# Forecasts of Asia-Pacific Economic Activity to 2000

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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.[2] 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, 1996:4; Japan, 1996:4; Korea, 1996:4; Australia, 1996:4;

[1] All computations and graphics were performed on a P6 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 the Ray Fair, Colin Hargreaves, Joong Sik Lee of the Bank of Korea, and Alasdair Scoot 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, 1996:4. The initialisations 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.

**USA Variables and Data:**

Real gross domestic product (1987$bil., SA)
Real personal consumption expenditure (1987$bil., SA)
Real fixed investment (1987$bil., SA)
Price deflator of GDP
3-month Treasury Bill rate (percentage points)
M1-Money stock, end of quarter ($bil., SA)
Unemployment rate, all workers 16 and over (percentage points, SA)
Sample Period: 1952:1 – 1996:4
Source: National Income and Product Accounts (chain link data)
Forecast Period: 1997:1 – 2000:4 (16 quarters)

**Japan Variables and Data:**

Real gross domestic product (1990Ybil., SA)
Real personal consumption expenditure (1990Ybil., SA)
Real fixed investment (1990Ybil., SA)
Price deflator of GDP
M1-Money stock, end of quarter (Ybil., SA)
Unemployment rate (percentage points, SA)
Sample Period: 1971:1 – 1996:4
Source: Nikkei Database
Forecast period: 1997:1 – 2000:4 (16 quarters)

**Korea Variables and Data:**

Real gross national product (1990Wbil., SA)
Real personal consumption expenditure (1990Wbil., SA)
Real exports (1990 US$mil., SA)
Consumer price index (1990 = 100)
M1-Money stock, end of quarter (Wbil., SA)
Sample Period: 1970:1 – 1996:4
Source: Bank of Korea
Forecast period: 1997:1 – 2000:4 (16 quarters)

**Australia Variables and Data:**

Real gross domestic product (1989/90$mil., SA)
Real personal consumption exp. (1989/90$mil., SA)
Real fixed investment (1989/90$mil., SA)
Price deflator of GDP
M1-Money stock, end of quarter (currency + demand deposits, $mil., SA)
90-day Money market rate (percentage points)
Sample Period: 1975:1 – 1996:4
Source: Australian Bureau of Statistics
Forecast period: 1997:1 – 2000:4 (16 quarters)

**New Zealand Variables and Data:**

Real gross domestic product (production based) (1989/90$mil., SA)
Real private consumption exp. (1989/90$mil., SA)
Real fixed investment (1989/90$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 – 1996:4
Source: Reserve Bank of New Zealand
Forecast period: 1997:1 – 2000:4 (16 quarters)

## 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

As in our last set of forecasts, there is high variation in the forecasts of real GDP growth across models. The FAIR model predicts growth to be in the 2–3% range over the entire period. The ECM model is more optimistic and predicts sustained growth around 3%. The RRR and BVAR models are the least optimistic and forecast a tailing off in growth from the present level to below 2% by the end of 1998. The BVAR model also predicts a dip in growth in the second quarter of 1997. The scalar BAR model is considerably more optimistic than the vector models and forecasts growth in the 3.8–4% range throughout the period.

All the time series models predict a rise in inflation, although the FAIR model forecasts a dip in inflation for the first quarter of 1997, followed by a steady rise thereafter. The vector time series models predict inflation rising to the 3.5–3.75% level by the final quarter of the year 2000, while the FAIR model keeps inflation below the 3% level throughout the period. As in our last several sets of forecasts, the ECM inflation forecasts are closest to those of the FAIR model. Again, 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 5–5.5% range for most of the period; and the RRR model shows a slight dip in the rate in 1997:1, followed by a slow rise thereafter. As in our last set of forecasts, the models give generally similar forecast profiles for real investment growth. The BVAR and ECM models are the least favourable in the short term, showing a small decline in investment growth in 1997 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 4–5% range for the remainder of the period. The FAIR model is the least favourable in the longer term, showing investment falling to below 1% by the end of the period.

**Japan**

The ECM and BAR models give similar forecasts for real GDP growth out to the year 2000. The ECM model forecasts are the most optimistic in the short term, putting growth at 4.2% for 1997:1, declining to 3.6% in 1997:2 and then staying above 4% until 1991:1. The RRR forecasts suggest a decline in growth in the first quarter of 1997, followed by a rise in growth to the 3% level by the year 2000. The BVAR model is the least favourable and indicates a steady decline in growth and a recession starting in 1999:2. The inflation forecasts are even more variable across models than the growth forecasts. The ECM model predicts inflation rising to nearly 4% by the turn of the millennium. The BVAR model also predicts a rise in inflation, but not as great, to around the 2% level. The RRR model forecasts deflation throughout the period and the scalar BAR model suggests inflation levels comparable to the prevailing level around 1%.

**Korea**

As in our last set of forecasts, there is a big difference between the ECM model forecasts for real GNP growth and the RRR, BVAR and BAR forecasts. Again, the ECM model predicts a general decline in real GNP growth, this time from present levels to around 4% by 1998 followed by a slower decline to around 3.6% by the turn of the millennium. 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 millennium. The other models have more optimistic projections for real GNP and real exports and also forecast faster growth in M. The RRR and BVAR models forecast real GNP growth rate to continue the rise in the final quarter of 1996 and again in mid 1997, and thereafter to decline slowly to the 7–8% range by the end of the decade. Both these models predict more robust and sustained growth in real exports (in the range 7–10%) than the ECM model. The BVAR model has by far the most optimistic growth predictions for real GNP in the short term, indicating a growth rate in the 10–11% range for the final quarter of 1997 and the first quarter of 1998.

**Australia**

All models except the RRR model give a broadly similar pattern of projection for real GDP growth, indicating growth in the 2–3% band for most of the period through to 2000:4. As in our last set of forecasts, the RRR model is less optimistic and shows a slow but steady decline from mid 1997 to the end of the period, with growth ending up around 1.5% at the turn of the millennium. The new inflation forecasts are very similar to our last set of forecasts. Inflation is predicted to remain below 2% by each of the ECM, BVAR and BAR models, while the RRR model forecasts inflation rising to 3% during 1997 and slowly declining to 2.6% by 2000:4.

**New Zealand**

As in our last set of forecasts from 1996:2, all the multivariate models predict a general decline in the growth rate of real GDP. In particular, from the second quarter of 1997 real GDP growth is forecast to decline from 2.8% to around 1% level by the end of the decade. The ECM model forecasts are the most pessimistic. In contrast,. the scalar BAR model forecasts GDP growth around 3% levels for 1997–1999, rising slowly to 3.5% by 2000:4. The ECM, BVAR and RRR models all forecast higher inflation in the range 3–5% through 1997. The RRR model then predicts a decline in inflation rates through 1998 to below 2%. These forecasts for 1997 are outside the new wider RBNZ inflation target zone of 0–3%, but none of the models employ policy reaction functions to influence inflation forecasts. The scalar BAR model predicts much lower inflation rates for the CORE

CPI during 1997 and forecasts deflation from 1997:4.

