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7

Comparisons of Macroeconomic Forecasts

7.1 INTRODUCTION

Our comparison begins with an examination of the various ex ante and ex post average absolute forecast errors (*AAFE*s) from the tables showing forecast versus realization in Chapters 5 and 6. Relative performance in predicting important aggregates is highlighted in summary tables for nominal and real GNP and for unemployment (pp. 346–347). These show that the original (*OR*) ex ante and ex post results dominate those using other methods of constant adjustment. Next we compare these *OR* results, in turn, with corresponding noneconometric ex ante and ex post forecasts. A simulation experiment is also presented to determine whether we show econometric models at a disadvantage by considering them over a period of trend growth rather than a period of fluctuation.

7.2 WHARTON AND OBE FORECASTS

Table 7.1 shows the average absolute forecasting error (*AAFE*) for the original adjustment (*OR*), the average residual adjustment (*AR*), and

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(*GNP58*), GNP in current dollars
(*UNRATE*). We feature the *AR* f
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A comparison of the *AR* ex p
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the no adjustment (*NO*) forecasts by Wharton[1] for GNP in 1958 dollars (*GNP58*), GNP in current dollars (*GNP*), and the unemployment rate (*UNRATE*). We feature the *AR* forecast here because it is a closer approximation of the adjustment used by the Wharton forecasters than is the *GG* (Goldberger-Green) method.

A comparison of the *AR* ex post and ex ante forecasts with their unadjusted (*NO*) counterparts reveals that forecasts are substantially improved (often by 50 per cent) by mechanical equation adjustment. This is consistent with our findings, with adjustments used on a single model, in Chapter 3, and is largely explained by reference to the persistent structural equation residuals (*SER*s) in the wage bill equations found in Chapter 5.

The largest improvement comes in the first quarter of forecast. In the forecast versus realization tables, disposable income (*DI$*, appendix, p. A138) has an *AAFE* in the first quarter of about $25 billion, both ex post and ex ante, when no constant adjustments are made, but this error is less then $10 billion under *AR* adjustment. This error is reflected in the consumption (*C$*, appendix, Table A123) error of about $19 billion, which compares with an *AR* error, ex post and ex ante, of less than one-third of the *NO* error. This difference is reflected in all three components of consumption (appendix, Tables A120–A122), and is caused entirely by induced error due to the underestimate of *DI$* (Tables 5.4–5.16). There is also a substantial improvement due to the *AR* adjustment in the investment (Table A131) forecast, where the *AR* *AAFE* is about $6 billion and the *NO* error, about $15 billion. This difference is largely accounted for by regulated and mining investment in plant and equipment (*IPR$*, appendix, Table A125), investment and nonfarm residential construction (*IH$*, appendix, Table A129), and in the change in inventory stocks (*DII$*, appendix, Table A130). From our tables on the decomposition of first quarter error (Tables 5.4–5.16), we can see that the errors in *IPR$* are due to persistent negative *SER*s where the equation is not adjusted, while the inferiority of *NO* forecasts to the *AR* forecast for *IH$* and *DII$* can be attributed to the induced error resulting from the fact that the entire *NO* forecast is too low. The first quarter of forecast error for exports (*FE$*, appen-

[1] See Chapter 1, pp. 6–9, for an explanation of these adjustments.

dix, Table A132) is lower for *NO* than for *AR*. The imports figure (*FI$*, appendix, Table A133) shows a persistently greater underestimate for *NO* than for *AR*. From the decomposition tables (5.4–5.16) we see that this is due mainly to error induced by the persistent underestimates of GNP when no adjustments are made. Since imports enter negatively into GNP, this error in imports works in the opposite direction from the other GNP error. The extent of underestimate of the GNP deflator (*P*, appendix, Table A136) is about the same for *AR* and *NO*. Since the wage bill is underestimated in the *NO* forecast and wages are one of the values subtracted from national income to determine profits, it is not surprising that corporate profits before taxes (*PCB*, Table A137) are overestimated more in the first quarter of the *NO* forecast than in the first quarter of the other forecasts.

The superiority of *AR* to *NO* diminishes as the span of the forecast increases (Table 7.1). This occurs because the *AAFE* for the *NO* forecast does not increase along with the span of the forecast, while the *AR* error does grow as a result of the errors in lagged inputs from the earlier quarters of forecast. The *NO* forecast shows a decrease in the inventory error (*DII$*, Table A130) in the third and fourth quarters of forecast. In general, the errors in lagged inputs in the latter periods of the *NO* forecast either offset other error or do not systematically increase forecast error.

In addition, in Table 7.1 we also see that further improvement occurs when the *OR* adjustments replace the *AR* adjustments. In the ex post case, this shows that the Wharton forecasters must have made important improvements in their model by introducing information that was exogenous to the model but not included as explicit exogenous variables. Specific instances of improvement in particular equations in the first quarter of forecast can be found by comparing the *SER* − *CON* columns for *AR* and *OR* in the tables on decomposition of first quarter error (Tables 5.4–5.16). For example, the reduction from 1.88 to 0.88 in the *SER* − *CON* from the *AR* to the *OR* columns for change in inventory in the third quarter of 1966 (Table 5.4) means the *OR* adjustment improved the inventory equation by one billion dollars. While the general improvement from *AR* to *OR* can be seen in the ex post columns of Table 6.1, it is difficult to isolate specific consistent areas of improvement in the ex post forecasts.

