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THE ACCURACY OF HOUSING FORECASTING IN AUSTRALIA

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ABSTRACT

Forecasting is an integral part of all business planning, and forecasting the outlook for housing is of interest to many firms in the housing construction sector. This research measures the performance of a number of industry forecasting bodies; this is done to provide users with an indicator to of the value of housing forecasting undertaken in Australia.

The accuracy of housing commencement forecasts of three Australian organisations – the Housing Industry Association (HIA), the Indicative Planning Council for the Housing Industry (IPC) and BIS-Shrapnel - is examined through the empirical analysis of their published forecasts supplemented by qualitative data in the form of opinions elicited from several industry 'experts' employed in these organisations.

Forecasting performance was determined by comparing the housing commencement forecast with the actual data collected by the Australian Bureau of Statistics on an *ex-post* basis. Although the forecasts cover different time periods, the level of accuracy is similar, at around 11-13% for four-quarter-ahead forecasts. In addition, national forecasts are more accurate than forecasts for individual states. This is the first research that has investigated the accuracy of both private and public sector forecasting of housing construction in Australia. This allows users of the information to better understand the performance of various forecasting organisations.

Keywords: Housing, housing commencements, forecasting, accuracy, Australia.

INTRODUCTION

Forecasting is an integral part of all business planning, and forecasting the outlook for housing is of interest to many firms in the housing construction sector. However, in spite of the importance of forecasting housing activity, little research has been undertaken to determine the accuracy of forecasts produced by high profile forecasting organisations in Australia. This research attempts to redress that situation by measuring the performance of a number of industry forecasting bodies. This is done to provide an indicator to users of the value of housing forecasting in Australia.

The housing industry needs to strategically plan for the effects of future changes in the economy and a number of public and private sector organisations publish activity forecasts for this purpose. Many studies have examined the accuracy of forecasts of major economic indicators such as inflation and economic growth (McNees and Ries 1983; Adams 1986). These have shown that some economic indicators are more consistent than are others, and so easier to predict. In addition, some economic indicators change at different rates under different conditions, and at different times. It is important; therefore, to know the level of confidence that can be placed in the forecast, this is because if unreliable forecasts are used they may turn out to be misleading. To do this, the performance of economic forecasters needs to be consistently monitored and put into the context of the economic circumstances of the time.

Very few studies have considered the forecasting of housing commencements. One study by Weber and Devaney (1996) in the USA, investigated the forecasting accuracy of housing starts (commencements), in order to determine whether consumer

sentiment could be used to improve forecasts of the number of housing starts. Three forecasting models were examined using combinations of time-series models with indices of housing and consumer confidence. This involved the use of two sentiment surveys: The University of Michigan's Index of Consumer Sentiment (ICS) and the Index of Housing Sentiment (IHS). The results showed that inclusion of the surveys reduced the Root Mean Squared Error (RMSE) of the statistical forecasts by approximately 34% - the forecasts being produced using an Error Correction Model (ECM) and a Box-Jenkins Auto-regressive Integrated Moving Average (ARIMA) model. The consumer sentiment measures were both based on five questions, eliciting the respondents' view of current business conditions as well as their perceptions of future economic prospects. In addition, the IHS survey tracked consumer views on whether the current period was a good or bad time to buy a house. While the IHS forecasts were slightly more accurate, the near identical specification and high statistical correlation between the IHS and ICS forecasts suggested that both indices reflect similar information and neither is superior to the other in forecasting housing starts, a somewhat surprising finding, given the more narrowly defined Index of Housing Sentiment.

Forecasting is an essential aspect of all business planning, the above research has shown that qualitative and quantitative methods can be used to make predictions about the future levels of housing activity. It is also possible that different forecasting methods will be more accurate at different times, or under different economic circumstances. However, this is seldom done in practice, and hence the motivation in this paper to determine the level of accuracy of forecasts produced by these organisations. This research considers the accuracy of housing commencement

forecasts of three Australian organisations – the Housing Industry Association (HIA), the Indicative Planning Council for the Housing Industry (IPC) and BIS-Shrapnel – and is examined through the empirical analysis of their published forecast data. This is supplemented by qualitative data in the form of opinions elicited from several industry 'experts' employed in these organisations.

METHOD

Forecasting performance was determined by comparing the forecast with the actual number of housing commencements for the period as collected several months later by the Australian Bureau of Statistics. The forecasts produced by three organisations were collected to analyse the performance of Australian housing industry forecasting. These organisations comprised:

1. The Housing Industry Association (HIA)-A private-sector industry association comprising mainly house construction contractors. Forecasts produced by the HIA were produced by an economic forecaster who is employed to produce predictions as an information service to members,

2. The Indicative Planning Council for the Housing Industry (IPC) – Government sponsored agency directed by an industry advisory board, which provides housing forecasts for use by industry and the general public.

