

Forecasts of Asia-Pacific Economic Activity to 1998

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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, Australia, and New Zealand for the period through to the fourth quarter of 1998 and updates the forecasts for these countries over this horizon that were reported in the previous issue of the Journal.

The forecasts given here are based on time series models that make extensive use of automated model selection procedures.² The judgemental 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.

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.

Data

The final sample observations that were available at the time these forecasts were generated were as follows: USA, 1995:4; Japan, 1995:4; Australia, 1995:4; New Zealand, 1995:3. 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: 1954:1–1995:4

Source: National Income and Product Accounts (chain link data)

Forecast Period: 1996:1–1998:4 (12 quarters)

Japan Variables and Data:

Real gross domestic product (1985Ybil., SA)
Real personal consumption expenditure (1985Ybil., SA)
Real fixed investment (1985Ybil., SA)
Price deflator of GDP
M1-Money stock, end of quarter (Y100mil., SA)
Unemployment rate (percentage points, SA)

¹ All computations and graphics were performed on a P5 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, and 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).

Sample Period: 1970:1–1995:4
 Source: Nikkei Database
 Forecast period: 1996:1–1998:4 (12 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: 1975:1–1995:4
 Source: Australian Bureau of Statistics
 Forecast period: 1996:1–1998:4 (12 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: 1982:1–1995:3
 Source: Reserve Bank of New Zealand
 Forecast period: 1995:4–1998:4 (13 quarters)

Results

Tables 1–4 give the forecast results for the main variables included in each model. Figures 1–4 graph the forecasts over the forecast horizon together with recent historical data. In these tables and graphs we show growth rates for the main macroeconomic aggregates and level forecasts for interest rates in the case of the USA. The growth rates are computed on an annual basis for Australia and New Zealand.

USA

The ECM model shows a rise in real GDP growth from 1.1% in the first quarter of 1996 to 2.8% by the end of 1997. The Fair model and BVAR model are more optimistic about the first quarter of 1996, but less optimistic about medium to

longer term real GDP growth. The RRR and BVAR model forecasts for real GDP growth are quite close from mid-1996 on. The scalar BAR model gives distinctly more optimistic forecasts of real GDP growth than the multivariate models.

There is a big difference in inflation forecasts between the FAIR model and the time series models. The FAIR model predicts that inflation will rise to 1.5% in the first quarter of 1996 followed by a steady but slow rise thereafter. In contrast, the vector time series models predict a slow rise in inflation from its present level to 3% by 1998. The FAIR, RRR and BVAR models all forecast a similar future path for the 90 day T-bill rate, all showing a slow and steady decline in the rate to around 4.7% by 1998. The models also give generally similar forecast profiles for real investment growth. The BVAR model is the least favourable, showing a small decline in investment growth until mid-1997 before a rise in investment growth occurs, while the BAR model is the most optimistic showing growth in investment around the 5% level throughout the period.

Japan

The multivariate models give similar projections for real GDP, indicating that growth during the first three quarters of 1996 will be around 3.5%. The ECM and RRR models forecast that this pattern of growth will continue during 1997 and 1998. The BVAR model gives less favourable forecasts at longer horizons, indicating a slow-down in growth during 1997 and a mild recession in 1998. The scalar BAR model is more optimistic about GDP growth at longer horizons. As in our last forecasts, the BVAR inflation forecasts are much higher than those of the other models and are associated with the growth slow-down in real GDP that this model predicts for 1996. The RRR inflation forecasts are in the region of 1–2% over most of the forecast period.

Australia

Reflecting our recent forecasting experience for Australia, all models except the RRR give a similar pattern of projection for real GDP growth: the growth rate is in the range 3–3.5% in the first quarter of 1996 and declines to the 1.9% (RRR) – 2.9% (BVAR) range in the second quarter. The ECM, BVAR and BAR models predict a subsequent slow pick up in the growth rate, while the RRR model forecasts a continuing slow decline in real GDP growth through to 1998. Inflation is predicted to remain below 3%, with the ECM, BVAR and

BAR models showing decreases in inflation, and the RRR model showing a small increase in the inflation rate over the forecast period to 1998.

New Zealand

All the multivariate models predict a decline in the growth rate of real GDP in the fourth quarter of 1995 and the first quarter of 1996. Thereafter, the BVAR, and RRR models predict a steady but slow rise in the growth rate into 1997, with a rate around 4% being sustained into 1998. The ECM model gives a very different forecast profile, indicating that the growth rate in real GDP will fall to around 0.5% during 1996 and only slowly recover during 1997 and 1998. The lower growth rate projection of the ECM model is associated with a lower inflation rate forecast, a decline in real investment, and a contraction in M1. The BVAR and RRR models give more favourable predictions for real investment growth. All models indicate that inflation, at least as measured by the core CPI (less GST effects), will stay within the RBNZ target zone of 0–2%.

