1 Philosophical Considerations

1.1 Introduction

The advantages of accurate forecasts of future economic activity need hardly be emphasized. Such forecasts are desirable for government policy-makers in the formulation of economic policies as well as for corporate managers in the development of business plans. Decision-makers need accurate forecasts both for long periods ahead, such as a year or more, and for shorter monthly or quarterly periods. Since the timing of various actions can be quite important, accurate monthly or quarterly forecasts can be extremely useful.

The purpose of this book is to describe a short-run forecasting model of the United States economy that has been developed by the author. The model differs from most other econometric models in that it has been designed *almost exclusively for forecasting purposes.* The model has been kept relatively small, and an attempt has been made to make maximum use of the various expectational variables that are available. The econometric techniques used to estimate the model also differ somewhat from the techniques used to estimate previous models. In estimating the expenditure equations of the model, account has been taken of both simultaneous equation bias and serial correlation of the error terms. The technique that has been used for this purpose is described briefly in Chapter 2 below and in more detail in Fair [17]. The housing market has also been estimated in a different way in this study. The technique that has been used is described in Chapter 8 below and in more detail in Fair and Jaffee [20] and Fair [16].

The outline of this book is as follows. In this chapter the philosophy that underlies the construction of the model is discussed and the model is briefly outlined. In Chapter 2 the technique that has been used to estimate the expenditure equations of the model is explained and the data and periods of estimation are discussed. In Chapters 3 through 10 the various sectors of the model are examined and the equation estimates are presented. The expenditure equations are discussed in Chapters 3 through 7, the monthly housing starts equations in Chapter 8, the employment and labor force equations in Chapter 9, and the price equation in Chapter 10.

In Chapters 11, 12, and 13 the forecasting ability of the model is examined in detail. The within-sample forecasts or simulations are examined in Chapter 11, and various versions of the model are tested. In Chapter 12 the stability of the estimated relationships of the model is examined and a number of outside-sample forecasts are generated. Finally, in Chapter 13 the sensitivity of the forecasting performance of the model to errors made in forecasting the exogenous variables is examined. The forecasts in Chapter 13 are all outside-sample forecasts, and they come close to being forecasts that could have been generated *ex ante*. The examination of the performance of the model in Chapters 11, 12, and 13 is fairly extensive, and the results should give a good indication of the likely future performance of the model.

In Chapter 14 the forecasting results of the model are compared with the results achieved by others. In particular, the results are compared with the results achieved by the Wharton and Office of Business Economics (OBE) models and by the forecasters studied by Zarnowitz [48]. Comparisons of the results achieved by various models and methods must be interpreted with some caution, since the assumptions on which different forecasts are made generally differ from one model or method to the next; but the informal results in Chapter 14 indicate that the present model compares favorably with other models and methods.

In Chapter 15 a summary of the major results of this study is presented. There are two appendices to the book. In Appendix A the data series that have been used in the model and that are not readily available elsewhere are presented. In Appendix B the estimates of the expenditure equations obtained by using the technique described in Chapter 2 are compared with the estimates obtained by using simpler techniques.

1.2 Structural versus Forecasting Models

With respect to its sophistication as a forecasting tool, the present model lies somewhere between the rather informal and subjective methods practiced by many business economists and the use of large-scale econometric models. The model is free from the use of subjective methods in that, given data on the exogenous variables of the model, the forecasts can be generated in a deterministic way. The forecasting ability of the model can thus be analyzed in objective terms, with some confidence placed on the assumption that the past forecasting performance of the model will be capable of achievement in the future. The disadvantage with informal forecasting techniques is that they are difficult to quantify; and it is thus difficult to determine the likelihood of their future success given their past forecasting performance.

Aside from its size, the present model differs from large-scale structural models in two main ways. The first is the use of expectational variables in the model. Expectational variables, such as plant and equipment investment expectations and consumer attitudes and buying plans, are likely to be quite useful for forecasting purposes; but they have no real justification for being treated as exogenous in models that are designed to explain the structure of the economy. In structural models these variables should be (and generally are) explained within the model or else bypassed completely in the explanation of the other endogenous variables. For short-run forecasting purposes an understanding and explanation of the determinants of these variables is, of course, not as critical.

