On Macroeconomic Theories and Models†

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Critique of the Policy-Making Framework

We have argued — in the best stabilization theory tradition — that the search for optimal policy is a technical problem which can be solved given an objective function and a macroeconometric model. Optimal policy derived within this standard policy-making framework, in general, can be expressed as a quantitative feedback rule. By quantitative we mean that the optimal policy can be numerically calculated and depends on the values of the model's parameters. By feedback we mean that the actual values at which the instrument variables should be set in the current period depend on recently observed values of endogenous and exogenous variables.

But can a defensible objective function and a defensible model from among existing estimated macroeconomic models be supplied? We think not.

Our doubts reflect to a large extent our dissatisfaction with the current state of macroeconomics and monetary theory. Unlike other fields in economics, these two branches traditionally have not made use of models which contain behavioral relationships grounded explicitly in theories of individual optimization.

This situation cannot be regarded as desirable. Macroeconomics developed this way because until very recently optimizing models did not exist which could account for fluctuations in aggregate real economic activity. Monetary theory developed this way because optimizing models still do not exist which explain the way financial institutions and the exchange mechanism evolve and operate under various government rules.

Reliance on *ad hoc* models in these fields has forced welfare analysis of alternative government rules to be based on *ad hoc* notions of desirable

†The first two sections of this paper contain arguments which were made previously in Muench-Wallace [7]. (Note that numbers in brackets [ ] correspond to the reference list, p.50)

paths of aggregates like unemployment and the price level. Standard welfare economics based on the Pareto criterion cannot be applied to models which are not explicitly grounded in individual optimizing behavior.

Thus, the theory of stabilization policy usually involves application of *ad hoc* welfare functions to *ad hoc* macroeconomic models to search for "optimal" policy rules. We are very dubious that implications from this type of analysis are at all useful.

Microeconomic Approach

To explain in greater detail our doubts about currently used macroeconometric models, it is helpful to begin by briefly describing the microeconomic approach and then to contrast general equilibrium microeconomic models with the current genre of macroeconometric models.

We view the microeconomic approach to macroeconomic policy as one that builds models of the economy with the following characteristics:

- The models are based explicitly on the assumption that individuals optimize.
- They can explain observable phenomena such as the Phillips curve,† unemployment (voluntary and involuntary), and inflation.
- The models allow for the analysis of a range of policies.
- The traditional (Pareto-type) welfare criterion can be applied to evaluate policies.

In a microeconomic general equilibrium model, individual maximization subject to one or more constraints implies relationships between individual choice variables (often quantities demanded or supplied) and variables that appear in the constraints (prices). The equilibrium prices and quantities are determined from market-clearing conditions (that is, demand equals supply in every market) obtained by summing the individual supply and demand relationships. If this procedure is carried out explicitly, it insures a certain kind of consistency; namely, the price-quantity solutions are consistent with the choice problems which individuals were assumed to face. The imposition of "rational expectations" or, more simply, "rationality" in a model is the extension of this kind of consistency to stochastic models. The idea is that the distributions of endogenous variables implied by the model should be the same as those which individuals were assumed to face in deriving their supply and demand relationships.

Macroeconometric models are not constructed in this fashion. Instead, they consist of estimated relationships behind each of which, at best, is an *implicit partial equilibrium* optimizing model of some aspect of the behavior of some sector of the economy. This procedure is very likely to produce inconsistencies. First, these different partial equilibrium

†The Phillips curve is interpreted broadly here as the negative correlation between aggregate demand variables and the unemployment rate.

models are very likely inconsistent with one another. The money demand function in the MPS model,† for example, is reportedly derived from a partial equilibrium model in which an individual's asset alternatives are assumed to be money and an interest-bearing security. In other sectors of the model, however, it is assumed that individuals also hold inventories of a produced good. If holdings of this physical good had been allowed at the outset in addition to the money and securities, a very different money demand function would have resulted.‡

A second type of inconsistency occurs when the estimated relationships are put together and the resulting distributions of endogenous variables — prices, incomes, etc. — implied by the macroeconometric model are found to be different from those implicitly assumed in the various underlying partial equilibrium models. If the stochastic environment in which individuals are assumed to make decisions were constrained at the outset to be the same as the one implied by the model, then, once again, very different types of aggregate relationships would result.

These inconsistencies are usually implicit rather than explicit because macroeconometric models tend to leave behind the detail of the underlying partial equilibrium models. The inconsistencies get revealed when in the face of some "structural change" — for example, a change in policy regime — the old estimated relationships no longer fit the data.