Forecasting Record

Figures 5(a) and 5(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 – 1995:4. The RMSE's are calculated for forecast horizons up to 4-periods ahead. So far, we have a track record of 4 observations on the 1-period ahead forecasts, 2 observations on the 2-period ahead forecasts and 1 observation on the 3- and 4-period ahead forecasts. With this small 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 5(a) gives the forecasting record for real GDP. There is a lot of variability in the RMSE profiles across the forecast horizon for the time series models. The forecasting record of the Fair model is much more consistent across the 4-period horizon and it has the smallest 1-period ahead forecast RMSE. The BVAR model has the most variability in performance, showing the best results for RMSE of 2-period and 4-period forecasts and the worst performance for 3-period ahead forecasts. In forecasting inflation, there is less variability across horizons than for GDP. The Fair model is the best over 2, 3 and 4 quarter horizons. The ECM model is a close second and has the best 1-period ahead forecast performance.

Table 1: USA Forecasts

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

	ECM	RRR	BVAR	BAR	Fair Model
1996:1	1.17	1.22	1.83	3.12	2.67
1996:2	2.18	1.01	0.57	3.47	2.75
1996:3	2.61	1.61	1.25	3.72	2.32
1996:4	2.65	1.66	1.18	3.74	2.26
1997:1	2.86	1.71	1.39	3.74	2.21
1997:2	2.88	1.67	1.48	3.71	2.13
1997:3	2.84	1.61	1.54	3.68	2.18
1997:4	2.82	1.55	1.55	3.66	2.26
1998:1	2.78	1.49	1.56	3.63	2.24
1998:2	2.72	1.45	1.54	3.61	2.29
1998:3	2.68	1.42	1.51	3.58	2.38
1998:4	2.65	1.39	1.48	3.56	2.52

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

	ECM	RRR	BVAR	BAR	Fair Model
1996:1	2.21	2.48	2.35	2.56	1.52
1996:2	2.45	2.77	2.53	2.89	1.82
1996:3	2.50	3.10	2.62	3.13	1.93
1996:4	2.62	3.28	2.76	3.45	2.03
1997:1	2.77	3.37	2.86	3.71	2.10
1997:2	2.88	3.40	2.92	3.94	2.18
1997:3	2.96	3.41	2.98	4.15	2.24
1997:4	3.06	3.41	3.02	4.35	2.30
1998:1	3.14	3.39	3.04	4.52	2.37
1998:2	3.22	3.37	3.06	4.68	2.43
1998:3	3.29	3.35	3.07	4.82	2.49
1998:4	3.35	3.33	3.08	4.95	2.55

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

	ECM	RRR	BVAR	BAR	Fair Model
1996:1	-2.26	1.13	-2.00	5.44	0.57
1996:2	-0.37	-0.17	-1.85	5.55	2.00
1996:3	0.22	0.27	-2.39	5.47	2.34
1996:4	-0.26	1.11	-2.07	5.39	1.53
1997:1	0.71	1.49	-1.71	5.31	1.56
1997:2	1.41	1.67	-1.04	5.22	1.23
1997:3	1.79	1.67	-0.38	5.14	1.13
1997:4	2.21	1.60	0.23	5.06	1.21
1998:1	2.50	1.50	0.69	4.98	1.25
1998:2	2.67	1.40	1.01	4.91	1.35
1998:3	2.80	1.31	1.21	4.85	1.58
1998:4	2.89	1.25	1.30	4.78	1.88

(d) 3-Month Treasury Bill Rate

	ECM	RRR	BVAR	BAR	Fair Model
1996:1	5.40	4.77	5.03	5.42	5.14
1996:2	5.39	4.62	4.94	5.57	5.18
1996:3	5.33	4.52	4.93	5.68	5.19
1996:4	5.35	4.48	4.84	5.82	5.14
1997:1	5.39	4.47	4.77	5.96	5.07
1997:2	5.40	4.47	4.73	6.09	5.02
1997:3	5.44	4.47	4.71	6.22	4.97
1997:4	5.49	4.46	4.69	6.33	4.92
1998:1	5.53	4.45	4.68	6.45	4.87
1998:2	5.58	4.44	4.68	6.55	4.83
1998:3	5.63	4.42	4.68	6.65	4.79
1998:4	5.67	4.40	4.69	6.74	4.76