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to a different interpretation. Since the first quarter of forecast is half-completed at the time of forecast, adjustments may be made in the constant term to bring the final forecast value of an endogenous variable in line with the forecaster's notion of what this value will be. For example, if preliminary figures indicate that unemployment in the first month of the quarter is 6 per cent and the model predicts 7 per cent for the quarter, the econometrician might adjust the unemployment equation 0.8 of a percentage point to make the model forecast 6.1 per cent, or something near this, when it reverberates through the system. This may improve the ex ante forecast if the forecaster's guess is better than the model prediction. It may or may not improve the ex post forecast, since the reason the model predicted 7 per cent instead of around 6 per cent may have been due to the inaccurate exogenous values that were used in the model forecast. If the improvement due to this latter type of *OR* adjustment is to continue into the ex ante forecast for the year ahead, the forecaster would have to be able to predict values of some of the model's endogenous variables more reliably than the model does itself.

We are surprised that the ex ante *OR* forecasts are superior to the ex post *OR* forecasts. This evidence indicates that some of the adjustments may have been made to bring the model forecast into line with good a priori judgment about the trend of the economy despite incorrect values for the exogenous variables. Even more surprisingly, the *AR* and *NO* forecasts do not show a clear dominance of the ex post over the ex ante forecasts. Thus, even the selection of the projected exogenous values may have been influenced by the forecast implied by these values.

In Table 7.2 we repeat for OBE the information presented in Table 7.1 for Wharton, with one exception: the *AR* adjustment is replaced with the *GG* adjustment because *GG* is closer than the *AR* adjustment to the procedure used at OBE to adjust the equations.

It is evident from Table 7.2 that mechanical adjustments improve OBE forecasts over *NO* forecasts, but not as dramatically as in the Wharton case. We might speculate that the frequent model changes at OBE would explain why the adjustments have less impact on their results than in the Wharton case. However, reference to Tables 3.6 through 3.11 in Chapter 3 show that even when a single version of the OBE model is used for ex post predictions over the forecast period, the OBE forecasts are only slightly improved by the *GG* adjustment. The following table summarizes some information from the Chapter 3 tables.

OBE Model: Root Mean Squared Error

	First Quarter			One Year Ahead		
	NO	*AR*	*GG*	*NO*	*AR*	*GG*
GNP58	4.79	4.43	4.40	5.86	8.08	5.44
GNP	10.29	7.60	7.17	17.75	14.05	14.43
UNRATE	0.23	0.29	0.21	0.34	0.32	0.36

This table shows that, with the exception of the year-ahead *AR* result of 8.08 versus 5.86 for *NO*, the mechanical adjustments improve the forecasts a little when they replace *NO* adjustment in the forecast period, even when the same model is used for OBE.

Returning to the results with the OBE models that were actually used in forecasting (see Chapter 6), we find that the *AAFE* for consumption (see appendix, Table A143) was 2.61 for *GG*, compared with 4.63 for *NO* in the one-quarter-ahead forecast. The *GG* improvement appears to stem from the better overall forecast rather than improvement in the *SER* – *CON*s in the individual equations (Tables 6.4–6.9). The one billion dollar improvement of the *AAFE* for investment (appendix, Table A147) in *GG* over *NO* is due to the superior results for fixed investment (*ISE*, Table A144). This improvement was in the *SER* – *CON* of the equation for *ISE* and occurred mainly in the fourth quarter of 1968 (Table 6.6) and the second quarter of 1969 (Table 6.8). The net export (*EX*, appendix, Table A148) shows an *AAFE* for *GG* that is $2 billion below the *NO AAFE*. This again can be traced to the improvement in the *SER* – *CON* for the import equations (Tables 6.4–6.9). The one-year-ahead *AAFE*s are so close for *GG* and *NO* that they can be explained by the difference in the first quarter outcomes.

On the basis of the above results, one can conclude that the improvement from equation adjustment is largely dependent on whether any of the equations develop persistent *SER*s in the forecast period. Thus, where the wage bill equations in Wharton developed serious persistent *SER*s, the equation adjustments on the basis of past residuals substantially improved the prediction results. This was especially true of the first quarter of forecast. However, for OBE the improvement due to equation adjustment was more modest in the first quarter, since none of the equations showed persistent large errors.

the Chapter 3 tables.

