibrium asset pricing theories developed for private bonds and equities. These theories price a firm's bonds and equities according to the risky streams of prospective returns that "back" them. In this view, the return stream backing the government's debt is the prospective excess of its explicit tax collections over its expenditures. This approach is valuable, if only for the qualifications that it immediately invites. First, in some monetary regimes it seems that the government is <u>not</u> entirely like a firm, in that it can create some

entirely unbacked net government indebtedness in the form of fiat money or government debt that is valued by the market in spite of there being no plan to pay it off in the future by levying taxes. Second, for private debt, the models of finance theory imply that there can be no asset whose return is dominated by that of another asset or portfolio of assets. Yet for government debt, such rate of return dominance is a fact, since, for example, U.S. Treasury bills routinely pay a higher nominal interest rate than does currency, despite being equally safe. The ways, implicit or explicit, in which one explains these two "facts" are sensitive matters in macroeconomics, not merely for the reason that those two "facts" are key ones in themselves, but also for the reason that the way one explains them invariably has important implications about a range of other important positive and normative issues, including such matters as (a) the effects of and the optimal conduct of open market operations, (b) the administration of the discount window, (c) the feasibility and relative merits of fiat and commodity money systems, (d) the feasibility and desirability of floating exchange rates, and (e) the optimal regulation of financial intermediaries.

Neil Wallace, Robert Townsend, and others have advocated that the first of these two facts be explained by using an explicit general equilibrium model with restrictions on the physical technology, the intertemporal patterns of agents' endowments, and agents' location in time and space which are severe enough to induce failure of a rational expectations competitive equilibrium without government debt to be Pareto optimal. This kind of market failure provides a social role for unbacked money, and sets up what can be interpreted as a force for unbacked money to become valued.[11] Bryant

and Wallace suggest that the second class of observations can be explained as stemming from legal restrictions on financial intermediation, in particular, as resulting from a government monopoly on the issue of small denomination notes. The hypothesis of legal restrictions can also be used to explain the existence of valued fiat money or net government indebtedness in general equilibrium settings in which valued unbacked government debt cannot exist without such restrictions.

The advantages of proceeding in such an abstract and explicit[12] way to explain the two facts are that new insights are gained into positive and normative issues like (a)-(e), and old insights are deepened.[13] As an example of a set of old insights that are deepened, take the set of papers by James Tobin[14] demonstrating the importance for macroeconomic theory and policy of the structure of demand substitutability among assets such as base money, bank money, interest bearing government debt, and private securities. Tobin's analysis was mostly static, and was mostly constructed with demand curves for stocks of assets as the primitive analytical objects, with the structure of substitutability of demand relations among assets as the free parameters of the model.[15] Within this structure, Tobin raised several basic questions such as whether it might not be better to assume a system of asset demands in which government interest-bearing bonds are better substitutes for government money than they are for private securities, in contradistinction to the assumption made by John Maynard Keynes and in most modern textbooks, that private and government interest-bearing securities are perfect substitutes with there being a single margin of substitution between interest bearing securities and money. Building on this setup, Tobin conducted a variety of interesting analyses including ones of debt

management and of some of the pitfalls of interpreting time series data on asset prices and quantities.[16]

Work along the lines of explicit dynamic theory has extended and deepened Tobin's insights in several ways and for several reasons. First, in this line of model, the parameters of cross substitutabilities of asset demands remain important, but are not themselves among the free parameters of a model, instead being dependent on deeper aspects of the model such as agents' locations in time and space and their preferences, production possibilities, the probability laws governing the random variables in the model, the structure of legal restrictions on intermediaries, and monetary and fiscal policy, in the sense of laws of motion for the components of government indebtedness. It is the parameters of this list of objects which are the free parameters of the model, and of which asset demand elasticities are functions. A second and related point is that since the analyses are dynamic, the asset demand curves are predicted to change systematically with changes in the monetary and fiscal policy rules, and in the structure of regulation of financial intermediaries.

