

Forecasts of Asia-Pacific Economic Activity to 2000:4

Peter C. B. Phillips¹

Cowles Foundation for Research in Economics

Yale University

and

University of Auckland

This section of the Journal reports regular forecasts of macroeconomic activity for a selection of Asia-Pacific nations. This issue gives quarterly *ex ante* forecasts for the USA, Japan, Korea, Australia, and New Zealand for the period through to the fourth quarter of the year 2000 and updates the forecasts for these countries over this horizon that were reported in the previous issue of the Journal. An analysis of past forecasting performance for the US economy is provided.

The forecasts given here are based on time series models that make extensive use of automated model selection procedures. The judgmental elements in making these forecasts are minimal and are confined to the choice of variables, the selection of the model classes to be used, and the setting of certain maximal parameters like maximal lag order in an autoregression or vector autoregression. The choice of variables is similar across all the countries considered and includes real gross domestic product, real private consumption expenditure, real fixed investment, real exports, a short run interest rate, the M1 money stock, and the unemployment rate. This choice leads to comparable small-scale time series models of the RUMPY variety for each country. None of the models incorporate policy reaction functions, and in consequence forecasts are generated under the implicit assumption of current policy settings.

The in-house models used to generate forecasts are all linear (in variables) time series models. The models are either classical or Bayesian versions of vector autoregressions (VAR's, and BVAR's), reduced rank regressions (RRR's), error correction models (ECM's) or univariate versions of these models. For the USA we also report forecasts obtained from Ray Fair's (1994) structural

econometric model of the US economy. In future issues, coverage of the region will expand and we hope to compare our automated time series forecasts with structural econometric models of other countries in the region. We also plan to include some automated econometric analyses of economic policy.

The approach we are following is to report forecasts from all of the main time series models for each country. Reporting the results this way helps to show the effects of model specification and model uncertainty on *ex ante* forecasting, something that is seldom done in other published work. As is apparent from the forecasts given here and in earlier issues, there is often considerable variation across models in forecasts, sometimes even for short periods ahead and between models that are in the same general class, like ECM and RRR models. In other cases, forecast profiles are much closer together. This, in itself, is of interest. But, since no econometric model is correctly specified, we hope that the exercise of multi-model forecasting will help to shed light on the importance of econometric model determination in the production of good forecasts. In future issues, we hope to address the problem of combining forecasts and choosing a best overall model. At that point we will also include prediction intervals. At the moment, forecast evaluations are reported only for the USA, where data revisions are slight. We hope to extend this evaluation exercise to some of the other countries in future issues.

Data

The final sample observations that were available at the time these forecasts were generated were as follows: USA, 1997:1; Japan, 1997:1; Korea, 1997:1; Australia, 1997:1;

¹ All computations and graphics were performed on a Pentium Pro PC using programs written in GAUSS. My thanks are due to Ray Fair for permission to reproduce here the *ex ante* forecasts of the US economy from his structural econometric model — see Fair(1994). Thanks also go to Ray Fair, Colin Hargreaves, Joong Sik Lee of the Bank of Korea, and Alasdair Scott of the Reserve Bank of New Zealand for supplying the data.

² The models and methods are explained in an earlier issue of the Journal — see Phillips (1995) — and the model determination techniques are given in Phillips (1996).

New Zealand, 1997:1. The initializations of the data sets were selected on the basis of the quarterly data that was available for all of the series to ensure a balanced data set for each country. All variables are transformed to natural logarithms except for the interest rate.

90-day Money market rate (percentage points)
 Sample Period: 1975:1 – 1997:1
 Source: Australian Bureau of Statistics
 Forecast period: 1997:2 – 2000:4 (15 quarters)

USA Variables and Data:

Real gross domestic product (1987\$b bil., SA)
 Real personal consumption expenditure (1987\$b bil., SA)
 Real fixed investment (1987\$b bil., SA)
 Price deflator of GDP
 3-month Treasury Bill rate (percentage points)
 M1-Money stock, end of quarter (\$ bil., SA)
 Unemployment rate, all workers 16 and over (percentage points, SA)
 Sample Period: 1952:1 – 1997:1
 Source: National Income and Product Accounts (chain link data)
 Forecast Period: 1997:2 – 2000:4 (15 quarters)

New Zealand Variables and Data:

Real gross domestic product (production based) (1989/90\$m mil., SA)
 Real private consumption exp. (1989/90\$m mil., SA)
 Real fixed investment (1989/90\$m mil., SA)
 Core CPI
 M1-Money stock, end of quarter (currency + demand deposits, \$ mil., SA)
 90-day RBNZ Bill yield (percentage points)
 Sample Period: 1983:1 – 1997:1
 Source: Reserve Bank of New Zealand
 Forecast period: 1997:2 – 2000:4 (15 quarters)

Japan Variables and Data:

Real gross domestic product (1990Y bil., SA)
 Real personal consumption expenditure (1990Y bil., SA)
 Real fixed investment (1990Y bil., SA)
 Price deflator of GDP
 M1-Money stock, end of quarter (Y bil., SA)
 Unemployment rate (percentage points, SA)
 Sample Period: 1971:1 – 1997:1
 Source: Nikkei Database
 Forecast period: 1997:2 – 2000:4 (15 quarters)

Korea Variables and Data:

Real gross national product (1990W bil., SA)
 Real personal consumption expenditure (1990W bil., SA)
 Real exports (1990 US\$m mil., SA)
 Consumer price index (1990 = 100)
 M1-Money stock, end of quarter (W bil., SA)
 Sample Period: 1970:1 – 1997:1
 Source: Bank of Korea
 Forecast period: 1997:2 – 2000:4 (15 quarters)

Australia Variables and Data:

Real gross domestic product (1989/90\$m mil., SA)
 Real personal consumption exp. (1989/90\$m mil., SA)
 Real fixed investment (1989/90\$m mil., SA)
 Price deflator of GDP
 M1-Money stock, end of quarter (currency + demand deposits, \$ mil., SA)

Results

Tables 1–4 give the forecast results for the main variables included in each model. Four variables are included for each country: two macroeconomic aggregates (output and either investment or rts) and two monetary variables (inflation and either M1 or a 90 day interest rate). Figures 1–5 graph the forecasts over the forecast horizon together with recent historical data. In these tables and graphs we show growth rates for output and investment (exports, in the case of Korea), inflation, M1 and, in the case of the USA, level forecasts for interest rates. The growth rates are computed on a quarterly basis for the USA and Japan and on an annual basis for Korea, Australia and New Zealand. As indicated in the introduction, none of the time series models incorporate policy reaction functions, and therefore forecasts from these models implicitly assume current policy settings.