Table 2: Japan Forecasts

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

	ECM	RRR	BVAR	BAR
1996:1	3.91	3.60	3.72	4.39
1996:2	3.80	3.18	3.40	4.54
1996:3	3.58	3.70	2.78	4.83
1996:4	3.33	3.60	2.28	4.94
1997:1	3.63	4.36	1.74	4.92
1997:2	2.55	3.14	0.87	4.89
1997:3	2.92	3.72	0.57	4.80
1997:4	2.76	3.24	0.13	4.69
1998:1	2.49	3.38	-0.19	4.58
1998:2	2.53	3.28	-0.26	4.46
1998:3	2.49	3.31	-0.31	4.34
1998:4	2.37	3.25	-0.27	4.23

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

	ECM	RRR	BVAR	BAR
1996:1	1.19	0.83	2.34	-0.17
1996:2	0.35	-1.34	2.68	-0.54
1996:3	3.87	2.45	5.91	0.01
1996:4	2.63	0.28	6.08	0.07
1997:1	3.86	1.41	7.27	0.22
1997:2	3.62	0.73	7.73	0.28
1997:3	3.71	1.65	7.82	0.33
1997:4	3.34	1.53	7.66	0.35
1998:1	3.33	2.26	7.28	0.36
1998:2	2.96	2.06	6.60	0.36
1998:3	2.78	2.23	5.90	0.36
1998:4	2.59	2.04	5.12	0.35

Table 2 cont: Japan Forecasts**(b) Real Investment: growth rate (% annual rate)**

	<u>ECM</u>	<u>RRR</u>	<u>BVAR</u>	<u>BAR</u>
1996:1	3.59	5.82	7.75	5.78
1996:2	6.50	6.96	8.76	6.37
1996:3	5.11	5.91	7.27	5.60
1996:4	3.50	3.84	5.35	4.72
1997:1	3.97	5.61	4.17	4.48
1997:2	2.29	3.88	2.31	4.20
1997:3	2.07	4.35	0.94	4.03
1997:4	1.93	3.87	-0.26	3.92
1998:1	1.76	4.19	-1.34	3.84
1998:2	1.57	3.88	-2.05	3.78
1998:3	1.76	4.04	-2.52	3.75
1998:4	1.64	3.73	-2.82	3.72

(d) M1 growth (% annual rate)

	<u>ECM</u>	<u>RRR</u>	<u>BVAR</u>	<u>BAR</u>
1996:1	11.16	9.17	11.60	5.84
1996:2	6.29	8.83	7.94	3.62
1996:3	6.80	12.51	9.91	4.38
1996:4	3.81	12.93	8.19	4.21
1997:1	3.35	9.34	6.46	4.43
1997:2	2.27	7.18	5.23	4.48
1997:3	2.70	6.00	3.74	4.58
1997:4	1.76	5.15	2.46	4.65
1998:1	2.06	5.84	1.74	4.72
1998:2	1.55	5.65	0.99	4.78
1998:3	1.84	6.42	0.43	4.84
1998:4	1.69	6.33	0.13	4.90

Table 3: Australia Forecasts**(a) Real GDP: growth rate (% annual rate)**

	<u>ECM</u>	<u>RRR</u>	<u>BVAR</u>	<u>BAR</u>
1996:1	3.62	3.33	3.77	3.46
1996:2	3.58	3.01	3.78	3.33
1996:3	2.68	1.93	2.96	2.36
1996:4	2.92	1.95	3.25	2.52
1997:1	2.86	1.96	3.17	2.58
1997:2	2.76	1.92	3.16	2.56
1997:3	2.77	1.86	3.26	2.63
1997:4	2.75	1.80	3.38	2.71
1998:1	2.74	1.74	3.46	2.77
1998:2	2.73	1.69	3.55	2.83
1998:3	2.72	1.64	3.64	2.88
1998:4	2.71	1.59	3.70	2.92

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

	<u>ECM</u>	<u>RRR</u>	<u>BVAR</u>	<u>BAR</u>
1996:1	2.91	2.64	2.64	2.54
1996:2	2.16	2.03	1.84	1.55
1996:3	1.92	1.90	1.45	0.98
1996:4	2.14	2.25	1.49	0.78
1997:1	1.80	2.39	1.26	0.41
1997:2	1.79	2.45	1.12	0.18
1997:3	1.70	2.49	0.98	-0.06
1997:4	1.58	2.52	0.84	-0.29
1998:1	1.52	2.54	0.72	-0.51
1998:2	1.43	2.55	0.60	-0.72
1998:3	1.36	2.56	0.50	-0.94
1998:4	1.29	2.56	0.41	-1.16