## 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 8 periods ahead. So far, we have a track record of 6 observations on the 1-period ahead forecasts, 5 observations on the 2-period ahead forecasts, 4 observations on the 3-period ahead forecasts, 4 observations on 4-period ahead forecasts, 3 observations on the 5-period ahead forecasts, 2 observations on the 6-period ahead forecasts and 1 observation each on the 7- and 8-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 FAIR model is the best for one, three and four periods out. The ECM model has the best two period ahead performance. Overall, the performance of the ECM model and the FAIR model is very close. These models do worst in forecasting six periods out, this being the only forecast horizon for which the other models is comparable. Interestingly, the average forecast RMSE's for the FAIR and ECM models do not seem to increase much with the length of the forecast horizon, although the longer horizon forecast RMSE's are computed with fewer observations. The BVAR model seems generally to have the worst forecast performance for real GDP growth.

In forecasting inflation, there is less variability within models across horizons than there is for GDP. There is also a narrower band of performance across models than for GDP, with the exception of the RRR model, which is consistently the worst performer. The FAIR model is uniformly the best inflation forecasting instrument over all horizons, but the ECM model is again a close second and has two- six- and seven- period ahead forecast performance very close to that of the FAIR model.

These results corroborate our 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

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# Table 1: USA Forecasts

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

| | ECM | RRR | BVAR | BAR | Fair Model |
|---|---|---|---|---|---|
| 1997:1 | 3.31 | 3.05 | 2.76 | 3.85 | 2.92 |
| 1997:2 | 3.22 | 2.53 | 1.30 | 3.83 | 2.47 |
| 1997:3 | 2.92 | 2.91 | 2.50 | 3.71 | 2.23 |
| 1997:4 | 3.14 | 2.62 | 2.31 | 3.68 | 2.10 |
| 1998:1 | 3.24 | 2.38 | 2.49 | 3.64 | 2.09 |
| 1998:2 | 3.30 | 2.12 | 2.50 | 3.61 | 2.11 |
| 1998:3 | 3.29 | 1.92 | 2.43 | 3.59 | 2.16 |
| 1998:4 | 3.26 | 1.77 | 2.33 | 3.57 | 2.35 |
| 1999:1 | 3.22 | 1.67 | 2.25 | 3.54 | 2.48 |
| 1999:2 | 3.18 | 1.62 | 2.15 | 3.52 | 2.52 |
| 1999:3 | 3.12 | 1.60 | 2.06 | 3.50 | 2.55 |
| 1999:4 | 3.07 | 1.61 | 1.99 | 3.48 | 2.66 |
| 2000:1 | 3.03 | 1.63 | 1.93 | 3.46 | 2.66 |
| 2000:2 | 2.99 | 1.65 | 1.88 | 3.44 | 2.56 |
| 2000:3 | 2.95 | 1.68 | 1.84 | 3.43 | 2.47 |
| 2000:4 | 2.92 | 1.70 | 1.80 | 3.41 | 2.48 |

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

| | ECM | RRR | BVAR | BAR | Fair Model |
|---|---|---|---|---|---|
| 1997:1 | 1.78 | 2.23 | 2.10 | 2.17 | 1.27 |
| 1997:2 | 1.99 | 2.64 | 2.37 | 2.52 | 1.66 |
| 1997:3 | 2.14 | 3.11 | 2.56 | 2.78 | 1.84 |
| 1997:4 | 2.31 | 3.40 | 2.79 | 3.12 | 1.94 |
| 1998:1 | 2.45 | 3.57 | 2.96 | 3.40 | 2.01 |
| 1998:2 | 2.59 | 3.68 | 3.10 | 3.65 | 2.07 |
| 1998:3 | 2.72 | 3.75 | 3.23 | 3.89 | 2.14 |
| 1998:4 | 2.83 | 3.80 | 3.34 | 4.11 | 2.21 |
| 1999:1 | 2.93 | 3.83 | 3.43 | 4.30 | 2.27 |
| 1999:2 | 3.03 | 3.84 | 3.50 | 4.48 | 2.35 |
| 1999:3 | 3.11 | 3.84 | 3.57 | 4.64 | 2.42 |
| 1999:4 | 3.19 | 3.83 | 3.62 | 4.79 | 2.49 |
| 2000:1 | 3.26 | 3.81 | 3.66 | 4.92 | 2.56 |
| 2000:2 | 3.32 | 3.79 | 3.70 | 5.03 | 2.63 |
| 2000:3 | 3.38 | 3.77 | 3.72 | 5.14 | 2.70 |
| 2000:4 | 3.43 | 3.74 | 3.74 | 5.23 | 2.76 |

# Table 1 cont: USA Forecasts

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

| | ECM | RRR | BVAR | BAR | Fair Model |
|---|---|---|---|---|---|
| 1997:1 | 2.95 | 4.36 | 1.61 | 5.60 | 4.92 |
| 1997:2 | 2.08 | 3.63 | 0.07 | 4.90 | 4.10 |
| 1997:3 | 0.10 | 3.83 | –0.59 | 4.60 | 3.35 |
| 1997:4 | –0.20 | 4.17 | –0.14 | 4.45 | 2.63 |
| 1998:1 | 0.02 | 3.93 | 0.49 | 4.35 | 1.46 |
| 1998:2 | 0.25 | 3.49 | 1.33 | 4.29 | 0.99 |
| 1998:3 | 0.70 | 3.00 | 1.98 | 4.25 | 0.77 |
| 1998:4 | 1.12 | 2.57 | 2.47 | 4.22 | 0.73 |
| 1999:1 | 1.48 | 2.23 | 2.75 | 4.19 | 0.81 |
| 1999:2 | 1.80 | 1.99 | 2.85 | 4.18 | 0.88 |
| 1999:3 | 2.06 | 1.85 | 2.82 | 4.16 | 0.95 |
| 1999:4 | 2.27 | 1.79 | 2.72 | 4.15 | 1.11 |
| 2000:1 | 2.45 | 1.77 | 2.57 | 4.14 | 1.19 |
| 2000:2 | 2.59 | 1.79 | 2.41 | 4.13 | 1.14 |
| 2000:3 | 2.70 | 1.82 | 2.25 | 4.12 | 1.03 |
| 2000:4 | 2.80 | 1.86 | 2.10 | 4.11 | 0.96 |