ean Squared Error

One Year Ahead		
NO	*AR*	*GG*
5.86	8.08	5.44
17.75	14.05	14.43
0.34	0.32	0.36

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In Table 7.2 the ex post *AAFE* for the *OR* adjustment shows an improvement of 0.2 or more from the *GG* result in the first quarter for nominal GNP and real GNP. The improvements that occurred in individual equations can be found by examining the difference between the *SER* − *CON* columns from *GG* to *OR* in the first quarter decomposition tables (Tables 6.4–6.9). However, there is an improvement of at least \$2 billion in the year-ahead *AAFE OR* results compared with the *GG* results, for both nominal and real GNP. An important part of this improvement came from the investment sector (*I\$*, appendix, Table A146), where fixed nonresidential investment (*ISE\$*, appendix, Table A144), residential investment (*IH*, Table A145), and change in inventory (*DII\$*, Table A146) all showed *OR AAFE* at about \$1 billion below the corresponding *GG AAFE*. Net exports (*EX\$*, Table A148) also had a \$1 billion lower error, but the consumption (*C\$*, Table A143) error for *OR* was \$2 billion more than it was for *GG*.

In the first quarter the OBE *OR* ex ante forecast is much superior to the corresponding *OR* ex post prediction. Also, the gain from *GG* to *OR* is greater in the ex ante than in the ex post case. Thus, there may have been some *OR* adjustments to bring the forecast into line with good a priori notions about the correct values for the endogenous variables. However, after the first quarter, the OBE *OR* ex ante and ex post forecasts are as similar as their *GG*, *AR*, and *NO* ex ante and ex post comparisons. Also, in the year-ahead forecasts, the *OR* ex post forecasts are as good as the ex ante forecasts (slightly better for *GNP* and *GNP58*, slightly worse for *UNRATE*). Therefore, we feel that the OBE forecasters probably did not make as many adjustments as the Wharton econometricians did to bring their forecast (after the first quarter) into line with a good a priori forecast. Together, the evidence in Table 7.1 and 7.2 seems to indicate that, in the first quarter of forecast, constant adjustments are made both at Wharton and OBE to bring the model forecast into line with a good a priori forecast, despite incorrect exogenous values. When the current exogenous values are put in, the forecast is shifted and becomes inferior to the *OR* ex ante forecast.

The OBE *GG* and *NO* ex post forecast errors are larger than the corresponding ex ante errors in over one-half of the cases in Table 7.2. This implies that the selection of exogenous values by OBE may have been influenced by the forecast that these values yielded. We find that the magnitude of the errors in the exogenous variables for both OBE and Wharton, even a year ahead, is not reflected in increased ex post error.[2] Thus, unless we are victims of a random occurrence in a small sample, it appears that there is a systematic tendency for error in the projected values of the exogenous variables to offset deficiencies in both models. On the other hand, the Wharton forecast's *OR* ex ante record is much better than its *OR* ex post record, whereas OBE shows no such difference after the first quarter. As a result, we conclude that the Wharton procedure may not differ much from the use of model output as input "for the formation of expert opinion,"[3] while the OBE approach may lean less heavily than Wharton on adjustments after the first quarter of forecast.

From the tables showing forecasting versus realization in Chapters 5 and 6 we can compare the OBE and Wharton *OR* ex post forecast error over the period from the second quarter of 1967 to the third quarter of 1969. For nominal GNP, the *OR* one-year-ahead error from the second quarter, 1967, to the fourth quarter, 1968 was 8.4 for Wharton versus 11.2 for OBE; the *GNP58* error was 6.9 and 5.8 for Wharton and OBE, respectively; finally, for unemployment, the Wharton *AAFE* of 0.6 compares with an OBE value of 0.4.

7.3 EX ANTE ECONOMETRIC FORECASTS VERSUS OTHER EX ANTE FORECASTS

In view of the evidence noted above that the forecaster's judgment, as reflected in the selection of constant adjustments and of values for the exogenous variables, plays an important role in forecasting (especially for Wharton), the question arises, do econometric models help forecasters at all—or could the same economists who impose their judgment upon these models do as well without their aid?

We have no direct evidence on this question, since there is no record available of the *same* forecaster's prediction with and without the benefit of econometric models. One can only compare the econo-

[2] For example, the *AAFE* (in billions of dollars) regarding government spending for the 1st, 2nd, 3rd, and 4th quarter and the year ahead was, respectively, 1.2, 2.4, 2.2, 2.8, and 2.4 for OBE, and 1.6, 2.4, 2.6, 3.1, and 2.3 for Wharton (Table 5). See Tables 5.4–5.16 and 6.4–6.9 for more information on errors in exogenous variables.

[3] Verdoorn, O.E.C.D. Conference on Forecasting Manpower Requirements, May 1970, Chapter 1, p. 14.

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7.4 COMPARISONS OF VARI

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[4] "Forecasting Economic Conditions: T
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[5] Frank P. Murphy, "Construction of In
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FORECASTS VERSUS OTHER EX

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metric ex ante predictions with judgmental forecasts. The results of such a comparison are presented in Table 7.3, where we compare the Wharton and OBE ex ante forecasts with three comparable groups of judgmental forecasts, the data for which were obtained from a study by Victor Zarnowitz, under the auspices of the National Bureau.[4] We see that, on the whole, the Wharton and OBE forecasts are superior to the judgmental ones, with one major exception: the real GNP forecast of set S (Zarnowitz's designation of the average of a certain large group of forecasters). Thus, our circumstantial evidence indicates that forecasters should benefit from their interaction with the models.

