Microeconomic Theories of Macroeconomic Phenomena and Their Implications for Monetary Policy

by Neil Wallace†

Professor of Economics, University of Minnesota and Consultant to the Federal Reserve Bank of Minneapolis

This note arises from an assignment to make a prescription for monetary policy, where it is understood from the outset that the recommendation "Wait until we know more!" is not an acceptable response. "Wait" is, in a sense, my preferred response, because economists are still some distance from having a reasonably complete theory of inflation, unemployment, and money. This being the case, any prescription made at this time should be viewed as a guess—more or less plausible—at what will be implied by more complete theories still to be developed.

The prescription whose plausibility I will defend is that the goal of monetary policy ought to be enhancement of the public's ability to predict the course of the price level. In particular, monetary policy should make the price level as predictable as possible. This would be accomplished by having the Federal Reserve announce a target path for the price level and commit itself, in a believable way, to come as close to this path as possible.

While this prescription is far from new and is not without well-known proponents—Buchanan, Friedman—it represents a sharp break from past and current Federal Reserve policy and at this time is almost certainly not accepted by a majority of the economics profession. My reason for offering another defense is that recent developments in economic theory offer new grounds for taking the prescription seriously.

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To put it baldly, the above prescription is my guess about the Pareto-optimal monetary policy that would emerge from a still-to-be-worked-out theory of observed features of fluctuations in aggregate economic activity.

To provide background for the discussion, Section I describes why there is a need to go beyond the existing macroeconometric models, whether those models are Keynesian or monetarist, "large" or "small," or so-called "structural" or "reduced form." Implicit in the way all these models are manipulated is the assumption that observed correlations will continue to hold in the face of alternative rules for policy variables—an assumption supported neither by theoretical arguments nor by the data.

Section II attempts to describe some of the new developments in economic theory that show promise in confronting key macroeconomic phenomena: Phillips curve-type correlations and involuntary unemployment. These new developments form the basis for the policy prescription which is discussed in detail in Section III.

I. Macroeconometric Models

Perhaps the main problem confronting macroeconomics is the explanation of observed positive correlations between aggregate demand variables, on one hand, and output and employment, on the other hand. More directly, why do not shifts in aggregate demand impact only on prices as is implied by what might be called the "classical" full employment flexible wage and price macroeconomic model?

That positive correlations between aggregate demand variables and output and employment are paradoxical from the viewpoint of the "classical" macroeconomic model follows from its labor market specification. This consists of three relationships: (1) a demand schedule giving the quantity demanded as a function of the real wage—the position of the schedule depending only on the technology and the capital stock, both of which are inherited from the past; (2) a supply schedule giving the quantity supplied as a function of the real wage—the position of the schedule dependent, perhaps, on demographic characteristics inherited from the past; and (3) a market clearing condition equating the quantity demanded and the quantity supplied. These relationships determine both the real wage and employment, and the latter, by way of a production function, determines output. Thus, in the output-price level plane, the model produces a vertical (perfectly inelastic) aggregate supply curve, one which makes output independent of the price level. It follows from this model, then, that movements in employment and output are to be explained entirely by shifts in the labor demand and supply schedules and, hence, by movements in the capital stock, technology, and demographic characteristics. And aggregate demand

shifts impinge on the price level but not on output and employment.

Since these implications seem to be contradicted by the correlations between aggregate demand variables and output and employment, everyone seems to agree that the above labor market specification is inadequate. But, as emphasized repeatedly since the appearance of Keynes' *General Theory*, neither Keynes nor the post-Keynesian macroeconometric models in use today supplies an alternative theory.† Instead, currently used macroeconometric models simply include versions of the paradoxial correlations and treat them as invariant (structural) relationships, invariant in the face of alternative policy rules. In so-called structural models, the paradoxical correlations are typically imbedded by way of a regression of the rate of change of the money wage on a function of unemployment, previous inflation rates, and some other variables. In so-called reduced form models, the paradoxical correlations are imbedded in the form of regressions of real output or unemployment on aggregate demand variables: the money supply, the full employment deficit, etc. But the invariance of all such correlations is coming under severe attack, both on theoretical and on empirical grounds.