USA

There is less variation in the forecasts of real GDP growth across models than in our recent forecasts. The FAIR model predicts growth to decline from its current level to below 2% by the first quarter of 1998. The ECM model is more optimistic and predicts sustained growth around 3%, following a robust second quarter 1997 growth of nearly 5%. The RRR and BVAR models are less optimistic than the ECM model and forecast a tailing off in growth from the present level to around 2%–2.5% by mid 1998. The BVAR model is the least optimistic in the longer horizon forecasts to the year 2000. The ECM and FAIR model have similar

forecasts out to 2000:4. The scalar BAR model shows less fluctuation in growth forecasts and from 1998 is more optimistic than the vector models, predicting growth in the 3.8%–4% range throughout the period.

The inflation forecasts are similar to those made from 1996:4. In particular, all the time series models predict slowly rising inflation. The FAIR model forecasts a dip in inflation for the second quarter of 1997, followed by a steady rise thereafter. The vector time series models predict inflation rising to the 3.5%–4% level by the year 2000, while the FAIR model keeps inflation below the 3% level throughout the entire period. As in our last several sets of forecasts, the ECM inflation forecasts are closest to those of the FAIR model.

The FAIR, ECM, and BVAR models all give similar long term forecasts for the 90 day T-bill rate, showing a steady rate in the 5%–6% range for most of the period. The RRR model shows a slight dip in the rate in 1997:2, followed by a slow rise thereafter. As in our last several sets of forecasts, the models give generally similar forecast profiles for real investment growth. The BVAR and ECM models are the least favourable time series forecasts in both the short and long term, showing a reduction in investment growth through 1999:1 before a rise in investment growth occurs. The BAR model is the most optimistic showing growth in investment falling initially and then stabilising around the 3%–4% range for the remainder of the period. The FAIR model continues to be the least favourable in the longer term, showing investment growth falling to around 0% by the end of the period.

Japan

As in our last forecasts, the ECM and BAR models give similar predictions for real GDP growth out to 2000:4, and show growth maintained in the 3%–4% range for most of the period. The BVAR model forecasts are much less optimistic, especially in the short term, and show real GDP declining in the second quarter 1997, recovering later in 1997 but staying in the 1%–2% range for the remainder of the forecast period. The RRR forecasts are also less optimistic in the short term, but show growth recovering by 1998 to around the 3% level. The inflation forecasts for Japan are again more variable across models than the growth forecasts. The ECM model predicts inflation rising to nearly 3% by 1999 and then slowly declining by the turn of the millenium. The BVAR model predicts fluctuations in the

inflation rate during 1997 but a low rate of inflation, below 1%, thereafter. The RRR model gives inflation forecasts over the longer horizon similar to the BVAR model, but predicts no large initial fluctuations in the rate of inflation during 1997.

Korea

As is very clear in the graphs for Figure 3(a), there is a substantial difference between the ECM model forecasts for real GNP growth and the RRR, BVAR and BAR forecasts. As in our earlier forecasts, the ECM model continues to predict a general decline in real GNP growth, from present levels to around 4% by 1998:1, followed by a slower decline to around 3.6% by the turn of the millenium. The ECM model prediction of a decline in real GNP growth is accompanied by the model's prediction of a decline in real export growth to around 2.5% by the turn of the millenium. The other models have much more optimistic projections for real GNP and somewhat more optimistic projections for real exports; they also forecast faster growth in M1 than the ECM model.

Australia

All models except the RRR model give a broadly similar pattern of projection for real GDP growth, indicating growth in the region of 2.5% for the remainder of 1997 and growth in the band 2.6%–3.1% by 200:4. As in our previous two sets of forecasts, the RRR model is less optimistic about real GDP growth and shows a slow but steady decline from 2.3% growth in 1997:2 to the end of the period, with growth ending up around 1.3% by the turn of the millenium. The new inflation forecasts are very similar to our last set of forecasts. Inflation is predicted to remain below 2.5% by each of the ECM, BVAR and BAR models, while the RRR model forecasts inflation rising to 3% by 1997:4 and staying around the 3% level through to 2000:4.

New Zealand

The models show conflicting patterns about the future path of real GDP. The RRR model predicts a slow increase in the growth rate from the present level to around 2.5% by 1998:1. The BAR model gives similar forecasts. The BVAR model is less optimistic and predicts growth around the 1% level until mid 1998 and a slow decline in growth through to 2000:4. The ECM model forecasts of real GDP growth are the most pessimistic, showing growth in the 0%–1% band for most of the period and a small recession in the 1997:4

quarter. All models predict a drop in the inflation rate from the present level to the 0%–1.5% band during the remainder of 1997. Thereafter, the forecasts are quite different. The RRR model predicts some deflation during 1998 and 1999, followed by rise in inflation to around the 2% level by 2000:4. The ECM model predicts inflation in the 0%–1% range for the rest of 1997, followed by a rise in inflation to around 1.5% by 1998:4 and inflation in the 1%–1.5% range for the remainder of the period. The BVAR model predicts steady inflation rates during the rest of 1997 around 1.5%, followed by a rise in inflation to 2.2% in 1998:1 and inflation in the 2%–2.5% band till 2000:4.

Forecasting Record

Figures 6(a) and 6(b) show the average forecast RMSE's of our in-house models and the FAIR structural econometric model of the US economy over the period 1995:1 – 1996:4. The RMSE's are calculated for forecast horizons up to 9 periods ahead. So far, we have a track record of 7 observations on the 1-period ahead forecasts, 6 observations on the 2-period ahead forecasts, 5 observations on the 3-period ahead forecasts, 5 observations on the 4-period ahead forecasts, 4 observations on the 5-period ahead forecasts, 3 observations on the 6-period ahead forecasts, 2 observations on the 7- and 8-period ahead forecasts, and 1 observation on the 9-period ahead forecasts. With this number of observations, we can expect to see some variability in the forecast performance as measured by averaging the RMSE's for each forecast horizon.