In these models, asset demands for base money and interest bearing government securities depend in an intricate way on the structure of financial regulation and on government monetary and fiscal policy rules. In particular, with a given structure of financial regulation, the demand schedule for base money depends intricately on the government's strategy for retiring the interest bearing bonds. We can illustrate this by considering two polar monetary-fiscal regimes. In the first or Ricardian regime, the issuing of additional interest bearing government securities is always accompanied by a planned increase in future explicit tax collections just

sufficient to repay the debt. In this regime, increased government interest bearing securities in the hands of the public signal increased future explicit tax collections.[17] In the second polar regime, increased government interest bearing securities will be paid off not by collecting higher explicit taxes, but by eventually collecting seignorage through issuing base money.[18] In this regime, additional interest bearing government securities signify a government promise to issue more base money in the future and eventually to monetize the interest bearing debt. The nature of asset demands, and in particular the demand for base money, as functions of current and lagged observables, depends sensitively on which of these two regimes, or which of the many other imaginable regimes, agents find themselves. John Bryant and Wallace observed that under the second regime, government interest bearing securities and base money can be regarded as very good substitutes. On the other hand, Robert Barro and others have described asset demands under the first of our two polar regimes in which, with details depending precisely on the legal restrictions or other devices used to rationalize the demand for unbacked base money, base money and interest bearing government securities are much less perfect substitutes than under the regime imagined by Bryant and Wallace.

These differences in asset demand functions in response to differences in regimes have practical implications about the recently popular question of whether large current government deficits are inflationary if they are accompanied by current tight monetary policy actions. The answer is that it all depends on which of our two polar fiscal regimes, or other possible regimes, we are in. In the Ricardian fiscal regime, current deficits are much less inflationary than they are in the Bryant-Wallace regime. Note also that it is an implication of Lucas and Prescott's basic insight

that one cannot necessarily prove that current deficits aren't inflationary simply by running time series regressions of inflation on the deficit and finding a negligible effect. The reason is that the time series may have been drawn from a system operating under the Ricardian fiscal regime, and that this regression is predicted to change if the policy regime is altered to the one analyzed by Bryant and Wallace. These regressions are predicted to change because they depend on the demand schedules for assets, which will change systematically across fiscal policy regimes.

Another implication of explicit dynamic theory is that monetary, fiscal, and financial regulation policies are interrelated and must be coordinated. The reason is that the structure of regulations on financial intermediation and the policy strategy for open market operations help to determine the stream of prospective seignorage revenues, which is a component of the intertemporal budget that constrains fiscal policy. The macroeconomic literature on the implications of the government budget constraint is being reworked from this viewpoint, with new insights being provided, for example, about the case for and against a k-percent rule for the monetary base. Sargent and Wallace [1981a] delineate a set of circumstances under which it is not feasible to adhere to such a k-percent rule forever, and in which it is not desirable to use such a rule even temporarily. Those circumstances are, first, when enough interest bearing government debt is outstanding that high pre-tax real rates of interest are needed to place the debt; second, when the fiscal authorities are dominant vis-a-vis the monetary authorities, in the sense that the fiscal authorities select a path or policy for government expenditures and explicit taxes implying growth rates of total government indebtedness to which the monetary authorities must adjust; and third, when the deficit path selected by the fiscal authorities is

sufficiently in deficit in a present value sense. (Those circumstances seem to have prevailed in some Latin American countries recently, such as Brazil and Argentina. It is arguable whether they also occur in the U.K. and U.S. today.) The case for the k-percent rule for the monetary base rests at least partly on its claim to be a device that can prevent the second circumstance from emerging. If the monetary authority is sufficiently powerful vis-a-vis the fiscal authority that it can announce and forever adhere to a k-percent rule for the monetary base (with a small k), then it can tell the fiscal authority the stream of seignorage revenues that it can expect, and to which it must adjust the relation of its expenditure path to its path of explicit tax collections. That is, a k-percent rule is a monetary mechanism for disciplining fiscal policy.

