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How Much Are Exchange Rate Forecasts Worth — Source link

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* I am grateful to Professor Kenneth W. Clements for his guidance in preparing this paper. I would also like to acknowledge the help of Peter Goldschmidt, Soroja Selvanathan, Antony Selvanathan, Kal Stening and Alfred Wong.

February 1987

HOW MUCH ARE EXCHANGE RATE FORECASTS WORTH?

by

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1. INTRODUCTION

The floating of the Australian dollar in late 1983 has led to an increased interest in the behaviour and operation of the foreign exchange market. It is now widely accepted that the $A is one of the most volatile currencies in the world. This paper undertakes empirical tests of the ability of foreign exchange market participants to forecast the future value of the $A for one- and four-week horizons. A new set of survey data published in The Australian newspaper is used for this purpose. The performance of the forecasts is pertinent to the issue of the rationality (or otherwise) of the foreign exchange market.

Section 2 discusses the nature of the forecasts and Section 3 presents a graphical description of the data. In Section 4 we find that the rate follows a random walk whereby the best predictor of the future rate is the current value. The random walk model finds support in the theory of efficient markets. Section 5 provides a time-series analysis of the forecasts to assess the quality of the survey forecasts in comparison with those given by the random walk model. Later sections of the paper relate to other aspects of the quality of the forecasts, including the combination of the the two sets of forecasts (the survey and the random walk) into an optimal portfolio and an analysis of the nature of the forecast band defined as the difference between the highest and lowest individual forecasts in the survey.

2. THE FORECASTS

On March 11, 1985 The Australian newspaper commenced a weekly survey of expectations of the future value of the Australian dollar (in terms of $US) for one-week and four-week horizons. Sixteen foreign exchange market participants are surveyed and the average, together with the highest and lowest values, are published each Monday.

The actual and the forecast values of the rate are given in Table 1. For each week there are four dates involved:

(i) The date of publication of the newspaper. This is given column (1) of the table.

(ii) The date of the actual value of the rate [column (2)]. This is the value on the Friday prior to the Monday when the paper is published. This date is also when the survey is conducted.

(iii) The date to which the one-week forecasts refer [column (7)]. This is the Friday subsequent to the publication date.

(iv) The date to which the four-week forecasts refer [column (11)].

Looking at the first row of Table 1 the actual value of the rate on Friday 8/3/85 was 68.95 US cents. This was published on Monday, 11/3/85. The average of the forecast value of the rate for one week in the future (Friday 15/3/85) was 68.2 cents, with a high and low of 70.5 and 66.5, respectively. Similarly, the average of the four-week forecasts made on Friday 8/3/85 was 68.5 cents with the high and low given in columns (8) and (10), respectively. This four-week forecast refers to the value of the rate on Friday 4/4/85. In the table A_t

Table 1

ACTUAL AND FORECAST VALUES OF THE AUSTRALIAN DOLLAR

(US cents)

Date of publication	Date of actual rate	Actual	One-week forecast				Four-week forecast			
			High	Average	Low	Reference date	High	Average	Low	Reference date
		A_t		$P_{t+1,t}$				$P_{t+4,t}$		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
11/3/85	8/3/85	68.95	70.5	68.2	66.5	15/3/85	72.0	68.5	65.0	4/4/85
18/3/85	15/3/85	68.45	69.9	68.1	66.8	22/3/85	71.5	69.1	65.4	12/4/85
25/3/85	22/3/85	69.98	71.3	70.4	68.3	29/3/85	72.0	70.1	67.0	19/4/85
1/4/85	29/3/85	70.64	72.0	71.0	68.5	4/4/85	73.0	70.8	68.5	26/4/85
8/4/85	4/4/85	65.70	67.5	66.0	64.5	12/4/85	70.0	66.8	63.0	3/5/85
15/4/85	12/4/85	67.03	68.75	67.31	65.5	19/4/85	70.0	67.13	64.0	10/5/85
22/4/85	19/4/85	63.85	66.5	64.7	62.5	26/4/85	68.0	64.57	61.0	17/5/85
29/4/85	26/4/85	65.50	68.5	65.8	64.3	3/5/85	71.0	66.3	61.0	24/5/85
6/5/85	3/5/85	66.05	67.2	66.1	64.2	10/5/85	69.0	66.6	61.0	31/5/85
13/5/85	10/5/85	68.85	70.9	69.3	67.5	17/5/85	71.8	69.4	66.0	7/6/85
20/5/85	17/5/85	68.07	70.3	67.8	66.0	24/5/85	73.0	68.3	65.5	14/6/85
27/5/85	24/5/85	68.03	68.8	67.8	66.5	31/5/85	70.1	67.8	65.0	21/6/85
3/6/85	31/5/85	65.70	67.3	65.9	64.5	7/6/85	70.0	66.4	63.2	28/6/85
10/6/85	7/6/85	66.28	67.5	66.2	65.3	14/6/85	68.7	66.4	64.5	5/7/85
17/6/85	14/6/85	66.40	67.5	66.2	65.2	21/6/85	68.0	66.0	64.5	12/7/85
–	21/6/85	66.75	–	–	–	–	–	–	–	–
1/7/85	28/6/85	66.55	67.2	66.3	65.3	5/7/85	68.0	66.5	64.8	26/7/85
9/7/85	5/7/85	67.00	68.0	67.1	66.5	12/7/85	69.0	66.7	65.0	2/8/85
15/7/85	12/7/85	69.96	72.0	70.3	68.8	19/7/85	73.0	69.7	67.5	9/8/85
22/7/85	19/7/85	71.25	72.5	71.5	69.5	26/7/85	74.6	71.7	68.5	16/8/85
29/7/85	26/7/85	70.50	71.7	70.4	69.4	2/8/85	72.6	70.4	68.2	23/8/85
5/8/85	2/8/85	71.37	73.1	72.0	71.4	9/8/85	74.6	71.6	69.0	30/8/85
12/8/85	9/8/85	70.55	71.8	70.7	69.5	16/8/85	72.8	70.0	68.8	6/9/85
19/8/85	16/8/85	70.05	71.0	69.5	68.5	23/8/85	71.5	69.0	67.0	13/9/85
26/8/85	23/8/85	70.45	71.2	69.9	67.5	30/8/85	70.5	69.0	63.0	20/9/85
2/9/85	30/8/85	70.30	70.8	69.9	68.8	6/9/85	70.8	69.4	67.5	27/9/85
9/9/85	6/9/85	68.75	69.5	68.4	67.5	13/9/85	69.5	68.0	66.5	4/10/85
16/9/85	13/9/85	67.30	68.5	67.1	66.3	20/9/85	69.5	66.7	64.0	11/10/85
23/9/85	20/9/85	68.05	68.5	67.8	66.0	27/9/85	69.5	67.6	65.0	18/10/85
30/9/85	27/9/85	71.25	73.8	71.3	69.5	4/10/85	75.0	71.5	69.5	25/10/85
7/10/85	4/10/85	71.70	73.5	72.3	70.8	11/10/85	75.0	71.6	69.8	1/11/85
14/10/85	11/10/85	70.00	71.8	70.4	68.8	18/10/85	74.5	70.4	67.5	8/11/85
21/10/85	18/10/85	70.25	71.8	70.7	69.8	25/10/85	74.5	70.8	68.8	15/11/85
28/10/85	25/10/85	69.95	71.4	70.2	69.6	1/11/85	73.5	70.5	68.8	22/11/85
4/11/85	1/11/85	69.95	70.9	70.1	69.4	8/11/85	73.5	70.3	68.8	29/11/85
11/11/85	8/11/85	67.50	68.5	67.1	66.0	15/11/85	69.2	66.7	63.5	6/12/85
18/11/85	15/11/85	67.10	68.3	67.0	65.9	22/11/85	69.2	66.9	64.5	13/12/85
25/11/85	22/11/85	68.35	69.5	68.2	65.9	29/11/85	70.8	67.7	63.5	20/12/85
2/12/85	29/11/85	68.45	69.2	68.4	67.2	6/12/85	69.5	67.9	66.0	27/12/85
9/12/85	6/12/85	67.93	68.5	67.7	66.3	13/12/85	69.8	67.6	65.5	3/1/86
17/12/85	13/12/85	68.40	69.3	68.4	67.5	20/12/85	69.8	68.1	66.3	10/1/86
–	20/12/85	68.15	–	–	–	–	–	–	–	–
–	27/12/85	68.00	–	–	–	–	–	–	–	–

(contd)

Table 1 (contd)

Date of publication	Date of actual rate	Actual A_t	One-week forecasts				Four-week forecasts			
			High	Average $P_{t+1,t}$	Low	Reference date	High	Average $P_{t+4,t}$	Low	Reference date
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
-	3/1/86	68.35	-	-	-	-	-	-	-	-
13/1/86	10/1/86	69.40	70.5	69.6	68.5	17/1/86	70.5	69.0	67.4	7/2/86
20/1/86	17/1/86	69.90	70.8	70.0	69.1	24/1/86	71.2	69.5	68.5	14/2/86
27/1/86	24/1/86	70.75	72.8	71.1	70.0	31/1/86	72.8	70.1	69.0	21/2/86
3/2/86	31/1/86	71.50	72.5	71.4	69.8	7/2/86	73.3	70.8	69.0	28/2/86
10/2/86	7/2/86	69.40	69.8	68.9	68.0	14/2/86	70.5	68.7	67.0	7/3/86
17/2/86	14/2/86	69.93	71.5	70.0	68.5	21/2/86	71.5	69.0	67.2	14/3/86
24/2/86	21/2/86	70.20	71.1	69.6	68.3	28/2/86	71.5	69.8	67.5	21/3/86
3/3/86	28/2/86	70.10	70.8	69.6	68.5	7/3/86	70.3	69.2	67.5	28/3/86
10/3/86	7/3/86	70.10	70.7	69.6	67.5	14/3/86	70.6	69.4	67.0	4/4/86
17/3/86	14/3/86	70.40	71.2	70.0	68.4	21/3/86	70.8	69.4	67.8	11/4/86
24/3/86	21/3/86	71.30	71.9	71.3	70.5	28/3/86	72.5	70.9	69.3	18/4/86
31/3/86	28/3/86	71.30	72.3	71.2	70.5	4/4/86	73.5	70.6	68.7	25/4/86
7/4/86	4/4/86	71.85	72.5	71.9	71.1	11/4/86	73.5	71.2	68.8	2/5/86
14/4/86	11/4/86	71.37	72.3	71.5	70.7	18/4/86	73.3	70.5	68.7	9/5/86
21/4/86	18/4/86	71.42	72.0	71.2	70.1	24/4/86	72.5	70.6	68.0	16/5/86
28/4/86	24/4/86	72.70	74.2	72.8	71.8	2/5/86	75.3	72.4	68.0	23/5/86
5/5/86	2/5/86	73.30	74.5	73.3	72.0	9/5/86	76.4	73.3	70.0	30/5/86
12/5/86	9/5/86	74.18	75.4	74.4	73.5	16/5/86	77.0	73.8	70.0	6/6/86
19/5/86	16/5/86	71.66	72.5	71.5	68.7	23/5/86	73.0	71.3	69.5	13/6/86
26/5/86	23/5/86	71.40	72.6	71.4	70.3	30/5/86	72.5	70.8	69.0	20/6/86
2/6/86	30/5/86	71.54	72.0	71.1	70.4	6/6/86	72.5	70.5	69.0	27/6/86
9/6/86	6/6/86	69.05	70.3	68.5	67.0	13/6/86	70.0	67.5	65.0	4/7/86
16/6/86	13/6/86	68.98	70.0	69.0	67.8	20/6/86	70.5	68.4	66.9	11/7/86
23/6/86	20/6/86	69.32	70.2	69.3	68.4	27/6/86	70.3	68.6	67.5	18/7/86
30/6/86	27/6/86	67.15	68.8	67.1	65.5	4/7/86	69.0	66.5	62.0	25/7/86
7/7/86	4/7/86	64.40	65.5	63.9	61.0	11/7/86	68.0	63.5	60.0	1/8/86
14/7/86	11/7/86	63.85	65.5	63.9	63.0	18/7/86	66.0	63.2	60.0	8/8/86
21/7/86	18/7/86	63.88	65.0	63.5	61.0	25/7/86	67.5	63.4	59.3	15/8/86
28/7/86	25/7/86	61.17	62.5	60.6	58.5	1/8/86	62.8	60.3	57.4	22/8/86
4/8/86	1/8/86	60.30	62.0	60.1	57.5	8/8/86	65.0	60.4	55.0	29/8/86
11/8/86	8/8/86	60.94	62.3	60.3	58.5	15/8/86	64.0	60.2	55.0	5/9/86
18/8/86	15/8/86	62.56	64.0	62.5	61.5	22/8/86	65.5	61.6	59.5	12/9/86
25/8/86	22/8/86	60.90	62.2	60.5	58.0	29/8/86	62.5	60.1	57.0	19/9/86
1/9/86	29/8/86	60.83	62.2	60.8	59.8	5/9/86	62.0	59.9	58.0	26/9/86
8/9/86	5/9/86	61.45	62.3	61.8	60.5	12/9/86	63.0	60.8	59.0	3/10/86
15/9/86	12/9/86	61.80	62.5	61.85	61.2	19/9/86	63.0	61.48	59.8	10/10/86
22/9/86	19/9/86	62.60	63.25	62.6	61.55	26/9/86	63.5	61.6	59.8	17/10/86
29/9/86	26/9/86	62.90	63.5	63.0	62.3	3/10/86	65.0	62.5	60.2	24/10/86
6/10/86	3/10/86	63.40	63.8	63.2	61.6	10/10/86	64.5	62.7	59.8	31/10/86
13/10/86	10/10/86	63.83	64.3	63.7	63.0	17/10/86	66.0	63.4	62.1	7/11/86
20/10/86	17/10/86	63.70	64.3	63.4	63.0	24/10/86	64.5	63.1	60.2	14/11/86
27/10/86	24/10/86	64.30	65.4	64.2	63.8	31/10/86	64.5	63.5	62.5	21/11/86

Source: The Australian, Finance Section, Monday issues.

denotes the actual value of the rate at week t (Friday of week t) and $P_{t+\tau,t}$ denotes the average forecast made at t referring to τ weeks in the future (τ = 1,4).

As can be seen from Table 1, there were four occasions when the survey was not published. For these weeks, the actual value of the rate was obtained from the Australian Financial Review. As we need an equal number of observations for the actual and forecast series, in what follows we omit the observations which have no forecast values. Tables 2 and 3 give the actual and forecast values with those observations omitted. These data are used in all subsequent computations. For more details of the data, see Stening and Manzur (1986).