Ex ante forecasts can also be made using statistical techniques that do not utilize a structural econometric model. Such forecasts are made by the General Electric Company. In Table 7.4 below we compare the Wharton and OBE forecasts with ex ante forecasts that were internally recorded at General Electric, using the nonstructural G.E. statistical model.[5] On the basis of these data there is no evidence that structural models are superior to nonstructural ones for ex ante forecasting.

7.4 COMPARISONS OF VARIOUS EX POST FORECASTS

If econometric models are to serve as a reliable guide to policy makers, their conditional forecasts must be accurate. The primary evidence for conditional forecasting performance is given by the ex post forecasts. Since the *OR* ex post forecasts use the model to the best advantage, both in terms of our findings above and the forecaster's implied a priori preference, this is the appropriate record to examine.

As benchmarks for analyzing the *OR* ex post forecasts we use the naive models and the St. Louis (reduced form) model described in Chapter 1 (see pages 11–12).

Table 7.5 illustrates our results. The most striking finding is that the St. Louis equation outperforms both OBE and Wharton *OR* ex post forecasts for nominal GNP. It is true that this equation was not proposed until the middle of the period under review so that the specification may

[4] "Forecasting Economic Conditions: The Record and the Prospect," in Victor Zarnowitz, ed., *The Business Cycle Today*, NBER, 1972.

[5] Frank P. Murphy, "Construction of Industry Sales Forecasting Models," speech delivered at American Statistical Association meeting, Pittsburgh, Pennsylvania, August 22, 1968.

have benefited from hindsight. But the specification is very simple and therefore not subject to possibly undue respecification to make it fit; also, the equation was estimated over the Wharton and OBE sample periods. The effect on performance of changes in the sample period and forecast period is very marked for the autoregressive model, but the St. Louis equation's *AAFE* record is consistently better than the econometric model performance. The St. Louis *AAFE* record conceals that the error has a negative bias for the 1953–66 coefficients and a positive bias for the 1948–64 coefficients. The autoregressive *AAFE* for GNP is better than the OBE *AAFE*, but inferior to the Wharton record for predicting the third and fourth quarters ahead and for year-ahead forecasts. The record is just the opposite for real GNP in 1958 dollars, except that the OBE forecast is superior to the autoregressive equation for the first two quarters as well as for the longer forecasts. The low "same change" forecast error is evidence of persistent trend growth during the period. Yet it is distressing to see that the forecast error record for the "same change" model is virtually equivalent to that of both Wharton and OBE over this period. The OBE and Wharton error was a little over 20 per cent of the no change forecast error for nominal GNP and one-third and one-half, respectively, for real GNP. The unemployment error for Wharton is high by any standard of comparison. The unemployment figure is determined as a residual in the model and evidently is not to be trusted at all. OBE's unemployment error is marginally superior to Wharton's, while the autoregressive error for unemployment, with the use of the OBE sample and forecasting period, is very large relative to the error resulting from the three other methods.

7.5 TREND-DOMINATED VERSUS FLUCTUATION PERIOD

Econometric forecasting models are frequently changed to incorporate new specifications based on developments in the economy and in economic research. Thus, we cannot count on a long period over which to evaluate model performance. Since all of our results discussed above originated in a recession-free period, we wanted to see whether or not the comparison of econometric forecasts with other ex post benchmark forecasts would be more favorable to econometric models in a fluctuation period than in a trend-dominated period. To this end, we ran

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ls are frequently changed to incorpo- evelopments in the economy and in ot count on a long period over which ice all of our results discussed above d, we wanted to see whether or not lcasts with other ex post benchmark ible to econometric models in a ominated period. To this end, we ran

sample period simulations with the Wharton model, using *GG* constant adjustments for the periods from first quarter, 1953 to second quarter, 1961 and from third quarter, 1961 to the fourth quarter, 1964. The former period is characterized by economic fluctuation (it included three recessions), in contrast to the latter period, which was recession-free and thus more closely approximates growth around a trend line. These sample period simulations were accomplished by the same procedure as that used to obtain the *GG* ex post forecasts in the forecast period. The outcomes are presented in Table 7.6.

Note that the Wharton results are compared with the four benchmark forecasts for corresponding periods. The "same change" extrapolation can serve as a measure of fluctuation, since steady growth would show only small errors for this benchmark. For all variables the one-year-ahead error is more than three times larger in the fluctuation period than in the trend period—despite the fact that the "no change" forecast projects nominal and real GNP values that are twice as large in the trend period as in the fluctuation period. Table 7.6 also indicates that the autoregressive forecasts deteriorate badly in the fluctuation period, while the St. Louis model shows a slightly larger error for that period. However, the Wharton forecast error becomes much worse in the fluctuation period. Comparing the ratio of Wharton to autoregressive error for one-year-ahead forecasts, we find that it is the same for both periods in the case of nominal GNP, smaller in the trend period for real GNP, and smaller in the fluctuation period for unemployment. The ratio of the Wharton error to the St. Louis error is smaller in the trend period than it is in the fluctuation period. These sample period simulations can only suggest what the likely relative forecast period performance might be. Nevertheless, the evidence indicates that the forecast period of the late sixties, which was a recession-free period, is probably relatively favorable for econometric models in relation to the autoregressive or St. Louis approach.