A further set of issues concerns normative and positive aspects of the effects of changes in the stocks of base money and broader monetary aggregates, and the most useful definitions of "money" for various purposes. The variety of dynamic "finance-like" models we are describing are ones in which agents value assets according to the streams of returns backing them. This viewpoint invites interpreting the monetary authority as a financial intermediary, and evaluating the consequences of open market purchases partly by inspecting the nature of the assets that the authority is buying, and which therefore "back" base money. Historically, it has been common for Central Banks to back their base money with some combination of more or less safe private securities (the safe ones are called "real bills"), real commodities such as gold, silver, or grain, foreign currencies or securities, and domestic interest bearing government securities. Because these sources of backing can be different in the stream of returns over which they represent a command, the implications for the price level and

real allocations and production decisions of a given increase in base money can be quite different depending on the particular assets purchased by the authority.[19] Sargent and Wallace [1981b] have described circumstances in which Central Bank purchases of safe real bills with base money are not as inflationary as purchases of government securities[20], and also have beneficial welfare effects in a variety of directions. The nature of the different price level and real effects of changes in base money backed by different assets depends precisely on the structure of regulations on financial intermediation and other frictions that inhibit arbitrage. For example, Sargent and Wallace [1981b] describe a free banking equilibrium in which Central Bank open market purchases of real bills have no price level or allocative effects at all, due to a Modigliani-Miller-like proposition that operates under their free banking regime.[21] Sargent and Wallace also describe circumstances in which it is both feasible and in a concrete sense optimal for the Central Bank to administer its discount window according to the prescriptions of the real bills doctrine: peg the nominal interest rate on "safe" private loans by making its discounts available "on tap". That analysis[22] rationalizes a partial rehabilitation of the "real bills doctrine", and is to be contrasted with Sargent and Wallace's [1975] earlier model in which it was not wise for the Central Bank to peg the interest rate at any level, since doing so left the price level indeterminate. The difference in these two analyses stems sensitively from the fact that the older one took the demand function for money and a particular definition of money as the primitive objects, while the later paper goes deeper and has primitive objects in the form of preferences, opportunities, endowments, and explicit restrictions on financial intermediation.

Caveats and Conclusions

The preceding list of examples could readily be extended to include analyses of additional interrelated subjects such as international exchange rates and the "monetary approach to the balance of payments";[23] optimal seignorage, which includes as aspects optimal regulation of financial intermediaries, setting of reserve requirements, and open market strategies; and alternative international monetary standards — fiat or commodity. These are some of the important areas of research that the logic of dynamic macroeconomics, with its built-in impetus toward explicit general equilibrium setups and its invitation to look beyond demand and supply schedules, impels us to open or reopen. However, it should be recognized that aside from indicating that these issues should be reopened, the general ideas of dynamic macroeconomics and rational expectations in themselves leave open such a variety of possible specifications about fundamentals (i.e. preferences, spatial separation, technologies, legal restrictions, and so on) that those ideas still can accommodate a wide variety of differences in explanations and interpretations of data. The results in our particular examples <u>are</u> dependent on such arbitrary and specific assumptions, and would probably be controverted by many workers who adhere to the discipline imposed by rational expectations dynamic macroeconomic theory in their own work. The point of citing these examples, therefore, is not to announce or summarize the thinking of a unified "school", but to illustrate the kinds of questions that the general principles of rational expectations theory direct us to address, the kinds of standards they impose for acceptable answers, and the terms in which they invite us to reason.

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Footnotes

1. The work of John F. Muth, Zvi Griliches, and Marc Nerlove are among these efforts

2. Economists more quickly learned and used the techniques of intertemporal optimization developed by mathematicians and control scientists than they did the tools of optimal prediction and filtering of stochastic processes. From a technical viewpoint, this is peculiar since the optimal control and optimal filtering problems are dual to one another and involve essentially the same mathematics. In the 50's and early 60's, much literature occurred in which agents were imagined to solve optimal control problems using the calculus of variations, but also to use static or adaptive expectations generating mechanisms. Given the belief in the usefulness of optimizing economic theory that the first part of this research plan reflected, it was only a matter of time and technical understanding that optimizing theory would also be applied to restrict the formation of expectations.