3. GRAPHICAL DESCRIPTION OF THE DATA

In Figure 1 we plot the value predicted last week for the current week, $P_{t,t-1}$, against the current week's realised value, A_t. As can be seen, while there is quite a lot of dispersion, the points seem to be more or less scattered randomly around the 45^{o} line which corresponds to perfect fit. Figure 2 plots these two variables against time. This shows that the forecast value tends to lag the actual by precisely one week. To put it another way, the forecast for next week made this week is quite close to this week's actual rate. This result is even clearer in Figure 3 which plots against time the actual, A_t, and this week's forecast (which refers to next week), $P_{t+1,t}$. While the two series are not identical, they are still very close to one another. Figure 4 is the scattergram version of Figure 3. This evidence strongly indicates that the forecast value is closely approximated by the current value of the rate.

Table 2

ACTUAL AND ONE-WEEK FORECAST VALUES
OF THE AUSTRALIAN DOLLAR

(US cents)

Date	Actual A_t	Forecast		
		High	Average $P_{t,t-1}$	Low
(1)	(2)	(3)	(4)	(5)
15/3/85	68.45	70.5	68.2	66.5
22/3/85	69.98	69.9	68.1	66.8
29/3/85	70.64	71.3	70.4	68.3
4/4/85	65.70	72.0	71.0	68.5
12/4/85	67.03	67.5	66.0	64.5
19/4/85	63.85	68.75	67.31	65.5
26/4/85	65.50	66.5	64.7	62.5
3/5/85	66.05	68.5	65.8	64.3
10/5/85	68.85	67.2	66.1	64.2
17/5/85	68.07	70.9	69.3	67.5
24/5/85	68.03	70.3	67.8	66.0
31/5/85	65.70	68.8	67.8	66.5
7/6/85	66.28	67.3	65.9	64.5
14/6/85	66.40	67.5	66.2	65.3
21/6/85	66.75	67.5	66.2	65.2
5/7/85	67.00	67.2	66.3	65.3
12/7/85	69.96	68.0	67.1	66.5
19/7/85	71.25	72.0	70.3	68.8
26/7/85	70.50	72.5	71.5	69.5
2/8/85	71.37	71.7	70.4	69.4
9/8/85	70.55	73.1	72.0	71.4
16/8/85	70.05	71.8	70.7	69.5
23/8/85	70.45	71.0	69.5	68.5
30/8/85	70.30	71.2	69.9	67.5
6/9/85	68.75	70.8	69.9	68.8
13/9/85	67.30	69.5	68.4	67.5
20/9/85	68.05	68.5	67.1	66.3
27/9/85	71.25	68.5	67.8	66.0
4/10/85	71.70	73.8	71.3	69.5
11/10/85	70.00	73.5	72.3	70.8
18/10/85	70.25	71.8	70.4	68.8
25/10/85	69.95	71.8	70.7	69.8
1/11/85	69.95	71.4	70.2	69.6
8/11/85	67.50	70.9	70.1	69.4
15/11/85	67.10	68.5	67.1	66.0
22/11/85	68.35	68.3	67.0	65.9
29/11/85	68.45	69.5	68.2	65.9
6/12/85	67.93	69.2	68.4	67.2
13/12/85	68.40	68.5	67.7	66.3
20/12/85	68.15	69.3	68.4	67.5
17/1/86	69.90	70.5	69.6	68.5

(contd)

Table 2 (contd)

Date	Actual A_t	Forecast		
		High	Average $P_{t,t-1}$	Low
(1)	(2)	(3)	(4)	(5)
24/1/86	70.75	70.8	70.0	69.1
31/1/86	71.50	72.8	71.1	70.0
7/2/86	69.40	72.5	71.4	69.8
14/2/86	69.93	69.8	68.9	68.0
21/2/86	70.20	71.5	70.0	68.5
28/2/86	70.10	71.1	69.6	68.3
7/3/86	70.10	70.8	69.6	68.5
14/3/86	70.40	70.7	69.6	67.5
21/3/86	71.30	71.2	70.0	68.4
28/3/86	71.30	71.9	71.3	70.5
4/4/86	71.85	72.3	71.2	70.5
11/4/86	71.37	72.5	71.9	71.1
18/4/86	71.42	72.3	71.5	70.7
24/4/86	72.70	72.0	71.2	70.1
2/5/86	73.30	74.2	72.8	71.8
9/5/86	74.18	74.5	73.3	72.0
16/5/86	71.66	75.4	74.4	73.5
23/5/86	71.40	72.5	71.5	68.7
30/5/86	71.54	72.6	71.4	70.3
6/6/86	69.05	72.0	71.1	70.4
13/6/86	68.98	70.3	68.5	67.0
20/6/86	69.32	70.0	69.0	67.8
27/6/86	67.15	70.2	69.3	68.4
4/7/86	64.40	68.8	67.1	65.5
11/7/86	63.85	65.5	63.9	61.0
18/7/86	63.88	65.5	63.9	63.0
25/7/86	61.17	65.0	63.5	61.0
1/8/86	60.30	62.5	60.6	58.5
8/8/86	60.94	62.0	60.1	57.5
15/8/86	62.56	62.3	60.3	58.5
22/8/86	60.90	64.0	62.5	61.5
29/8/86	60.83	62.2	60.5	58.0
5/9/86	61.45	62.2	60.8	59.8
12/9/86	61.80	62.3	61.8	60.5
19/9/86	62.60	62.5	61.85	61.2
26/9/86	62.90	63.25	62.6	61.55
3/10/86	63.40	63.5	63.0	62.3
10/10/86	63.83	63.8	63.2	61.6
17/10/86	63.70	64.3	63.7	63.0
24/10/86	64.30	64.3	63.4	63.0

Note: The four incomplete observations are omitted.

Table 3

ACTUAL AND FOUR-WEEK FORECAST VALUES
OF THE AUSTRALIAN DOLLAR

(US cents)

Date	Actual A_t	Forecast		
		High	Average $P_{t,t-4}$	Low
(1)	(2)	(3)	(4)	(5)
4/4/85	65.70	72.0	68.5	65.0
12/4/85	67.03	71.5	69.1	65.4
19/4/85	63.85	72.0	70.1	67.0
26/4/85	65.50	73.0	70.8	68.5
3/5/85	66.05	70.0	66.8	63.0
10/5/85	68.85	70.0	67.13	64.0
17/5/85	68.07	68.0	64.57	61.0
24/5/85	68.03	71.0	66.3	61.0
31/5/85	65.70	69.0	66.6	61.0
7/6/85	66.28	71.8	69.4	66.0
14/6/85	66.40	73.0	68.3	65.5
21/6/85	66.75	70.1	67.8	65.0
28/6/85	66.55	70.0	66.4	63.2
5/7/85	67.00	68.7	66.4	64.5
12/7/85	69.96	68.0	66.0	64.5
26/7/85	70.50	68.0	66.5	64.8
2/8/85	71.37	69.0	66.7	65.0
9/8/85	70.55	73.0	69.7	67.5
16/8/85	70.05	74.6	71.7	68.5
23/8/85	70.45	72.6	70.4	68.2
30/8/85	70.30	74.6	71.6	69.0
6/9/85	68.75	72.8	70.0	68.8
13/9/85	67.30	71.5	69.0	67.0
20/9/85	68.05	70.5	69.0	63.0
27/9/85	71.25	70.8	69.4	67.5
4/10/85	71.70	69.5	68.0	66.5
11/10/85	70.00	69.5	66.7	64.0
18/10/85	70.25	69.5	67.6	65.0
25/10/85	69.95	75.0	71.5	69.5
1/11/85	69.95	75.0	71.6	69.8
8/11/85	67.50	74.5	70.4	67.5
15/11/85	67.10	74.5	70.8	68.8
22/11/85	68.35	73.5	70.5	68.8
29/11/85	68.45	73.5	70.3	68.8
6/12/85	67.93	69.2	66.7	63.5
13/12/85	68.40	69.2	66.9	64.5
20/12/85	68.15	70.8	67.7	63.5
27/12/85	68.00	69.5	67.9	66.0
3/1/86	68.35	69.8	67.6	65.5
10/1/86	69.40	69.8	68.1	66.3

(contd)

Table 3 (contd)

Date	Actual A_t	Forecast		
		High	Average $P_{t,t-4}$	Low
(1)	(2)	(3)	(4)	(5)
7/2/86	69.40	70.5	69.0	67.4
14/2/86	69.93	71.2	69.5	68.5
21/2/86	70.20	72.8	70.1	69.0
28/2/86	70.10	73.3	70.8	69.0
7/3/86	70.10	70.5	68.7	67.0
14/3/86	70.40	71.5	69.0	67.2
21/3/86	71.30	71.5	69.8	67.5
28/3/86	71.30	70.3	69.2	67.5
4/4/86	71.85	70.6	69.4	67.0
11/4/86	71.37	70.8	69.4	67.8
18/4/86	71.42	72.5	70.9	69.3
24/4/86	72.70	73.5	70.6	68.7
2/5/86	73.30	73.5	71.2	68.8
9/5/86	74.18	73.3	70.5	68.7
16/5/86	71.66	72.5	70.6	68.0
23/5/86	71.40	75.3	72.4	68.0
30/5/86	71.54	76.4	73.3	70.0
6/6/86	69.05	77.0	73.8	70.0
13/6/86	68.98	73.0	71.3	69.5
20/6/86	69.32	72.5	70.8	69.0
27/6/86	67.15	72.5	70.5	69.0
4/7/86	64.40	70.0	67.5	65.0
11/7/86	63.85	70.5	68.4	66.9
18/7/86	63.88	70.3	68.6	67.5
25/7/86	61.17	69.0	66.5	62.0
1/8/86	60.30	68.0	63.5	60.0
8/8/86	60.94	66.0	63.2	60.0
15/8/86	62.56	67.5	63.4	59.3
22/8/86	60.90	62.8	60.3	57.4
29/8/86	60.83	65.0	60.4	55.0
5/9/86	61.45	64.0	60.2	55.0
12/9/86	61.80	65.5	61.6	59.5
19/9/86	62.60	62.5	60.1	57.0
26/9/86	62.90	62.0	59.9	58.0
3/10/86	63.40	63.0	60.8	59.0
10/10/86	63.83	63.0	61.48	59.8
17/10/86	63.70	63.5	61.6	59.8
24/10/86	64.30	65.0	62.5	60.2

Note: The four incomplete observations are omitted.

Figure 1

Actual (A_t) against One-week Forecast ($P_{t,t-1}$) Exchange Rates

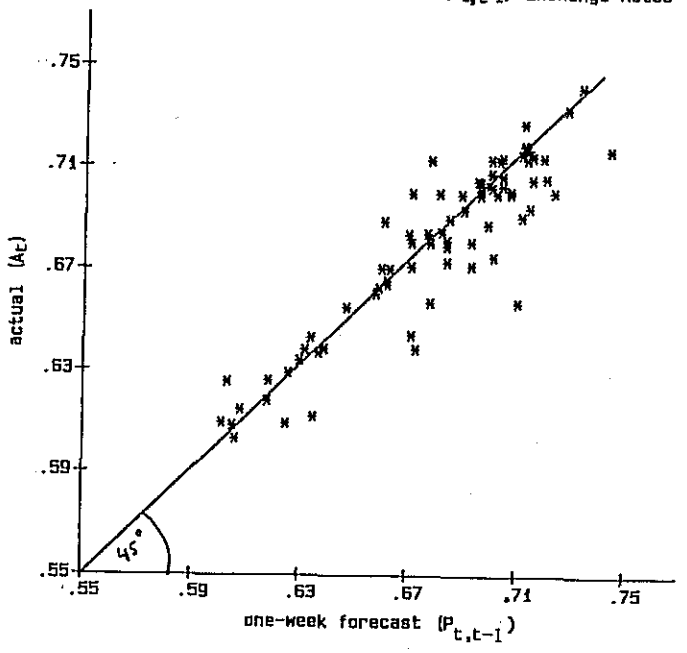


Figure 2

Actual (A_t) and One-week Forecast ($P_{t,t-1}$)
Exchange Rates against Time

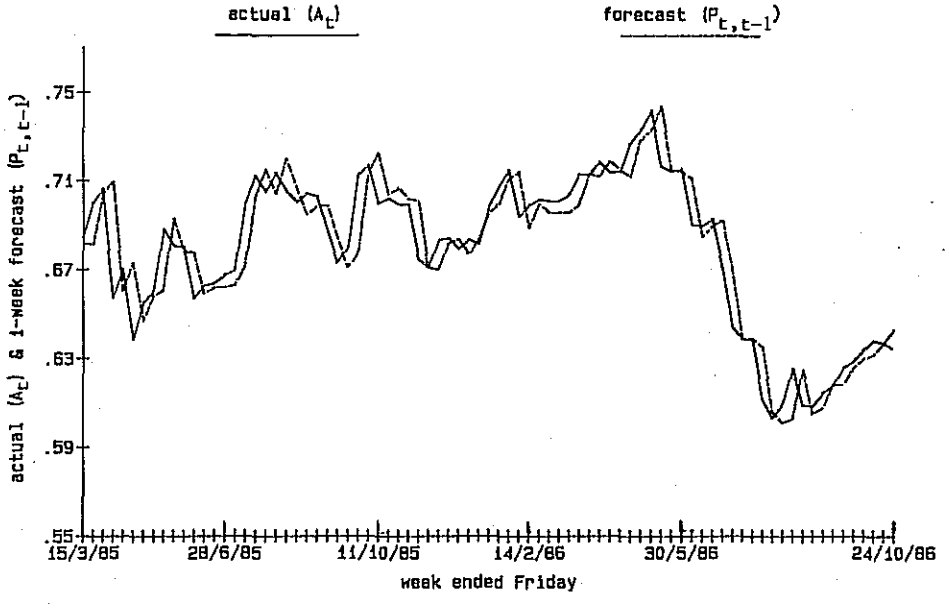


Figure 3

Actual (A_t) and Future Value of One-week Forecast ($P_{t+1,t}$) Exchange Rates against Time