The second main way in which the present model differs from large-scale structural models relates to the choice of the other exogenous variables to be included in the model. For a forecasting model, the exogenous variables (aside from policy variables) must be chosen with the restriction that they be at least no more difficult to forecast than the variables they are designed to explain. Since the values of the exogenous variables in a model must be forecast ahead of the overall forecast, no forecasting accuracy is likely to be gained by including in the model exogenous variables that are to begin with as difficult to forecast as the endogenous variables themselves. For structural models this restriction is not relevant: exogenous variables should not be excluded from these models merely because they are difficult to forecast.

Ideally there should be no conflict between developing a model for purposes of explaining the structure of the economy and for purposes of forecasting. If the structure is correctly specified and is stable over time and if the model is large enough so that there are few truly exogenous variables, there should be no need, when using a model for purposes of forecasting, to rely on exogenous expectational variables or to omit any hard-to-forecast variables. Also, if the structure is well specified and is stable, the fact that large-scale models tend to be unwieldly to experiment with and costly to reestimate on a short-run basis should not hinder their forecasting ability. Unfortunately, the development of large-scale models has not yet reached a point in which confidence can be placed on their forecasting ability. There are still many sectors of the economy that are not well understood and explained, and large-scale models have yet to demonstrate that they can be useful for forecasting purposes.

Friend and Jones [22] argue a much stronger point in defense of small-scale models. They feel that it is unlikely that large-scale models will ever be superior to smaller models for purposes of forecasting. This view is based in part on their feeling that smaller models are likely to be associated with less proliferation of random errors than are larger models.[1] While it is true that

[1] Friend and Jones [22], pp. 279–280.

there are many nonsystematic factors affecting economic variables that it seems unlikely even large-scale models will ever be able to explain, it is by no means certain that because of these random elements, errors in large-scale models will proliferate and result in poorer forecasts than those achieved by smaller models. In the future the specification of large-scale models should improve, and there is no reason to believe that their very size alone will lead to more error proliferation and poorer forecasts.

Friend and Jones point out that it is an empirical question whether large-scale models currently are superior in their forecasting ability to smaller models.[2] It should perhaps be further pointed out that it is also an empirical question whether even if large-scale models currently are inferior to smaller models in their forecasting ability, they are forever doomed by their very nature to yield inferior forecasting results. It is also, of course, an empirical question whether econometric models in general can yield better forecasting results than other techniques. It may be, for example, that random elements are so significant or the structure of the economy and the behavioral relationships so unstable that econometric techniques cannot successfully be used for forecasting purposes. One of the purposes of analyzing in some detail the forecasting performance of the present model is to provide a standard of comparison for future large-scale models and other forecasting techniques.

1.3 The Present Model versus Other Forecasting Models

The Friend et al. Model

The model developed in this study in its primary emphasis on forecasting is more closely related to the model developed by Friend and various collaborators [6, 22, 23] than to any of the other published models. It differs from the Friend et al. model, however, in a number of ways. First, it is a quarterly model as opposed to an overlapping semiannual model.[3] Secondly, the basic estimation technique used in this study differs from the one used by Friend et al., who estimated their model in first differenced form using the two-stage least squares technique. The technique used here, by providing an estimate of the serial correlation coefficient of the error terms to be made

[2] Ibid., p. 280.

[3] Friend and Jones [22] did experiment with a quarterly model, but they gave it up in favor of an overlapping semiannual model. The semiannual model is the model discussed in Friend and Taubman [23] and Crockett and Friend [6].

for each equation of the model, is likely to be a substantial improvement over this method. Finally, the specification of the present model is quite different than that of the Friend et al. model; and the present model includes price and employment sectors, which the Friend et al. model does not.

