LARGE-SCALE MACRO-ECONOMETRIC MODELS
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ECONOMIC THEORY, MODEL SIZE, AND MODEL PURPOSE

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I. INTRODUCTION

The purpose of this paper is to discuss several issues pertaining to the specific question, "Does economic theory have a practical role to play in determining the appropriate size of a macroeconometric model?" For the purpose of this discussion "size" will be defined simply as the number of stochastic equations in a model, although the number of parameters might in some cases provide a better definition. Based on this definition, Table 1 illustrates the variation in model size for a representative group of macroeconometric models developed since Tinbergen's (1939) study. Even if we allow for advances in computer technology, the variation in model size is quite large and appears to be growing.

The term "economic theory" as used in the above question cannot, of course, be defined so simply, and this is one of the reasons why the question is controversial. For the purpose of this discussion, economic theory will be defined broadly as a method of reasoning based on models describing the interaction of utility maximizing individuals subject to budget, technological, and legal constraints. Although very broad, these definitions narrow the scope of discussion considerably. For example, the paper is not concerned with the role of statistical theory in determining model size, nor is it concerned with the research funding constraint which is clearly a practical limitation to model size in many cases. And finally the paper does not attempt to determine which of the many strands of economic theory--for example, market clearing versus disequilibrium methods--are more appropriate microtheoretic foundations for macroeconometric models.1/

II. TEXTBOOK THEORY AND ECONOMETRIC PRACTICE

Most textbook discussions of econometric methods appear to answer the above question in the affirmative. Consider, for example, the static linear simultaneous equations system

$$(1) \qquad By_t + \Gamma x_t = u_t \;, \quad t = 1,2,\ldots T.$$

where y_t is a vector of G endogenous variables, x_t is a vector of K

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exogenous variables, and u_t is a vector of G unobservable disturbances. Let $Eu_tu_t' = V$ and $Eu_tu_s' = 0$ for $t \neq s$. According to our definition, the size of model (1) is G. However, if the last $G - G_1$ elements of the first G_1 rows of B and V are known to be a zero, then the first G_1 equations of the system can be considered in isolation from the rest, and for the purpose of explaining these endogenous variables, the model can be reduced to size G_1. That is, if B and V can be written

$$B = \begin{pmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{pmatrix} \qquad V = \begin{pmatrix} V_{11} & V_{12} \\ V_{21} & V_{22} \end{pmatrix}$$

with $B_{12} = 0$ and $V_{12} = 0$, then the first G_1 elements of y_t are exogenous to the last $G - G_1$ elements and for forecasting, multiplier analysis, and a general examination of the dynamic stochastic properties of these variables, one only needs to estimate B_{11}, V_{11} and the appropriate elements of Γ.

The question is whether economic theory can tell us whether $B_{12} = 0$ and $V_{12} = 0$. The type of information we need, therefore, is similar to the standard "zero restriction" information normally used for identification of the structure of the model. According to most textbook discussions, economic theory can be used to determine whether a model is identified or not, and by this analogy theory can also be used to tell us whether a model of size G or G_1 is sufficient for explaining the first G_1 elements of y_t. Johnston's (1972, p.352) description of the role of economic theory is representative of this textbook view and would apply both to the identification problem and to model size. "A priori knowledge thus results in a specific configuration for B and Γ and a specific set of assumptions about the distributions of the disturbances."

In practice, however, we usually find that economic theory is not precise enough to provide restrictions which are this strong. Identification restrictions are difficult enough to find,[2] let alone the additional restrictions necessary in order to eliminate equations. Koopmans (1950, p. 402) points out the enormity of the problem:

> Which factors in man's physical and historical environment are not influenced by his economic activity? If the question is put in this way one can think of little else besides changes in weather, climate, geology, and geography that are brought about by natural causes. There remains a host of sociological, political, and psychological factors that are in continuous interaction with economic activity, and therefore cannot, on any grounds so far adduced, be accepted as they come without incorporating the explanation of their fluctuations in the system of equations.