Figure 6(a) gives the forecasting record for real GDP. The forecasting record of the ECM model is the best for 3–9 periods ahead, and the FAIR model has the best 1–2 period ahead performance. Overall, the performance of the ECM model and the FAIR model is close, but the ECM model now seems to be doing better than the FAIR model on medium to longer term forecasts of real GDP growth. As remarked

previously, it is interesting that the average forecast RMSE's for the FAIR and ECM models do not seem to increase much with the length of the forecast horizon. One reason for this may be that the period since 1994 has been one of stable growth and sustained low inflation for the US. Also, it needs to be said that the longer horizon forecast RMSE's are computed with fewer observations. The BVAR and RRR models, on the other hand, do show increasing forecasting RMSE's with horizon length, so these considerations do not appear to apply with these methods. These models also do noticeably worse than the FAIR and ECM models in predicting real GDP growth.

In forecasting inflation, the RRR model is consistently the worst performer. The FAIR model is the best inflation forecasting instrument over longer horizons of 4–9 periods ahead and one period ahead. The FAIR model is no longer uniformly better than the time series models in inflation forecasting. The ECM model has better average performance over 2–3 periods ahead and is a close second to the FAIR model on the other horizons.

These results continue to corroborate earlier findings in these evaluation exercises that the ECM model and the FAIR model have the best overall performance in predicting the course of inflation and real GDP growth in the USA economy. The results therefore seem to confirm the value of imposing structural elements in time series models for forecasting purposes, at least on the basis of the record for the US economy.

References

- Fair, Ray C. (1994), *Testing Macroeconometric Models*, Cambridge: Harvard University Press.
- Phillips, Peter C. B. (1995), 'Automated forecasts of Asia-Pacific Economic Activity', *Asia Pacific Economic Review*, 1, pp. 92–102.
- (1996), 'Econometric Model Determination', *Econometrica*, Vol. 64, No. 4, July 1996, pp. 763–812.

Table 1: USA Forecasts

(a) Real GDP: growth rate (% annual rate)

	ECM	RRR	BVAR	BAR	Fair Model
1997:2	4.93	4.43	3.57	4.10	3.59
1997:3	3.12	2.96	2.85	3.89	2.68
1997:4	3.16	3.20	2.89	3.71	2.40
1998:1	3.30	2.84	2.71	3.64	1.96
1998:2	3.19	2.72	2.36	3.60	1.81
1998:3	3.21	2.57	2.15	3.57	1.84
1998:4	3.21	2.48	1.98	3.54	2.00
1999:1	3.20	2.41	1.83	3.52	2.17
1999:2	3.18	2.37	1.73	3.50	2.28
1999:3	3.14	2.35	1.66	3.48	2.37
1999:4	3.09	2.34	1.61	3.46	2.52
2000:1	3.05	2.34	1.58	3.44	2.57
2000:2	3.01	2.34	1.55	3.42	2.50
2000:3	2.97	2.34	1.54	3.41	2.43
2000:4	2.93	2.34	1.54	3.39	2.44

(c) Inflation — GDP deflator (% annual rate)

	ECM	RRR	BVAR	BAR	Fair Model
1997:2	2.25	2.75	2.43	2.61	1.55
1997:3	2.48	3.17	2.66	2.93	1.60
1997:4	2.70	3.45	2.92	3.28	1.65
1998:1	2.77	3.66	3.09	3.57	1.71
1998:2	2.94	3.78	3.25	3.84	1.79
1998:3	3.07	3.86	3.39	4.07	1.86
1998:4	3.17	3.92	3.50	4.28	1.92
1999:1	3.27	3.96	3.60	4.47	1.98
1999:2	3.36	3.99	3.68	4.64	2.05
1999:3	3.44	4.01	3.74	4.79	2.12
1999:4	3.51	4.02	3.79	4.92	2.19
2000:1	3.58	4.02	3.82	5.03	2.27
2000:2	3.64	4.02	3.84	5.13	2.34
2000:3	3.69	4.02	3.85	5.22	2.42
2000:4	3.74	4.02	3.85	5.29	2.49

(b) Real Investment: growth rate (% annual rate)

	ECM	RRR	BVAR	BAR	Fair Model
1997:2	5.81	6.23	2.93	6.63	7.04
1997:3	3.46	5.38	1.97	5.53	5.80
1997:4	2.15	4.53	1.51	4.79	4.96
1998:1	1.06	4.32	1.07	4.35	3.23
1998:2	0.69	3.92	0.94	4.11	1.75
1998:3	0.55	3.63	0.81	3.98	0.97
1998:4	0.65	3.36	0.70	3.92	0.39
1999:1	0.87	3.16	0.64	3.89	0.15
1999:2	1.12	3.01	0.64	3.87	0.07
1999:3	1.38	2.92	0.68	3.87	0.08
1999:4	1.62	2.86	0.74	3.88	0.19
2000:1	1.83	2.83	0.83	3.88	0.27
2000:2	2.02	2.82	0.91	3.89	0.22
2000:3	2.18	2.82	1.00	3.90	0.10
2000:4	2.32	2.82	1.08	3.91	0.02

(d) 3-Month Treasury Bill Rate

	ECM	RRR	BVAR	BAR	Fair Model
1997:2	5.32	4.98	5.16	5.27	5.19
1997:3	5.45	5.12	5.25	5.40	5.37
1997:4	5.48	5.21	5.38	5.51	5.47
1998:1	5.55	5.29	5.49	5.66	5.49
1998:2	5.62	5.36	5.59	5.80	5.47
1998:3	5.66	5.42	5.67	5.91	5.45
1998:4	5.70	5.47	5.74	6.03	5.44
1999:1	5.75	5.50	5.80	6.14	5.42
1999:2	5.79	5.52	5.84	6.24	5.40
1999:3	5.84	5.54	5.88	6.34	5.39
1999:4	5.88	5.55	5.91	6.43	5.39
2000:1	5.93	5.55	5.93	6.51	5.39
2000:2	5.98	5.55	5.96	6.59	5.39
2000:3	6.03	5.56	5.98	6.67	5.39
2000:4	6.08	5.56	5.99	6.74	5.39

Table 2: Japan Forecasts

(a) Real GDP: growth rate (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	2.99	1.96	-0.01	3.92
1997:3	3.80	1.77	1.52	4.31
1997:4	4.81	2.56	2.12	4.42
1998:1	3.63	3.02	2.11	4.17
1998:2	4.03	3.37	1.73	4.18
1998:3	3.90	3.50	2.80	4.14
1998:4	3.65	3.53	2.42	4.06
1999:1	3.61	3.50	2.54	4.02
1999:2	3.53	3.45	2.63	3.97
1999:3	3.44	3.40	2.59	3.92
1999:4	3.39	3.35	2.49	3.88
2000:1	3.34	3.32	2.50	3.84
2000:2	3.30	3.31	2.43	3.80
2000:3	3.27	3.30	2.39	3.77
2000:4	3.24	3.29	2.38	3.74