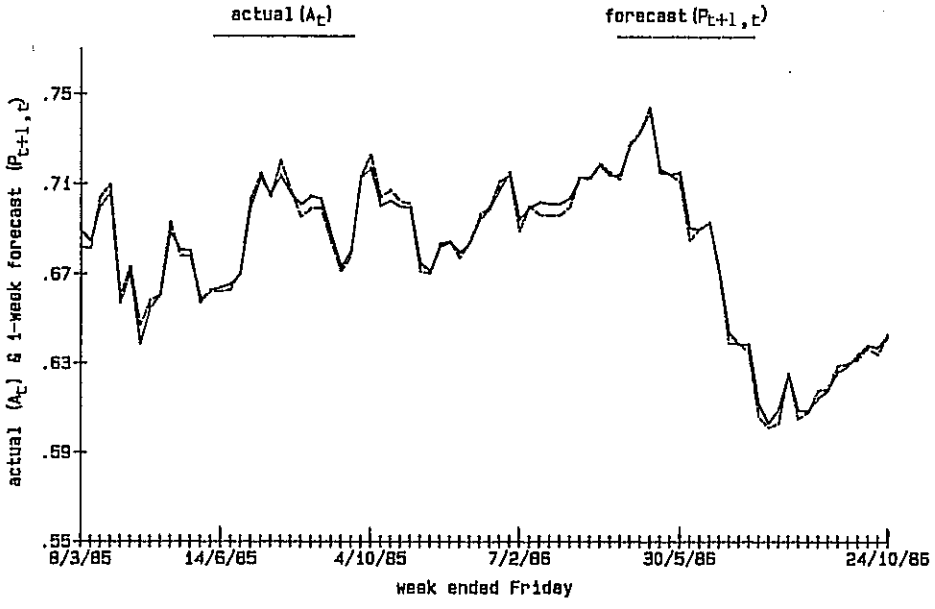
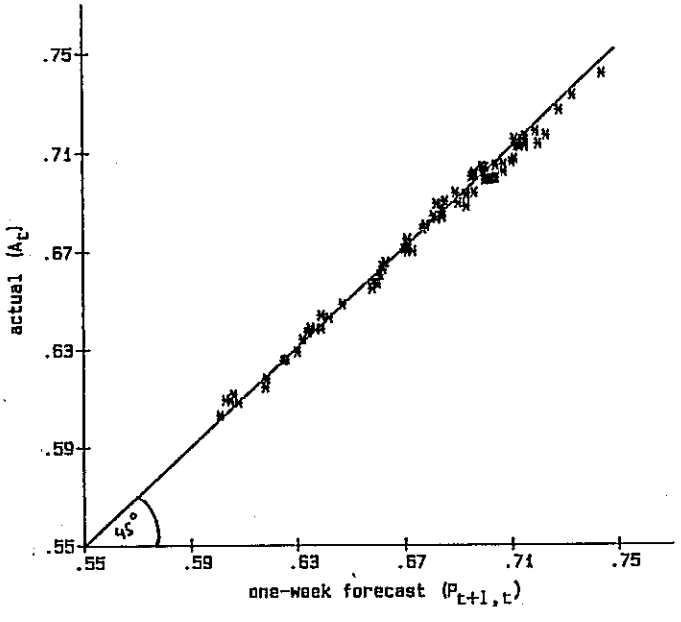


Figure 4

Actual (A_t) against Future Value of One-week Forecast ($P_{t+1,t}$) Exchange Rates



Figures 5 and 6 are the 4-week versions of Figures 1 and 2 (note that the scales are identical). As can be seen from Figure 5 there is now more dispersion around the 45^{o} line, indicating a decline in the quality of the forecasts as the horizon increases. This can also be seen from Figure 6. Figures 7 and 8 show that the four-week forecast is approximately equal to the current rate, as in the one-week case.

4. DOES THE RATE FOLLOW A RANDOM WALK?

In the previous section we found that the one-week forecast tends to lag the actual by precisely one week, that is, the forecast for next week made this week ($P_{t+1,t}$) is quite close to this week's actual rate (A_t). The four-week forecasts also exhibited this property. If, in fact, the best predictor of the future value of the rate is its current value, then the process generating the data is a random walk. The random walk model finds support in efficient markets theory. This theory emphasises that economic agents' expectations about future events dominate the determination of asset prices. Asset prices fully reflect all publicly-available information and are thus highly sensitive to the receipt of new information. The theory of efficient markets implies that successive price changes are independent and identically distributed; that is, in an efficient market prices follow a random walk (Fama, 1970).

We now test whether or not the rate follows a random walk. Table 4 gives the autocorrelations of the first-difference of the actuals. This table also contains corresponding values for the one-week and the four-week forecasts. The number of autocorrelations (M) is selected

Figure 5

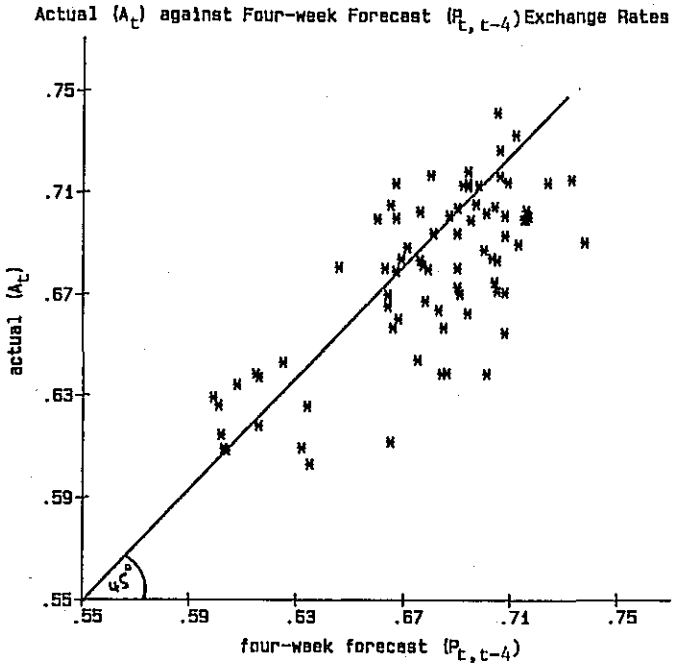


Figure 6

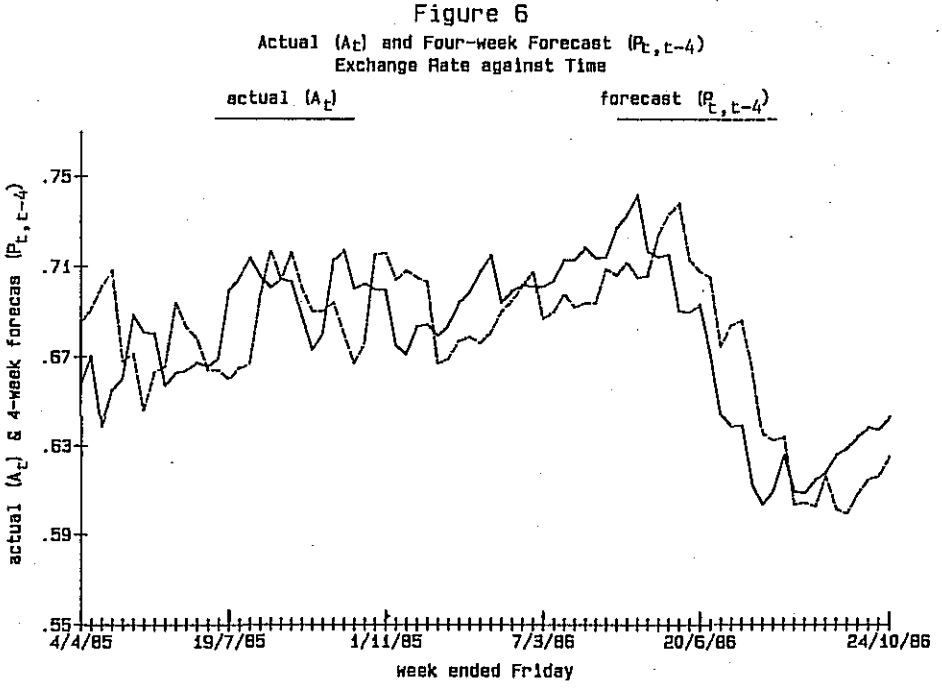


Figure 7

Actual (A_t) and Future Value of Four-week Forecast ($P_{t+4,t}$) Exchange Rates against Time

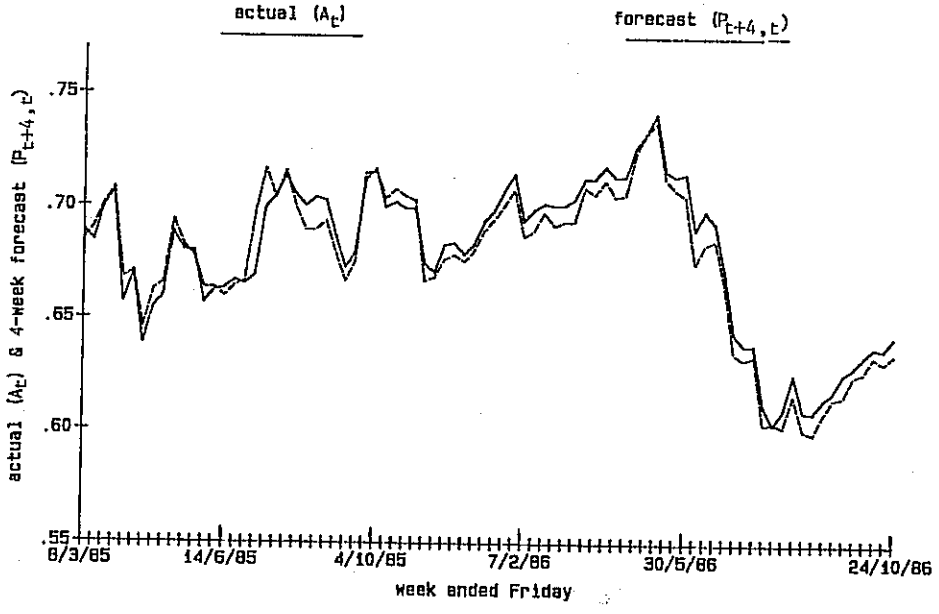


Figure 8

Actual (A_t) against Future Value of Four-week Forecast ($P_{t+4,t}$) Exchange Rates

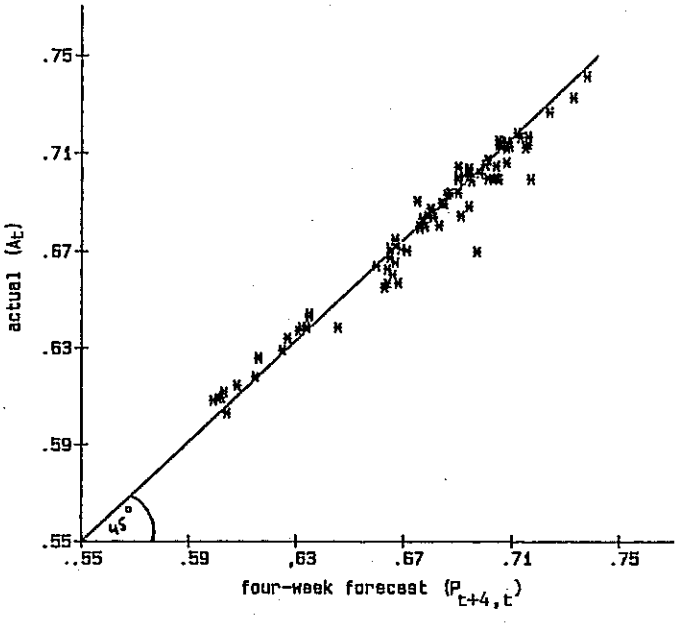


Table 4

AUTOCORRELATIONS OF THE FIRST-DIFFERENCE OF THE ACTUAL, ONE-WEEK FORECAST AND FOUR-WEEK FORECAST VALUES OF THE AUSTRALIAN DOLLAR

Actual

k	1	2	3	4	5	6	7	8	9	10
r(k)	-.04	-.02	-.10	.15	-.11	-.03	.02	.10	-.05	.02
k	11	12	13	14	15	16	17	18	19	20
r(k)	-.01	-.10	-.13	.07	.04	-.22	-.16	-.01	.07	.02
k	21	22	23	24	25	26	27			
r(k)	.05	-.02	-.08	.00	-.07	.07	-.06			

One-week Forecast

k	1	2	3	4	5	6	7	8	9	10
r(k)	-.06	-.05	-.03	.11	-.15	-.10	.08	.07	-.04	-.02
k	11	12	13	14	15	16	17	18	19	20
r(k)	.04	.00	-.18	.04	.05	-.20	-.10	-.04	.05	.03
k	21	22	23	24	25	26	27			
r(k)	.03	.05	-.07	.01	-.11	.10	-.02			

Four-week Forecast

k	1	2	3	4	5	6	7	8	9	10
r(k)	-.00	-.02	-.12	.13	-.14	-.15	.07	.10	-.04	-.05
k	11	12	13	14	15	16	17	18	19	20
r(k)	.03	-.06	-.10	-.05	.09	-.24	-.07	-.09	.09	.01
k	21	22	23	24	25	26	27			
r(k)	.03	.00	-.03	.00	-.08	.04	.01			

Note: r(k) is the autocorrelation at lag k.

according to the formula M = min (n/2, 3 x $\sqrt{n}$), where n is the number of observations. As we have n = 81 for each of these series, M = 27. Figures 9-11 plot these autocorrelations. As can be seen, all the autocorrelations, except one in the four-week case (Figure 11), lie within the two standard error band given by ($-2/\sqrt{n}$, $2/\sqrt{n}$). These results indicate that there is no reason to reject the random walk model, both for the actual rate and the forecasts.

The overall adequacy of the random walk model can be tested by the adjusted Box-Pierce Q-statistic given by

$$Q = n(n+2) \cdot \sum_{k=1}^{M} \frac{r^2(k)}{(n-k)} \quad ,$$

where n is the number of observations (less lags); M is the number of autocorrelations selected according to the formula given earlier; and r(k) is the autocorrelation at lag k. The test statistic Q has a chi-squared distribution with M-K degrees of freedom, where K is the number of parameters in the model.[1] The observed values of Q for the three series are 15.9, 15.6 and 16.4, respectively. Comparing these with the critical value at the 5 percent level of 38.9, we conclude that these Q's are not significant. Again the random walk model passes the test.