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

	<u>ECM</u>	<u>RRR</u>	<u>BVAR</u>	<u>BAR</u>
1996:1	-0.80	-0.69	-0.42	-1.40
1996:2	-0.01	0.65	0.02	-0.87
1996:3	-0.33	0.41	-0.61	-1.32
1996:4	2.38	3.10	1.59	1.29
1997:1	2.27	2.80	0.65	1.80
1997:2	2.74	2.60	1.09	2.54
1997:3	2.79	2.45	1.14	2.77
1997:4	2.76	2.31	1.42	2.89
1998:1	2.70	2.19	1.67	2.86
1998:2	2.60	2.08	1.89	2.78
1998:3	2.50	1.99	2.10	2.65
1998:4	2.41	1.90	2.28	2.53

(d) M1 growth (% annual rate)

	<u>ECM</u>	<u>RRR</u>	<u>BVAR</u>	<u>BAR</u>
1996:1	7.86	8.59	8.10	9.79
1996:2	8.96	10.30	9.65	12.35
1996:3	8.05	10.11	9.30	12.86
1996:4	4.31	7.49	6.41	10.90
1997:1	4.62	8.02	7.29	10.94
1997:2	4.27	7.96	7.37	10.83
1997:3	3.92	7.73	7.39	10.76
1997:4	3.99	7.45	7.54	10.77
1998:1	3.95	7.17	7.62	10.79
1998:2	3.93	6.90	7.67	10.81
1998:3	3.94	6.66	7.67	10.84
1998:4	3.93	6.43	7.66	10.86

Table 4: New Zealand Forecasts

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

	ECM	RRR	BVAR	BAR
1995:4	1.99	3.01	2.71	2.91
1996:1	1.02	2.62	2.70	3.15
1996:2	1.33	3.76	3.78	4.28
1996:3	0.58	4.23	4.09	4.76
1996:4	0.57	4.37	4.25	4.90
1997:1	0.86	5.04	4.43	5.04
1997:2	0.69	4.72	4.34	5.18
1997:3	0.95	4.48	4.34	5.32
1997:4	1.00	4.21	4.31	5.46
1998:1	1.03	4.17	4.28	5.60
1998:2	1.10	4.29	4.27	5.74
1998:3	1.10	4.35	4.25	5.88
1998:4	1.13	4.29	4.25	6.02

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

	ECM	RRR	BVAR	BAR
1995:4	0.73	1.57	1.05	0.88
1996:1	0.81	1.43	1.29	1.12
1996:2	0.60	1.29	1.09	0.79
1996:3	0.44	0.99	1.00	0.58
1996:4	0.49	0.94	0.89	0.52
1997:1	0.58	1.34	0.99	0.46
1997:2	0.45	1.53	0.97	0.40
1997:3	0.44	1.42	0.96	0.35
1997:4	0.51	1.25	0.96	0.30
1998:1	0.59	1.27	0.95	0.26
1998:2	0.64	1.41	0.94	0.21
1998:3	0.66	1.51	0.93	0.17
1998:4	0.72	1.41	0.92	0.13

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

	ECM	RRR	BVAR	BAR
1995:4	7.43	13.90	11.43	11.52
1996:1	-0.17	7.25	6.33	6.82
1996:2	-6.03	6.70	4.84	5.49
1996:3	-2.15	17.23	14.64	14.72
1996:4	-3.19	18.24	15.33	15.18
1997:1	-4.71	19.40	16.29	15.64
1997:2	-4.45	20.01	16.83	16.09
1997:3	-3.34	17.60	16.44	16.55
1997:4	-2.12	16.10	16.31	17.01
1998:1	-1.59	16.44	16.06	17.46
1998:2	-1.21	16.28	15.83	17.92
1998:3	-1.02	16.30	15.70	18.37
1998:4	-0.80	16.28	15.60	18.82