(c) Inflation — GDP deflator (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	0.93	-0.24	0.87	1.53
1997:3	2.07	0.98	2.28	2.39
1997:4	2.05	0.41	-1.16	1.88
1998:1	2.61	0.26	0.52	1.90
1998:2	2.70	0.19	-0.30	1.59
1998:3	2.95	0.16	0.16	1.56
1998:4	2.98	0.19	-0.11	1.46
1999:1	3.04	0.26	0.17	1.47
1999:2	3.01	0.33	0.04	1.45
1999:3	2.99	0.40	0.19	1.45
1999:4	2.94	0.45	0.20	1.43
2000:1	2.88	0.49	0.24	1.42
2000:2	2.81	0.52	0.24	1.40
2000:3	2.75	0.54	0.24	1.38
2000:4	2.68	0.55	0.20	1.36

Table 2 cont: Japan Forecasts

(b) Real Investment: growth rate (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	7.20	5.55	2.68	1.45
1997:3	-0.74	0.42	-1.02	1.25
1997:4	5.36	2.51	1.91	3.42
1998:1	3.38	3.59	3.59	4.57
1998:2	3.59	4.17	3.16	5.01
1998:3	3.43	4.41	3.97	5.30
1998:4	3.21	4.41	3.85	5.37
1999:1	2.97	4.30	3.70	5.35
1999:2	2.92	4.16	3.52	5.28
1999:3	2.82	4.03	3.39	5.17
1999:4	2.76	3.92	3.13	5.06
2000:1	2.73	3.85	3.00	4.94
2000:2	2.70	3.81	2.87	4.83
2000:3	2.70	3.79	2.76	4.72
2000:4	2.70	3.78	2.70	4.63

(d) M1 growth (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	0.87	4.72	6.44	2.82
1997:3	6.18	-1.85	3.59	3.03
1997:4	5.99	2.55	4.26	3.48
1998:1	6.18	4.18	6.72	3.74
1998:2	5.56	4.98	9.14	3.98
1998:3	5.15	5.45	8.75	4.18
1998:4	4.77	5.63	9.80	4.35
1999:1	4.69	5.64	9.61	4.51
1999:2	4.47	5.56	9.50	4.65
1999:3	4.35	5.45	9.19	4.77
1999:4	4.19	5.36	9.07	4.87
2000:1	4.05	5.29	8.90	4.96
2000:2	3.92	5.25	8.90	5.04
2000:3	3.80	5.24	8.96	5.11
2000:4	3.68	5.24	9.07	5.18

Table 3: Korea Forecasts

(a) Real GDP: growth rate (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	4.67	5.84	7.04	6.07
1997:3	4.39	6.41	8.16	6.65
1997:4	4.29	7.23	9.64	7.66
1998:1	4.05	7.83	10.77	8.46
1998:2	4.27	7.73	9.90	8.40
1998:3	4.07	7.47	9.43	8.41
1998:4	4.01	7.28	8.87	8.37
1999:1	3.92	7.09	8.38	8.32
1999:2	3.88	6.93	8.00	8.28
1999:3	3.81	6.79	7.71	8.25
1999:4	3.78	6.67	7.51	8.22
2000:1	3.74	6.56	7.39	8.19
2000:2	3.70	6.46	7.33	8.16
2000:3	3.67	6.37	7.31	8.13
2000:4	3.63	6.28	7.33	8.11

(c) Inflation — GDP deflator (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	4.40	4.24	3.73	4.03
1997:3	4.86	4.91	3.69	4.18
1997:4	6.55	6.63	4.70	5.37
1998:1	6.69	6.68	3.98	4.85
1998:2	6.87	6.91	4.09	4.72
1998:3	7.33	6.97	4.33	4.74
1998:4	7.58	6.93	4.57	4.67
1999:1	7.73	6.86	4.88	4.62
1999:2	7.88	6.79	5.07	4.59
1999:3	8.00	6.72	5.12	4.55
1999:4	8.08	6.66	5.06	4.51
2000:1	8.14	6.61	4.90	4.47
2000:2	8.19	6.56	4.66	4.44
2000:3	8.22	6.53	4.38	4.41
2000:4	8.25	6.49	4.08	4.37

(b) Real Investment: growth rate (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	17.14	16.63	17.31	18.56
1997:3	15.78	14.71	15.69	18.14
1997:4	8.29	7.56	7.82	11.77
1998:1	5.32	5.42	4.66	10.29
1998:2	4.85	6.25	3.86	9.88
1998:3	3.67	6.51	2.89	9.31
1998:4	3.06	6.57	2.80	9.30
1999:1	2.93	6.63	3.13	9.42
1999:2	2.73	6.70	3.52	9.56
1999:3	2.62	6.79	4.02	9.75
1999:4	2.59	6.88	4.55	9.94
2000:1	2.57	6.97	5.05	10.12
2000:2	2.56	7.06	5.51	10.29
2000:3	2.57	7.15	5.91	10.44
2000:4	2.58	7.24	6.26	10.57

(d) M1 growth (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	5.23	7.60	7.30	6.45
1997:3	6.61	11.59	10.36	9.16
1997:4	7.78	15.14	12.81	11.65
1998:1	8.77	18.10	14.80	13.81
1998:2	9.03	17.71	13.76	14.02
1998:3	9.14	16.77	12.82	13.99
1998:4	9.31	15.93	12.17	13.99
1999:1	9.31	15.23	11.51	13.98
1999:2	9.31	14.65	10.98	13.95
1999:3	9.32	14.17	10.58	13.93
1999:4	9.31	13.77	10.28	13.90
2000:1	9.29	13.43	10.07	13.88
2000:2	9.28	13.15	9.93	13.86
2000:3	9.26	12.91	9.84	13.84
2000:4	9.23	12.71	9.77	13.82