And in his applied econometrics textbook Klein (1962, p. 180) writes:

> In some studies, theory has been used to make more explicit specifications about the form of the relationship. Macroeconomic models are, however, more intuitive and less rigid-

Table 1

ECONOMETRIC MODEL SIZES FOR THE U.S., 1939 - 1975

Model	Date	Size
Hickman-Coen	1975	50
DRI	1974	379
Liu-Hwa	1974	51
Chase Econometrics	1974	125
Wharton III, Anticipations	1974	79
Wharton Annual	1972	155
Wharton Mark III	1972	67
Morishima-Saito	1972	7
Brookings (Fromm *et. al.*)	1971	156
Fair	1971	14
Michigan Quarterly	1970	35
St. Louis	1968	5
MPS	1968	75
Wharton	1967	47
OBE/BEA	1966	58
Brookings (Duesenberry *et. al.*)	1965	101
Liu	1963	19
Suits	1962	16
Duesenberry *et. al.*	1960	10
Valvanis	1955	12
Klein-Goldberger	1955	15
Klein	1950	3
Tinbergen	1939	32

Source: Intriligator (1978, pp. 454-456). Model sizes refer to the number of stochastic equations.

> ly tied to a theory of rational behavior...There are few acceptable rules limiting the scope and variety of such systems.

Even when we take into account the important recent advances in microeconomic foundations of macroeconomics, the use of theory to limit the size of the models still appears quite limited. Moreover, if we were successful in building up a complete aggregate model from explicit individual maximization postulates--a goal toward which much macrotheory is now aiming--it is not clear why the interdependences which Koopmans refers to would be weakened, or that the role of theory in determining the appropriate size of the model should be any stronger.

One objection to this conclusion that economic theory has such a limited role to play in determining model size, is that the zero restrictions should not be taken so literally. Accordingly economic theory can be used to determine which equations are relatively unimportant and can safely be omitted. However, if one is interested in forecasting or multiplier analysis even relatively unimportant variables can in principle be of great assistance in reducing error (recall that we are abstracting from problems of statistical estimation error), and cannot therefore be omitted from the model on economic theory grounds alone.

The conditions required for limiting model size are even stronger for dynamic models which are the rule rather than the exception in macroeconometric work. A dynamic linear simultaneous equations system which generalizes (1) is

$$(2) \qquad By_t + C(L)y_t + \Gamma x_t = u_t$$

where $C(L) = C_1L + \ldots + C_pL^p$ is a matrix polynomial in the lag operator L, and where the error term u_t has the same distribution properties as were assumed for (1). The matrix polynomial $C(L)$ can be partitioned as

$$(3) \qquad C(L) = \begin{pmatrix} C_{11}(L) & C_{12}(L) \\ C_{21}(L) & C_{22}(L) \end{pmatrix}$$

Now the first G_1 equations can be considered in isolation if $B_{12} = 0$, $V_{12} = 0$, and $C_{12}(L) = 0$. Then, the first G_1 elements of y_t are exogenous to the last $G - G_1$ elements. For dynamic models, the number of a priori conditions required for reducing model size increases with the order of the dynamic model, that is, with the order of the polynomial $C_{12}(L)$ in (3).

III. MODEL PURPOSE AND MODEL SIZE

An oversimplified empirical demonstration of this limited role of economic theory in determining model size is to assume--as a first order approximation--that all the builders of the macroeconomic models represented in Table 1 had about the same access to economic theory and were equally adept at using this theory in constructing their models. If this assumption is at all accurate, then after controlling for changes in computer technology, there should be relatively little variation in model size. Table 1 illustrates how far from the truth this is. Evidently there are some important missing variables.

The most obvious candidate for explaining this observed variation in model size is the model-builder's purpose of model construction. To put things simply: for some purposes large models are necessary, but for other purposes small models are necessary, or at least sufficient. For example, a large model with a detailed investment sector and a detailed government tax sector is necessary to examine questions about the quantitative impact of an investment tax credit; a large model with a detailed interindustry structure is necessary for forecasting steel shipments; and a large financial sector is necessary for determining the likely outcome of a change in one of the many Federal Reserve policy instruments. On the other hand, a very small model might be sufficient for determining the relative effectiveness of broadly defined monetary and fiscal variables. An examination of the econometric models represented in Table 1 shows that much of the variation in model size can indeed be traced to the underlying purpose of the model.