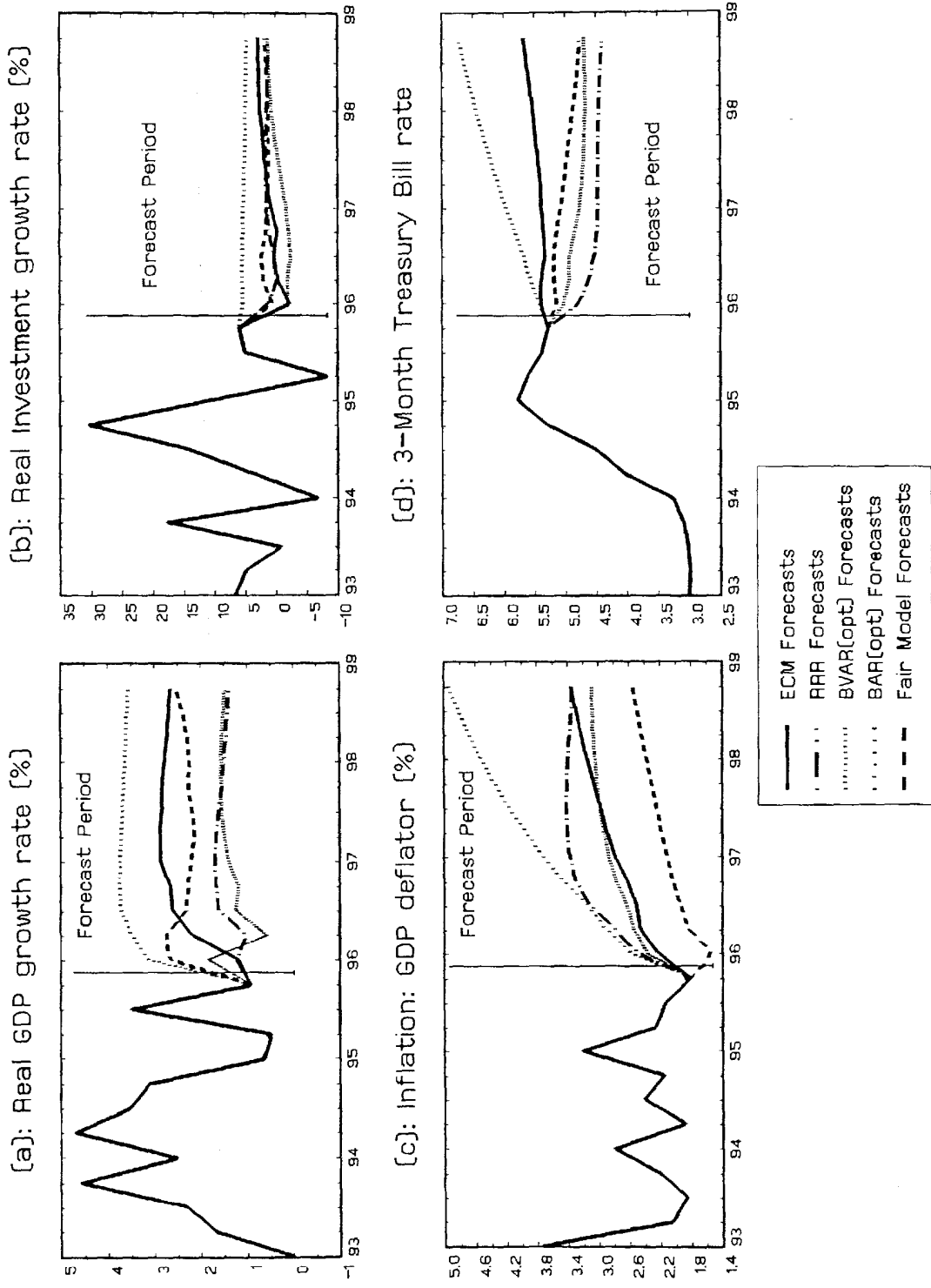
(d) M1 growth (% annual rate)

	ECM	RRR	BVAR	BAR
1995:4	-3.26	3.75	0.62	-1.12
1996:1	-3.77	4.96	4.58	2.42
1996:2	-9.50	4.12	2.69	-0.02
1996:3	-9.24	8.06	7.11	3.47
1996:4	-10.44	7.09	5.99	3.55
1997:1	-9.25	8.26	6.14	3.58
1997:2	-8.74	8.24	6.10	3.63
1997:3	-8.00	5.82	5.58	3.63
1997:4	-7.02	4.56	5.44	3.64
1998:1	-6.46	5.27	5.26	3.64
1998:2	-5.82	6.20	5.14	3.65
1998:3	-5.57	7.13	5.11	3.65
1998:4	-5.35	7.07	5.07	3.65