**(d) 3-Month Treasury Bill Rate**

| | ECM | RRR | BVAR | BAR | Fair Model |
|---|---|---|---|---|---|
| 1997:1 | 5.02 | 4.46 | 4.76 | 5.04 | 4.85 |
| 1997:2 | 5.17 | 4.50 | 4.82 | 5.25 | 5.02 |
| 1997:3 | 5.21 | 4.59 | 4.88 | 5.38 | 5.15 |
| 1997:4 | 5.21 | 4.69 | 4.85 | 5.49 | 5.15 |
| 1998:1 | 5.25 | 4.78 | 4.87 | 5.64 | 5.12 |
| 1998:2 | 5.31 | 4.85 | 4.93 | 5.77 | 5.10 |
| 1998:3 | 5.35 | 4.90 | 4.99 | 5.89 | 5.10 |
| 1998:4 | 5.39 | 4.92 | 5.05 | 6.01 | 5.09 |
| 1999:1 | 5.44 | 4.92 | 5.12 | 6.12 | 5.09 |
| 1999:2 | 5.50 | 4.91 | 5.18 | 6.22 | 5.09 |
| 1999:3 | 5.55 | 4.89 | 5.24 | 6.32 | 5.09 |
| 1999:4 | 5.60 | 4.87 | 5.30 | 6.41 | 5.11 |
| 2000:1 | 5.66 | 4.84 | 5.36 | 6.49 | 5.14 |
| 2000:2 | 5.72 | 4.81 | 5.40 | 6.57 | 5.16 |
| 2000:3 | 5.77 | 4.78 | 5.45 | 6.65 | 5.17 |
| 2000:4 | 5.83 | 4.75 | 5.49 | 6.72 | 5.19 |

# Table 2: Japan Forecasts

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 4.23 | 2.22 | 1.94 | 3.28 |
| 1997:2 | 3.57 | 2.57 | 1.52 | 3.96 |
| 1997:3 | 4.55 | 2.32 | 1.45 | 4.38 |
| 1997:4 | 4.36 | 3.13 | 0.93 | 4.33 |
| 1998:1 | 4.29 | 2.98 | 0.74 | 4.42 |
| 1998:2 | 4.33 | 2.74 | 0.46 | 4.43 |
| 1998:3 | 4.24 | 3.10 | 0.28 | 4.35 |
| 1998:4 | 4.11 | 3.13 | 0.13 | 4.29 |
| 1999:1 | 4.06 | 3.11 | 0.02 | 4.21 |
| 1999:2 | 3.96 | 3.31 | –0.06 | 4.12 |
| 1999:3 | 3.88 | 3.00 | –0.13 | 4.03 |
| 1999:4 | 3.81 | 3.06 | –0.19 | 3.95 |
| 2000:1 | 3.75 | 3.07 | –0.24 | 3.87 |
| 2000:2 | 3.69 | 2.98 | –0.30 | 3.80 |
| 2000:3 | 3.65 | 3.02 | –0.36 | 3.74 |
| 2000:4 | 3.60 | 3.04 | –0.42 | 3.68 |

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 0.07 | –0.74 | 0.35 | –0.28 |
| 1997:2 | 0.07 | –2.46 | 0.36 | –0.14 |
| 1997:3 | 1.22 | –2.56 | 1.23 | 0.56 |
| 1997:4 | 1.58 | –2.17 | 1.59 | 0.72 |
| 1998:1 | 2.34 | –2.43 | 2.00 | 0.96 |
| 1998:2 | 2.66 | –1.65 | 2.16 | 0.99 |
| 1998:3 | 3.11 | –1.82 | 2.21 | 1.04 |
| 1998:4 | 3.32 | –1.40 | 2.17 | 1.02 |
| 1999:1 | 3.56 | –1.53 | 2.10 | 1.02 |
| 1999:2 | 3.67 | –1.63 | 2.01 | 0.99 |
| 1999:3 | 3.78 | –1.67 | 1.93 | 0.98 |
| 1999:4 | 3.83 | –1.72 | 1.85 | 0.96 |
| 2000:1 | 3.87 | –1.71 | 1.79 | 0.95 |
| 2000:2 | 3.87 | –1.60 | 1.74 | 0.93 |
| 2000:3 | 3.86 | –1.58 | 1.70 | 0.92 |
| 2000:4 | 3.83 | –1.51 | 1.66 | 0.91 |

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 8.89 | 5.88 | 5.13 | 3.11 |
| 1997:2 | 3.59 | –0.07 | 3.20 | 2.70 |
| 1997:3 | 6.00 | 2.45 | 3.17 | 3.24 |
| 1997:4 | 5.72 | 4.63 | 2.58 | 3.60 |
| 1998:1 | 5.41 | 4.58 | 1.99 | 3.69 |
| 1998:2 | 5.11 | 5.47 | 1.49 | 3.78 |
| 1998:3 | 5.05 | 5.06 | 1.11 | 3.82 |
| 1998:4 | 4.62 | 5.08 | 0.78 | 3.83 |
| 1999:1 | 4.48 | 4.74 | 0.53 | 3.83 |
| 1999:2 | 4.28 | 4.81 | 0.33 | 3.82 |
| 1999:3 | 4.12 | 4.55 | 0.16 | 3.80 |
| 1999:4 | 3.99 | 4.47 | 0.02 | 3.79 |
| 2000:1 | 3.90 | 4.61 | –0.11 | 3.77 |
| 2000:2 | 3.81 | 4.65 | –0.23 | 3.75 |
| 2000:3 | 3.75 | 4.61 | –0.36 | 3.74 |
| 2000:4 | 3.71 | 4.72 | –0.47 | 3.72 |

**(d) M1 growth (% annual rate)**

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 8.76 | 6.34 | 9.06 | 4.01 |
| 1997:2 | 8.71 | 5.17 | 8.60 | 3.30 |
| 1997:3 | 9.39 | 2.03 | 6.94 | 3.26 |
| 1997:4 | 9.36 | 2.82 | 7.47 | 3.54 |
| 1998:1 | 9.43 | 0.72 | 7.43 | 3.76 |
| 1998:2 | 9.16 | 1.57 | 7.59 | 3.96 |
| 1998:3 | 9.02 | 3.45 | 7.60 | 4.12 |
| 1998:4 | 8.82 | 4.21 | 7.56 | 4.27 |
| 1999:1 | 8.70 | 5.49 | 7.44 | 4.41 |
| 1999:2 | 8.53 | 5.13 | 7.31 | 4.53 |
| 1999:3 | 8.39 | 4.82 | 7.16 | 4.64 |
| 1999:4 | 8.22 | 4.29 | 7.02 | 4.74 |
| 2000:1 | 8.06 | 3.67 | 6.88 | 4.83 |
| 2000:2 | 7.90 | 3.49 | 6.74 | 4.90 |
| 2000:3 | 7.75 | 3.46 | 6.60 | 4.98 |
| 2000:4 | 7.59 | 3.61 | 6.46 | 5.04 |