The implication of these simple observations is that it is a mistake to examine the role of economic theory in the context of macromodels <u>in general</u>, rather than in the context of models of a <u>given purpose</u>. Although economic theory may have a small role in limiting the size of general multipurpose models, this is not the case for models designed for a specific purpose. The remarks of Koopmans and Klein mentioned above are clearly directed at models in the abstract without a specific purpose in mind.

IV. ALTERNATIVE MODEL PURPOSES: PREDICTION vs. STABILIZATION

Two alternative purposes of econometric models which have been widely discussed in the literature are prediction and stabilization. In this section we show how the appropriate size of a model depends on which of these two purposes the model builder has in mind. We consider the reduced form of the dynamic model introduced in equation (2) above, but specialized to the case of one lag. By suitable stacking of vectors, higher order systems can be represented as such a first order system. The model takes the form:

$$(4)\qquad \begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix} = \begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \end{pmatrix} + \begin{pmatrix} C_1 \\ C_2 \end{pmatrix} x_t + \begin{pmatrix} \nu_{1t} \\ \nu_{2t} \end{pmatrix} .$$

We assume that the vector $(\nu_{1t}\ \nu_{2t})$ is serially uncorrelated with mean zero and covariance matrix Ω. The system (4) could be constructed with the aim of <u>forecasting</u> y_{1t} or of <u>stabilizing</u> y_{1t}. In the stabilization case we assume that the vector x_t is a control variable which can be used to control or stabilize y_{1t}. In the forecasting case we assume that x_t is exogenous and that the path of x_t is known for all t. We assume in both cases that the model builder is not directly interested in the behavior of y_{2t} except through its influence on y_{1t} and thereby on the forecasting and stabilization goals. The question is whether knowledge of

A_{21} or A_{22} is necessary for predicting or stabilizing y_{1t}.

Consider the problem of forecasting y_{1t+s} for $s > 0$ based on information through period t-1; that is, given $y_{t-1}, y_{t-2}, \ldots,$ and x_t for all t. Under the minimum mean squared error criterion, we must choose a function $\hat{y}_{1t+s}$ of these observations so that the prediction error covariance matrix $E(y_{1t+s}-\hat{y}_{1t+s})(y_{1t+s}-\hat{y}_{1t+s})'$ is a minimum in the positive definite sense. It is easy to show that the conditional mean of y_{1t+s} given the observations, is the best predictor and that if $A_{12} \neq 0$ this conditional mean depends on both A_{21} and A_{22}. Hence, if one is interested in predicting the vector y_{1t} it is necessary to estimate the complete model; unless of course $A_{12} = 0$.

Next consider the problem of stabilizing y_{1t}, using a quadratic criterion function. That is, we attempt to minimize $Ey_{1t}'\Lambda_1 y_{1t}$ in the steady state (where Λ_1 is a symmetric weighting matrix) by choosing x_t to be a function of observables $y_s' = (y_{1s}', y_{2s}')$, where $s < t$. Since we are not concerned with the behavior of y_{2t} the implicit weights on the elements of y_{2t} in the weighting matrix are 0. Hence in terms of the full model the objective is to minimize

$$(5) \qquad Ey_t' \begin{pmatrix} \Lambda_1 & 0 \\ 0 & 0 \end{pmatrix} y_t$$

subject to the stochastic constraints

$$(6) \qquad y_t = Ay_{t-1} + Cx_t + \nu_t$$

with respect to the elements of the matrix G where $x_t = Gy_{t-1}$. (The system (6) is identical to (4) without explicit partitioning.) If C_1 is <u>invertible</u>, then the optimal value of G takes the form $G = (G_1\ G_2)$ where

$$(7) \qquad \begin{aligned} G_1 &= -C_1^{-1} A_{11} \\ G_2 &= -C_1^{-1} A_{12} \end{aligned}$$

(see Chow (1975), for example). Hence, the optimal stabilization rule does not depend on either A_{21} or A_{22}. Since C_1 is invertible it is possible to isolate y_{1t} from the extra fluctuations due to the y_{2t} dynamics. In terms of model size this isolation implies that we can ignore the equations which describe the behavior of y_{2t}.