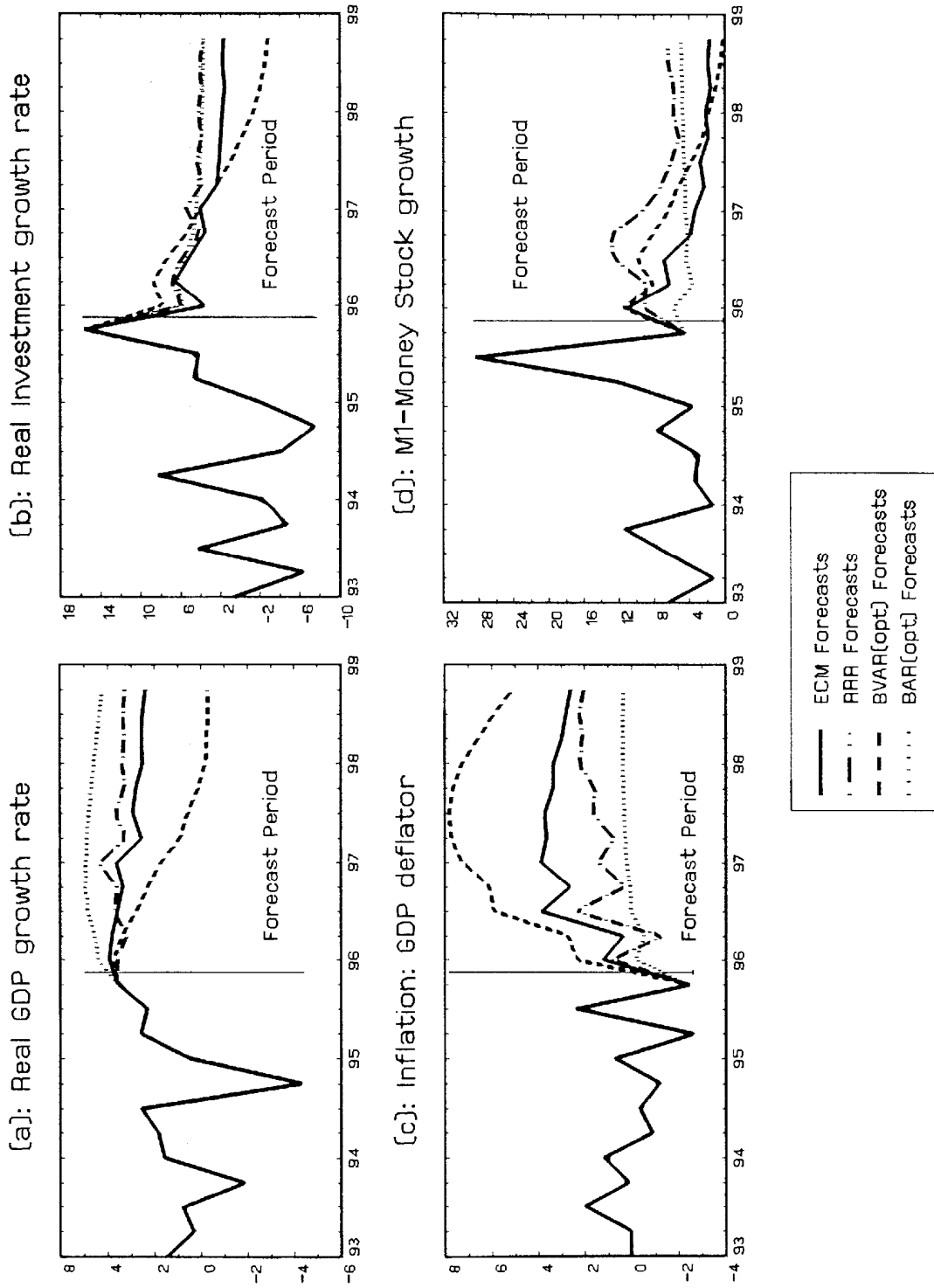
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