# Table 3: Korea Forecasts

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 5.70 | 6.93 | 7.56 | 6.34 |
| 1997:2 | 5.36 | 7.64 | 8.88 | 6.90 |
| 1997:3 | 4.91 | 8.26 | 9.95 | 7.42 |
| 1997:4 | 4.83 | 9.11 | 11.33 | 8.36 |
| 1998:1 | 4.33 | 8.29 | 10.28 | 8.27 |
| 1998:2 | 4.20 | 7.96 | 9.65 | 8.30 |
| 1998:3 | 4.04 | 7.60 | 9.06 | 8.27 |
| 1998:4 | 3.93 | 7.38 | 8.47 | 8.24 |
| 1999:1 | 3.84 | 7.19 | 8.01 | 8.21 |
| 1999:2 | 3.76 | 7.04 | 7.67 | 8.18 |
| 1999:3 | 3.71 | 6.91 | 7.42 | 8.15 |
| 1999:4 | 3.67 | 6.80 | 7.26 | 8.13 |
| 2000:1 | 3.62 | 6.69 | 7.18 | 8.11 |
| 2000:2 | 3.58 | 6.60 | 7.15 | 8.09 |
| 2000:3 | 3.54 | 6.52 | 7.15 | 8.07 |
| 2000:4 | 3.51 | 6.44 | 7.18 | 8.06 |

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 10.70 | 11.28 | 10.73 | 12.17 |
| 1997:2 | 14.22 | 15.22 | 14.19 | 16.93 |
| 1997:3 | 12.59 | 13.53 | 12.29 | 16.23 |
| 1997:4 | 5.01 | 7.03 | 4.72 | 10.25 |
| 1998:1 | 4.93 | 7.30 | 4.67 | 10.25 |
| 1998:2 | 4.31 | 7.17 | 4.26 | 9.97 |
| 1998:3 | 3.02 | 7.05 | 3.63 | 9.52 |
| 1998:4 | 2.91 | 6.99 | 4.07 | 9.64 |
| 1999:1 | 2.72 | 7.01 | 4.52 | 9.76 |
| 1999:2 | 2.47 | 7.07 | 4.98 | 9.88 |
| 1999:3 | 2.44 | 7.15 | 5.54 | 10.05 |
| 1999:4 | 2.41 | 7.23 | 6.06 | 10.21 |
| 2000:1 | 2.37 | 7.31 | 6.54 | 10.35 |
| 2000:2 | 2.37 | 7.39 | 6.97 | 10.49 |
| 2000:3 | 2.38 | 7.47 | 7.33 | 10.61 |
| 2000:4 | 2.38 | 7.54 | 7.64 | 10.72 |

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 3.80 | 3.43 | 3.73 | 3.70 |
| 1997:2 | 3.37 | 2.78 | 2.80 | 2.81 |
| 1997:3 | 3.75 | 3.29 | 2.59 | 2.78 |
| 1997:4 | 5.21 | 4.91 | 3.49 | 3.78 |
| 1998:1 | 5.98 | 6.03 | 3.77 | 4.02 |
| 1998:2 | 6.32 | 6.51 | 4.12 | 4.11 |
| 1998:3 | 6.74 | 6.69 | 4.74 | 4.22 |
| 1998:4 | 7.12 | 6.72 | 5.30 | 4.25 |
| 1999:1 | 7.34 | 6.71 | 5.70 | 4.25 |
| 1999:2 | 7.51 | 6.68 | 5.97 | 4.24 |
| 1999:3 | 7.67 | 6.65 | 6.09 | 4.22 |
| 1999:4 | 7.77 | 6.62 | 6.08 | 4.19 |
| 2000:1 | 7.85 | 6.59 | 5.98 | 4.16 |
| 2000:2 | 7.91 | 6.57 | 5.81 | 4.13 |
| 2000:3 | 7.96 | 6.55 | 5.59 | 4.10 |
| 2000:4 | 7.99 | 6.53 | 5.36 | 4.06 |

**(d) M1 growth (% annual rate)**

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 6.72 | 8.61 | 7.81 | 7.08 |
| 1997:2 | 6.75 | 11.37 | 9.94 | 8.44 |
| 1997:3 | 7.81 | 15.31 | 13.13 | 11.23 |
| 1997:4 | 9.40 | 18.84 | 16.25 | 14.00 |
| 1998:1 | 8.80 | 18.09 | 16.04 | 14.29 |
| 1998:2 | 8.64 | 16.95 | 15.26 | 14.24 |
| 1998:3 | 9.06 | 15.99 | 14.79 | 14.27 |
| 1998:4 | 8.91 | 15.26 | 14.23 | 14.26 |
| 1999:1 | 8.77 | 14.68 | 13.72 | 14.24 |
| 1999:2 | 8.85 | 14.23 | 13.35 | 14.22 |
| 1999:3 | 8.83 | 13.85 | 13.09 | 14.19 |
| 1999:4 | 8.78 | 13.55 | 12.91 | 14.17 |
| 2000:1 | 8.77 | 13.30 | 12.80 | 14.15 |
| 2000:2 | 8.76 | 13.10 | 12.72 | 14.13 |
| 2000:3 | 8.73 | 12.93 | 12.68 | 14.11 |
| 2000:4 | 8.71 | 12.79 | 12.65 | 14.10 |

# Table 4: Australia Forecasts

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 2.05 | 1.89 | 2.01 | 1.94 |
| 1997:2 | 2.40 | 2.05 | 2.23 | 2.23 |
| 1997:3 | 2.45 | 1.88 | 2.18 | 2.24 |
| 1997:4 | 2.67 | 1.86 | 2.23 | 2.45 |
| 1998:1 | 2.69 | 1.80 | 2.11 | 2.59 |
| 1998:2 | 2.71 | 1.75 | 2.13 | 2.70 |
| 1998:3 | 2.72 | 1.71 | 2.14 | 2.79 |
| 1998:4 | 2.72 | 1.67 | 2.24 | 2.85 |
| 1999:1 | 2.71 | 1.64 | 2.41 | 2.90 |
| 1999:2 | 2.71 | 1.61 | 2.54 | 2.94 |
| 1999:3 | 2.70 | 1.57 | 2.66 | 2.96 |
| 1999:4 | 2.69 | 1.54 | 2.78 | 2.97 |
| 2000:1 | 2.68 | 1.52 | 2.87 | 2.98 |
| 2000:2 | 2.68 | 1.49 | 2.95 | 2.99 |
| 2000:3 | 2.67 | 1.46 | 3.02 | 2.99 |
| 2000:4 | 2.66 | 1.44 | 3.07 | 2.99 |