5. THE QUALITY OF THE FORECASTS

To assess the quality of the forecasts we start with a univariate time series analysis of the forecast errors. Columns (2) and (3) of Table 5 contain the actual values of the rate and the average of the one-week survey forecasts. The survey errors are given in column (4)

Figure 9

Autocorrelations of the First-difference
of the Actual Values of the Australian Dollar

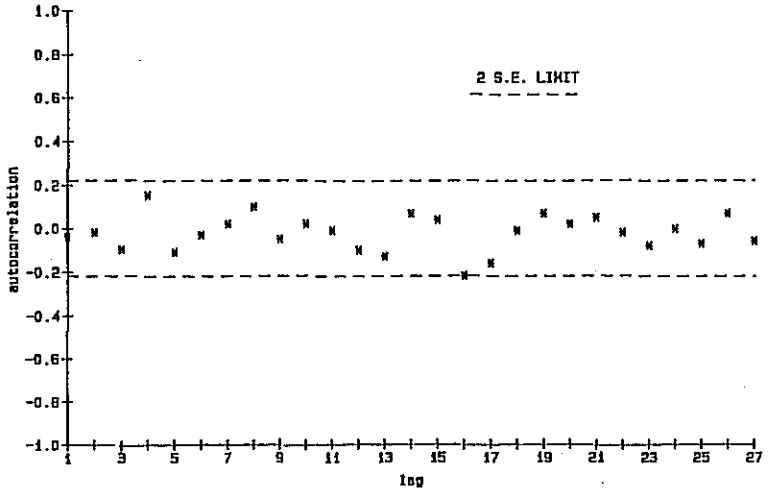


Figure 10

Autocorrelations of the First-difference
of the One-week Forecast Values of the Australian Dollar

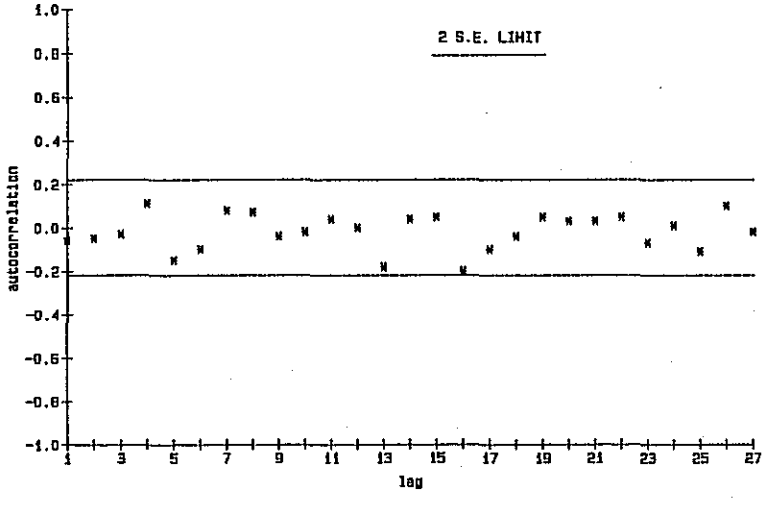


Figure 11

Autocorrelations of the First-difference
of the Four-week Forecast Values of the Australian Dollar

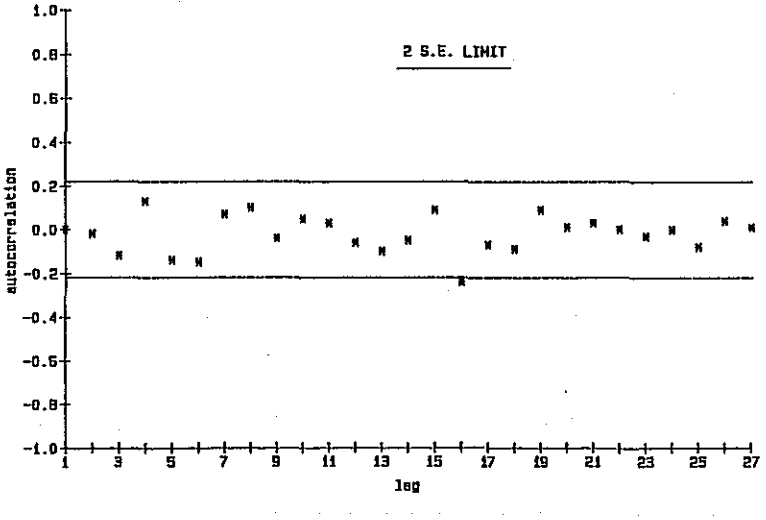


Table 5

ACTUALS, ONE-WEEK FORECASTS AND FORECAST ERRORS: AUSTRALIAN DOLLAR

(US cents)

Date	Actual	Forecast			
		Survey	Survey error	Random walk	Random walk error
	A_t	$P_{t,t-1}$	(2)-(3)	A_{t-1}	(2)-(5)
(1)	(2)	(3)	(4)	(5)	(6)
15/3/85	68.45	68.2	.25	68.95	-.50
22/3/85	69.98	68.1	1.88	68.45	1.53
29/3/85	70.64	70.4	.24	69.98	.66
4/4/85	65.70	71.0	-5.30	70.64	-4.94
12/4/85	67.03	66.0	1.03	65.70	1.33
19/4/85	63.85	67.31	-3.46	67.03	-3.18
26/4/85	65.50	64.7	.80	63.85	1.65
3/5/85	66.05	65.8	.25	65.50	.55
10/5/85	68.85	66.1	2.75	66.05	2.80
17/5/85	68.07	69.3	-1.23	68.85	-.78
24/5/85	68.03	67.8	.23	68.07	-.04
31/5/85	65.70	67.8	-2.10	68.03	-2.33
7/6/85	66.28	65.9	.38	65.70	.58
14/6/85	66.40	66.2	.20	66.28	.12
21/6/85	66.75	66.2	.55	66.40	.35
5/7/85	67.00	66.3	.70	66.75	.25
12/7/85	69.96	67.1	2.86	67.00	2.96
19/7/85	71.25	70.3	.95	69.96	1.29
26/7/85	70.50	71.5	-1.00	71.25	-.75
2/8/85	71.37	70.4	.97	70.50	.87
9/8/85	70.55	72.0	-1.45	71.37	-.82
16/8/85	70.05	70.7	-.65	70.55	-.50
23/8/85	70.45	69.5	.95	70.05	.40
30/8/85	70.30	69.9	.40	70.45	-.15
6/9/85	68.75	69.9	-1.15	70.30	-1.55
13/9/85	67.30	68.4	-1.10	68.75	-1.45
20/9/85	68.05	67.1	.95	67.30	.75
27/9/85	71.25	67.8	3.45	68.05	3.20
4/10/85	71.70	71.3	.40	71.25	.45
11/10/85	70.00	72.3	-2.30	71.70	-1.70
18/10/85	70.25	70.4	-.15	70.00	.25
25/10/85	69.95	70.7	-.75	70.25	-.30
1/11/85	69.95	70.2	-.25	69.95	0.0
8/11/85	67.50	70.1	-2.60	69.95	-2.45
15/11/85	67.10	67.1	0.0	67.50	-.40
22/11/85	68.35	67.0	1.35	67.10	1.25
29/11/85	68.45	68.2	.25	68.35	.10
6/12/85	67.93	68.4	-.47	68.45	-.52
13/12/85	68.40	67.7	.70	67.93	.47
20/12/85	68.15	68.4	-.25	68.40	-.25
17/1/86	69.90	69.6	.30	68.15	1.75
24/1/86	70.75	70.0	.75	69.90	.85
31/1/86	71.50	71.1	.40	70.75	.75

(contd)

Table 5 (contd)

Date	Actual	Forecast			
		Survey	Survey error	Random walk	Random walk error
	A_t	$P_{t,t-1}$	(2)-(3)	A_{t-1}	(2)-(5)
(1)	(2)	(3)	(4)	(5)	(6)
7/2/86	69.40	71.4	-2.00	71.50	-2.10
14/2/86	69.93	68.9	1.03	69.40	.53
21/2/86	70.20	70.0	.20	69.93	.27
28/2/86	70.10	69.6	.50	70.20	-.10
7/3/86	70.10	69.6	.50	70.10	.00
14/3/86	70.40	69.6	.80	70.10	.30
21/3/86	71.30	70.0	1.30	70.40	.90
28/3/86	71.30	71.3	.00	71.30	.00
4/4 86	71.85	71.2	.65	71.30	.55
11/4/86	71.37	71.9	-.53	71.85	-.48
18/4/86	71.42	71.5	-.08	71.37	.05
24/4/86	72.70	71.2	1.50	71.42	1.28
2/5/86	73.30	72.8	.50	72.70	.60
9/5/86	74.18	73.3	.88	73.30	.88
16/5/86	71.66	74.4	-2.74	74.18	-2.52
23/5/86	71.40	71.5	-.10	71.66	-.26
30/5/86	71.54	71.4	.14	71.40	.14
6/6/86	69.05	71.1	-2.05	71.54	-2.49
13/6/86	68.98	68.5	.48	69.05	-.07
20/6/86	69.32	69.0	.32	68.98	.34
27/6/86	67.15	69.3	-2.15	69.32	-2.17
4/7/86	64.40	67.1	-2.70	67.15	-2.75
11/7/86	63.85	63.9	-.05	64.40	-.55
18/7/86	63.88	63.9	-.02	63.85	.03
25/7/86	61.17	63.5	-2.33	63.88	-2.71
1/8/86	60.30	60.6	-.30	61.17	-.87
8/8/86	60.94	60.1	.84	60.30	.64
15/8/86	62.56	60.3	2.26	60.94	1.62
22/8/86	60.90	62.5	-1.60	62.56	-1.66
29/8/86	60.83	60.5	.33	60.90	-.07
5/9/86	61.45	60.8	.65	60.83	.62
12/9/86	61.80	61.8	.00	61.45	.35
19/9/86	62.60	61.85	.75	61.80	.80
26/9/86	62.90	62.6	.30	62.60	.30
3/10/86	63.40	63.0	.40	62.90	.50
10/10/86	63.83	63.2	.63	63.40	.43
17/10/86	63.70	63.7	.00	63.83	-.13
24/10/86	64.30	63.4	.90	63.70	.60
Mean	67.94	67.95	-.02	68.00	-.06
Standard error	3.42	3.46	1.41	3.39	1.37

which are obtained by subtracting the values in column (3) from those in column (2). The entries in column (5) are the forecasts from the random walk model, while column (6) contains the corresponding errors. Looking at the second last row of the table, it is observed that the means of the errors from the two models are both essentially zero, indicating that the forecasts are unbiased. It can be seen from the last row of the table that the standard error of the survey errors is slightly above that of the random walk errors (1.41 vs. 1.37). Consequently, the random walk model does slightly better than the survey for the one-week horizon.

Table 6 contains the same results for the four-week horizon. Relative to the one-week horizon, the mean errors are larger, but they are still not significant. The forecast standard errors have both almost doubled. The standard error of the survey errors is now slightly lower than that of the random walk (2.49 vs. 2.53).

In Figures 12-15 we plot each of the errors against time. Figures 12 and 13, which both refer to the one-week horizon, look more or less the same, again implying that the survey forecasts are closely approximated by those from the random walk model. The evidence for the four-week horizon (Figures 14 and 15) seems to provide support for this finding. This becomes even clearer when we plot the survey errors against the random walk errors as in Figures 16 and 17.

The autocorrelations for each set of errors are plotted in Figures 18-21.[2] As can be seen, none of the autocorrelations for the one-week errors is significant. Using the Q-statistic, we find that these autocorrelations are jointly insignificant (see Figures 18 and 19 for details). However, the autocorrelations for the four-week horizon (given in Figures 20 and 21) seem to follow a systematic pattern and

Table 6

ACTUALS, FOUR-WEEK FORECASTS AND FORECAST ERRORS: AUSTRALIAN DOLLAR

(US cents)

Date	Actual	Forecast			
		Survey	Survey error	Random walk	Random walk error
	A_t	$P_{t,t-4}$	(2)-(3)	A_{t-4}	(2)-(5)
(1)	(2)	(3)	(4)	(5)	(6)
4/4/85	65.70	68.5	-2.80	68.95	-3.25
12/4/85	67.03	69.1	-2.07	68.45	-1.42
19/4/85	63.85	70.1	-6.25	69.98	-6.13
26/4/85	65.50	70.8	-5.30	70.64	-5.14
3/5/85	66.05	66.8	-.75	65.70	.35
10/5/85	68.85	67.13	1.72	67.03	1.82
17/5/85	68.07	64.57	3.50	63.85	4.22
24/5/85	68.03	66.3	1.73	65.50	2.53
31/5/85	65.70	66.6	-.90	66.05	-.35
7/6/85	66.28	69.4	-3.12	68.85	-2.57
14/6/85	66.40	68.3	-1.90	68.07	-1.67
21/6/85	66.75	67.8	-1.05	68.03	-1.28
28/6/85	66.55	66.4	.15	65.70	.85
5/7/85	67.00	66.4	.60	66.28	.72
12/7/85	69.96	66.0	3.96	66.40	3.56
26/7/85	70.50	66.5	4.00	66.75	3.75
2/8/85	71.37	66.7	4.67	66.55	4.82
9/8/85	70.55	69.7	.85	67.00	3.55
16/8/85	70.05	71.7	-1.65	69.96	.09
23/8/85	70.45	70.4	.05	70.50	-.05
30/8/85	70.30	71.6	-1.30	71.37	-1.07
6/9/85	68.75	70.0	-1.25	70.55	-1.80
13/9/85	67.30	69.0	-1.70	70.05	-2.75
20/9/85	68.05	69.0	-.95	70.45	-2.40
27/9/85	71.25	69.4	1.85	70.30	.95
4/10/85	71.70	68.0	3.70	68.75	2.95
11/10/85	70.00	66.7	3.30	67.30	2.70
18/10/85	70.25	67.6	2.65	68.05	2.20
25/10/85	69.95	71.5	-1.55	71.25	-1.30
1/11/85	69.95	71.6	-1.65	71.70	-1.75
8/11/85	67.50	70.4	-2.90	70.00	-2.50
15/11/85	67.10	70.8	-3.70	70.25	-3.15
22/11/85	68.35	70.5	-2.15	69.95	-1.60
29/11/85	68.45	70.3	-1.85	69.95	-1.50
6/12/85	67.93	66.7	1.23	67.50	.43
13/12/85	68.40	66.9	1.50	67.10	1.30
20/12/85	68.15	67.7	.45	68.35	-.20
27/12/85	68.00	67.9	.10	68.45	-.45
3/1/86	68.35	67.6	.75	67.93	.42
10/1/86	69.40	68.1	1.30	68.40	1.00

(contd)

Table 6 (contd)