Table 4: Australia Forecasts**(a) Real GDP: growth rate (% annual rate)**

	ECM	RRR	BVAR	BAR
1997:2	2.55	2.30	2.52	2.52
1997:3	2.32	1.79	2.34	2.26
1997:4	2.64	1.79	2.50	2.57
1998:1	2.64	1.47	2.28	2.58
1998:2	2.65	1.39	2.08	2.65
1998:3	2.67	1.36	1.87	2.74
1998:4	2.66	1.35	1.91	2.81
1999:1	2.66	1.34	2.04	2.87
1999:2	2.66	1.33	2.24	2.91
1999:3	2.65	1.33	2.44	2.94
1999:4	2.64	1.32	2.62	2.97
2000:1	2.63	1.31	2.80	2.98
2000:2	2.63	1.31	2.95	2.99
2000:3	2.62	1.30	3.07	2.99
2000:4	2.61	1.29	3.16	2.99

(c) Inflation — GDP deflator (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	1.65	2.17	2.03	1.42
1997:3	1.89	2.91	2.51	1.39
1997:4	1.53	3.09	2.36	0.74
1998:1	1.54	3.62	2.49	0.40
1998:2	1.44	3.54	2.14	0.17
1998:3	1.32	3.48	1.87	-0.07
1998:4	1.27	3.42	1.65	-0.26
1999:1	1.18	3.37	1.43	-0.45
1999:2	1.11	3.33	1.20	-0.63
1999:3	1.04	3.28	1.00	-0.81
1999:4	0.98	3.24	0.82	-1.00
2000:1	0.92	3.19	0.67	-1.18
2000:2	0.86	3.15	0.54	-1.36
2000:3	0.81	3.11	0.44	-1.55
2000:4	0.76	3.07	0.35	-1.73

(b) Real Investment: growth rate (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	7.39	7.32	7.18	7.95
1997:3	7.14	6.29	6.27	7.53
1997:4	5.52	4.78	4.04	5.52
1998:1	1.09	0.58	-0.90	0.78
1998:2	1.07	0.90	-1.23	-0.23
1998:3	0.14	1.04	-1.94	-1.28
1998:4	0.10	1.10	-1.74	-1.21
1999:1	0.19	1.13	-1.42	-0.96
1999:2	0.38	1.15	-0.91	-0.42
1999:3	0.64	1.16	-0.34	0.13
1999:4	0.89	1.17	0.21	0.69
2000:1	1.13	1.17	0.73	1.17
2000:2	1.34	1.17	1.20	1.56
2000:3	1.51	1.18	1.62	1.87
2000:4	1.66	1.18	1.97	2.09

(d) M1 growth (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	11.08	11.06	10.71	11.90
1997:3	10.82	10.31	9.35	12.38
1997:4	7.91	7.02	5.54	10.43
1998:1	7.27	5.99	4.15	10.82
1998:2	6.93	5.31	3.47	10.77
1998:3	6.49	5.05	3.56	10.74
1998:4	6.28	4.94	3.82	10.78
1999:1	6.09	4.90	4.09	10.81
1999:2	5.91	4.88	4.45	10.84
1999:3	5.75	4.86	4.81	10.87
1999:4	5.60	4.85	5.14	10.90
2000:1	5.46	4.83	5.42	10.92
2000:2	5.33	4.81	5.66	10.95
2000:3	5.19	4.79	5.85	10.97
2000:4	5.07	4.77	5.99	10.99

Table 5: New Zealand Forecasts**(a) Real GDP: growth rate (% annual rate)**

	ECM	RRR	BVAR	BAR
1997:2	1.35	1.68	1.62	1.77
1997:3	0.59	1.81	1.09	1.45
1997:4	-0.39	1.27	0.64	1.45
1998:1	0.37	2.54	1.44	2.68
1998:2	0.22	2.20	1.14	2.71
1998:3	-0.06	1.71	0.85	2.74
1998:4	0.46	2.61	0.79	2.77
1999:1	0.29	2.60	0.68	2.80
1999:2	0.23	3.19	0.60	2.83
1999:3	0.41	3.27	0.55	2.85
1999:4	0.20	2.80	0.48	2.88
2000:1	0.22	2.83	0.43	2.91
2000:2	0.26	2.65	0.38	2.94
2000:3	0.15	2.60	0.35	2.97
2000:4	0.19	2.68	0.32	2.99

(c) Inflation — Core CPI (% annual rate)

	ECM	RRR	BVAR	BAR
1997:2	0.99	0.38	1.48	0.97
1997:3	0.38	-1.35	1.59	0.53
1997:4	0.27	-1.45	1.51	-0.45
1998:1	0.63	-1.81	2.22	-0.57
1998:2	1.14	-0.95	2.42	-0.71
1998:3	1.98	-0.01	2.59	-0.84
1998:4	1.58	-1.39	2.46	-0.97
1999:1	1.72	-0.94	2.42	-1.10
1999:2	1.69	-1.02	2.41	-1.23
1999:3	1.43	-0.25	2.37	-1.35
1999:4	1.50	0.96	2.33	-1.47
2000:1	1.41	1.26	2.29	-1.59
2000:2	1.29	1.71	2.22	-1.71
2000:3	1.32	1.99	2.14	-1.82
2000:4	1.21	2.08	2.06	-1.93

Table 5 cont: New Zealand Forecasts

(b) Real Investment: growth rate (% annual rate)

	ECM	RBB	BVAR	BAR
1997:2	-1.29	-5.39	2.08	2.48
1997:3	-2.55	-3.08	2.52	2.08
1997:4	-1.76	-1.33	6.18	5.04
1998:1	-6.05	-3.14	3.81	2.68
1998:2	-2.61	7.80	4.34	2.75
1998:3	-2.98	6.40	3.31	2.80
1998:4	-1.46	8.98	2.20	2.83
1999:1	0.10	9.71	1.77	2.87
1999:2	-0.52	6.60	1.18	2.91
1999:3	0.24	6.58	0.80	2.94
1999:4	0.19	5.64	0.63	2.98
2000:1	-0.29	4.85	0.43	3.01
2000:2	0.14	5.66	0.32	3.04
2000:3	-0.17	4.57	0.24	3.07
2000:4	-0.23	4.56	0.16	3.10

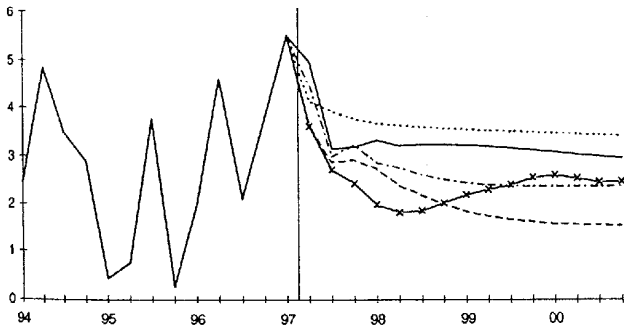
(d) M1 growth (% annual rate)