TABLE 7.1

Wharton Model: Comparison of Average Absolute Forecast Error under Various Adjustments, 3rd Quarter, 1966–3rd Quarter, 1969

	Original Adjustment (OR)		Average Residual Adjustment (AR)		No Adjustment (NO)	
	Ex Ante	Ex Post	Ex Ante	Ex Post	Ex Ante	Ex Post
One quarter ahead						
GNP[a]	3.8	6.0	9.6	11.0	28.7	27.3
GNP58[b]	2.8	5.1	5.3	6.9	20.0	19.3
Unemployment rate[c]	0.2	0.3	1.3	1.8	2.6	2.5
Two quarters ahead						
GNP[a]	7.8	10.1	17.2	19.1	38.2	35.3
GNP58[b]	5.7	8.4	8.6	13.1	19.9	19.5
Unemployment rate[c]	0.4	0.6	1.8	2.3	3.3	2.2
Three quarters ahead						
GNP[a]	10.4	11.7	20.6	20.8	30.2	26.3
GNP58[b]	7.2	10.6	9.4	14.0	10.9	14.6
Unemployment rate[c]	0.5	0.9	1.8	2.4	2.3	2.2
Four quarters ahead						
GNP[a]	12.6	14.2	23.9	22.4	27.4	25.0
GNP58[b]	6.7	12.2	8.9	14.3	7.1	13.5
Unemployment rate[c]	0.5	1.0	1.7	2.4	1.7	1.5
One year ahead						
GNP[a]	6.6	8.7	14.3	13.8	27.8	23.8
GNP58[b]	5.3	8.0	6.8	9.9	9.7	10.9
Unemployment rate[c]	0.4	0.6	1.5	2.2	2.4	2.2

[a] In billions of current dollars. [b] In billions of 1958 dollars. [c] Per cent.

TABLE 7.2

OBE Model: Comparison of Average Absolute Forecast Error under Various Adjustments, 3rd Quarter, 1966–3rd Quarter, 1969

	Original Adjustment (OR)		Goldberger-Green (GG)		No Adjustment (NO)	
	Ex Ante	Ex Post	Ex Ante	Ex Post	Ex Ante	Ex Post
One quarter ahead						
GNP[a]	2.1	4.4	4.7	4.6	6.3	6.4
GNP58[b]	1.8	2.3	3.0	2.6	4.7	3.8
Unemployment rate[c]	0.1	0.1	0.3	0.2	0.4	0.4
Two quarters ahead						
GNP[a]	7.8	8.8	10.3	9.3	13.7	13.8
GNP58[b]	4.8	4.6	6.5	6.3	7.4	8.5
Unemployment rate[c]	0.2	0.3	0.4	0.4	0.5	0.6

[illegible]	[illegible]	[illegible]	[illegible]	13.1	19.9	19.5
Unemployment rate[c]	0.4	0.6	1.8	2.3	3.3	2.2
Three quarters ahead						
GNP[a]	10.4	11.7	20.6	20.8	30.2	26.3
GNP58[b]	7.2	10.6	9.4	14.0	10.9	14.6
Unemployment rate[c]	0.5	0.9	1.8	2.4	2.3	2.2
Four quarters ahead						
GNP[a]	12.6	14.2	23.9	22.4	27.4	25.0
GNP58[b]	6.7	12.2	8.9	14.3	7.1	13.5
Unemployment rate[c]	0.5	1.0	1.7	2.4	1.7	1.5
One year ahead						
GNP[a]	6.6	8.7	14.3	13.8	27.8	23.8
GNP58[b]	5.3	8.0	6.8	9.9	9.7	10.9
Unemployment rate[c]	0.4	0.6	1.5	2.2	2.4	2.2

[a] In billions of current dollars. [b] In billions of 1958 dollars. [c] Per cent.

TABLE 7.2

OBE Model: Comparison of Average Absolute Forecast Error under Various Adjustments, 3rd Quarter, 1966–3rd Quarter, 1969