Date	Actual	Forecast			
		Survey	Survey error	Random walk	Random walk error
	A_t	$P_{t,t-4}$	(2)-(3)	A_{t-4}	(2)-(5)
(1)	(2)	(3)	(4)	(5)	(6)
7/2/86	69.40	69.0	.40	68.15	1.25
14/2/86	69.93	69.5	.43	68.00	1.93
21/2/86	70.20	70.1	.10	68.35	1.85
28/2/86	70.10	70.8	-.70	69.40	.70
7/3/86	70.10	68.7	1.40	69.40	.70
14/3/86	70.40	69.0	1.40	69.93	.47
21/3/86	71.30	69.8	1.50	70.20	1.10
28/3/86	71.30	69.2	2.10	70.10	1.20
4/4 86	71.85	69.4	2.45	70.10	1.75
11/4/86	71.37	69.4	1.97	70.40	.97
18/4/86	71.42	70.9	.52	71.30	.12
24/4/86	72.70	70.6	2.10	71.30	1.40
2/5/86	73.30	71.2	2.10	71.85	1.45
9/5/86	74.18	70.5	3.68	71.37	2.81
16/5/86	71.66	70.6	1.06	71.42	.24
23/5/86	71.40	72.4	-1.00	72.70	-1.30
30/5/86	71.54	73.3	-1.76	73.30	-1.76
6/6/86	69.05	73.8	-4.75	74.18	-5.13
13/6/86	68.98	71.3	-2.32	71.66	-2.68
20/6/86	69.32	70.8	-1.48	71.40	-2.08
27/6/86	67.15	70.5	-3.35	71.54	-4.39
4/7/86	64.40	67.5	-3.10	69.05	-4.65
11/7/86	63.85	68.4	-4.55	68.98	-5.13
18/7/86	63.88	68.6	-4.72	69.32	-5.44
25/7/86	61.17	66.5	-5.33	67.15	-5.98
1/8/86	60.30	63.5	-3.20	64.40	-4.10
8/8/86	60.94	63.2	-2.26	63.85	-2.91
15/8/86	62.56	63.4	-.84	63.88	-1.32
22/8/86	60.90	60.3	.60	61.17	-.27
29/8/86	60.83	60.4	.43	60.30	.53
5/9/86	61.45	60.2	1.25	60.94	.51
12/9/86	61.80	61.6	.20	62.56	-.76
19/9/86	62.60	60.1	2.50	60.90	1.70
26/9/86	62.90	59.9	3.00	60.83	2.07
3/10/86	63.40	60.8	2.60	61.45	1.95
10/10/86	63.83	61.48	2.35	61.80	2.03
17/10/86	63.70	61.6	2.10	62.60	1.10
24/10/86	64.30	62.5	1.80	62.90	1.40
Mean	67.73	67.84	-.10	68.03	-.29
Standard error	3.40	3.40	2.49	3.30	2.53