The theoretical attack is basically a version of the correlation-does-not-imply-causation argument. The role of theory is to provide arguments, more or less plausible, for or against any given correlation or other datum being causal or invariant to particular kinds of intervention. Indeed, what supposedly distinguishes the economist from the layperson is the former's demand for and ability to produce invariance arguments. Thus, the economist typically chides the layperson for taking certain observations as invariant: for example, gasoline consumption in the face of alternative tax rates per gallon. But, a correlation is, in principle, no different from an observation on gasoline consumption. Yet in the macroeconomic area, most economists have been ready to interpret correlations causally and, hence, to treat them as invariant to various kinds of intervention. In fact, I would claim that existing macroeconometric models consist of nothing more than a hodge-podge of correlations, for which no invariance argument has ever been given and for which there are strong arguments suggesting noninvariance.

Macroeconometric models consist of estimated relationships behind each of which, at best, is an implicit partial equilibrium model of some aspect of the behavior of some sector of the economy. These models are meant to provide invariance arguments, but ironically, a close look at any of them provides a noninvariance argument.‡ These noninvariance arguments point out the permanent disequilibria im-

†Leontief and Tobin were early critics of the implicit assumptions in the *General Theory*.

‡Lucas [9] provides several such noninvariance arguments. (Numbers in brackets correspond to reference list, page 98)

plicit in macroeconometric models; and they also point out that the extent of such disequalibria are made dependent on the policy regime in effect since no offsetting response of the public is allowed.

Thus, implicit in many of the relationships of macroeconometric models are descriptions of the way economic actors predict the future on the basis of the past. These descriptions, though, do not allow economic actors to use all the information available to them in the best way, and in particular, they do not allow knowledge of government policies to affect predictions.† For example, many of the important relationships contain implicit forecasting schemes for the future course of the price level. The schemes are generally taken to be fixed distributed lags of previous realizations of the price level. But, at best, these schemes capture what were good forecasting schemes given the structure that held during the sample period. When these schemes are assumed to hold in the face of alternative policy rules, disequilibria are imposed, because individuals are assumed not to abandon forecasting schemes which work poorly. Thus, it could be the case that the structure during the sample period (including government policy) was such that the best forecast of the future price level is the current price level—often called static expectations. But such a scheme would not be best if for whatever reason, possibly a different government policy, the price level turns out to increase at, say, 7 percent per year. A model that implicitly assumes that people forecast as if the price level takes a random walk around a zero trend when, in fact, it has a nonzero trend is a disequilibrium model.

Such disequilibria are avoided in microeconomic general equilibrium models in which the equilibrium concept includes imposing equality between the conditions agents are assumed to face when deciding upon a course of action and the conditions actually turned up by the model. The imposition in a model of rational expectations is nothing but the application of this equilibrium concept to stochastic models.

But what, if anything, do the data suggest about the validity of these noninvariance arguments? The data and the way they are handled by macroeconometric model builders suggest that the noninvariance arguments are valid and important. An empirical invariance argument would have to establish that the same estimated relationships show

†Hurwicz [6] made the point that models ought to allow for such dependence:

> Whether the economist's policy goals are merely his general ones or are meant to express the "desires of the community," it must be taken into account that, while the government is attempting to carry out the policy, a good deal of freedom will be left to the individual units (consumers, entrepreneurs, labor unions, banks, etc.).
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> Such a unit is primarily motivated by its own objectives (individual utility maximization) and its decisions are based to a considerable extent on the expectations of future actions of the government. More precisely, the public, i.e., the aggregate of the individual units, follows a rule of behavior dependent on the (subjective) information available to it (p. 418).

up for many different subperiods and/or different countries during which, and in which, different policy rules seemed to be in effect. As a matter of fact, no empirical invariance argument has been nor, I think, can be presented for those models that today form the basis for consensus forecasting and policy prescription. Indeed, what is both remarkable and depressing is the absence of attempts to make such arguments. It seems as if large macroeconometric models are handled in such a way as to prevent confirmation with data sets from different subperiods of even United States experience.†

If currently used macroeconometric models are to be rejected for purposes of analyzing the effects of alternative policies, what should they be replaced by? As I hope the argument above suggests, no simple patching-up job will do. Rather, traditional macroeconomic theorizing and macroeconometric modeling should be replaced by microeconomic general equilibrium theorizing and modeling. In the next section, I review what seem to be some fruitful building blocks for such modeling.