3. It was inevitable that Lucas and Prescott's insight would have surfaced sooner or later. The same message is present in the literature on differential stochastic games, and would eventually have made its way into the macroeconomics literature (see José Cruz). The rational expectations equilibrium concept of Lucas and Prescott is approached in the limit as the number of players gets sufficiently large by the Nash equilibrium of a differential game in the space of feedback decision rules.

4. Sargent and Wallace's example was ready made in the literature at the time that they wrote. All they did was apply the new concept of rational expectations equilibrium to what was then a standard IS-LM-expectational Phillips curve model.

5. See John Taylor, Lars Peter Hansen and Sargent, and the literature summarized by Sargent [1981a].

6. See Finn Kydland and Prescott, Guillermo Calvo, Gregory Chow, and Lucas and Sargent.

7. The papers of Sargent [1980, 1981b] were intended as attempts to make informal (noneconometric) interpretations of events in light of the messages of dynamic macroeconomic theory.

8. The basic insight about the cross-equation nature of the restrictions delivered by dynamic economic theory applies in dynamic "disequilibrium" as well as in equilibrium contexts. Things get much more complicated in disequilibrium contexts because agents' decision rules inherit additional parameters from the dynamic stochastic rationing rules confronting individual agents.

9. See Sargent [1981a] for a discussion of how analysis of a "corn-model" naturally drives one to a "corn-hog model", then to a "corn-wheat-hog" model and beyond.

10. See the remarks of Lucas [1981a,b].

11. That insight was one of the contributions of Paul Samuelson.

12. Wassily Leontief made a case for explicit theorizing for explaining macroeconomic phenomena.

13. Models at such an explicit level must necessarily be highly abstract and "unrealistic" given our current research technology, a fact that has been interpreted as a negative reflection on them by some observers

(for example, see Tobin's remarks [1980]. It is true that at present these models are so abstract and simple that they cannot be used formally to restrict the rich array of financial variables that appear in say the FMP or DRI models using proper modern rational expectations econometric procedures, e.g. á la Hansen and Sargent. This feature of the constraints imposed by our current research technology is unfortunate, but does not seem to argue in favor of models that purchase superficial realism at the cost of making numerous implicit assumptions that violate the principles that emerge from the simple abstract models that we do have.

14. See Tobin [1968, 1971, 1963, 1965, 1961, 1960].

15. See Tobin [1971] and Brainard and Tobin.

16. See Tobin [1971] and Brainard and Tobin. In various articles, Tobin described settings in which the parameters of demand schedules for assets depend on the probability distribution of the rates of return confronting private agents. The subsequent analysis in the text pursues that insight further by taking into account that the distribution of returns itself depends on government policy rules, laws of motion of exogenous variables, and the structure of financial regulation.

17. Robert Barro has studied this regime.

18. Bryant and Wallace, Wallace, and Sargent and Wallace [1981a] have studied this regime.

19. For example, are domestic government interest bearing securities "real bills"? They are if we are in the Ricardian policy regime described above. They are not if we are in the Bryant-Wallace regime of debt retirement through eventual monetization. Various nineteenth century

writers in the real bills tradition argued that interest bearing government securities should be excluded from the category of real bills that the Central Bank should freely discount. Their reason was that prohibiting discounting of government securities is a means of imposing the Ricardian fiscal regime.

20. Under the Bryant-Wallace government debt repayment regime.

21. Sargent [1980] described observations on the comovement of prices and base money at the ends of European hyperinflations that can be economically interpreted in terms of this theoretical result.

22. This analysis has evident implications about the extent to which alternative monetary aggregates will be correlated with the price level and real variables.

23. The theory and practical application of which depend on assumed properties of demand schedules for currencies or monies across countries, and which therefore invites an analysis looking beyond those demand curves (see John Kareken and Wallace).