Figure 12

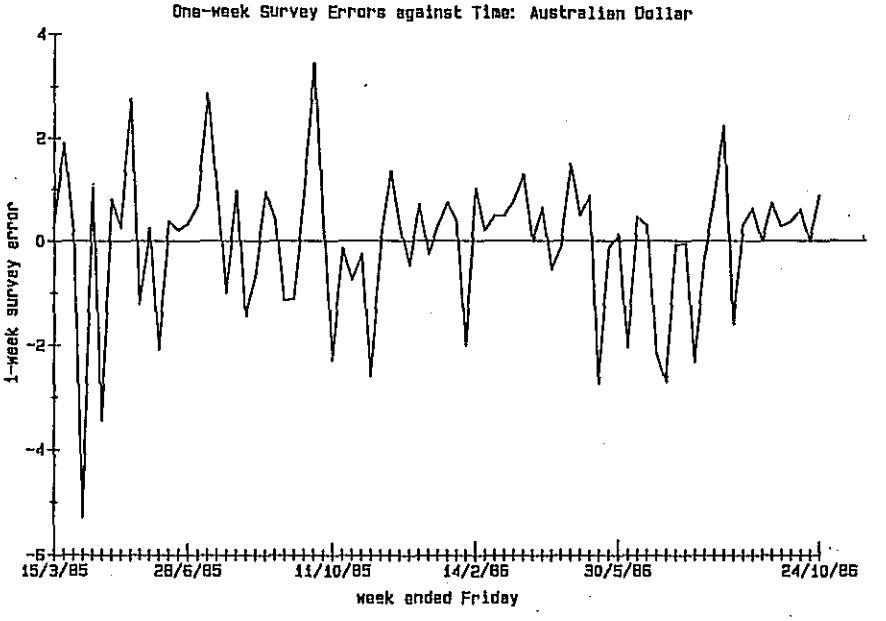


Figure 13

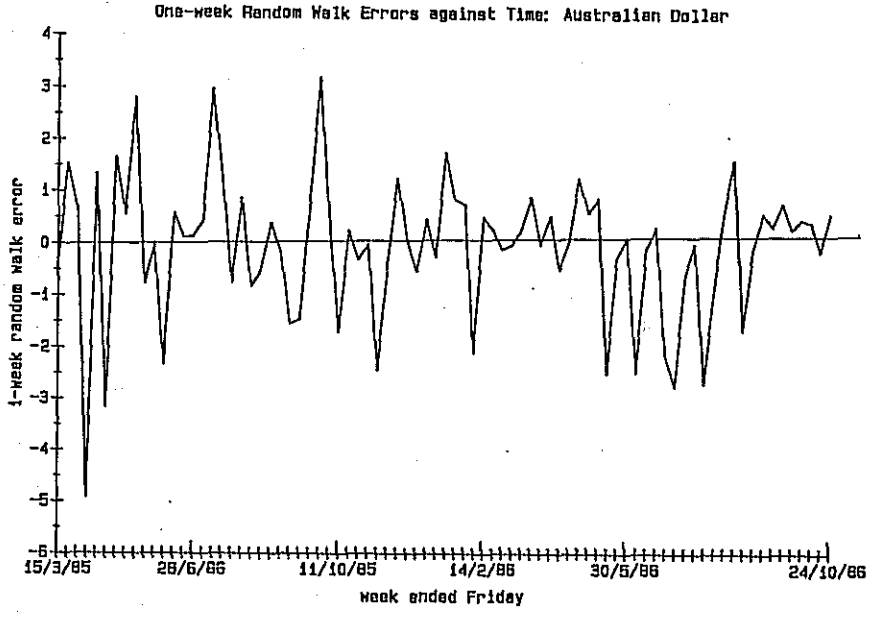


Figure 14

Four-week Survey Errors against Time: Australian Dollar

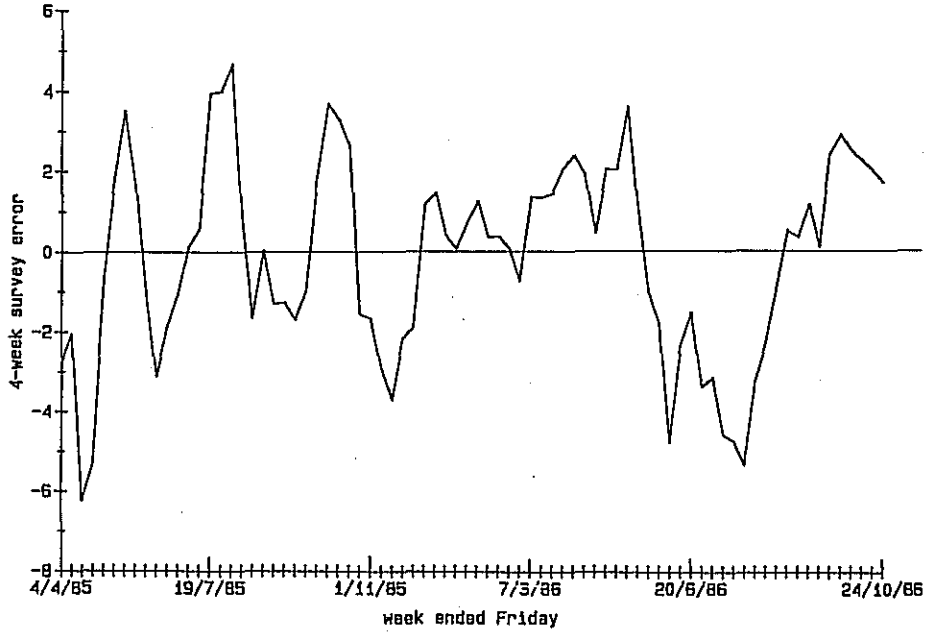


Figure 15

Four-week Random Walk Errors against Time: Australian Dollar

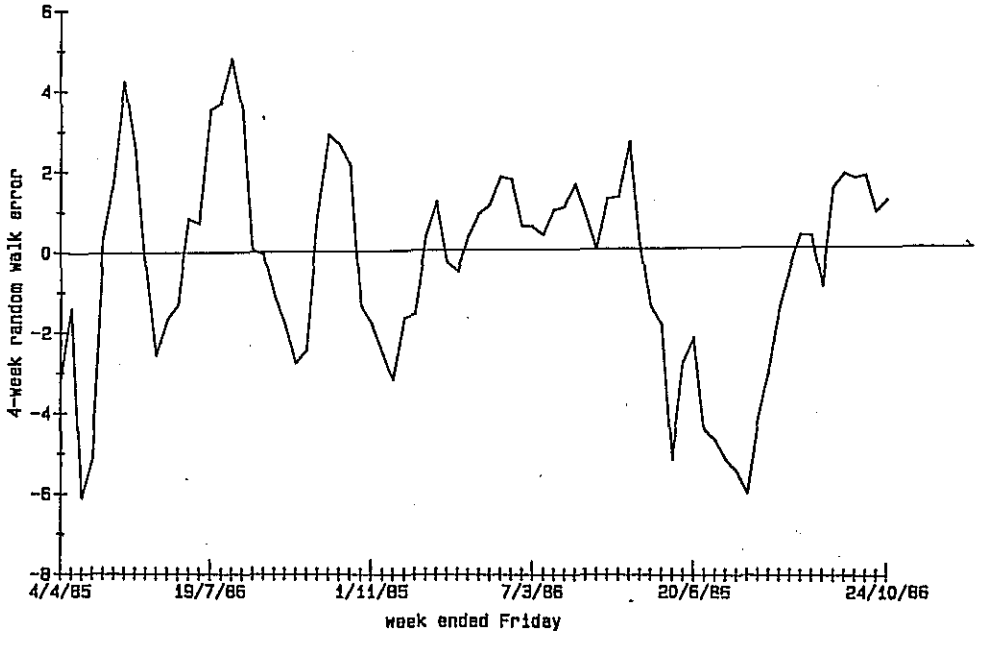


Figure 16

One-week Survey Errors against One-week Random Walk Errors: Australian Dollar

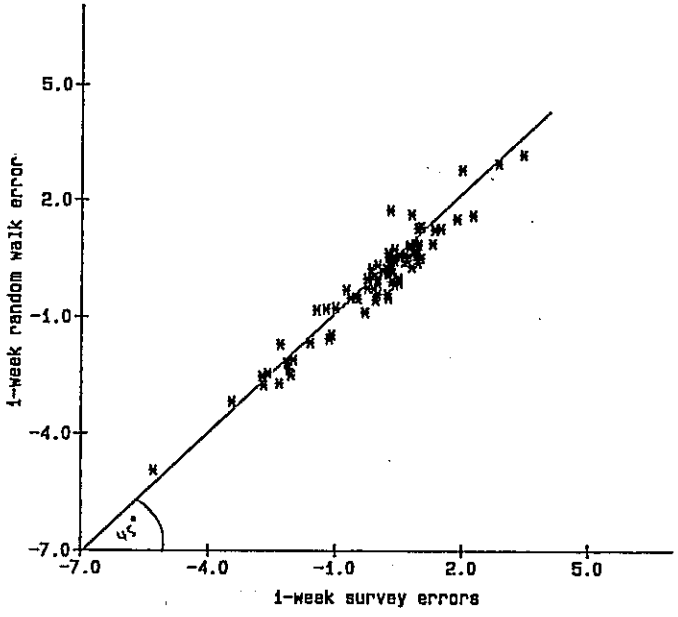


Figure 17

Four-week Survey Errors against Four-week Random Walk Errors: Australian Dollar

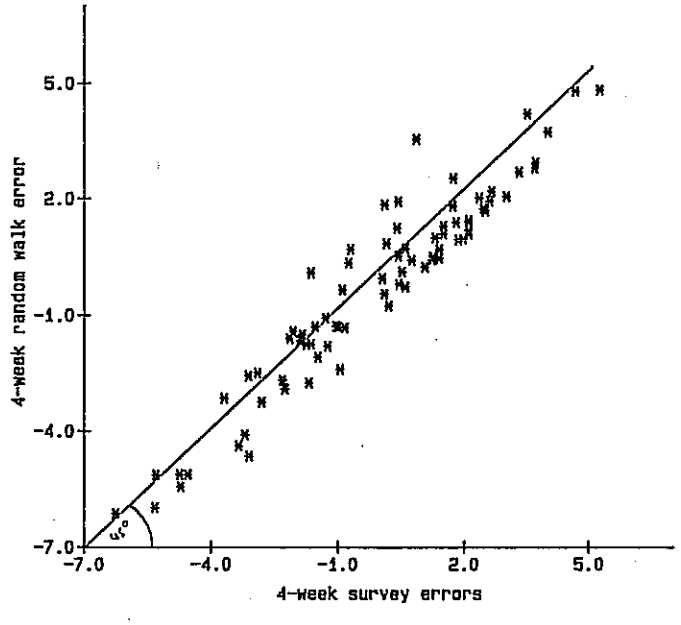


Figure 18

Autocorrelations of One-week Survey Errors: Australian Dollar

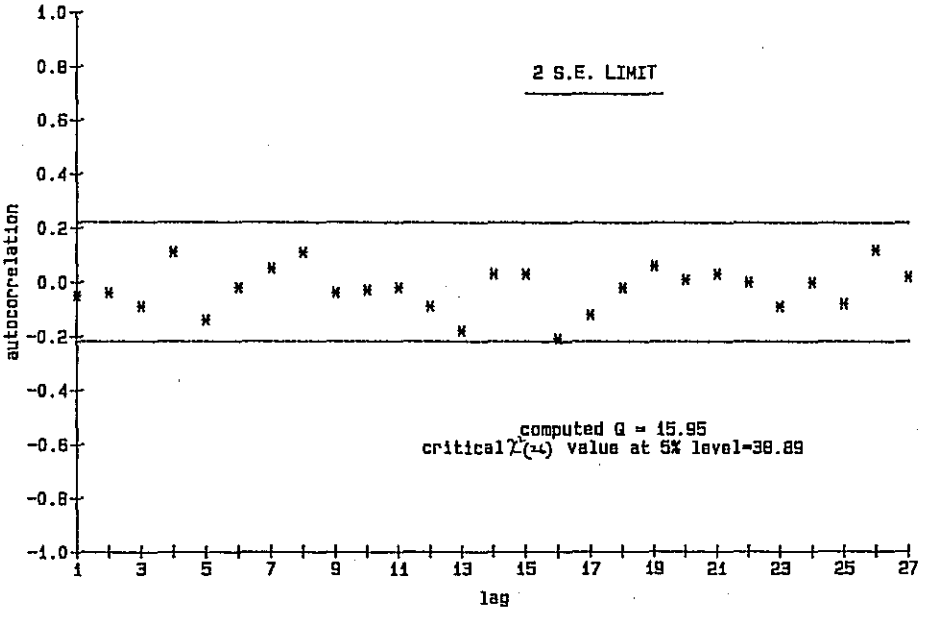


Figure 19

Autocorrelations of One-week Random Walk Errors: Australian Dollar

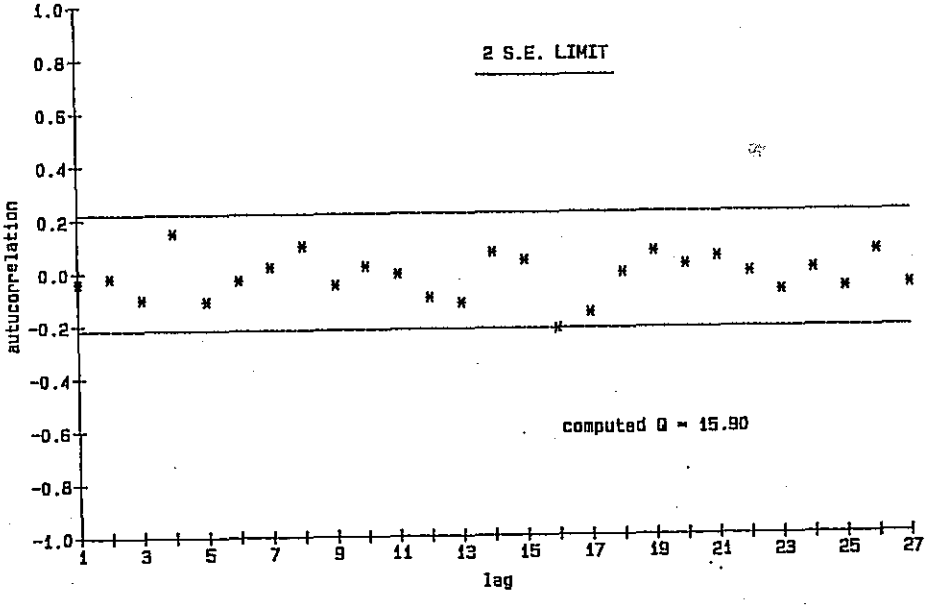


Figure 20

Autocorrelations of Four-week Survey Errors: Australian Dollar

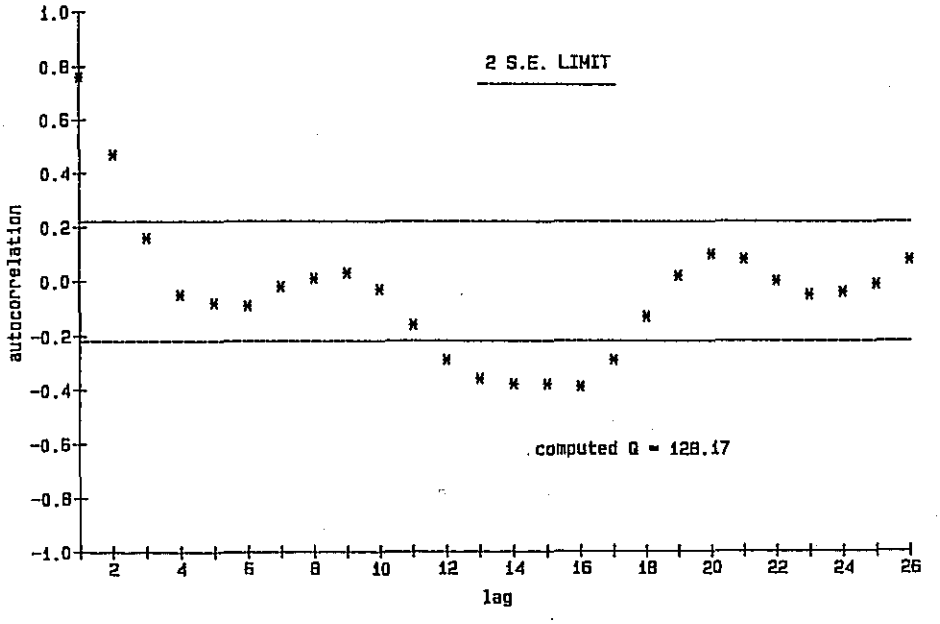
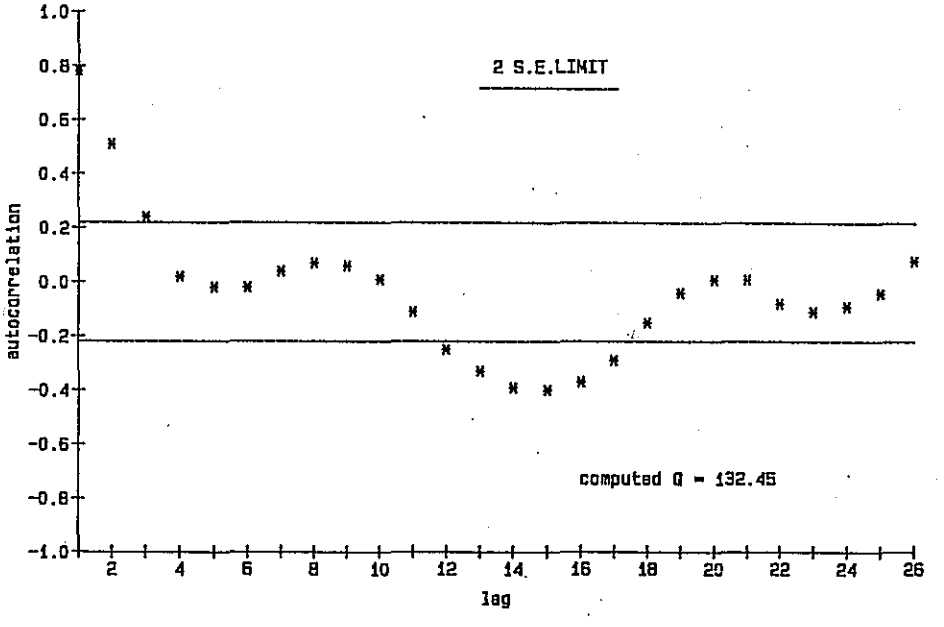


Figure 21

Autocorrelations of Four-week Random Walk Errors: Australian Dollar



the computed Q's are significant. This, however, is to be expected as the frequency of observations (1 per week) is shorter than the forecast horizon (4 weeks); see Hansen and Hodrick (1980).

6. AN ANALYSIS OF CHANGES

To gain further insight into the quality of the forecasts, in this section we follow the well-known methodology developed by Theil (1966) and analyse the forecasts in terms changes. Consider a graph with the log-changes of the predicted values measured along vertical axis and the log-changes of the realised values horizontally. A 45° degree line through the origin of such a graph is the line of perfect forecasts. When the graph is rotated clockwise such that the line of perfect forecasts becomes a horizontal line we get what is called the "prediction-realisation diagram". Figures 22 and 23 are two such diagrams for the one-week survey forecasts and the one-week random walk forecasts, respectively. The four-week versions of these diagrams are presented in Figures 24 and 25. As can be seen, the quality of the predictions is not excellent. The observations are far away from the line of perfect forecast and there are many turning point errors.

Table 7 provides a summary of the results from the prediction-realisation diagrams. For both the one- and four-week survey forecasts, almost one-half of the forecasts represent turning point errors; that is, the predicted changes are incorrect as far as their signs are concerned. This means that on average , for one out of every two cases, either a turning point is predicted which does not materialise or there is an observed turning point which was not predicted. The results also

Figure 22

Prediction-Realisation Diagram: Actual Against One-week Survey Forecast

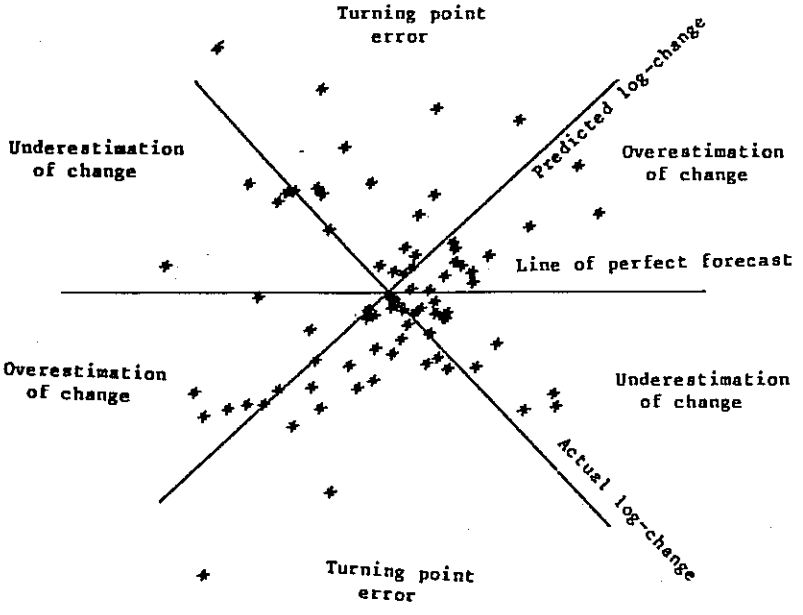


Figure 23

Prediction-Realisation Diagram: Actual Against One-week Random Walk Forecast

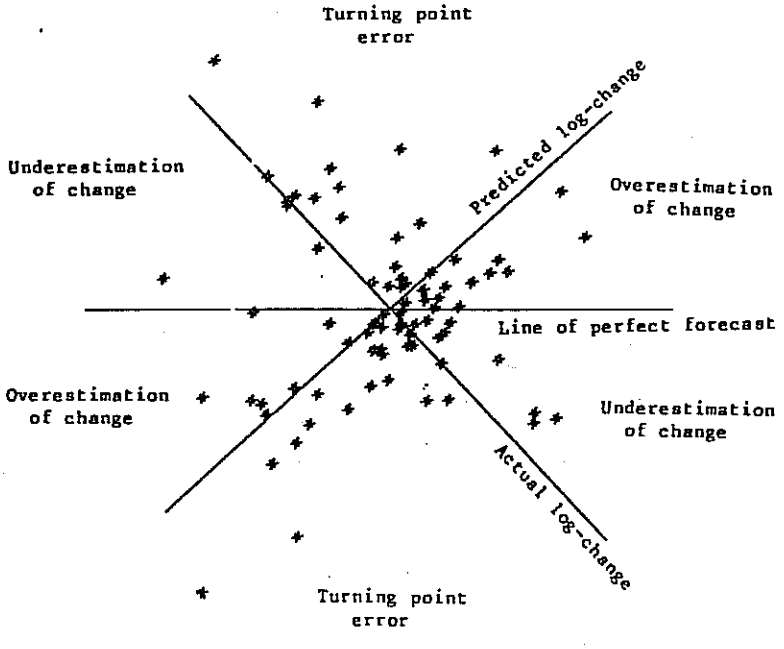


Figure 24

Prediction-Realisation Diagram: Actual
Against Four-week Survey Forecast

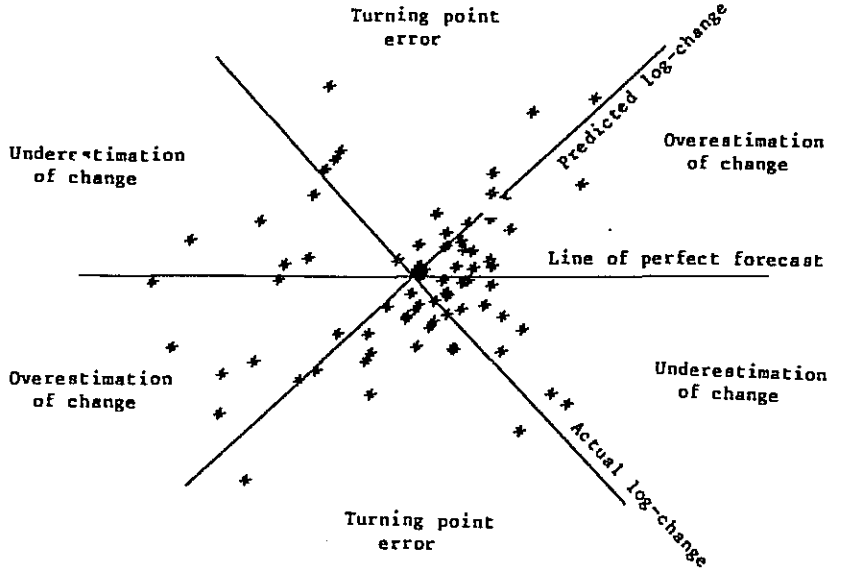
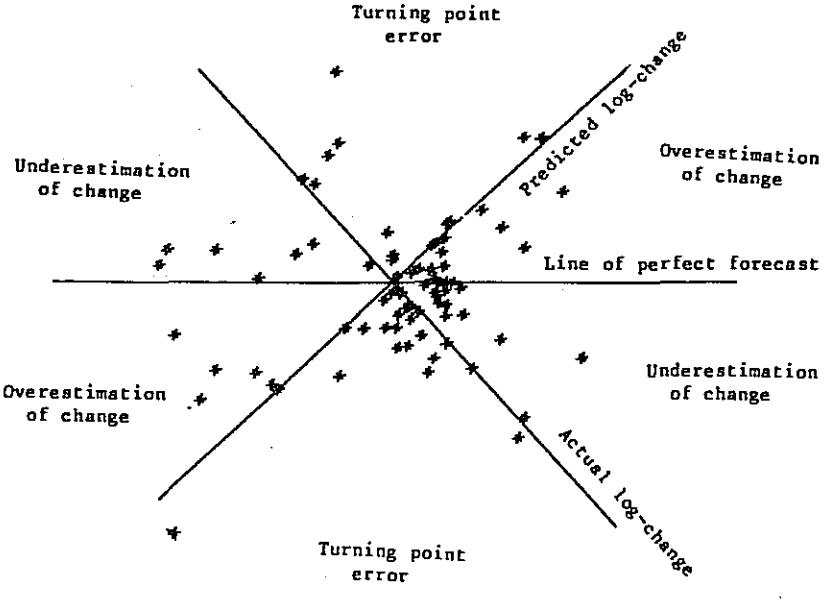


Figure 25

Prediction-Realisation Diagram: Actual
Against Four-week Random Walk Forecast



reveal that there is about an even split between underestimation and overestimation of changes. The situation with the random walk forecasts is more or less the same except that the proportion of turning point errors is slightly higher.