	ECM	RBB	BVAR	BAR
1997:2	4.71	5.52	4.43	3.56
1997:3	10.33	13.05	10.53	8.22
1997:4	8.57	10.87	9.34	5.83
1998:1	2.96	3.35	5.18	1.08
1998:2	2.98	1.55	5.02	0.79
1998:3	2.36	-2.48	4.30	0.50
1998:4	2.22	-3.67	3.81	0.21
1999:1	4.19	-1.49	4.09	-0.08
1999:2	3.20	-3.31	4.02	-0.37
1999:3	3.32	-2.99	4.04	-0.66
1999:4	3.44	-2.20	4.16	-0.95
2000:1	2.68	-1.49	4.17	-1.24
2000:2	2.84	0.74	4.18	-1.53
2000:3	2.69	1.99	4.16	-1.82
2000:4	2.38	2.75	4.08	-2.10

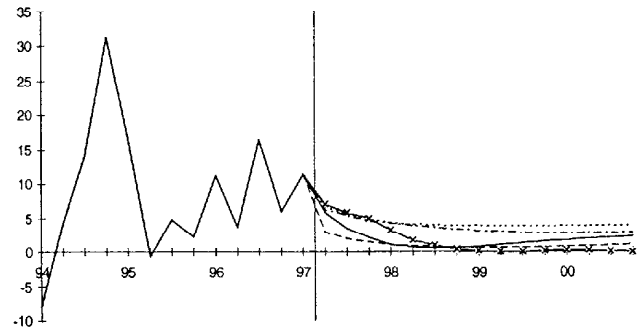
Figures 1(a)–(d): USA Forecasts

(——) = ECM, (- - -) = RRR, (- - - -) = BVAR(opt), (- - - -) = BAR(opt), (-x-x-) = Fair Model

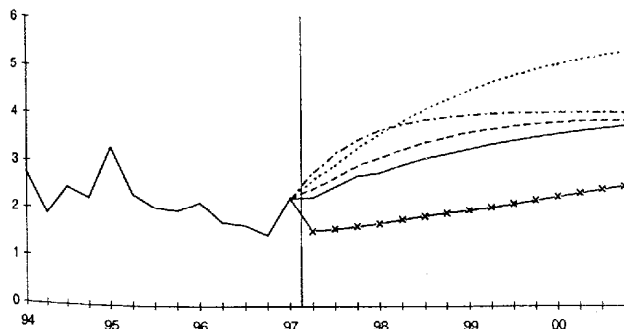
(a) Real GDP growth rate



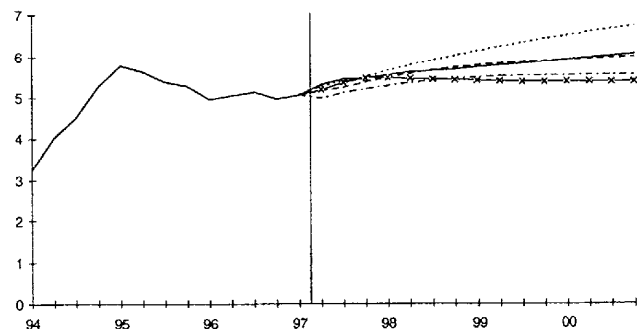
(b) Real Fixed Investment growth rate (%)



(c) Inflation: GDP deflator (%)



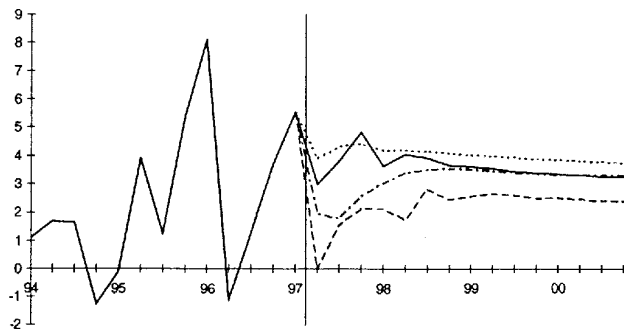
(d) 3-month Treasury Bill rate



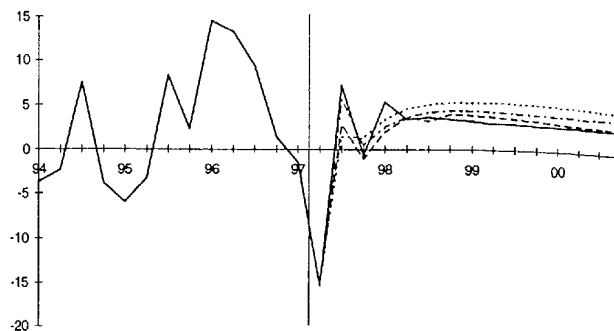
Figures 2(a)–(d): Japan Forecasts

(——) = ECM, (---) = RRR, (- - - -) = BVAR(opt), (----) = BAR(opt)

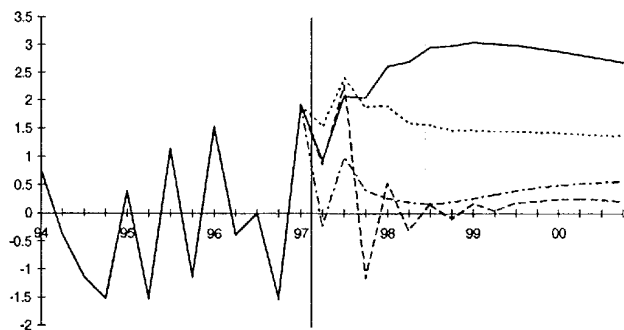
(a) Real GDP growth rate (% p.a.)



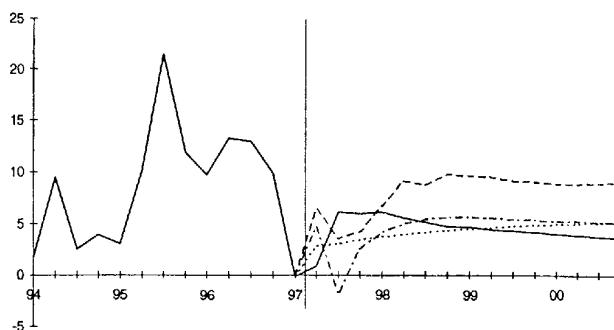
(b) Real Investment; growth rate (% p.a.)