II. New Developments in Explaining Macroeconomic Phenomena

My optimistic view is that we are witnessing some major advances in economic theory that for the first time show promise of bringing key macroeconomic phenomena within the purview of ordinary economic theory. My intent here is to give the reader a flavor of these developments. Toward that end, I first describe signal extraction theories that predict contemporaneous correlations between real variables like output or employment and aggregate demand variables like the money supply, while leaving no room for effective deliberate manipulation of aggregate demand. I then suggest that a merging of those theories with still-to-be-developed models of the kinds of nominal contracts that emerge in different circumstances will give rise to theories capable of confronting observed noncontemporaneous relationships among real and aggregate demand variables. And, finally, I suggest that such a theory when combined with models of risk-sharing in labor markets may provide an understanding of involuntary unemployment.

A. Signal Extraction and the Phillips Curve

Signal extraction theories produce correlations between real variables like output and employment and aggregate demand variables like the money supply by assuming environments in which individuals contend with two kinds of randomness but are unable, because of the limited information they have, to separately identify the realizations for the two random processes. One source of randomness is aggregate and potentially neutral in its impact; the other is micro and real and neces-

†See [11] for the results from applying a version of a standard statistical test for structural change to the reduced forms of two econometric models.

sarily nonneutral in its impact. The aggregate randomness matters because, given the information individuals have, its presence tends to hide somewhat the real randomness.

This kind of set-up can be illustrated in the context of an, as yet, incompletely worked-out version of the Lucas-Prescott search model of unemployment.† The economy consists of many separate markets, separate in a number of senses. First, prices and wages differ across markets because demand in each market follows a stochastic process that exhibits serial correlation. This is the micro or real disturbance. Second, workers see only current wage and price information from their own market. And, third, workers can shift between markets but, in order to do so, must be idle (unemployed) for one period—a kind of technological transaction cost. Having decided to search, the outcome of search for a worker is random but, on average, gets him to a market with average labor demand. In a sense, then, the worker's problem is simply that of inferring labor-demand conditions in his market relative to average labor-demand conditions elsewhere.

Suppose there also impinges on each market, in addition to the micro disturbance described above, an aggregate disturbance that is known to be common to all markets. This does not change what workers do; they still try to draw inferences about conditions in their market relative to conditions in other markets from only the observation in their own market. Put differently, if the aggregate demand disturbance were known, it could and would be netted out of their observations and its presence would not affect their search behavior. But, if not known, workers are left trying to identify two separate disturbances, their own micro-market disturbance and the aggregate disturbance from, in effect, a single piece of information. The best they can do is make optimal guesses on the basis of what they know about the *distributions* of the two kinds of disturbances.

To show how this process can produce a negative correlation between unemployment and aggregate demand, suppose u_i is the micro disturbance in a particular market and v is the aggregate disturbance, and suppose both are normally and independently distributed with zero means and variances σ_u^2 and σ_v^2, respectively. Suppose, also, that high values imply high demand and that the single piece of information that can be inferred from conditions in this market is the sum, $u_i + v$. Workers decide to stay or leave this market on the basis of their best guess about u_i, because it is u_i which determines conditions in their market relative to average conditions elsewhere. Under the normality assumptions, their best estimate of u_i—call it $\hat{u}_i$—is given by the prediction from the population regression of u_i on the sum, $u_i + v$; that is, $\hat{u}_i = \beta(u_i + v)$, where

†For a fully spelled-out general equilibrium version, see [8].

$$\beta = \text{covariance } (u_i, u_i+v)/\text{variance } (u_i+v) = \sigma_u^2/(\sigma_u^2 + \sigma_i^2) > 0.$$

Therefore, $\hat{u}_i$ and v are positively correlated:

$$\text{covariance } [\hat{u}_i, v] = \text{covariance } [\beta(u_i+v), v] = \beta\sigma_i^2 > 0.$$

Since this holds for all markets, this model provides a mechanism capable of producing a negative correlation between aggregate unemployment and v. This is the kind of mechanism used in existing natural rate-rational expectations models of aggregate fluctuations.