Table 7

UNDERESTIMATION AND OVERESTIMATION OF CHANGES AND TURNING POINT ERRORS: AUSTRALIAN DOLLAR

(Percent)

Type of error	One-week forecast		Four-week forecast	
	Survey	Random walk	Survey	Random walk
Turning point errors	41.8	47.5	42.9	43.4
Underestimation of change	29.1	21.3	26.0	27.6
Overestimation of change	29.1	31.3	31.2	29.0
Total	100.0	100.0	100.0	100.0

Note that totals may not add up to 100 due to rounding.

7. A COMPOSITE FORECAST

In the preceding analysis the survey and the random walk were treated as competitive forecasts of the exchange rate. In this section, following Nelson (1972), we combine the two sets of forecasts into a linear composite which may be viewed as an optimal "portfolio" of forecasts.

A linear composite forecast may be written as follows:

forecast for $t+\tau$ = α (survey forecast for $t+\tau$ made at t)

+ $(1-\alpha)$(random walk forecast for $t+\tau$ made at t)

$\tau = 1,4,$

where α is the weight given to the survey forecast. A similar equation also holds for the forecast referring to week t made at $t-\tau$. Introducing a random forecasting error (ξ_t), this latter equation can be written in terms of observables as

$$(1) \qquad A_t = \alpha P_{t,t-\tau} + (1 - \alpha) A_{t-\tau} + \xi_t , \quad \tau = 1,4,$$

where A_t is the actual value of the rate; and $P_{t,t-\tau}$ is the survey forecast made at $t-\tau$.

Rearrangement of equation (1) yields

$$(2) \qquad A_t - A_{t-\tau} = \alpha (P_{t,t-\tau} - A_{t-\tau}) + \xi_\tau .$$

It is readily seen that the variable on the left-hand side of equation (2) is the random walk error. The variable in brackets on the right-hand side is just the difference between the two forecasts. Accordingly, the greater the ability of this difference to account for the random walk errors, the larger will be the weight given to the survey forecasts, α . The composite forecast can be implemented by treating (2) as a regression equation to estimate the weight α .

The results of estimating (1) [in the form of (2)] are given in Table 8. As can be seen, the estimates of α are insignificantly different from zero. If the survey forecasts represent conditional

expectations of the future realisations implied by all publicly-available information, then these forecasts should make efficient use of this information. Thus the random walk model, which uses only a

Table 8

ESTIMATION RESULTS FOR THE COMPOSITE FORECAST OF THE AUSTRALIAN DOLLAR

$$A_t = \alpha P_{t,t-\tau} + (1-\alpha)A_{t-\tau} + \xi_t$$

(Standard errors in parentheses)

Equation	α	R^2	S.E.E	D-W	ρ
		One-week (τ = 1)			
OLS	.158 (.413)	.00	1.37	2.10	-.05
CORC	.173 (.405)	.00	1.37	2.00	-.00
		Four-week (τ = 4)			
OLS	.480 (.320)	.02	2.51	.42	.78
CORC	.330 (.231)	.62	1.55	1.56	.21

Note: OLS = ordinary least squares; CORC = Cochrane-Orcutt adjustment for autocorrelation; R^2 = coefficient of determination; S.E.E = standard error of the equation; D-W = Durbin-Watson statistic; and ρ = first-order residual autocorrelation coefficient.

subset of all the information, should receive little weight in the composite forecast. The above results, however, indicate that the survey does not use all available information since the random walk forecast receives such a large weight in the composite forecast.

8. AN ANALYSIS OF THE FORECAST BAND

As stated in Section 2, the survey averages are published together with the highest and lowest values. Consequently, the averages are contained within a forecast band. We now analyse the nature of this band.

We write $U_{t+\tau,t}$ for the upper value of the band made in week t for week $t+\tau$ ($\tau = 1,4$) and $L_{t+\tau,t}$ for the analogous lower value. Going back to Table 1, $U_{t+1,t}$ and $L_{t+1,t}$ are given in columns (4) and (6), while columns (8) and (10) contain the four-week counterparts. Figure 26 plots against time $U_{t+1,t}$, $P_{t+1,t}$ (the average forecast for t+1 made at t) and $L_{t+1,t}$. Figure 27 is the four-week version of Figure 26. As can be seen, the width of the band is much larger in the four-week case, reflecting the greater uncertainty of a more distant forecast.

Does the band always contain the realised rate? This question can be answered by replacing the average prediction in Figure 26, $P_{t+1,t}$, with the corresponding realised value, A_{t+1}, as is done in Figure 28. The band does not contain the realised rate in 17 out of 81 cases. In other words, on average there is a 21 percent chance of the future value of the rate lying outside the band. For the four-week horizon (Figure 29), there is an even greater chance (about 27 percent) that

Figure 26

High, Average and Low Values of One-week Forecast of the Australian Dollar

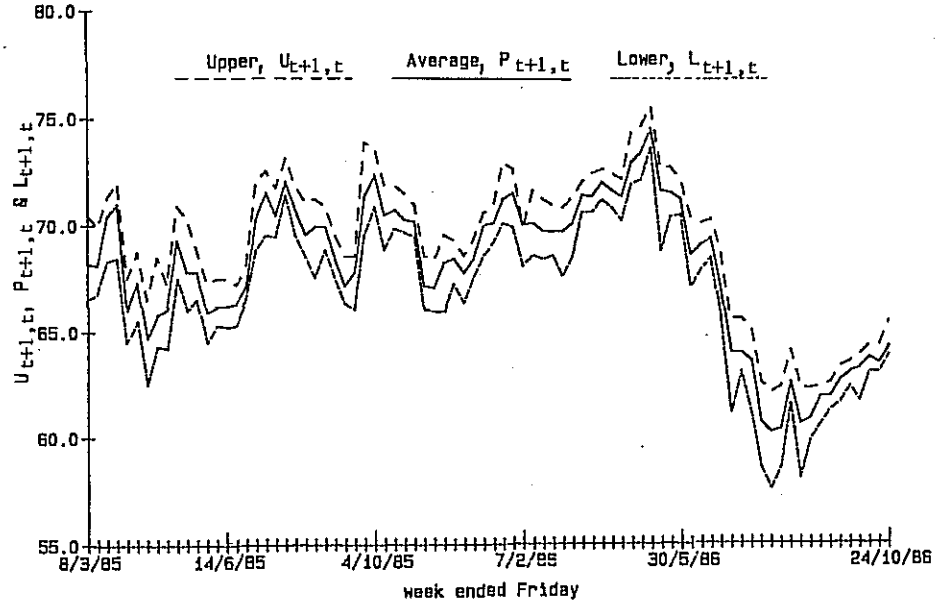


Figure 27

High, Average and Low Values of Four-week Forecast of the Australian Dollar

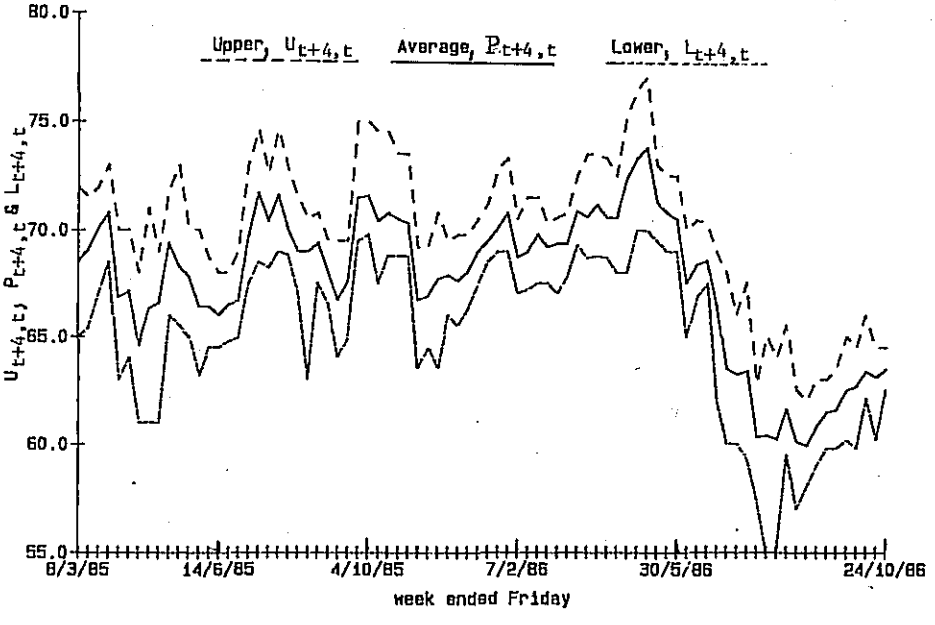


Figure 28

High and Low Values of One-week Forecast
and the Actual Values of the Australian Dollar

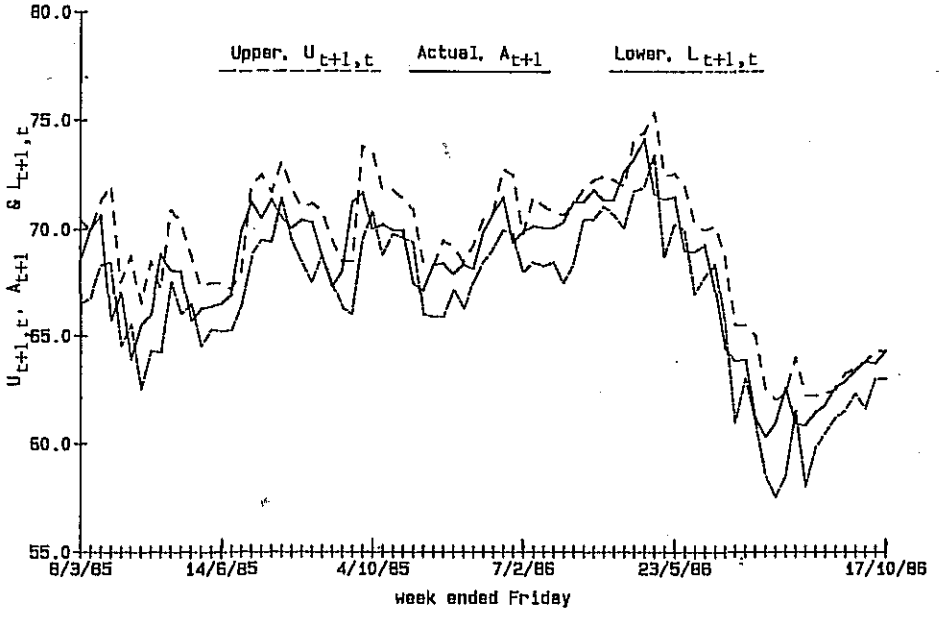
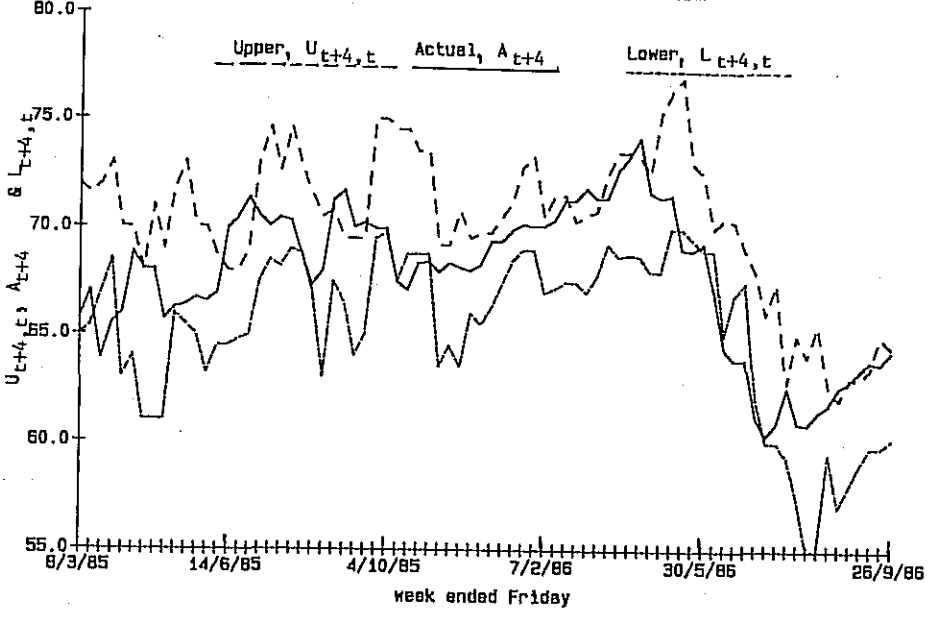


Figure 29

High and Low Values of Four-week Forecast
and the Actual Values of the Australian Dollar



the rate will be outside the band.

Columns (2) and (4) in Table 9 contain the band widths defined as

$$B_{t+\tau,t} = U_{t+\tau,t} - L_{t+\tau,t}, \qquad \tau = 1,4.$$

As can be seen from the third-last row of the table, on average the four-week band is twice as large as the one-week band. To what extent does the market percieve the upside risk to be more or less the same as that for the downside? In other words, how symmetric is the band around the average? This can be answered by computing the difference between the upper part of the band, $U_{t+\tau,t} - P_{t+\tau,t}$, and the lower part, $P_{t+\tau,t} - L_{t+\tau,t}$,

$$Z_{t+\tau,t} = (U_{t+\tau,t} - P_{t+\tau,t}) - (P_{t+\tau,t} - L_{t+\tau,t}), \qquad \tau = 1,4.$$

If the average is mid-way between the upper and lower values, Z is equal to zero. The Z variable is tabulated in columns (3) and (5) of Table 9. The last row of the table shows that the means of the Z-values are not significantly different from zero at conventional levels. The conclusion is that the band is symmetric for both the one-week and four-week horizons.

It is also of interest to examine the relationship (if any) between the band width and the survey errors. Figure 30 gives a scattergram of $B_{t+1,t}$ against the survey errors, $A_{t+1} - P_{t+1,t}$. Figure 31 is the four-week version of Figure 30. These figures both indicate that there seems to be almost no relationship between the two variables. This is also the case in Figures 32 and 33 where we plot the widths of the band against the absolute values of the survey errors.