If C_1 is <u>not invertible</u>, then in general G_1 and G_2 will depend on A_{21} and A_{22} so that we cannot reduce model size in this simple way. Intuitively, if C_1 is not invertible then y_{1t} cannot be completely cut off from the influence of y_{2t}. Hence, the way in which y_{2t} influences y_{1t} matters for the choice of feedback rule. There are some special cases, however, where the influence of y_{2t} can be eliminated even though

C_1 is not invertible. For example, if A_{12} can be written as a product of C_1 and an invertible matrix, then the feedback of y_{2t} on y_{1t} can be stopped. This type of situation arises in the application considered in the next section.

The importance of model purpose in determining model size is readily apparent from this comparison of prediction and stabilization. For prediction the complete model is needed. For stabilization the necessary size of the model depends on the invertibility of a certain matrix which describes the impact of the instruments on the variables to be controlled. However, economic theory does have a role to play in determining model size once the purpose of the model has been stated. If the purpose is stabilization, for example, then economic theory might be used to determine whether C_1 is invertible. A necessary condition is that C_1 be square (an order condition) which simply means that we have enough policy instruments to cut off the influence of y_{2t} on y_{1t}. Economic reasoning certainly seems potentially useful in determining whether this order condition is satisfied. The sufficient rank condition may be more difficult to establish on theory grounds, but could be tested using statistical techniques.[3]

Although these policy examples may represent special types of economic problems, they illustrate how simple theoretical considerations might be combined with a statement of model purpose to determine the appropriate size of a model. In the next section we consider an application of this principle to a particular macroeconomic problem--estimating the long-run policy tradeoff between inflation and unemployment. As will be shown, a small model may be sufficient for this purpose, even though a large scale model would be necessary for other purposes such as forecasting.

V. DECOMPOSING A LARGE-SCALE MODEL FOR ESTIMATING THE OUTPUT-INFLATION TRADEOFF

One of the appealing features of the old-style Phillips curve--the apparent static tradeoff between the level of unemployment (or the output gap) and the rate of inflation--was that it presented a simple list of options to policymakers. However, the realization that the Phillips curve in fact presented no such tradeoff has invalidated this simple list and unfortunately has left a much more complex list of intertemporal tradeoffs in its place. In this section we focus on a procedure for constructing a list of output-inflation options which has many of the advantages of a simple static tradeoff, yet is based on the modern dynamic theory of wage and price determination. The approach is to represent the output-inflation tradeoff as a negatively sloped relationship between the standard deviations, rather than the levels, of the output gap and inflation. With a vertical long-run Phillips curve there is no long-run tradeoff between the levels of output and inflation. And while in principle we should be interested in all aspects of the behavior of output and inflation, we focus on the standard deviations for convenience and because of their frequent use in the evaluation of macroeconomic stabilization policies. Moreover, optimal control techniques are particularly well-suited to computing such tradeoffs. For example, a tradeoff between the standard deviations of output and inflation was developed empirically by applying optimal control techniques to an estimated quarterly model with rational expectations in Taylor (1979).

The question which we wish to examine is whether economic theory can serve as a guideline for determining how large a macroeconometric model we need, given that the purpose of constructing this model is to estimate this trade-off between output and inflation stability. The problem is a special case of that examined in the previous sections. Consider therefore the following representative "large scale" macroeconometric model:[4]

$$y_{1t} = e'y_{2t} + x_t \quad , \tag{8}$$

$$y_{2t} = \sum_{i=1}^{L} (a_i y_{1t-i} + A_i y_{2t-i}) + u_{2t} \quad , \tag{9}$$

$$y_{3t} = \sum_{i=1}^{M} \theta_i y_{3t-i} + \beta(y_{1t} - y^*_{1t}) + u_{3t} \quad , \tag{10}$$

where y_{1t} = real GNP,

y_{2t} = a K dimensional vector containing the disaggregated compents of GNP,

y_{3t} = the rate of inflation in terms of the GNP deflator,

y^*_{1t} = potential or full capacity GNP,

x_t = federal government expenditures,

e = a K dimensional vector of ones,

a_i = arbitrary K dimensional column vectors of parameters,

A_i = arbitrary K x K dimensional matrices of parameters,

u_{2t} = a K dimensional vector of disturbances,

u_{3t} = a scalar disturbance.