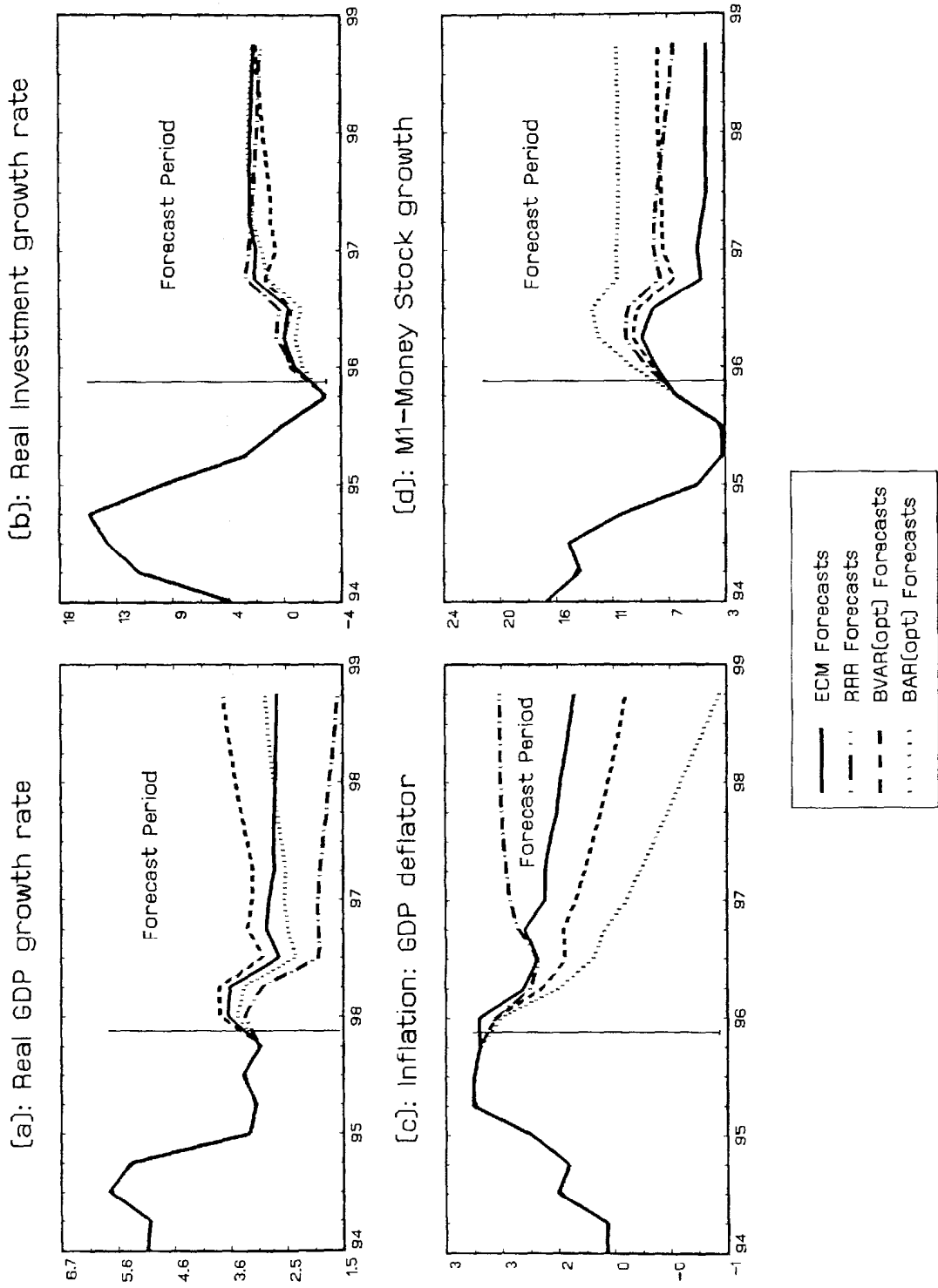
Figures 1[a]-[d]: USA Forecasts