The Wharton Model

The Wharton model, described in Evans and Klein [13] and Evans [12], is probably the most well known of all econometric forecasting models. The forecasts from the model are currently reported in *Business Week* and are generally followed by the financial press. The present model differs from the Wharton model in two main ways. First, the present model relies more exclusively on expectational variables. One of the two versions of the Wharton model, used for one- and two-quarter-ahead forecasts, does use expectational variables, but expectational variables are not in general as integral a part of the Wharton model as they are of the present model.

The second main way in which the present model differs from the Wharton model is in size. The Wharton model is larger and more complex than the present model: it consists of 47 behavioral equations and 29 identities, compared with 14 behavioral equations and 6 identities in the model developed here. These figures do exaggerate the degree of disaggregation of the Wharton model, however, since the Wharton model consists of only thirteen behavioral equations explaining national income expenditure components, compared with seven behavioral equations in the present model. The thirteen expenditure equations of the Wharton model include three consumption equations, three plant and equipment investment equations, one housing investment equation, two inventory investment equations, three import equations, and one export equation. The seven expenditure equations of the present model include three consumption equations, one plant and equipment investment equation, one housing investment equation, one inventory investment equation, and one import equation. Since the export and import sectors in the United States are of less importance than the other sectors, the basic difference in the degree of aggregation of the Wharton model and the present model is that the Wharton model includes three plant and equipment investment equations (manufacturing, regulated and mining, and commercial) and two inventory investment equations (manufacturing and nonmanufacturing), compared with one each for the present model.

Klein [33] in a far-ranging paper on the theory of economic prediction discusses some of the philosophy that underlies the Wharton model, and some of his views are quite contrary to the approach taken here. One view that Klein strongly supports is that "best predictions will be made from best structural models."[4] It was mentioned above that ideally there should be no conflict between structural models and forecasting models, but that at the present time this ideal seems far from being achieved. Certainly it would seem that a model should be much more disaggregated than the present Wharton model for there to be much confidence placed on the assumption that it is a reasonable approximation of the true structure of the economy. The Brooking model, described in Duesenberry et al. [9, 10], is a preliminary step in developing a realistic large-scale structural model of the United States economy; but it is still an open question whether a model as large as the Brookings model can be useful for forecasting purposes. It should perhaps be pointed out that it is not really computer restrictions that are likely to hinder the use of large-scale models for short-run forecasting purposes, but the large number of man hours involved in collecting new data and keeping the models updated.

Another view held by Klein is that models need to reach a certain critical size "in order to accommodate taxes, transfers, price level, wage rate, interest rate, foreign trade, and all the main components of GNP."[5] He holds this view partly because industrial users want more detail than merely forecasts of GNP components and partly because such things as tax law changes, shifts in monetary policy, and other "environmental changes" cannot readily be incorporated into small models.[6] The fact that industrial users want more detail than merely forecasts of the major components of GNP is beyond question, but forecasting the major components of GNP is still the main problem of economic forecasting, and accurate forecasts of these components should go a long way in helping individual users to forecast the particular economic variables they are interested in.

The argument that small-scale models cannot incorporate policy and other institutional changes is an important one; but, at least with respect to tax law changes, one major defense can be made for a model like the one developed in this study. This defense relates to the effects that tax law changes have on investment plans and on consumer attitudes and buying plans. Fiscal policy in the United States is not highly flexible, and generally many months pass between the initial proposal for a tax change and its actual passage into law. The debates in Congress and elsewhere on tax proposals and other economic legislation undoubtedly have effects on people's attitudes, expectations, and behavior; and to the extent that these effects are picked up

[4] Klein [33], p. 99.
[5] Ibid., p. 80.
[6] Ibid.

by the expectational variables, a small-scale forecasting model such as the present one is not completely impervious to policy changes.