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 1.43 | 1.92 | 1.58 | 1.27 |
| 1997:2 | 0.95 | 1.95 | 1.32 | 0.67 |
| 1997:3 | 1.13 | 2.59 | 1.65 | 0.63 |
| 1997:4 | 1.00 | 2.95 | 1.66 | 0.26 |
| 1998:1 | 0.94 | 2.89 | 1.55 | 0.08 |
| 1998:2 | 0.92 | 2.86 | 1.38 | −0.13 |
| 1998:3 | 0.85 | 2.84 | 1.19 | −0.34 |
| 1998:4 | 0.81 | 2.83 | 1.01 | −0.53 |
| 1999:1 | 0.77 | 2.81 | 0.83 | −0.73 |
| 1999:2 | 0.72 | 2.80 | 0.66 | −0.92 |
| 1999:3 | 0.69 | 2.78 | 0.51 | −1.11 |
| 1999:4 | 0.65 | 2.77 | 0.38 | −1.31 |
| 2000:1 | 0.62 | 2.75 | 0.26 | −1.51 |
| 2000:2 | 0.58 | 2.73 | 0.15 | −1.71 |
| 2000:3 | 0.55 | 2.71 | 0.06 | −1.91 |
| 2000:4 | 0.52 | 2.69 | −0.02 | −2.11 |

# Table 4 cont: Australia Forecasts

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 4.68 | 4.70 | 4.15 | 4.60 |
| 1997:2 | 3.64 | 3.74 | 2.84 | 3.31 |
| 1997:3 | 2.46 | 2.84 | 1.00 | 1.86 |
| 1997:4 | 1.40 | 2.07 | –0.40 | 0.55 |
| 1998:1 | 1.21 | 2.13 | –0.52 | 0.22 |
| 1998:2 | 1.05 | 2.11 | –0.79 | 0.12 |
| 1998:3 | 1.10 | 2.06 | –0.40 | 0.33 |
| 1998:4 | 1.22 | 2.00 | –0.21 | 0.62 |
| 1999:1 | 1.36 | 1.95 | 0.19 | 0.96 |
| 1999:2 | 1.50 | 1.89 | 0.54 | 1.29 |
| 1999:3 | 1.63 | 1.84 | 0.88 | 1.57 |
| 1999:4 | 1.75 | 1.79 | 1.19 | 1.81 |
| 2000:1 | 1.84 | 1.74 | 1.46 | 1.99 |
| 2000:2 | 1.91 | 1.69 | 1.70 | 2.12 |
| 2000:3 | 1.97 | 1.65 | 1.90 | 2.21 |
| 2000:4 | 2.01 | 1.61 | 2.06 | 2.27 |

**(d) M1 growth (% annual rate)**

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 10.86 | 11.29 | 10.83 | 11.72 |
| 1997:2 | 10.92 | 11.35 | 10.18 | 12.55 |
| 1997:3 | 10.79 | 11.17 | 9.65 | 13.26 |
| 1997:4 | 7.38 | 7.94 | 6.11 | 10.91 |
| 1998:1 | 7.12 | 7.39 | 5.81 | 10.87 |
| 1998:2 | 6.65 | 7.07 | 6.07 | 10.77 |
| 1998:3 | 6.17 | 6.84 | 6.14 | 10.70 |
| 1998:4 | 5.97 | 6.66 | 6.29 | 10.72 |
| 1999:1 | 5.73 | 6.50 | 6.42 | 10.75 |
| 1999:2 | 5.53 | 6.35 | 6.56 | 10.79 |
| 1999:3 | 5.36 | 6.21 | 6.68 | 10.82 |
| 1999:4 | 5.20 | 6.07 | 6.76 | 10.86 |
| 2000:1 | 5.05 | 5.95 | 6.82 | 10.89 |
| 2000:2 | 4.91 | 5.83 | 6.86 | 10.92 |
| 2000:3 | 4.78 | 5.71 | 6.87 | 10.94 |
| 2000:4 | 4.65 | 5.60 | 6.86 | 10.97 |

# Table 5: New Zealand Forecasts

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 2.27 | 2.82 | 2.50 | 2.65 |
| 1997:2 | 2.64 | 2.99 | 2.85 | 3.17 |
| 1997:3 | 2.50 | 2.85 | 2.44 | 2.95 |
| 1997:4 | 2.08 | 2.43 | 2.26 | 3.06 |
| 1998:1 | 2.30 | 2.18 | 2.16 | 3.10 |
| 1998:2 | 1.92 | 2.24 | 2.05 | 3.14 |
| 1998:3 | 1.29 | 1.97 | 1.90 | 3.18 |
| 1998:4 | 1.24 | 2.19 | 1.80 | 3.22 |
| 1999:1 | 0.81 | 1.80 | 1.66 | 3.26 |
| 1999:2 | 0.74 | 1.64 | 1.54 | 3.30 |
| 1999:3 | 0.74 | 1.37 | 1.44 | 3.33 |
| 1999:4 | 0.72 | 1.18 | 1.35 | 3.37 |
| 2000:1 | 0.78 | 1.20 | 1.27 | 3.41 |
| 2000:2 | 0.86 | 1.15 | 1.21 | 3.45 |
| 2000:3 | 0.88 | 1.10 | 1.17 | 3.49 |
| 2000:4 | 0.93 | 1.07 | 1.13 | 3.53 |

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 2.64 | 2.87 | 2.80 | 1.75 |
| 1997:2 | 3.07 | 4.16 | 3.46 | 1.01 |
| 1997:3 | 2.82 | 4.82 | 4.20 | 0.56 |
| 1997:4 | 3.31 | 5.42 | 4.52 | –0.42 |
| 1998:1 | 2.87 | 4.59 | 4.54 | –0.56 |
| 1998:2 | 2.89 | 3.13 | 4.24 | –0.70 |
| 1998:3 | 3.75 | 2.40 | 4.17 | –0.84 |
| 1998:4 | 3.51 | 1.45 | 4.00 | –0.97 |
| 1999:1 | 4.24 | 1.77 | 3.92 | –1.10 |
| 1999:2 | 4.36 | 1.91 | 3.86 | –1.22 |
| 1999:3 | 4.59 | 2.31 | 3.79 | –1.35 |
| 1999:4 | 4.78 | 2.66 | 3.73 | –1.47 |
| 2000:1 | 4.79 | 2.85 | 3.66 | –1.59 |
| 2000:2 | 4.79 | 3.04 | 3.59 | –1.70 |
| 2000:3 | 4.75 | 3.06 | 3.50 | –1.82 |
| 2000:4 | 4.64 | 2.86 | 3.41 | –1.93 |