We assume for simplicity that the model is linear, though similar methods could be used for nonlinear models. We also assume that the vector (u_{2t}, u_{3t}) is serially uncorrelated, with a diagonal covariance matrix.

Equation (8) is simply the national income identity. By permitting the vector y_{2t} to be quite large we are implicitly considering a large-scale model. For example, available data would permit consumer expenditures to be disaggregated into over 30 categories, and the potential range of disaggregation for net exports is even larger. Without a statement of a particular purpose for the model, economic theory does not appear to be of much use in limiting this disaggregation. The variable x_t, government expenditures, will be the sole aggregate demand policy instrument, although monetary policy would also be considered in a similar fashion.

Equation (9) is a reduced form representation for the individual components of GNP. Equation (1) represents the wage-price sector of a typical econometric model. While more disaggregation may be useful for estimating the output-inflation tradeoff, many econometric models can be reduced to such a representation if some of the exogenous variables, such as fluctuations of the minimum wage about trend, are considered as part of the disturbance u_{3t}. Since the main purpose of this section is to examine whether expenditure and production decomposition is necessary we will not pursue the adequacy of the approximation implicit in equation (1). (If a small model of the expenditure side is sufficient, more effort might be placed on developing the wage and price sectors.)

The output-inflation policy problem can be stated formally by substituting (9) into (8) and (10) to get

$$(11) \quad y_{1t} = e'[\sum_{i=1}^{L} (a_i y_{1t-i} + A_i y_{2t-i}) + u_{2t}] + x_t \quad ,$$

$$(12) \quad y_{3t} = \sum_{i=1}^{M} \Theta_i y_{3t-i} + \beta[e'[\sum_{i=1}^{L} (a_i y_{1t-i} + A_i y_{2t-i}) + u_{2t}]$$

$$+ \beta(x_t - y^*_{1t}) + u_{3t} \quad .$$

The policy objective is to find a feedback rule for x_t to minimize the expected squared deviations of y_{1t} and y_{3t} about given target levels. We take y^*_{1t} to be the target for y_{1t} and, to save on notation, we assume that the target inflation rate is zero. We also assume that the rule for x_t should be chosen to minimize $\lambda E(y_{1t} - y^*_{1t})^2 + (1 - \lambda)Ey^2_{3t}$ in the steady state. This criterion corresponds to equation (5) in the previous section. For this problem, the rule is always of the form:

$$(13) \quad x_t = y^*_1 - e' \sum_{i=1}^{L} (a_i y_{1t-i} + A_i y_{2t-i}) + \sum_{i=1}^{M} g_i y_{3t-i}$$

where the g_i coefficients depend on the weights in the objective function. Hence, equations (11) and (12) reduce to

$$(14) \quad y_{1t} = y^*_{1t} + \sum_{i=1}^{M} g_i y_{3t-i} + e'u_{2t} \quad ,$$

$$(15) \quad y_{3t} = \sum_{i=1}^{M} (\Theta_i + \beta g_i) y_{3t-i} + \beta e'u_{2t} + u_{3t} \quad .$$

The important thing to note about equations (14) and (15) is that neither y_{1t} nor y_{3t} depend on the parameters a_i and A_i which describe the behavior of the GNP components y_{2t}. Hence, the optimal tradeoff curve between the mean square deviations in y_{1t} and the mean square deviations in y_{3t} (which is a two-dimensional plot of the best pairs of deviations for alternative values of λ) does not depend on the behavior of the GNP components. If the purpose of the model is to estimate this tradeoff then we do not need to disaggregate GNP.

To illustrate the practical implications of this result we have calculated a tradeoff curve between the standard deviation of output (real GNP) and the standard deviation of inflation (the first difference in the logarithm of the GNP deflator) using annual data from 1954-76 in the U. S. Equation (10) was estimated using several values of M, the length of the lag in the inflation equation. Somewhat surprisingly it was found that the simple equation

$$(16) \qquad y_{3t} = y_{3t-1} + \underset{(3.36)}{.303}[(y_{1t} - y^*_{1t})/y^*_{1t}] + \underset{(2.55)}{.0081} + \varepsilon_t$$