What effects various policy measures have on economic activity and how these effects are distributed over time are not easy questions to answer—witness the surprise of most economists that the tax increase of June 1968 did not appreciably slow down economic activity in the last half of 1968—and they can only hoped to be answered within the context of structural models. Given the present state of knowledge, however, there may be some advantage in designing separate models for forecasting and policy purposes. For policy purposes, the question of the effects that various policy measures and the public discussion of these measures have on people's attitudes and behavior is critical—and as yet not well explored—but for forecasting purposes, given reasonably good expectational data, this question can more justifiably be ignored.

Related to the argument that small-scale models cannot incorporate environmental changes is the question of whether the relatively simple relationships that are specified to exist among the various aggregated variables in these models are stable enough in the short run to allow useful and reasonably accurate forecasts to be made. The estimated relationships in any model must be relatively stable over time if the model is to be at all useful for purposes other than descriptive history. In Chapter 12 the stability of the estimated relationships of the model developed in this study will be examined in some detail, and from the results a judgment can be made as to how useful the model is likely to be for future forecasting purposes.

The last view of Klein that will be discussed here is his view that purely mechanistic predictions can be improved upon by relying on such things as the recent history of error terms in the model and knowledge of special events that are likely to occur. He states that "as data are revised, behavior changes, or unforeseen variables begin to affect the economy's performance, the whole set of parameters [of the model] should be reestimated."[7] He then goes on to add that quarterly reestimation of a model the size of the Wharton model is not feasible and "therefore the scheme of *a priori* adjustment of constant terms is used to keep a given model in very close touch with reality on an updated basis."

The implications of this view are quite significant and pose a serious challenge to model builders. To begin with, if the structure of the economy is stable over time, a well-specified structural model should not need to be reestimated or updated frequently in order for its performance to be good. If, on the other hand, the structure of the economy is changing through time,

[7] Ibid., p. 50.

as Klein seems to be suggesting, the entire procedure of building structural models is called into question. For short-run forecasting models, an unstable structure may not be an extremely serious problem if the models are continuously updated and the estimated aggregate relationships of the models are reasonably stable in the short run. But building structural models has little meaning if the structure of the economy is not stable for periods longer than a year or so. The question as to the stability of the structure of the economy is still an open one, and in a more optimistic vein Klein's view can be interpreted to mean that the aggregate relationships estimated by a model the size of the Wharton model are not stable over long periods of time, but that for larger models the relationships will prove to be more stable.

Evans, Haitovsky, and Treyz [14] (hereafter referred to as Evans et al.) have analyzed the forecasting properties of the Wharton and OBE models rather extensively. The results that they achieved will be examined in Chapter 14, where the forecasting results of the present model are compared with the forecasting results of others; but the basic conclusion that they reached is worth mentioning now. Their basic conclusion is that "while econometricians may forecast very well, econometric models to date have had a most unimpressive record."[8] To understand this statement more clearly, a distinction that Evans et al. make between forecasts generated by econometric models and forecasts made by econometricians must be noted. Given the specification of a model, the values of the coefficient estimates, and the values of the exogenous variables, forecasts can be generated from the model. Depending on the nature of the experiment, the forecasts can either be within-sample forecasts or outside-sample forecasts and the values of the exogenous variables can either be the actual values or values determined in some other way. Evans et al. found that the forecasts generated in a mechanical way by the Wharton and OBE models were not very good, even when the forecasts were within-sample forecasts and the actual values of the exogenous variables were used. They also found, however, that the actual *ex ante* forecasts made by the people associated with the Wharton model and the OBE model were much more accurate than any forecasts generated *ex post* from the models. In actual forecasting situations the Wharton and OBE models are "fine tuned" by adjusting the constant terms in individual equations and by adjusting the values of the exogenous variables used. This fine tuning is apparently quite important for the forecasting accuracy of the models, since without it Evans et al. found that the models do not appear to be very useful for forecasting purposes. Evans et al. conclude that: "From the previous results it should be obvious that econometric models cannot generate good

[8] Evans et al. [14], p. 158.

forecasts if they are used only in a mechanical fashion. The art of forecasting still requires that a great deal of fine tuning be used with any econometric model presently in existence."[9]

It should be noted that fine tuning a model is a very subjective procedure. The constant adjustments that are made are not purely mechanical adjustments. Rather, the forecasters look at the initial set of forecasts from the model and decide which forecasts do not look reasonable to them. They then adjust the constant terms (or the values of the exogenous variables) in the appropriate equations and run a new set of forecasts. This new set of forecasts is then examined in the same way, and the procedure is repeated until the set of forecasts is consistent with the forecaster's views.[10] This procedure is to be contrasted with mechanical constant adjustment procedures, which are not subjective in the above sense.