But is such a critique of macroeconometric models of practical importance? Perhaps the critique is theoretical nit-picking and an arbitrary commitment to a particular way of modeling. If this were the case, then, at a minimum it would have to be argued that the estimated models pass tests for invariance over subperiods during which different policy rules seemed to be in effect. As a matter of fact, no empirical argument has been nor, we think, can be presented for those models that today form the basis for consensus forecasting and policy prescription.

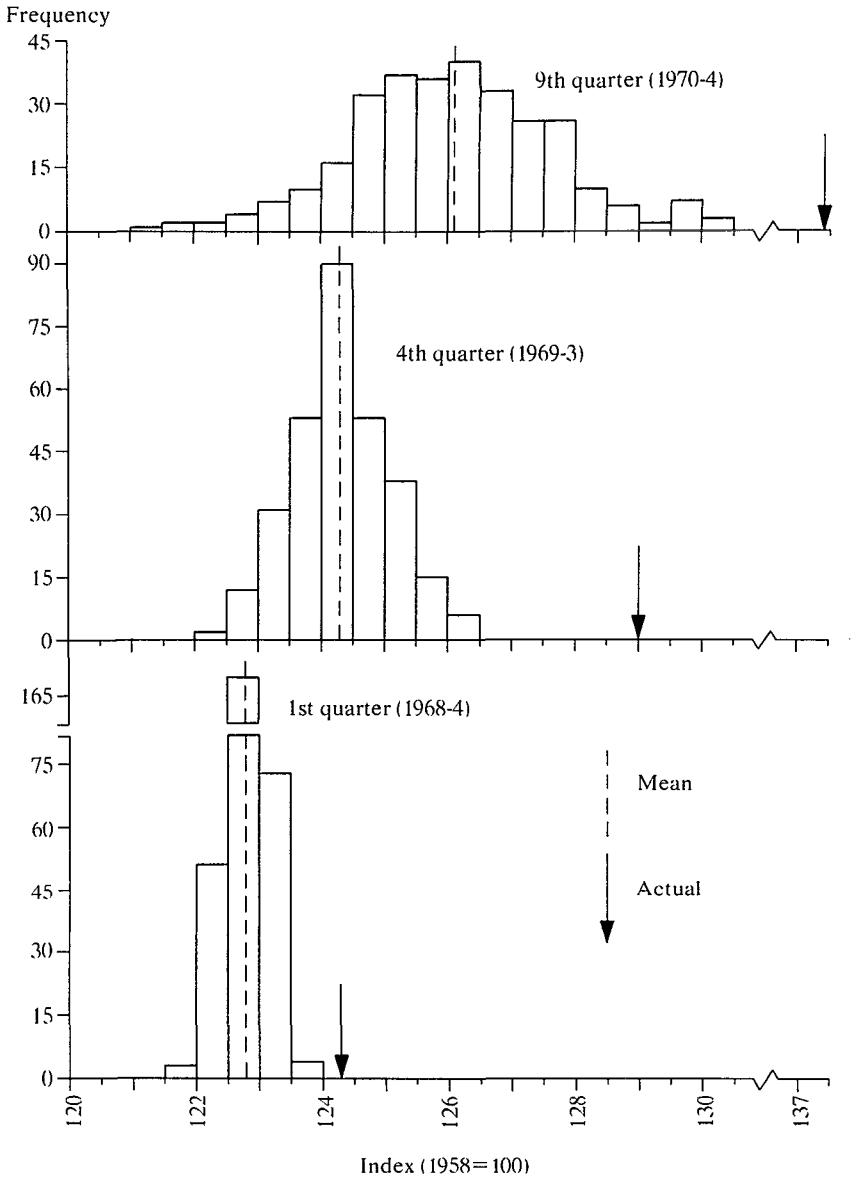
As far as we know, this Bank sponsored the only systematic testing of large macroeconometric models.§ The models examined did not pass versions of standard statistical tests. Figure 4 from the Bank's study [8], reproduced here as Figure 1, gives a flavor of the results. The bar distributions are forecast distributions of the GNP deflator made conditional on actual values of all variables for the third quarter of 1968 and earlier and on actual values of future paths of a set of exogenous variables which include M1, a set of fiscal variables, and some other variables taken to be exogenous by those who constructed the model,

†The MPS (MIT-Penn-SSRC) model is maintained by Wharton Econometric Forecasting Associates, Inc., in Philadelphia, Pennsylvania.

‡See Miller [6].

§See Muench *et al.* [8].

Figure 1
FRB-MIT: Forecast Distributions of the GNP Deflator



an old version of the FRB-MIT model. These distributions were obtained taking into account both residual and parameter estimation uncertainty. For all three forecast dates illustrated, the actual value of the deflator ended up outside the estimated distribution of possible outcomes forecast by the model; nine quarters out, the mean forecast is 126.7 while the actual value was 137.4. This and other evidence are consistent with the view that the estimated relationships which appear in macroeconometric models shift around in systematic but unspecified ways in the face of alternative policy regimes.