could not be rejected in favor of the less constrained models represented in (10). For these estimates the impact of aggregate demand is to reduce inflation by about 1 percentage point for each year that the GNP gap is 3 percent below its equilibrium value. For computing the efficiency locus we therefore set $\Theta_1 = 1$, $\Theta_i = 0$ for $i > 1$ in equation (10). The estimated standard error of this equation is 1.2 percent. (Note that in estimating this equation we have used the percentage GNP gap rather than the absolute gap; this does not change the earlier discussion and permits us to consider percentage fluctuations in GNP as our welfare measure.) Note that the significant constant term in equation (16) indicates that inflation will be rising when GNP is equal to potential GNP as currently estimated by the Council of Advisers. The "no change" inflation point appears to occur at the GNP gap of about 2-2/3 percent.

Using the estimates given in equation (16), the two relationships (14) and (15) reduce to

$$(17) \qquad y_{1t} = y^*_{1t} + g_1 y_{3t-1} + e'u_{2t}$$

$$(18) \qquad y_{3t} = (1 + \beta g_1) y_{3t-1} + \beta e' u_{2t} + u_{3t}$$

where we have adjusted y^*_{1t} to represent potential GNP less 2-2/3 percent, (so that the output target does not entail increasing inflation), and where we now interpret the output variable in percent. Given β, the variance of u_{3t}, and the variance of $e'u_{2t}$ the steady state variance-covariance matrix of y_{1t} and y_{3t} depends only on β.

In Figure 1 the curve labeled $\beta = .3$ represents the estimated output-inflation tradeoff curve assuming that the standard deviations of u_{1t} and u_{3t} are 1 and 1.2 percent respectively, in terms of the standard deviation of $y_{1t} - y^*_{1t}$ and y_{3t}. It is obtained by plotting the square roots of the diagonal elements of the variance covariance matrix of these variables for values of g_1 between 0 and 3.3. According to these estimates the aggregate demand accommodation parameter, g_1, should be slightly less than 1 but not as small as .7 if inflation fluctuations and output fluctuations would have to be 3 times more costly than inflation fluctuations (assuming linear indifference curves).

There is little that can be shown in general about how this graph will depend on β. This depends on the empirical values of the other parameters. We therefore consider the effect of β on the tradeoff curve, holding the variances constant at the values stated above. Figure 1 also shows two other tradeoff curves corresponding to two different values of β. The two curves are based on the estimated value of β plus or minus two estimated standard errors. The range between these two curves seems to cover most current estimates of the effect of aggregate demand on prices. Note that a steeper short-run curve makes the output-inflation tradeoff more favorable. As β increases, the opportunity set tends to encompass more points which are relevant policy choices, while eliminating points which would never be chosen anyway. Of course, as β increases above 1/2 we may begin to lose some relevant points, but values of β in this range are unrealistic.

Other comparative static questions could be examined by changing some of the other parameters of the model. An important question is the sensitivity of these results to changes in the wage and price dynamics implicit in the model, and in particular whether a more detailed wage-price sector would alter Figure 1. Recent research on rational expectations suggests, for example, that the tradeoffs represented in this figure are too pessimistic in the sense that greater efforts to stabilize inflation will not result in as great an increase in employment fluctuations as the tradeoffs suggest. The main point of the discussion of this paper is that these questions can in principle be investigated within the context of a model with a highly aggregated demand sector. The policy analysis is independent of the complex equation system which generates the components of GNP, and therefore it is sufficient to focus on the wage and price dynamics. On the other hand, if the purpose of the model changes to forecasting GNP, for example, then the detailed disaggregation again becomes potentially useful. This latter statement is a reminder that the arguments of this section apply only to models which have a limited number of purposes. The approach is not likely to have much of a role in limiting the size of multipurpose models.

It should also be emphasized that the decomposition procedure suggested here is more widely applicable than the particular example of this section may indicate. In general terms the procedure simply determines quantitatively whether the aims of an econometric model depend on certain economic relationships. If they do not, then we can eliminate these economic relationships. If they do not, then we can eliminate these economic relationships from consideration. While this principle is undoubtedly followed to some degree by most model builders, this paper has suggested how it might be formalized quantitatively when the objective of research is the estimation of optimal policy tradeoffs. It would be of interest to investigate whether other goals of economic modelling can be similarly quantified in order to weed out econometric relationships which are not essential.