Table 9

FORECAST BAND WIDTH AND ASYMMETRY MEASURES
FOR THE AUSTRALIAN DOLLAR

(US cents)

Date	One-week		Four-week	
	Band width	Degree of asymmetry of band	Band width	Degree of asymmetry of band
	$B_{t+1,t}$	$Z_{t+1,t}$	$B_{t+4,t}$	$Z_{t+4,t}$
(1)	(2)	(3)	(4)	(5)
8/3/85	4.0	.6	7.0	.0
15/3/85	3.1	.5	6.1	-1.3
22/3/85	3.0	-1.2	5.0	-1.2
29/3/85	3.5	-1.5	4.5	-.1
4/4/85	3.0	.0	7.0	-.6
12/4/85	3.25	-.37	6.0	-.26
19/4/85	4.0	-.4	7.0	-.14
26/4/85	4.2	1.2	10.0	-.6
3/5/85	3.0	-.8	8.0	-3.2
10/5/85	3.4	-.2	5.8	-1.0
17/5/85	4.3	.7	7.5	1.9
24/5/85	2.3	-.3	5.1	-.5
31/5/85	2.8	.0	6.8	.4
7/6/85	2.2	.4	4.2	.4
14/6/85	2.3	.3	3.5	.5
28/6/85	1.9	-.1	3.2	-.2
5/7/85	1.5	.3	4.0	.6
12/7/85	3.2	.2	5.5	1.1
19/7/85	3.0	-1.0	6.1	-.3
26/7/85	2.3	.3	4.4	.0
2/8/85	1.7	.5	5.6	.4
9/8/85	2.3	-.1	4.0	1.6
16/8/85	2.5	.5	4.5	.5
23/8/85	3.7	-1.1	7.5	-4.5
30/8/85	2.0	-.2	3.3	-.5
6/9/85	2.0	.2	3.0	.0
13/9/85	2.2	.6	5.5	.1
20/9/85	2.5	-1.1	4.5	-.7
27/9/85	4.3	.7	5.5	1.5
4/10/85	2.7	-.3	5.2	1.6
11/10/85	3.0	-.2	7.0	1.2
18/10/85	2.0	.2	5.7	1.7
25/10/85	1.8	-.6	4.7	1.3
1/11/85	1.5	.1	4.7	1.7
8/11/85	2.5	.3	5.7	-.7
15/11/85	2.4	.2	4.7	-.1
22/11/85	3.6	-1.0	7.3	-1.1
29/11/85	2.0	-.4	3.5	-.3
6/12/85	2.2	-.6	4.3	.1
13/12/86	1.8	.0	3.5	-.1
10/1/86	2.0	-.2	3.1	-.1

(contd)

Table 9 (contd)

Date	One-week		Four-week	
	Band width	Degree of asymmetry of band	Band width	Degree of asymmetry of band
	$B_{t+1,t}$	$Z_{t+1,t}$	$B_{t+4,t}$	$Z_{t+4,t}$
(1)	(2)	(3)	(4)	(5)
17/1/86	1.7	-.1	2.7	.7
24/1/86	2.8	.6	3.8	1.6
31/1/86	2.7	-.5	4.3	.7
7/2/86	1.8	.0	3.5	.1
14/2/86	3.0	.0	4.3	.7
21/2/86	2.8	.2	4.0	-.6
28/2/86	2.3	.1	2.8	-.6
7/3/86	3.2	-1.0	3.6	-1.2
14/3/86	2.8	-.4	3.0	-.2
21/3/86	1.4	-.2	3.2	.0
28/3/86	1.8	.4	4.8	1.0
4/4/86	1.4	-.2	4.7	-.1
11/4/86	1.6	.0	4.6	1.0
18/4/86	1.9	-.3	4.5	-.7
24/4/86	2.4	.4	7.3	-1.5
2/5/86	2.5	-.1	6.4	-.2
9/5/86	1.9	.1	7.0	-.6
16/5/86	3.8	-1.8	3.5	-.1
23/5/86	2.3	.1	3.5	-.1
30/5/86	1.6	.2	3.5	.5
6/6/86	3.3	.3	5.0	.0
13/6/86	2.2	-.2	3.6	.6
20/6/86	1.8	.0	2.8	.6
27/6/86	3.3	.1	7.0	-2.0
4/7/86	4.5	-1.3	8.0	1.0
11/7/86	2.5	.7	6.0	-.4
18/7/86	4.0	-1.0	8.2	.0
25/7/86	4.0	-.2	5.4	-.4
1/8/86	4.5	-.7	10.0	-.8
8/8/86	3.8	.2	9.0	-1.4
15/8/86	2.5	.5	6.0	1.8
22/8/86	4.2	-.8	5.5	-.7
29/8/86	2.4	.4	4.0	.2
5/9/86	1.8	-.8	4.0	.4
12/9/86	1.3	.0	3.2	-.16
19/9/86	1.7	-.4	3.7	.1
26/9/86	1.2	-.2	4.8	.2
3/10/86	2.2	-1.0	4.7	-1.1
10/10/86	1.3	-.1	3.9	1.3
17/10/86	1.3	.5	4.3	-1.5
24/10/86	1.6	.8	2.0	.0
Mean	2.6	-.13	5.1	-.04
Standard error	.1	.07	.2	.12
t-value		-1.94		-.30

Figure 30

One-week Forecast Band against One-week Survey Errors for the Australian Dollar

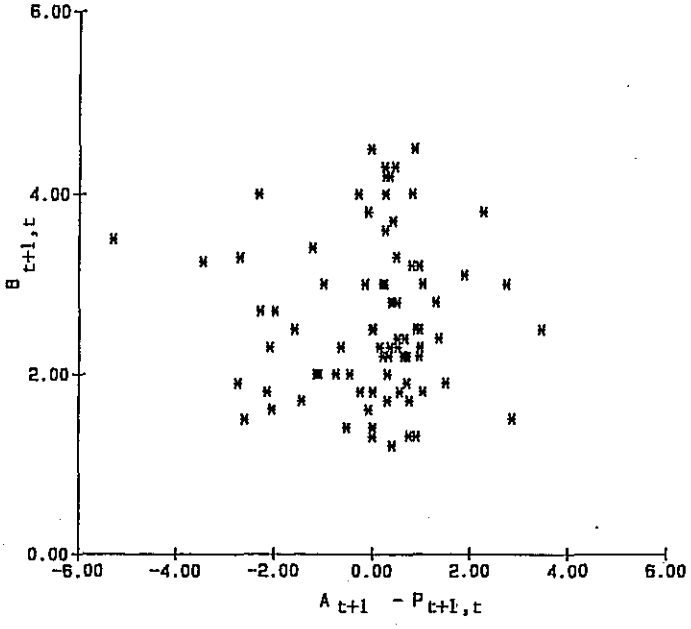


Figure 31

Four-week Forecast Band against Four-week Survey Errors for the Australian Dollar

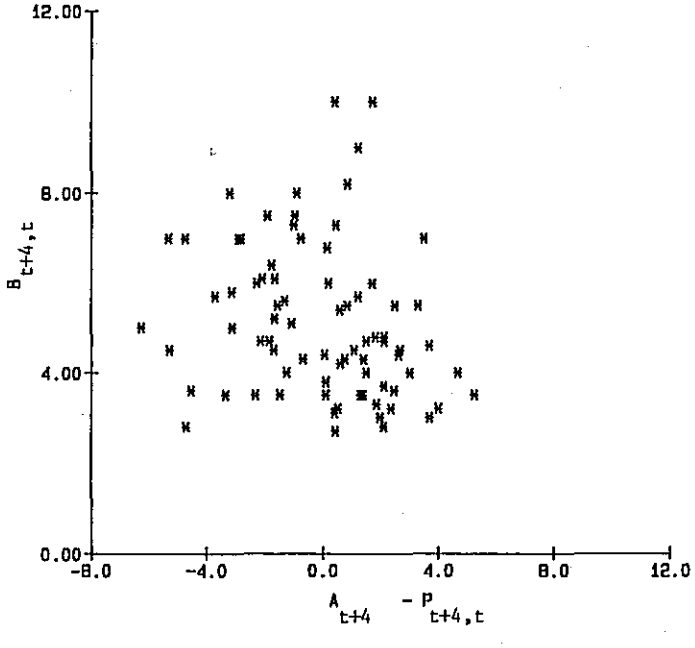


Figure 32

One-week Forecast Band against Absolute Value
of One-week Survey Errors for the Australian Dollar

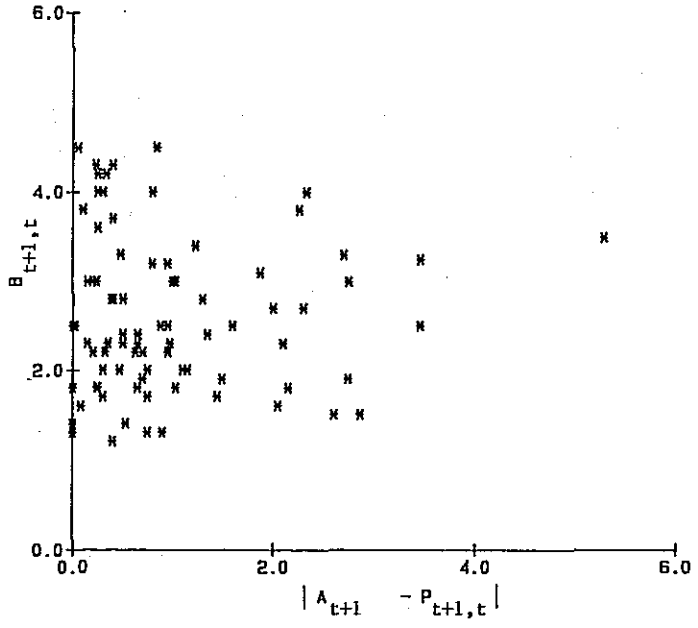
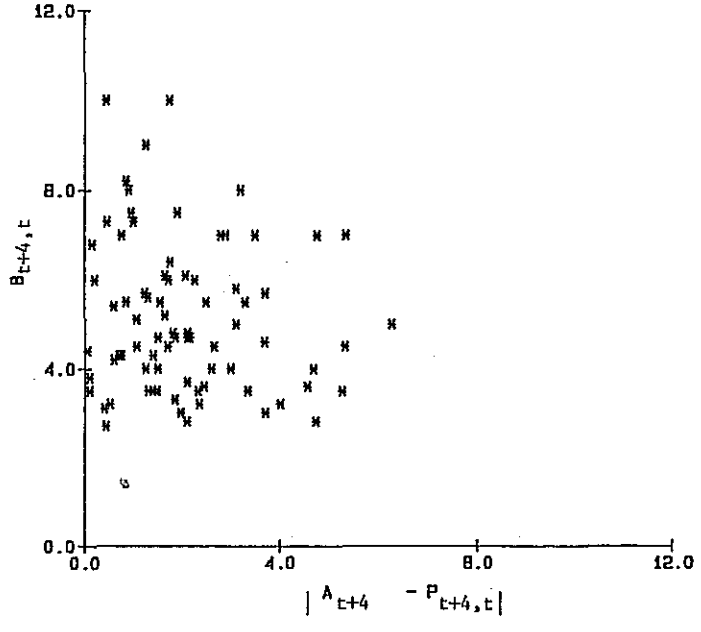


Figure 33

Four-week Forecast Band against Absolute Value
of Four-week Survey Errors for the Australian Dollar



9. COMPARISON WITH OTHER STUDIES

Frankel and Froot (1985) use survey data to test some hypotheses regarding exchange rate expectations. One of their major findings is that the actual exchange rate follows a random walk. They conclude that investors in forming their expectations would do better to put more weight on the contemporaneous value of the rate. This agrees with our result that the survey forecasts receive a small weight relative to the random walk in the composite forecast.

Dominguez (1986) examines the rationality of market surveys using the data provided by Money Market Services. The forecasts refer to the British pound, the German mark, the Swiss frank and the Japanese yen. The data used in the study are derived from predictions made by 30 professional exchange rate forecasters for the period from October 1983 to March 1986. The study concludes that the survey data fail consistently in predicting the future rate, and do no better than using the current spot rate. Again, this finding is consistent with ours.

A recent Australian study using survey forecasts is by Lowe and Trevor (1986). This work examines the exchange rate forecasts published in the Australian Financial Review (AFR) from March 1985 to December 1985. These forecasts relate to predictions of 49 foreign exchange dealers of the $A/$US and $US/Yen exchange rates for a one-week horizon. The study compares the accuracy of these forecasts with those generated from simple forecasting rules including no-change (the random walk model).

Lowe and Trevor use three criteria to compare forecasting performance: the mean absolute error (MAE), the mean square error (MSE) and the percentage of forecasts which predict the correct directional

movement. The authors find that the survey is slightly superior to using simple forecasting rules (including no-change) on the basis of the MAE criterion. On the basis of the MSE, they find that the survey is no better than no-change. This finding is also in agreement with ours for the one-week horizon. For the four-week horizon, however, we find the opposite to be true (see Tables 5 and 6).

On the percentage of forecasts predicting the direction of change, Lowe and Trevor find that the AFR forecasts produced the lowest percentage in the wrong direction (35 percent). Comparing this with the benchmark models, they find that the extrapolative model was the only one to produce forecasts in the wrong direction for less than 50 percent of the time. Our results indicate that 42 percent of the survey forecasts are in the wrong direction (see Table 7 for the one-week horizon). These results seem to be in reasonable agreement.

10. CONCLUSION

This paper has used a new set of data provided by The Australian newspaper to analyse the ability of foreign exchange market participants to forecast the future value of the Australian dollar. The main focus of the paper was to assess the accuracy of the forecasts and to compare them with simple alternatives. To provide benchmark forecasts, we use a univariate time-series model. The data indicate that the rate follows a random walk, whereby the current rate is the best predictor of the future rate. This result is consistent with the theory of efficient markets.

In terms of mean square error, we find that the random walk model performs slightly better than the survey for the one-week horizon; the opposite is true for the four-week horizon. Regarding predicting the direction of movement, the results indicate that 42 percent of the one-week survey forecasts are in the wrong direction. A similar result also holds for the four-week horizon.

We formed an optimal portfolio of forecasts by computing a weighted average of the survey forecasts and those from the random walk model. We found that the optimal weight given to the survey forecasts was insignificantly different from zero. On this criterion, the results indicate that The Australian's forecasts are outperformed by the simple alternative of no-change extrapolation.

We also analysed the nature of the forecast band defined as the difference between the highest and lowest individual forecasts in the survey. We found that there is, on average, a 21 percent chance of the actual rate lying outside the one-week forecast band. For the four-week horizon, there is a 27 percent chance. We also found that the band is symmetric around the average. An examination of the relationship between the band width and the forecast errors revealed that there was almost no relationship.

In conclusion, it is fair to say that the survey forecasts contain some information. This information would seem to be well worth its cost, $A 0.40 per week, the cost of the newspaper.

Footnotes

1. It is worth mentioning here that Hakkio (1986) carried out a Monte Carlo study of the performance of four different tests of the hypothesis that the exchange rate follows a random walk. He found that the Q-statistic performs the best.

2. Note that Figures 9 and 19 are the same.

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