The deficiencies of macreconomics and monetary theory place a great burden on the policy authority. They force the authority to supply considerable judgment in choosing the most reasonable model among alternative representations of the economy, and then they force the authority to limit the choice of an objective function to one consistent with that particular view of the world.† While the current state of objective knowledge is woefully incomplete, what does exist should not be ignored. The policy authority's judgment in choosing among economic models should be informed and should reflect the weight of accumulated theoretical and empirical evidence. It is the job of economists to construct and present that evidence. We now turn to that task.

Clarification of Issues and a Role for Judgment

In the next sequence of papers we will be presenting theoretical and empirical arguments addressing the question, Which model of the economy should the FOMC use as a basis for current policy-making decisions?

To sharpen this question let us suppress our misgivings about *ad hoc* macro welfare functions and suppose that the policy-maker's objective function can be written

$$U = -\sum_{t=1}^{N} r_t(X_t - X_t^*)^2 - \sum_{t=1}^{N} d_t(\pi_t - \pi_t^*)^2$$

where X_t and π_t are real GNP and the GNP deflator in period t, N is the number of periods in the policy-maker's horizon, and the r's and d's are time discount factors. The targets for real GNP and the GNP deflator in period t, X_t^*, and π_t^*, respectively, are chosen to indicate peak efficiency in the economy over time.

We suppose also that the economic model can be written in the form

†A distinction is being made here between a welfare function stated abstractly in terms of individual utilities and an objective function stated in terms of reported economic time series. The policy maker's view of the world determines which reported economic variables can serve as proxies for welfare. If all unemployment were viewed as being voluntary, for example, the unemployment rate would be a poor proxy for welfare and would not be included in the objective function.

of two somewhat general reduced-form equations

$$X_t = a_0 + a_1 X_{t-1} + a_2(P_t - \bar{P}_t) + a_3 \bar{P}_t + \epsilon_x(t)$$

$$\pi_t = b_0 + b_1 \pi_{t-1} + b_2(P_t - \bar{P}_t) + b_3 \bar{P}_t + \epsilon_\pi(t)$$

where a's and b's are known constants, P_t is the value of the Fed's portfolio in period t, $\bar{P}_t$ is the public's expectation of P_t as of the beginning of period t, and ϵ_x and ϵ_π are random disturbance terms. The economic model we have posed should be interpreted as the "true" model; no estimation is involved yet.

The question we are addressing in this next sequence of papers is, Can monetary policy have a systematic effect on real output or, more specifically, is $a_3 > 0$? Note, the issue is over the model of the economy. It is not over optimal policy. That follows from the model which is chosen. The issue can alternatively be stated, Is there an exploitable Phillips curve? In other words, do observed correlations between unemployment and prices constitute the policy maker's attainable set?

To stylize the argument, suppose P can be defined so that $a_3 + b_3 = 1$, and suppose that $a_3 = 1$ indicates policy has maximal effect on the real economic variable X. Rational expectations theorists hypothesize that a_3 is zero. In this case it follows that policy cannot have a systematic (or predictable) effect on real output and should, therefore, be directed at stabilizing the price level. Policy activists, however, hypothesize that a_3 is greater than zero, and some have been known to argue that it is close to one. Activists' prescriptions for policy follow because the closer a_3 is to one, the more policy should be directed at closing the gap between actual and desired real GNP and the less attention should be given to price stabilization.

Why not simply estimate our economic model and determine whether $a_3 = 0$? This turns out to be a difficult task. Thomas Sargent's paper in this volume shows that if P were set according to some rule over the historical period, then a number of models would fit the data equally well. In this case the data could not distinguish between a model with $a_3 = 0$ and others with $a_3 > 0$. Which model is the right one? The decisive experiment has not yet been performed.

It is important to note a significant property of these seemingly equivalent models: only one will remain invariant to a change in the policy rule. This property suggests a strategy for testing the correctness of particular models. First identify differences in policy rules either for a given country over time or across different countries. Then test whether the hypothesized models are invariant under the different policies. Sargent reports some results from these types of tests that, while suggestive, are not likely to settle the policy-making debate.

Where does this leave the policy maker? Based on theoretical arguments and empirical evidence, the policy maker must form judgment on

the true value of a_3. Judgment might then be equated with specifying a probability distribution over the set of feasible models. Presumably the more informed that judgment is, the more concentrated the distribution becomes. Our objective in the next set of papers, therefore, is to hammer away at policy makers' probability distributions to make them more concentrated around the value of a_3 we believe is correct.

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