(c) Inflation: GDP deflator (% p.a.)



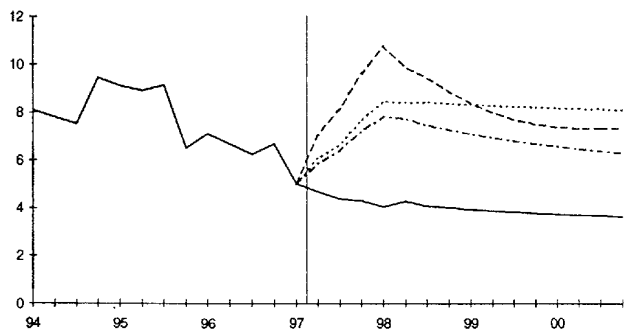
(d) M1 Growth rate (% p.a.)



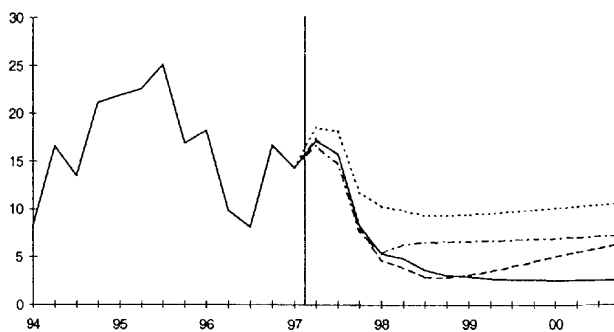
Figures 3(a)–(d): Korea Forecasts

(——) = ECM, (---) = RRR, (- - - -) = BVAR(opt), (----) = BAR(opt)

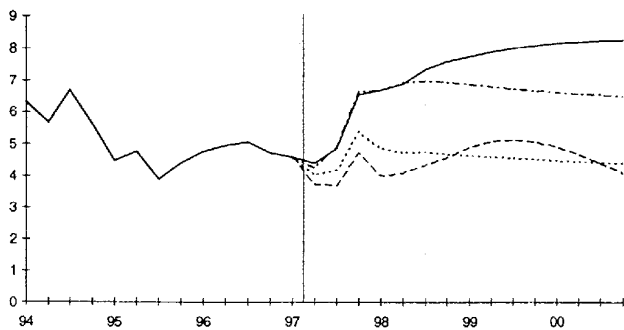
(a) Real GDP growth rate (% p.a.)



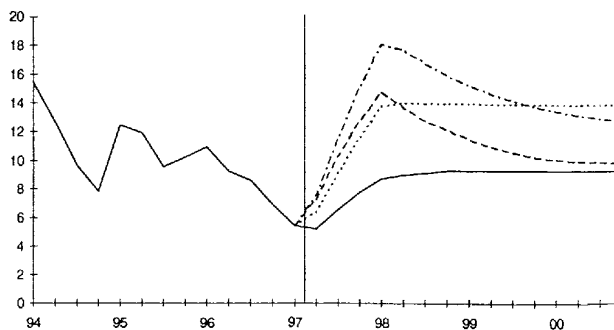
(b) Real Investment; growth rate (% p.a.)



(c) Inflation: GDP deflator (% p.a.)



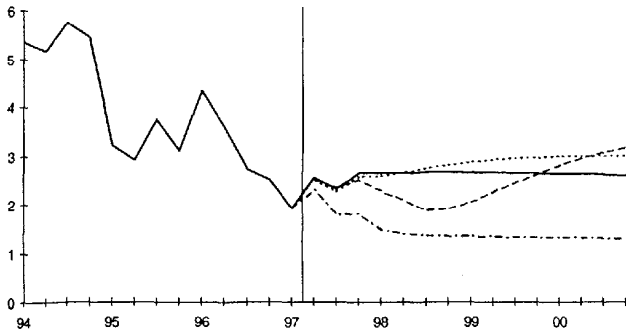
(d) M1 Growth rate (% p.a.)



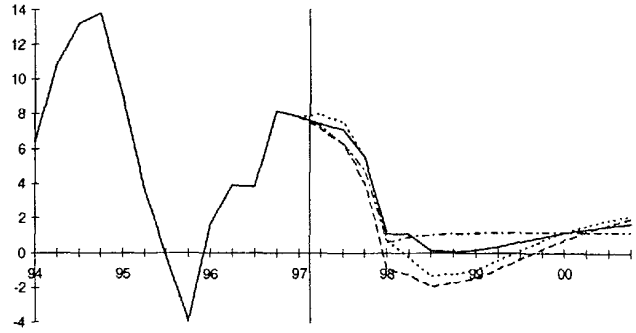
Figures 4(a)–(d): Australia Forecasts

(——) = ECM, (---) = RRR, (- - - -) = BVAR(opt), (- - - -) = BAR(opt)

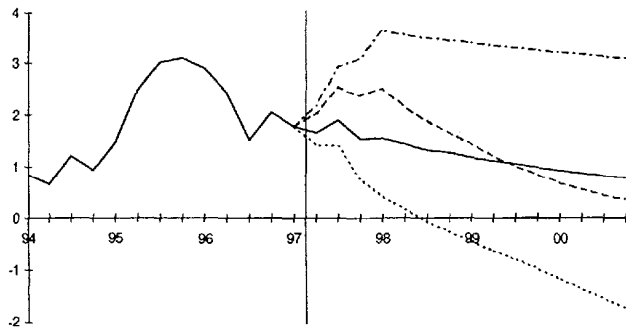
(a) Real GDP growth rate (% p.a.)



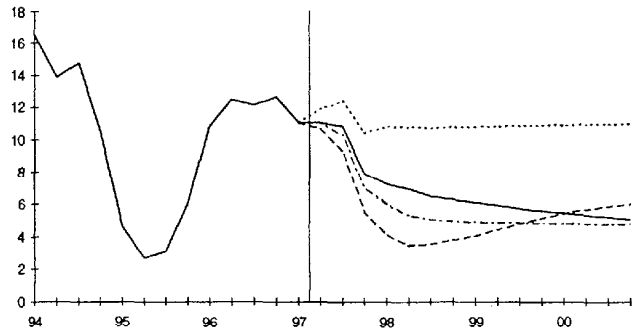
(b) Real Investment; growth rate (% p.a.)