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

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 3.62 | –0.00 | 3.45 | 0.68 |
| 1997:2 | 0.24 | –3.34 | 3.12 | –0.10 |
| 1997:3 | 2.73 | –1.00 | 4.15 | –0.62 |
| 1997:4 | 3.78 | 1.21 | 8.08 | 2.22 |
| 1998:1 | 0.87 | 3.10 | 6.11 | 2.24 |
| 1998:2 | 3.03 | 6.47 | 6.32 | 2.29 |
| 1998:3 | –1.76 | 3.89 | 5.23 | 2.34 |
| 1998:4 | –0.79 | 4.73 | 4.38 | 2.38 |
| 1999:1 | –2.05 | 3.43 | 3.74 | 2.42 |
| 1999:2 | –2.98 | 1.99 | 3.16 | 2.45 |
| 1999:3 | –1.79 | 1.29 | 2.70 | 2.48 |
| 1999:4 | –2.13 | 0.31 | 2.38 | 2.52 |
| 2000:1 | –1.49 | 0.08 | 2.11 | 2.55 |
| 2000:2 | –0.81 | 0.30 | 1.92 | 2.57 |
| 2000:3 | –0.89 | 0.46 | 1.78 | 2.60 |
| 2000:4 | –0.31 | 0.98 | 1.67 | 2.63 |

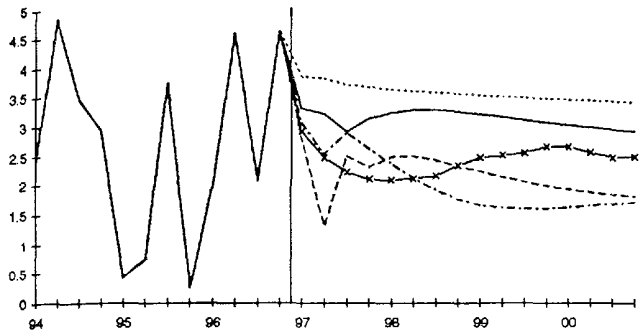
**(d) M1 growth (% annual rate)**

| | ECM | RRR | BVAR | BAR |
|---|---|---|---|---|
| 1997:1 | 0.09 | 2.40 | 1.77 | 0.35 |
| 1997:2 | –0.28 | 6.25 | 1.86 | –1.63 |
| 1997:3 | 5.81 | 14.04 | 8.49 | 2.64 |
| 1997:4 | 5.11 | 15.20 | 8.53 | –0.14 |
| 1998:1 | 5.88 | 16.35 | 9.35 | –0.48 |
| 1998:2 | 5.82 | 13.40 | 9.60 | –0.81 |
| 1998:3 | 4.25 | 10.42 | 9.47 | –1.15 |
| 1998:4 | 3.43 | 7.23 | 8.81 | –1.49 |
| 1999:1 | 3.45 | 4.10 | 8.41 | –1.82 |
| 1999:2 | 2.96 | 1.47 | 7.92 | –2.16 |
| 1999:3 | 3.94 | 1.75 | 7.54 | –2.49 |
| 1999:4 | 4.22 | 2.57 | 7.28 | –2.83 |
| 2000:1 | 5.08 | 3.93 | 7.07 | –3.16 |
| 2000:2 | 5.58 | 5.48 | 6.91 | –3.50 |
| 2000:3 | 5.95 | 6.65 | 6.78 | –3.83 |
| 2000:4 | 6.13 | 7.16 | 6.64 | –4.16 |

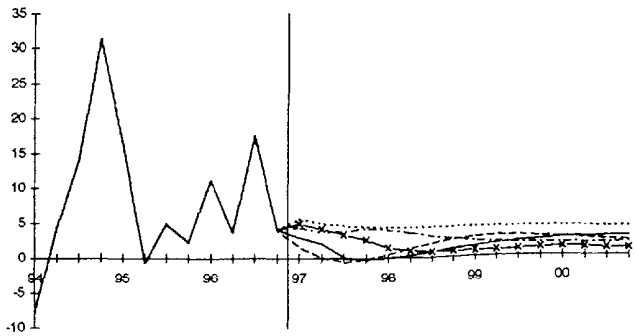
## Figures 1(a)–(d): USA Forecasts

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

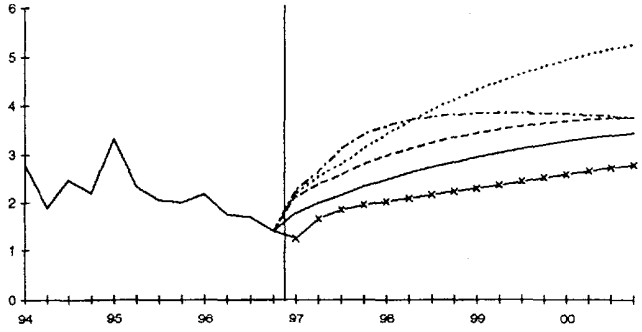
a) Real GDP growth rate



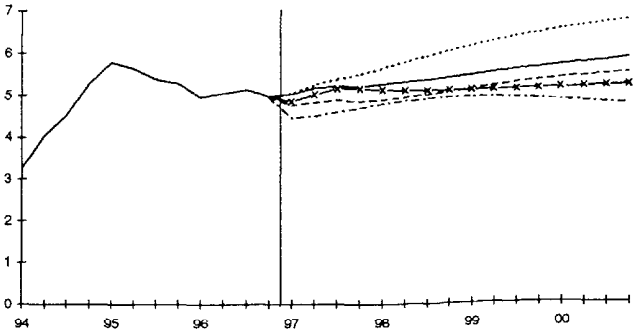
(b) Real Fixed Investment growth rate (%)



(c) Inflation: GDP deflator (%)