The above conclusion of Evans et al. is, of course, consistent with Klein's view that purely mechanistic predictions can be improved upon. While the conclusion may be true with respect to the Wharton and OBE models, it is nonetheless disturbing. First, the fact that the two models have to be fine tuned in order to produce reasonable results calls into question either the accuracy of their specification or the stability of the structure of the economy over time. Secondly, the more the models are fine tuned, the more subjective the forecasts become (in the extreme a model can be fine tuned to produce almost any forecast the forecaster desires); and thus the harder it is to place confidence on the assumption that the past forecasting performance of the model builders will be capable of achievement in the future. If it turns out to be the case that any econometric model must be extensively fine tuned in order to produce reasonably accurate forecasts, then it would appear that econometric models have a very limited role to play in forecasting work. If the models must be extensively fine tuned, the forecasts produced by model builders will differ little in terms of their subjectivity from the forecasts produced by other groups. This is not to argue that forecasts from econometric models should be completely devoid of human judgment—obviously human judgment is involved in the choice of the values of the exogenous variables—but only that forecasts from econometric models should not have to be based on extensive constant-term adjustments and other fine tuning devices of the model builder. The model developed in this study does not rely on constant-term adjustments and the like. An attempt has been made in the work below to present forecasting results that, aside from the specification of the values for the exogenous variables, are free of individual judgment.

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[9] Ibid., p. 160.

[10] See Evans et al. [14], p. 136, for a confirmation that this is in fact the procedure they have in mind when referring to the fine tuning of a model.

Taking the Wharton model as a purely forecasting tool, the present model has certain advantages over it. The present model can be easily reestimated and updated each quarter, and as was mentioned above, the stability over time of the estimated aggregate relationships can be carefully examined. The present model has fewer exogenous variables that must be forecast ahead of the overall forecast, and forecast errors from this source should therefore be less. Finally, the present model has been estimated on the assumption that the error terms in the individual equations are (first order) serially correlated, and the estimates of the serial correlation coefficients have been used in generating the forecasts. Many equations of the Wharton model appear to have serially correlated errors, and this is one of the reasons why the constant terms of the model are adjusted in actual forecasting situations. On the assumption of first order serial correlation of the error terms, the technique used in this study is likely to be more efficient than the Wharton constant-adjustment technique, and it has the further advantage that the forecasts produced by the model are less subjective than those produced by the Wharton model.

The OBE Model

The results of the OBE will be examined in Chapter 14, along with the results of the Wharton model and the present model, and so the OBE model will be briefly examined here. The present version of the OBE model is described in Green, Liebenberg, and Hirsch [25]. The OBE model is larger and more complex than the present model: the present version consists of 50 behavioral equations, compared with 14 in the model developed here. Again, however, these numbers exaggerate the degree of disaggregation of the OBE model relative to the present model. There are only eleven equations of the OBE model that explain national income expenditure components (four consumption equations, two plant and equipment investment equations, one housing investment equation, two inventory investment equations, and two import equations), compared with the seven equations of the present model. Ignoring the import sector, the OBE model consists of one more consumption equation, one more plant and equipment investment equation, and one more inventory investment equation than the present model.

As a forecasting tool, the model developed in this study has the same advantages over the OBE model as it does over the Wharton model. In particular, many of the equations of the OBE model appear to have serially correlated errors, and in actual forecasting situations the constant terms in the model are often adjusted in an attempt to account for this correlation.