(c) Inflation: GDP deflator (% p.a.)



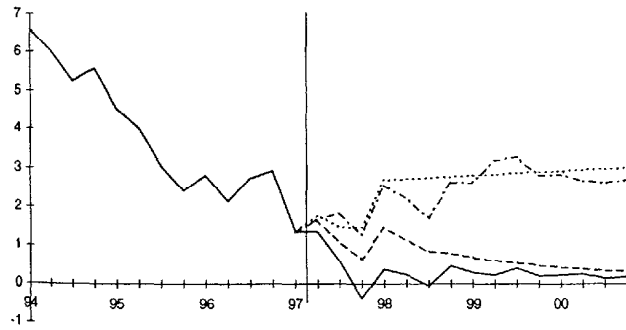
(d) M1 Growth rate (% p.a.)



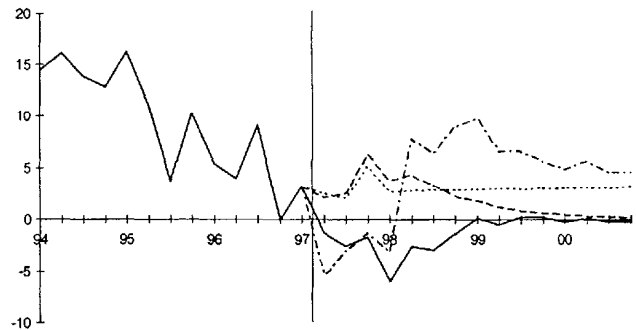
Figures 5(a)–(d): New Zealand Forecasts

(——) = ECM, (---) = RRR, (- - - -) = BVAR(opt), (- - - -) = BAR(opt)

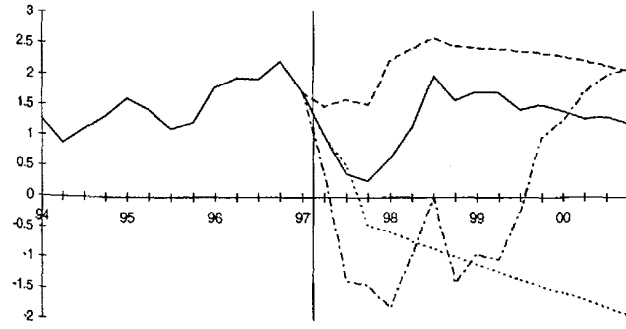
(a) Real GDP growth rate (% p.a.)



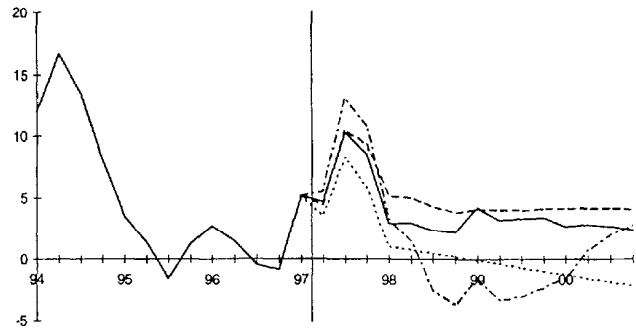
(b) Real Investment; growth rate (% p.a.)



(c) Inflation — Core CPI (% p.a.)



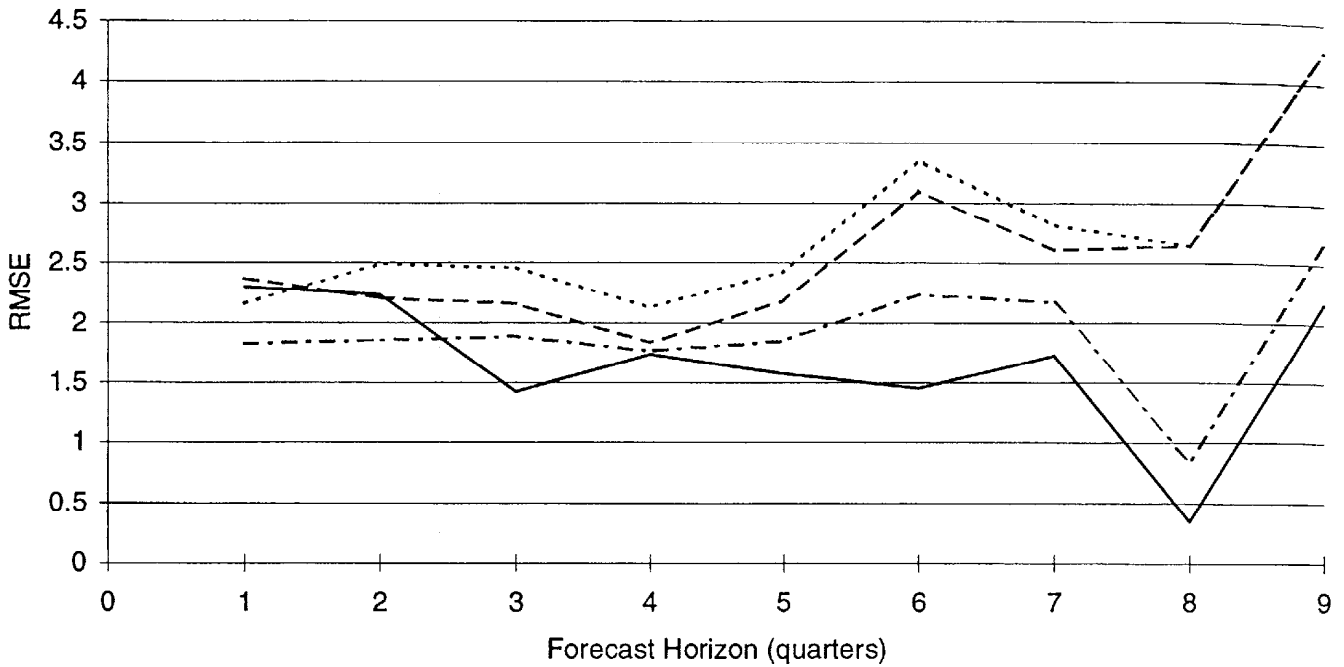
(d) M1 Growth rate (% p.a.)



Figures 6: Forecast RMSE Comparisons

(—) = ECM, (- - -) = RRR, (- · - · -) = BVAR(opt), (- - - -) = Fair

(a) USA: GDP Growth Rate



(b) USA: Inflation Rate