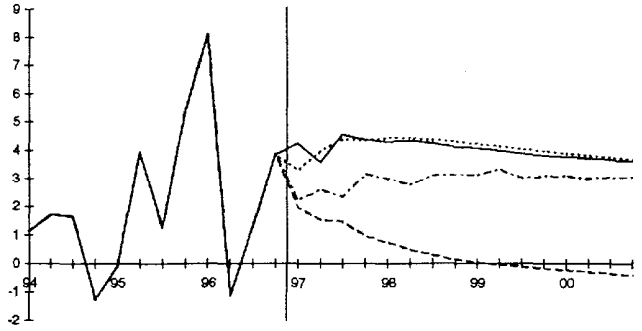
(d) 3-month Treasury Bill rate



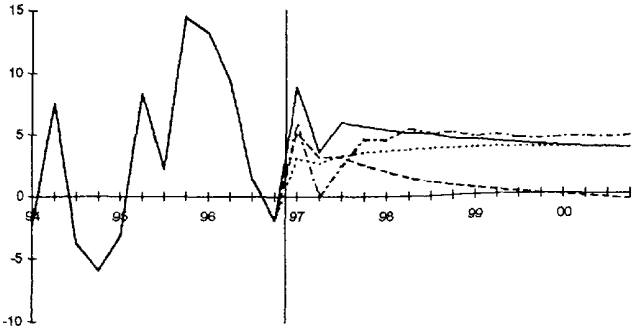
## Figures 2(a)–(d): Japan Forecasts

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

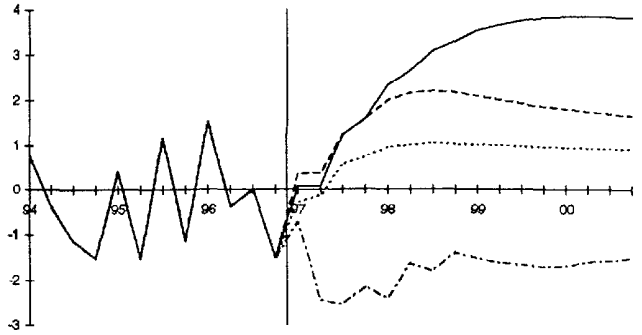
(a) Real GDP growth rate (% p.a.)



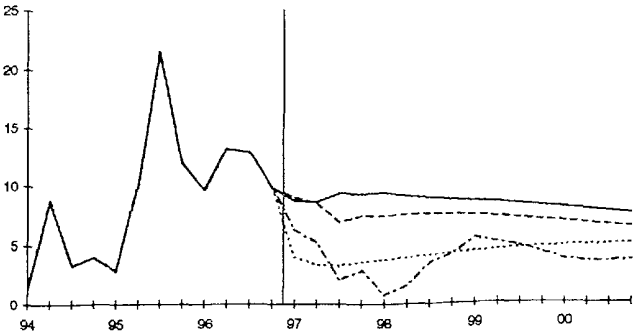
(b) Real Investment; growth rate (% p.a.)



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



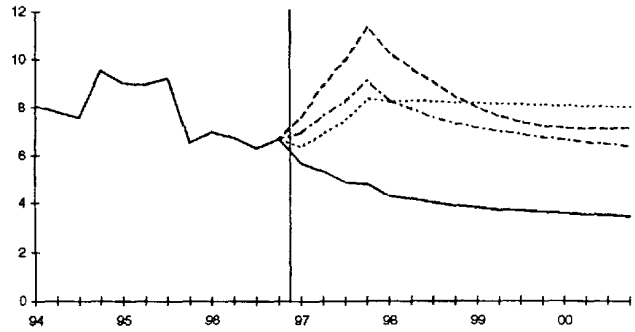
(d) M1 Growth rate (% p.a.)



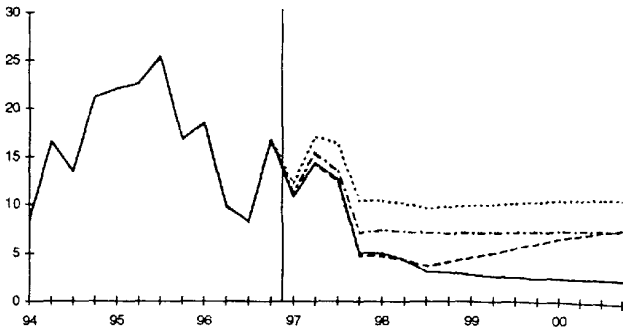
## Figures 3(a)–(d): Korea Forecasts

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

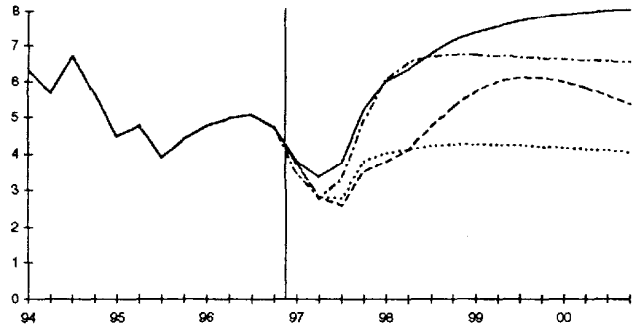
(a) Real GDP growth rate (% p.a.)



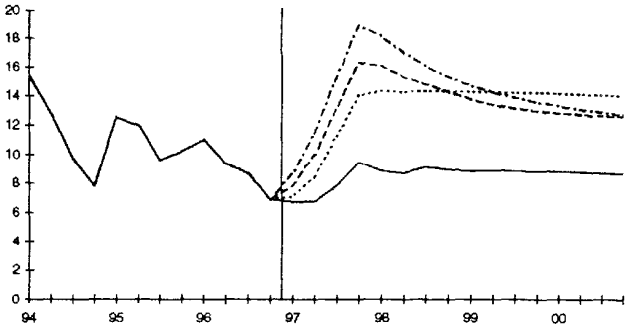

(b) Real Investment; growth rate (% p.a.)




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



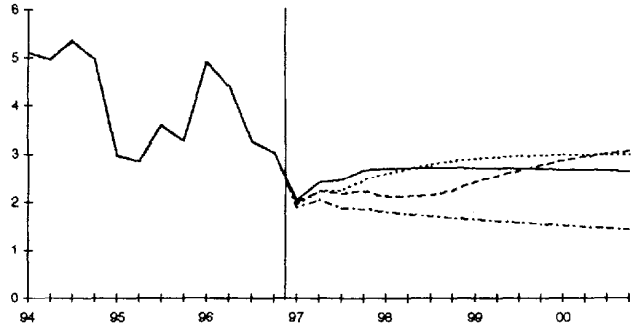

(d) M1 Growth rate (% p.a.)



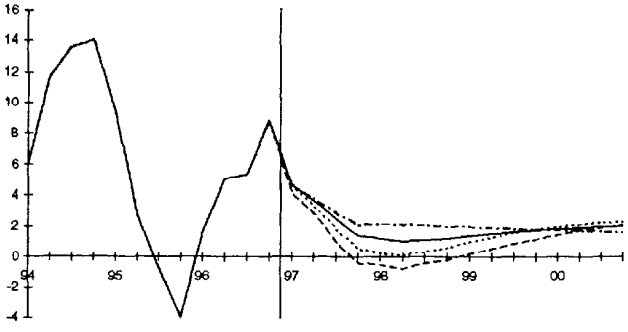

## Figures 4(a)–(d): Australia Forecasts

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

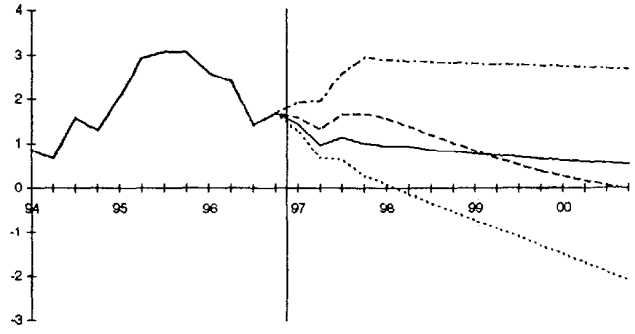
(a) Real GDP growth rate (% p.a.)