	Original Adjustment (OR)		Goldberger-Green (GG)		No Adjustment (NO)	
	Ex Ante	Ex Post	Ex Ante	Ex Post	Ex Ante	Ex Post
One quarter ahead						
GNP[a]	2.1	4.4	4.7	4.6	6.3	6.4
GNP58[b]	1.8	2.3	3.0	2.6	4.7	3.8
Unemployment rate[c]	0.1	0.1	0.3	0.2	0.4	0.4
Two quarters ahead						
GNP[a]	7.8	8.8	10.3	9.3	13.7	13.8
GNP58[b]	4.8	4.6	6.5	6.3	7.4	8.5
Unemployment rate[c]	0.2	0.3	0.4	0.4	0.5	0.6
Three quarters ahead						
GNP[a]	12.7	13.7	16.3	15.6	17.6	13.8
GNP58[b]	7.0	7.4	8.7	9.6	9.9	11.8
Unemployment rate[c]	0.3	0.5	0.5	0.6	0.6	0.7
Four quarters ahead						
GNP[a]	19.5	21.4	22.4	25.6	24.4	27.4
GNP58[b]	9.4	11.5	9.4	13.3	10.6	14.4
Unemployment rate[c]	0.5	0.6	0.7	0.9	0.7	0.8
One year ahead						
GNP[a]	11.5	12.1	15.0	15.4	17.5	19.4
GNP58[b]	6.1	6.1	7.1	8.9	8.5	11.0
Unemployment rate[c]	0.3	0.4	0.5	0.6	0.5	0.5

NOTE: The year-ahead and four quarters-ahead predictions exclude the 2nd quarter, 1967 forecast because the OBE ex ante forecast terminated in the fourth quarter of 1967.

[a] In billions of current dollars. [b] In billions of 1958 dollars. [c] Per cent.

TABLE 7.3

Comparison of Average Absolute Forecast Errors in Wharton and OBE Ex Ante Forecasts with Various Judgmental Forecasts

	Judgmental Set A			Judgmental Set G			Judgmental Set S		
	AAFE[a] of A	Ratio OBE/A	Ratio Wharton/A	AAFE[a] of G	Ratio OBE/G	Ratio Wharton/G	AAFE[a] of S	Ratio OBE/S	Ratio Wharton/S
One quarter ahead									
GNP	6.9	0.22	0.63	8.7	0.28	0.55	5.6	0.50	0.86
GNP58	—	—	—	6.5	0.31	0.62	1.9	0.68	0.98
Two quarters ahead									
GNP	13.5	0.83	0.47	16.9	0.63	0.47	10.6	0.94	0.99
GNP58	—	—	—	13.3	0.49	0.45	1.2	1.67	3.17
Three quarters ahead									
GNP	17.9	0.82	0.62	21.8	0.71	0.54	17.1	1.00	1.06
GNP58	—	—	—	17.4	0.56	0.37	1.2	2.02	4.07
Four quarters ahead									
GNP	n.a.	n.a.	n.a.	31.3	0.68	0.61	23.6	1.03	0.80
GNP58	—	—	—	25.5	0.50	0.30	n.a.	n.a.	n.a.

NOTE: The comparisons cover the following forecasts: Judgmental Set A: 1st quarter, 1968; first quarter, 1969. Judgmental Set G: *For GNP:* 3rd quarter, 1967; 1st quarter, 1968; 3rd quarter, 1968; 1st quarter, 1969; 3rd quarter, 1969. *For GNP58:* 3rd quarter, 1967; 1st quarter, 1968; 3rd quarter, 1968; 1st quarter, 1969; 3rd quarter, 1969. Judgmental Set S: *For GNP:* All forecasts throughout the period 3rd quarter, 1968–3rd quarter, 1969. *For GNP58:* All forecasts throughout the period 4th quarter, 1968–3rd quarter, 1969. Source: Data for judgmental sets are from Victor Zarnowitz, ed., *The Business Cycle Today*, NBER, 1972.

[a] These AAFE's were calculated by comparing the judgmental forecast values with the realized data set used for finding the forecasting errors for the OBE model. The judgmental AAFE's based on Wharton realized data sets did not differ significantly from those reported here.

GNP	17.9	0.82	0.62	21.8	0.71	0.54	17.1	1.00	1.06
GNP58	—	—	—	17.4	0.56	0.37	1.2	2.02	4.07
Four quarters ahead									
GNP	n.a.	n.a.	n.a.	31.3	0.68	0.61	23.6	1.03	0.80
GNP58	—	—	—	25.5	0.50	0.30	n.a.	n.a.	n.a.

NOTE: The comparisons cover the following forecasts: Judgmental Set A: 1st quarter, 1968; first quarter, 1969. Judgmental Set G: *For GNP*: 3rd quarter, 1967; 1st quarter, 1968; 3rd quarter, 1968; 1st quarter, 1969; 3rd quarter, 1969. *For GNP58*: 3rd quarter, 1967; 1st quarter, 1968; 3rd quarter, 1968; 1st quarter, 1969; 3rd quarter, 1969. Judgmental Set S: *For GNP*: All forecasts throughout the period 3rd quarter, 1968–3rd quarter, 1969. *For GNP58*: All forecasts throughout the period 4th quarter, 1968–3rd quarter, 1969. Source: Data for judgmental sets are from Victor Zarnowitz, ed., *The Business Cycle Today*, NBER, 1972.

[a] These AAFE's were calculated by comparing the judgmental forecast values with the realized data set used for finding the forecasting errors for the OBE model. The judgmental AAFE's based on Wharton realized data sets did not differ significantly from those reported here.