VI. CONCLUDING REMARKS

The central themes of this discussion have been: (1) that the research objective of a model-building effort is the most important determinant of the appropriate size of a macroeconometric model, (2) that the role of economic theory in determining model size becomes significant only when a well-specified set of objectives is known, and (3) that the appropriate decomposition of a model into smaller isolated parts depends on the purpose to which the model is put. To illustrate these points, quantitative results were presented showing that a relatively small model could be used for estimating macroeconomic policy tradeoffs between output and inflation stability, while a large-scale model would be necessary for prediction purposes.

Given this apparent importance of model objectives, it would be interesting to extend this research to statistical methods of model selection. These methods have been generally based on prediction criteria; the results of this paper indicate that their power might be enhanced by basing them on other model objectives such as optimal policy formation.

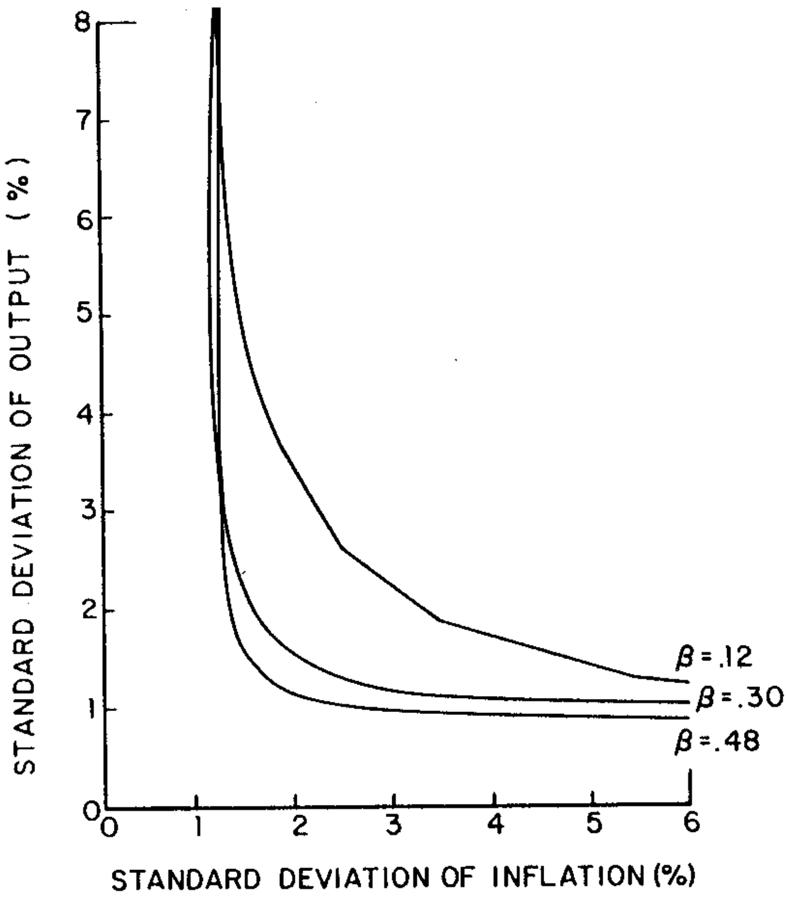

Figure 1

Notes

1. Previous methodological discussions which have touched upon issues related to economic theory and model size are found in Fromm and Klein (1975) and the collection of papers in Brunner (1972). Kmenta's (1972) summary of the discussions held at two conferences during 1967 and 1968 is particularly useful.

2. Sims (1979) argues that we rarely have enough theory to obtain identification. The same arguments would apply with greater force to the model decomposition problem.

3. It should be noted that some of the results in this section on stabilization policy will not carry over to rational expectations models. In these models, prediction is an integral part of the structure and usually takes the form of cross equation constraints. This generally makes decomposition more difficult, and suggests that models need to be bigger when expectations are assumed to be formed rationally.

4. It should be emphasized that these results are provided in order to illustrate a particular decomposition technique for a "representative" econometric model. No attempt is made here to incorporate rational expectations effects or explicit wage and price contracts as in Taylor (1979). Hence, although the results serve as a useful illustration, they are in principle subject to the potential criticism that the parameters are not stable across different policy regimes.

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