1.4 Further Philosophy Behind the Construction of the Model

Before proceeding with the outline of the model, two further tenets that guided the construction of the model should be mentioned. One tenet is that when highly aggregated data are used, such as in this model and in most of the other macroeconomic models that have been developed so far, it is asking too much of the data to expect that they can distinguish among various sophisticated hypotheses or specifications. It is too much, for example, to expect that highly aggregated national income accounts data can distinguish at all clearly among various theories of consumer or investment behavior.

The second tenet, which is closely related to the first, is that it is unlikely that highly aggregated data can distinguish among various complicated lag structures. Griliches [26], for example, has shown that quite small changes in coefficient estimates (within, say, a 95 percent confidence region) can lead to quite substantial changes in the implied lag structure. With highly aggregated data these problems are likely to be especially serious. Consequently, the specification of the individual equations in this study has been kept relatively simple: in general the equations have been specified to be linear, and only a few simple lag structures have been tested for each equation.

1.5 *Outline of the Model*

The model consists of seven equations explaining expenditure components of gross national product (GNP), two equations explaining the level of housing starts, one employment equation, one equation explaining the difference between the establishment-based employment data and the household-survey employment data, two labor force participation equations, one price equation, six identities, and one production function. There are nineteen endogenous variables in the model and about sixteen basic exogenous variables.

The seven expenditure equations and the GNP identity form a self-contained part of the model. The equations are in money (current dollar) terms, and this part of the model will be referred to as the "money GNP sector" of the model. In the money GNP sector the seven expenditure equations include three consumption equations, one each for durable, nondurable, and service consumption; one equation explaining nonresidential fixed investment; one equation explaining nonfarm residential fixed investment; one equation explaining the change in total business inventories; and one equation explaining total imports. The sum of government spending, exports, and farm residential fixed investment is treated as exogenous; and GNP is by definition equal to this sum plus the sum of the seven endogenous expenditure variables. The other variables that are exogenous to the money GNP sector are the OBE–SEC plant and equipment investment expectations variable, the Michigan Survey Research Center index of consumer sentiment, and the quarterly level of housing starts.

The endogenous variables in the money GNP sector are simultaneously determined, since current GNP is included as an explanatory variable in six of the seven behavioral equations of the sector and since current durable plus nondurable consumption is included in the inventory investment equation. There are also lagged endogenous variables included among the explanatory variables in the sector, and the error terms in the individual equations are assumed to be first order serially correlated. The estimation technique that is described in Chapter 2 allows consistent estimates of a sector or model that is characterized by these properties to be made, and this technique has been used to estimate the money GNP sector in this study.

The model does not have any income side. GNP is used as the income variable in the consumption equations instead of disposable personal income (DPI). It is thus unnecessary to have an income side in the model in order to determine consumption expenditures. The use of GNP instead of DPI in the consumption equations will be discussed in more detail in Chapter 3.

The level of housing starts is determined from two monthly housing starts equations. The housing market is assumed to be a market that is not always in equilibrium and the way the model is specified, there are two equations—one supply equation and one demand equation—that explain the same housing starts variable. For forecasting or simulation purposes, the forecast of housing starts for a given month is taken to be the average of the two forecasts generated by the supply and demand equations. These monthly forecasts are then used to construct forecasts of quarterly housing starts to be used in the housing investment equation in the money GNP sector. The monthly housing starts sector is thus peripheral to the money GNP sector. The monthly housing starts forecasts are used merely to construct values of the quarterly housing starts variable, which are treated as exogenous in the money GNP sector. There is, in other words, no feedback from the money GNP sector to the monthly housing starts sector.

The price sector consists of one behavioral equation and three identities. The change in the private output deflator is taken to be a function of current and lagged values of a demand pressure variable. The demand pressure variable is discussed in Chapter 10. It is a function of the current level of money GNP, among other things, but not of the current level of real GNP. The specification of the price equation thus allows the forecast of money GNP from the money GNP sector to be used in the forecast of the private output deflator. Government output in both real and money terms is taken to be exogenous in the model, and one of the identities in the price sector is used to relate money GNP and the private output deflator to real GNP. Real GNP is thus the "residual" in the model, since it is merely determined from the identity after money GNP and the price level have been determined. Real agricultural output is taken to be exogenous in the model, and the second identity in the price sector determines real nonfarm output as real GNP less real government and agricultural output. The third identity in the price sector defines the demand pressure variable.