TABLE 7.4

Comparison of OBE and Wharton Models with General Electric's Ex Ante Forecasts, 1st Quarter, 1968–3rd Quarter, 1969

	G. E. Forecast		Ratio of Wharton to G. E.		Ratio of OBE to G. E.	
	GNP AAFE	GNP58 AAFE	GNP	GNP58	GNP	GNP58
One quarter ahead	4.0	3.4	1.10	0.74	0.68	0.63
Two quarters ahead	8.1	5.3	1.14	1.07	1.27	0.93
Three quarters ahead	15.8	6.3	1.00	1.56	1.14	1.29
Four quarters ahead	22.0	6.5	1.03	1.66	1.20	1.88

TABLE 7.5

Comparison of OBE Average Absolute Forecast Error with Benchmark Forecasts, 2nd Quarter, 1967–3rd Quarter, 1969

	GNP	GNP58	Unemployment
One quarter ahead			
OR ex post	4.4	2.3	0.1
Autoregressive	2.4	3.6	0.2
Same change	3.1	2.7	0.1
No change	16.8	6.4	0.1
St. Louis	3.3	n.a.	n.a.
Two quarters ahead			
OR ex post	8.8	4.6	0.3
Autoregressive	3.8	8.3	0.6
Same change	7.3	5.8	0.3
No change	34.4	13.4	0.2
St. Louis	6.4	n.a.	n.a.
Three quarters ahead			
OR ex post	13.7	7.4	0.5
Autoregressive	4.5	12.9	1.0
Same change	12.9	10.9	0.4
No change	52.2	20.7	0.3
St. Louis	10.1	n.a.	n.a.
Four quarters ahead			
OR ex post	19.4	10.1	0.7
Autoregressive	4.9	16.9	1.3
Same change	20.3	17.0	0.5
No change	70.7	28.6	0.2
St. Louis	14.0	n.a.	n.a.
One year ahead			
OR ex post	11.2	5.8	0.4
Autoregressive	3.5	9.3	0.7
Same change	11.7	9.4	0.3
No change	43.7	18.2	0.2
St. Louis	8.3	n.a.	n.a.

NOTE: The 2nd quarter, 1967 forecast for four quarters ahead and one year ahead is excluded.

TABLE

Comparison of Wharton Average Absolute
3rd Quarter, 1966–

	GNP
One quarter ahead	
OR ex post	6.0
Autoregressive[a]	4.2
Same change	3.6
No change	15.4
St. Louis	3.4
Two quarters ahead	
OR ex post	10.1
Autoregressive[a]	9.6
Same change	7.5
No change	30.7
St. Louis	5.8
Three quarters ahead	
OR ex post	11.7
Autoregressive[a]	15.7
Same change	12.6
No change	46.0
St. Louis	7.3
Four quarters ahead	
OR ex post	14.2
Autoregressive[a]	25.[illegible]
Same change	17.[illegible]
No change	62.[illegible]
St. Louis	9.[illegible]
One year ahead	
OR ex post	8.[illegible]
Autoregressive[a]	14.[illegible]
Same change	10.[illegible]
No change	38.[illegible]
St. Louis	6.[illegible]

[a] The Wharton values for 1969 ar equation for the period from the 1st quarte are slightly different from those on the "f sample period for autoregressive projectio

BLE 7.5

Forecast Error with Benchmark Forecasts,
37–3rd Quarter, 1969

NP	GNP58	Unemployment
4.4	2.3	0.1
2.4	3.6	0.2
3.1	2.7	0.1
5.8	6.4	0.1
3.3	n.a.	n.a.
3.8	4.6	0.3
3.8	8.3	0.6
.3	5.8	0.3
.4	13.4	0.2
.4	n.a.	n.a.
.7	7.4	0.5
.5	12.9	1.0
.9	10.9	0.4
.2	20.7	0.3
.1	n.a.	n.a.
4	10.1	0.7
9	16.9	1.3
3	17.0	0.5
7	28.6	0.2
0	n.a.	n.a.
2	5.8	0.4
5	9.3	0.7
7	9.4	0.3
7	18.2	0.2
1	n.a.	n.a.

ast for four quarters ahead and one year

TABLE 7.6

Comparison of Wharton Average Absolute Forecast Error with Benchmark Forecasts, 3rd Quarter, 1966–3rd Quarter, 1969

	GNP	GNP58	Unemployment
One quarter ahead			
OR ex post	6.0	5.1	0.3
Autoregressive[a]	4.2	3.3	0.2
Same change	3.6	3.1	0.2
No change	15.4	6.1	0.1
St. Louis	3.4	n.a.	n.a.
Two quarters ahead			
OR ex post	10.1	8.4	0.6
Autoregressive[a]	9.6	5.1	0.4
Same change	7.5	5.9	0.3
No change	30.7	11.9	0.2
St. Louis	5.8	n.a.	n.a.
Three quarters ahead			
OR ex post	11.7	10.6	0.9
Autoregressive[a]	15.7	5.6	0.7
Same change	12.6	10.2	0.4
No change	46.0	17.9	0.2
St. Louis	7.3	n.a.	n.a.
Four quarters ahead			
OR ex post	14.2	12.2	1.0
Autoregressive[a]	25.5	6.6	1.0
Same change	17.7	14.6	0.5
No change	62.5	24.9	0.2
St. Louis	9.5	n.a.	n.a.
One year ahead			
OR ex post	8.7	8.0	0.6
Autoregressive[a]	14.2	4.8	0.6
Same change	10.8	8.5	0.3
No change	38.3	15.6	0.2
St. Louis	6.6	n.a.	n.a.