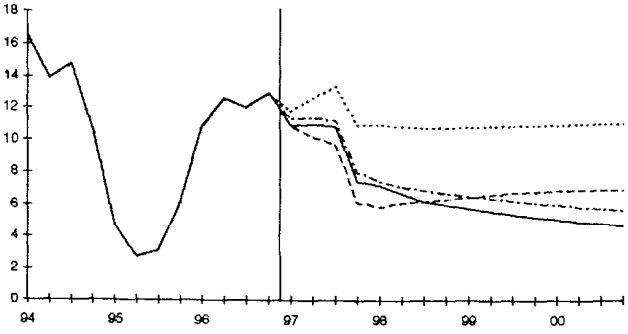

(b) Real Investment; growth rate (% p.a.)




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




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

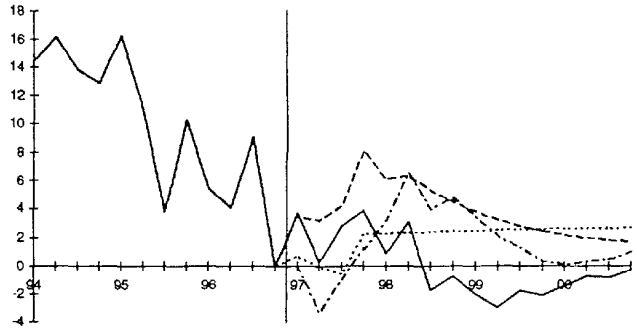


## Figures 5(a)–(d): New Zealand Forecasts

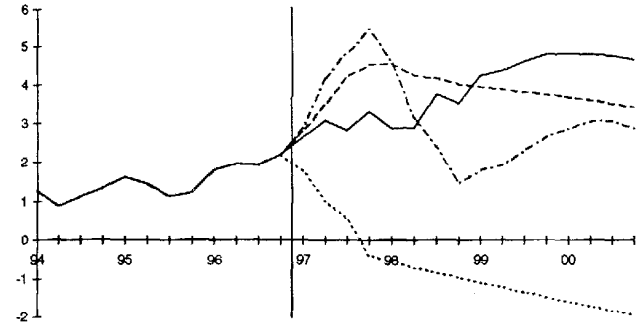
(———) = ECM, (– – –) = RRR, (- - - -) = BVAR(opt), (– - – -) = BAR(opt)

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

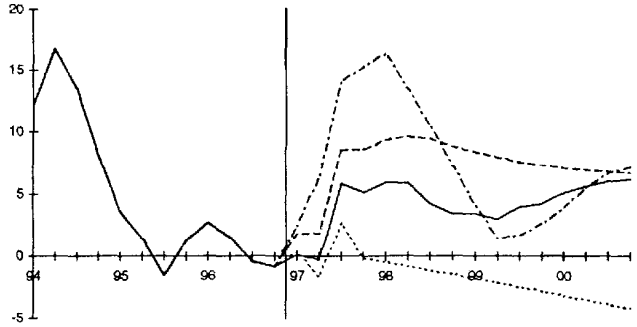

(b) Real Investment; growth rate (% p.a.)




(c) Inflation — Core CPI (% p.a.)



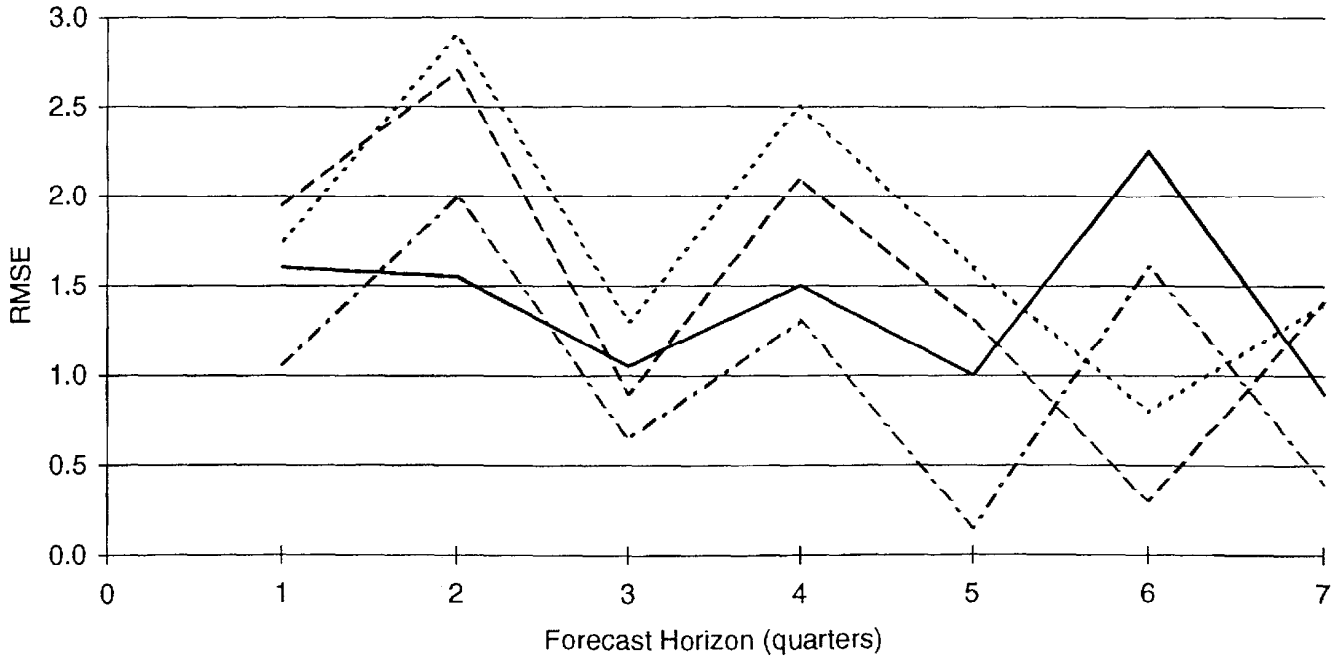

(d) M1 Growth rate (% p.a.)




## Figures 6: Forecast RMSE Comparisons

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

(a) USA: GDP Growth Rate



## Figures 6: Forecast RMSE Comparisons

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

(b) USA: Inflation Rate