The employment and labor force sector consists of four behavioral equations, two identities, and one production function. The six endogenous variables in the sector are the number of private nonfarm workers employed (from the establishment-based data), the difference between the establishment-based employment data and the household-survey employment data, the number of civilian workers employed (from the household-survey data), the total labor force of primary workers (males 25–54), the total labor force of secondary workers (all others over 16), and the civilian unemployment rate. The exogenous variables in the sector include the number of civilian government workers employed, the level of the armed forces, the number of farm workers employed, the population of males 25–54, and the population of all others over 16. Feeding into the employment and labor force sector is real private nonfarm output from the price sector. The four behavioral equations explain the number of private nonfarm workers employed, the difference between the establishment-based employment data and the household-survey employment data, the labor force participation of primary workers, and the labor force participation of secondary workers. The identities define the number of civilian workers employed and the civilian unemployment rate. The production function relates private nonfarm output to private nonfarm man-hour requirements.

There is no feedback in the model from the employment and labor force sector to any of the other three sectors. The causality in the model thus runs from the monthly housing starts sector, to the money GNP sector, to the price sector, to the employment and labor force sector.

Almost all of the quarterly variables in the model are seasonally adjusted. For a model such as this one, where the level of aggregation is quite high and where the specification of the individual equations is relatively simple, an attempt to explain and forecast seasonal fluctuations would probably prove futile. It is not at all clear, however, that seasonally adjusted data should be used for large-scale structural models. A considerable amount of information about short-run fluctuations of various economic variables is lost when the data are seasonally adjusted, and for a model attempting to explain the detailed structure of the economy this may be undesirable.[11]

The seasonality in the monthly housing starts sector is treated somewhat differently, and this will be discussed in Chapter 8. The published seasonally adjusted housing starts series was not used in this study because the series is not adjusted for the number of working days in the month.

In most macroeconomic models the expenditure equations are in real terms, and a defense needs to be made as to why the expenditure equations of the present model are specified in money terms. Whether a given expenditure equation in a model should be specified in real or money terms depends on whether the people doing the spending take money income and other money variables as given and determine how much money to spend as a function of these (and other) variables, or whether they deflate money income and the other money variables by some price level and determine how many goods to purchase as a function of these "real" (and other) variables. In the first case the number of goods purchased is the residual variable (people plan to spend a given amount of money, and real expenditures are determined merely as money expenditures divided by the price level); in the second case the money value of goods purchased is the residual variable (people plan to purchase a given number of goods, and money expenditures are determined merely as real expenditures times the price level).

In the long run it seems clear that real expenditures are determined by real variables, as standard economic theory suggests, but in the short run the case is not as clear. Given the uncertainty that exists in the short run and the lags involved in the collection and interpretation of information on price changes, people may behave in the short run in a way that is closer to the first case described above than it is to the second. An argument can thus be made for specifying expenditure equations in short-run models in money terms, although even for short-run models it may be the case that some equations should be specified in real terms. In the present model the expenditure equations were specified to be in money terms partly because of convenience and partly because of the feeling that real expenditures are closer to being determined as the residual in the short run than are money expenditures.

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[11] See Bonin [3] for an interesting article discussing the disadvantages of using seasonally adjusted data.

It should finally be stressed that the above discussion of the present model versus large-scale structural models was not meant to imply that the present model is completely nonstructural. It differs from large-scale structural models in its use of exogenous expectational variables, in its choice of the other exogenous variables to be included in the model, and in its size, but not in lack of any structure. Some equations of the model are more structural than others, but in general an attempt has been made to base the specification of each equation on plausible theoretical grounds.