The correlation between unemployment and v implies that a regression of unemployment on some aggregate demand measure—v plus the deterministic component of aggregate demand—turns up a negative coefficient on the aggregate demand measure. But, and this is an example of a noninvariance argument, if the above model is at all correct, one would go far wrong in taking the constant and coefficient in this regression as providing an invariant linear relationship between unemployment and the aggregate demand measure. According to the model, alterations in the deterministic component of aggregate demand do not affect unemployment because the deterministic part can be predicted exactly and does not affect relative wages in different markets. But that is not what would be implied by treating the linear regression as invariant. Also, according to the model, the negative coefficient on aggregate demand in the regression depends on the variance, σ_i^2. This is an important dependence that is ignored if one treats the regression equation as invariant.†

B. The Nature of Nominal Contracts and Noncontemporaneous Cyclical Correlations

Time series on real variables like output and employment exhibit positive serial correlation. This is recognized as posing a challenge to the kind of signal extraction theory described above in that the only completely spelled-out version of that theory implies that real variables are serially independent and, perhaps more important, are at most contemporaneously correlated with aggregate demand variables.

An advocate of such a signal extraction theory seems not to be able to invoke serial correlation in aggregate demand to explain serial correlation in real variables. According to that theory, only the unpredictable component of aggregate demand, the innovation, gives rise to any correlation between aggregate demand and real variables. The component of aggregate demand that is predictable on the basis of the

†As remarked above, it is the style of macroeconomics, to keep the correlation and throw out the model. Since the correlation can be recovered from the model, but not vice versa, it is better to throw out the correlation and keep the model.

past pattern of aggregate demand is part of the deterministic component, which, according to the theory, has no effect on real variables.

The signal extraction Phillips curve models that have so far been studied are discrete time models in which contracting periods and the information structure are taken as given. Moreover, they are models in which all prices are determined anew each period conditional on all past realizations of the aggregate demand process.

One possible route toward an explanation of noncontemporaneous cyclical correlations is to build on the casual observation that in many circumstances nominal contracts are negotiated periodically with a frequency lower than that at which aggregate data become available. For example, in many circumstances nonindexed, nominal wage agreements are in effect for one or more years, even though aggregate data become available at least quarterly and even though the monetary authority makes decisions with a frequency that matches the availability of the data. In such circumstances, if quarterly aggregate demand displays serial correlation, this could be transmitted into real variables, even though individuals are forecasting optimally.

If aggregate demand displays serial correlation, the uncertainty costs that attach to nominal contracting are smaller the more frequent the contracting. But, although economists do not have an adequate theory of exchange arrangements, it seems safe to say—based on the casual observations referred to above—that there must also be costs to gathering information and to contracting conditional on it. A theory which takes into account both the uncertainty from contracting in nominal terms over different horizons and the costs from contracting conditional on different amounts of information would seem to be rich enough to explain some noncontemporaneous correlations between real and aggregate demand variables.

While such a theory might explain noncontemporaneous correlations between aggregate demand variables and real variables, it does not suggest invariance of such correlations. Not surprisingly, we seem to observe more frequent nominal contracting—or indexing—the greater the variance of the price level or, more precisely, the greater the dependence of the conditional distribution of the price level on the conditioning information. Since alterations in the rule governing policy affect the degree of such dependence, we should expect the policy rule to affect contracting frequency and, hence, the kind of noncontemporaneous correlations that turn up between aggregate demand variables and real variables.

C. Markets Under Uncertainty and Involuntary Unemployment

Because the explicit signal extraction models of Phillips curve correlations so far developed tell stories either in terms of competitive

leisure-consumption choice or in terms of competitive voluntary search unemployment, some critics of those models take the existence of involuntary unemployment, lay-offs, and seemingly noncompetitive aspects of some labor markets to be facts at odds with the models. Indeed, these facts could be interpreted as making absurd the pursuit of explanations in terms of competitive equilibrium models.

Involuntary unemployment arises whenever individuals seem unable to sell their services at ruling prices: that is, when lay-offs occur or when qualified potential workers are not able to find positions at existing wage rates. Do such situations necessarily signify "market failure," or is the notion of a well-functioning market that lies behind such an interpretation too simple? Alchian's observation that queues and inventories play some allocative role in almost every market should make us hesitate before adopting the market-failure conclusion. Queues and inventories seem to play important roles in contexts in which uncertainty is present and in which contingent behavior—behavior dependent on what happens—is not completely spelled out beforehand. Recently, there have been attempts to interpret certain features of employment contracts—including the possibility of involuntary unemployment—as desirable arrangements for risk sharing in such circumstances.†