[a] The Wharton values for 1969 are based on estimating the autoregressive equation for the period from the 1st quarter, 1953 to 3rd quarter, 1968; thus, the totals are slightly different from those on the "forecast versus realization" tables, where the sample period for autoregressive projections was 1st quarter, 1948–4th quarter, 1964.

TABLE 7.7

Comparison of Wharton Sample Period Simulations (GG Constant Adjustments) with Benchmark Forecasts, in a Period Dominated by Fluctuation (1st Quarter, 1953–2nd Quarter, 1961) and a Period Dominated by Trend Growth (3rd Quarter, 1961–4th Quarter, 1964)

	GNP		GNP58		Unemployment	
	1st Q'53–2nd Q'61	3rd Q'61–4th Q'64	1st Q'53–2nd Q'61	3rd Q'61–4th Q'64	1st Q'53–2nd Q'61	3rd Q'61–4th Q'64
One quarter ahead						
Wharton	5.4	2.5	5.6	2.2	1.1	0.6
Autoregressive	4.1	1.7	4.3	1.7	0.3	0.1
Same change	5.6	2.1	5.1	1.9	0.4	0.2
No change	6.0	9.3	5.2	6.8	0.4	0.2
St. Louis	3.7	2.5	n.a.	n.a.	n.a.	n.a.
Two quarters ahead						
Wharton	6.9	3.8	6.8	2.7	1.3	0.7
Autoregressive	6.9	3.1	7.4	3.6	0.6	0.3
Same change	11.2	3.8	10.7	3.5	1.0	0.4
No change	10.8	18.9	9.1	13.8	0.8	0.3
St. Louis	5.9	4.4	n.a.	n.a.	n.a.	n.a.
Three quarters ahead						
Wharton	7.6	3.9	7.5	2.6	1.3	0.7
Autoregressive	9.1	4.9	10.2	6.4	0.8	0.3
Same change	17.4	6.4	17.9	5.9	1.6	0.5
No change	15.4	28.0	12.2	20.5	1.0	0.4
St. Louis	7.6	5.5	n.a.	n.a.	n.a.	n.a.
Four quarters ahead						
Wharton	7.6	3.3	8.5	1.7	1.4	0.7
Autoregressive	11.3	6.9	12.8	9.0	0.9	0.3
Same change	24.4	8.9	25.4	8.3	2.4	0.7
No change	19.5	37.0	14.4	27.1	1.3	0.5
St. Louis	8.0	6.9	n.a.	n.a.	n.a.	n.a.
One year ahead						
Wharton	5.5	3.1	5.7	2.0	1.0	0.6

Wharton	5.4	2.5	5.6	2.2	1.1	0.6
Autoregressive	4.1	1.7	4.3	1.7	0.3	0.1
Same change	5.6	2.1	5.1	1.9	0.4	0.2
No change	6.0	9.3	5.2	6.8	0.4	0.2
St. Louis	3.7	2.5	n.a.	n.a.	n.a.	n.a.
Two quarters ahead						
Wharton	6.9	3.8	6.8	2.7	1.3	0.7
Autoregressive	6.9	3.1	7.4	3.6	0.6	0.3
Same change	11.2	3.8	10.7	3.5	1.0	0.4
No change	10.8	18.9	9.1	13.8	0.8	0.3
St. Louis	5.9	4.4	n.a.	n.a.	n.a.	n.a.

Three quarters ahead						
Wharton	7.6	3.9	7.5	2.6	1.3	0.7
Autoregressive	9.1	4.9	10.2	6.4	0.8	0.3
Same change	17.4	6.4	17.9	5.9	1.6	0.5
No change	15.4	28.0	12.2	20.5	1.0	0.4
St. Louis	7.6	5.5	n.a.	n.a.	n.a.	n.a.
Four quarters ahead						
Wharton	7.6	3.3	8.5	1.7	1.4	0.7
Autoregressive	11.3	6.9	12.8	9.0	0.9	0.3
Same change	24.4	8.9	25.4	8.3	2.4	0.7
No change	19.5	37.0	14.4	27.1	1.3	0.5
St. Louis	8.0	6.9	n.a.	n.a.	n.a.	n.a.
One year ahead						
Wharton	5.5	3.1	5.7	2.0	1.0	0.6
Autoregressive	7.5	4.0	8.2	5.2	0.6	0.2
Same change	14.3	4.9	14.4	4.3	1.3	0.4
No change	12.5	23.3	9.6	17.3	0.8	0.3
St. Louis	5.9	4.9	n.a.	n.a.	n.a.	n.a.