Figures 2(a)–(d): JAPAN Forecasts



Figures 3[a]-[d]: AUSTRALIA Forecasts



Figures 4(a)–(d): New Zealand Forecasts

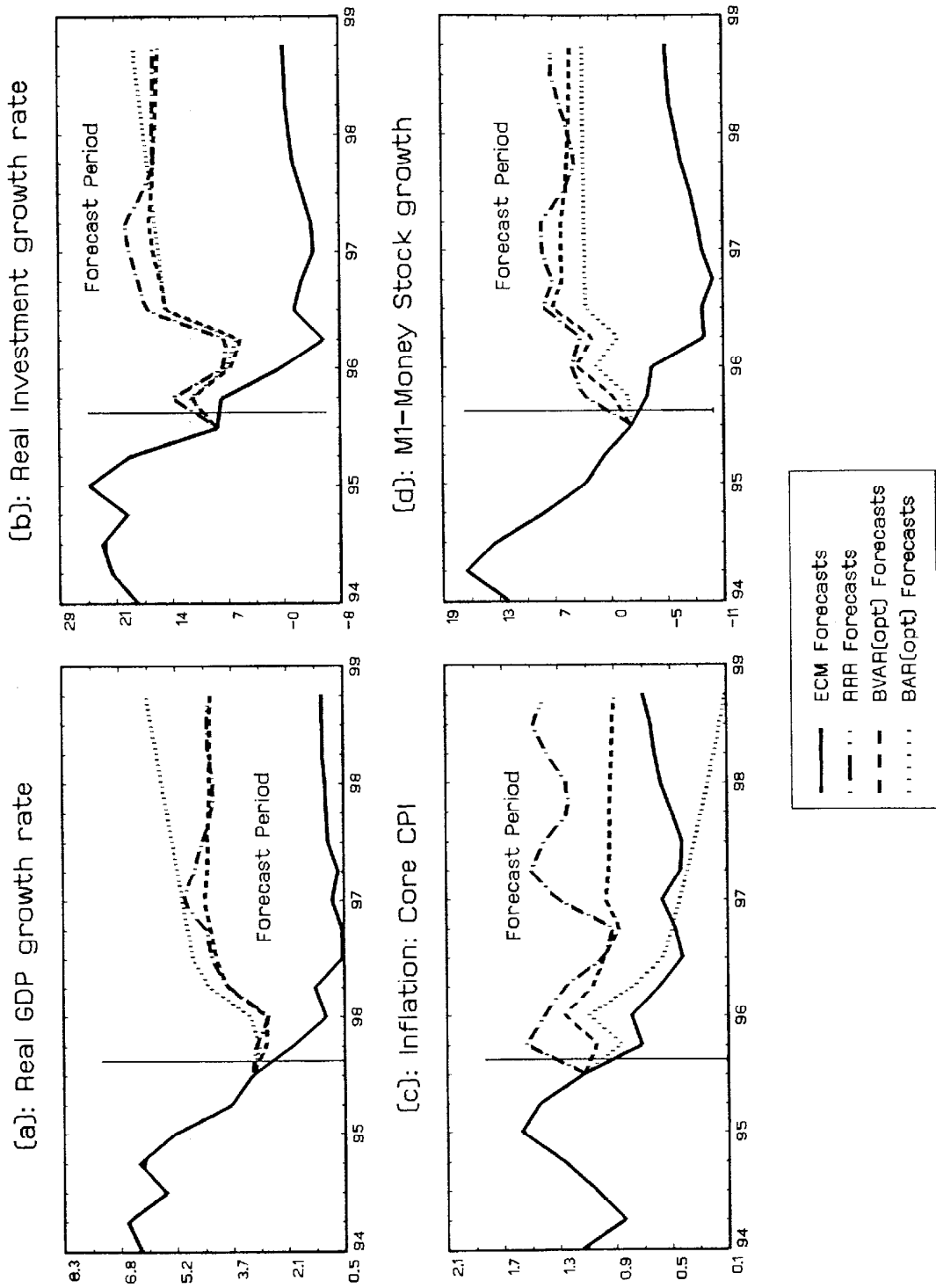
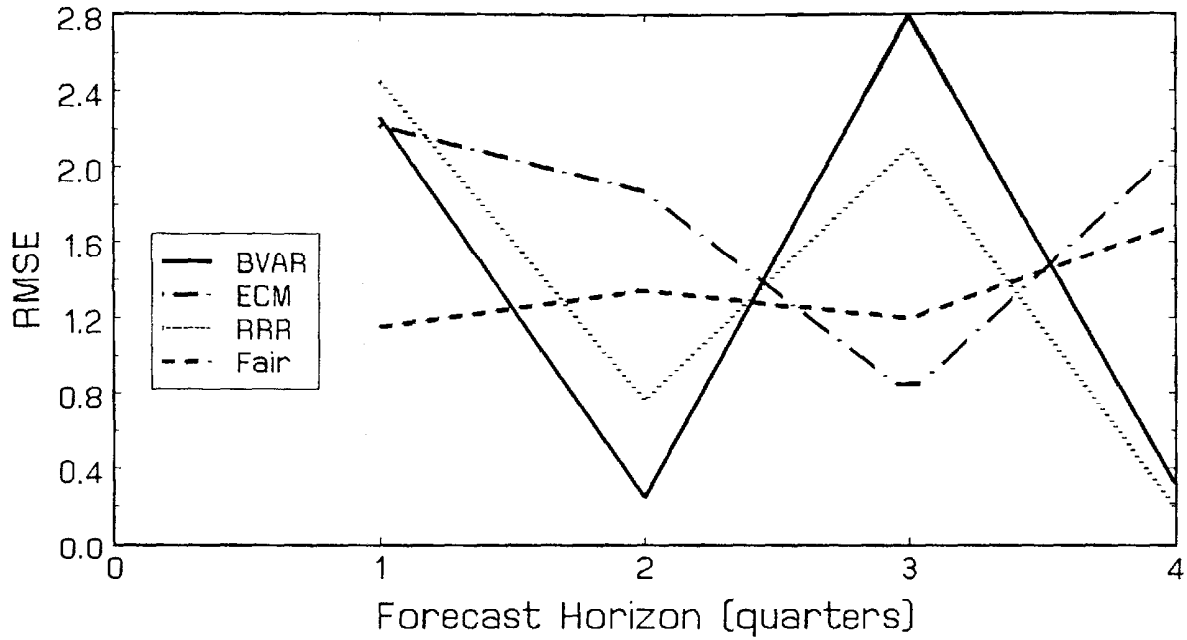


Figure 5: Forecast RMSE Comparisons
 (a) USA: GDP Growth Rate



(b) USA: Inflation Rate