To illustrate the main notion behind this work, consider again the search model environment described above. If an unfavorable state of demand occurs in a particular market, one possible outcome is a new, lower wage at which some workers leave and some stay, but at which all of them act voluntarily given the new state of demand. But if these workers are risk averse, then, except in very special circumstances, an optimal market arrangement would have involved some prior commitments for coping with the uncertainty. And if the workers differ, say, because they are in different stages of their working lives, it would be surprising if the optimal prior arrangement does not call for some ex post involuntary behavior in some circumstances for some workers. In general, risk-sharing arrangements always call for some ex post involuntary behavior. Azariadis has produced a model that can produce ex post lay-offs, but he has to impose the restriction that work cannot be shared. It remains to be seen whether that restriction can be dispensed with.

Given a model that can produce involuntary unemployment, there would seem to be little difficulty in imbedding it in an environment where the signal extraction problem arises. The result, then, would be a model capable of generating correlations between aggregate demand variables and involuntary unemployment.

†See [1], [3], and [14].

III. Policy Implications

The kinds of theories hinted at above seem to have one common implication: the less uncertainty the better. What does this suggest for monetary policy?

In models in which decision-making periods for the public and the monetary authority coincide and in which they have access to the same information, the amount of uncertainty faced by the public is unaffected by the kind of deterministic rule adopted by the monetary authority. One deterministic rule is as good as another. In other words, so long as the policy rule is not itself random, monetary policy has no role to play in these models.

This is not the case in the kind of model suggested above for accounting for noncontemporaneous cyclical correlations. There it matters how well the price level can be predicted over horizons longer than the decision period for policy. The monetary authority can maximize the public's ability to forecast the price level over all horizons by acting, period by period, to keep the price level as close to a predetermined, preannounced path as is possible. Put differently, the monetary authority should act period by period to make the conditional distribution of the price level independent of the conditioning information. This is the way it minimizes uncertainty.

While the existence of nominal contracting over horizons longer than the monetary authority's decision period would seem to offer the opportunity to offset through inflation or deflation the intended real terms implicit in such contracts, there are good reasons for not attempting to do this. First, such actions increase the uncertainty costs that attach to nominal contracting and, hence, create incentives for the public to change contracting arrangements. Second, and more fundamental, a deep analysis of cyclical phenomena is, as suggested above, unlikely to imply that such actions improve economic welfare.

The prescription for price-level predictability is closely related to the prescription for a fixed growth rate rule for some monetary aggregate. First, serious proponents of fixed growth rate rules seem to advocate those rules primarily on the ground that they are best for achieving price-level predictability.† If this is so, then proponents of such rules must also argue for acceptance of an underlying view of the economy that rationalizes price-level predictability as the goal for monetary policy. Second, in some models—those in which one deterministic feedback rule is as good as another, fixed growth rate rules can, on *a priori* grounds, be judged as best for achieving price-level predictability. More generally, such rules would be among the candidates in the search for the rule that would best achieve price-

†The only other ground I can think of is one of keeping close check on the monetary authority. On this, see the full disclosure discussion below.

level predictability. But, it is far from obvious that any such rule would win. Nothing, in principle, prevents discovery of invariant relationships between feedback rules for the monetary authority's instrument variable and the price level.† Given such a relationship, finding the best feedback rule is a standard optimal control problem. Finally, the prescription advocated here and fixed growth rate rules are both consistent with "full disclosure." It would seem entirely appropriate for the monetary authority to keep the public fully informed about its current model, its current feedback rule, and its view about how well, in the sense of variance, it thinks it will do in achieving the preannounced price-level path. Nor need the model and rule be kept fixed over time. Public awareness that the monetary authority is trying to improve its performance (by using more information to reduce the residual variance in the invariant relationship between feedback rules and the price level) would not seem to give rise to a situation in which the public tries to anticipate and offset the intended effects of a new government policy.‡ Unlike attempts by the monetary authority to exploit observed Phillips curve correlations or to offset through inflation existing nominal contracts, surprising or fooling the public is not necessary in order to achieve changes that promise to make the price level more predictable.

†For the reasons outlined above, the reduced forms for the price level implied by currently used macroeconometric models do not qualify as invariant relationships.

‡For an example in the context of an *ad hoc* model, see the Sargent-Wallace discussion of the implications of an informational advantage for the monetary authority [12, pp. 251-3].

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