3. BIS-Shrapnel-A private sector consultancy firm, which produces economic and housing forecasts as part of a subscription service to clients.

Data from each of the above organisations was collected and examined for suitability in determining the level of accuracy and bias of their forecasts. The information related to the forecast of the number of housing commencements in each time per period (quarterly, six-monthly, or yearly). These forecasts were then compared with the actual number of commencements for the period on an *ex-post* basis.

In addition, each of the above organisations was contacted and invited to comment on their methods. The interviewees comprised representatives from: the Canberra and Melbourne offices of the Housing Industry Association; a Senior Economist, Master Builders Association of Western Australia; and the Deputy Executive Director, Master Builders Association, Canberra. During interviews the aims of the forecasting were articulated, together with the costs associated with producing them, and any other additional information that affected their forecasting.

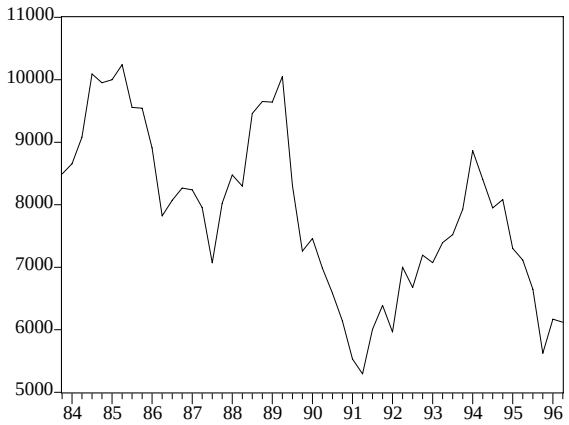
RESULTS

This research was limited to publicly available published information on housing forecasts, of which little actually exists. The results of the analysis, and discussion, of the three organisations' forecasts follow.

The Housing Industry Association

The Housing Industry Association (HIA) uses a combination of time-series and judgemental methods. Quarterly forecasts from 1983 to 1996 were published by the Victorian office, and have been analysed below.

Fig 1. Australian Housing Starts



Let a_t be the actual value for housing starts at time t, as shown in Fig 1. Let $f_{j,t}$ be the j quarter-ahead forecast of a_t. The series of one-quarter-ahead forecasts, $f_{1,t}$, is plotted with a_t in Fig 2. The one-quarter-ahead forecast errors are defined as $e_{j,t} = a_t - f_{j,t}$. The one-quarter-ahead forecast errors $e_{1,t}$ are plotted in Fig 3a.

Figure 2. One-quarter-ahead forecasts

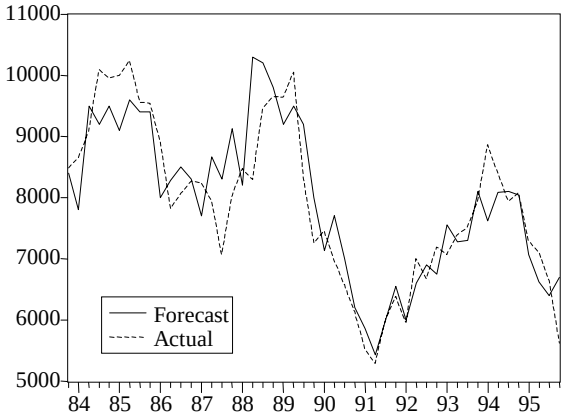


Figure 3a. One-quarter-ahead forecast errors

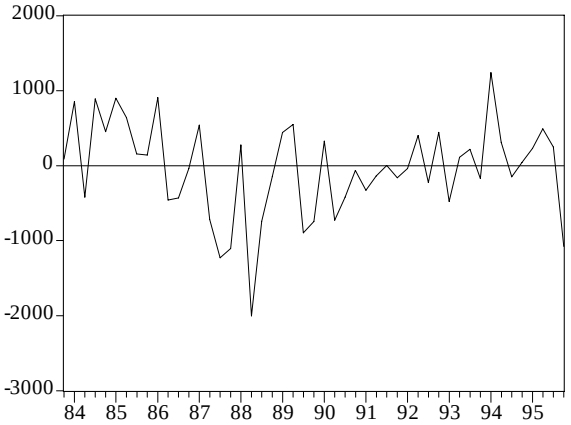


Table 1. Evaluation of the HIA forecasts

Quarters ahead	RMSE[1]	MAPE[2]	U[3]	Correct direction (%)	Bias
1	628.12	6.11	1.02	71	–40.31
2	790.22	7.87	1.30	59	–219.48
3	911.15	9.38	1.02	71	–204.22
4	1071.21	11.40	0.95	65	–371.92
5	1274.27	14.55	0.93	64	–666.86
6	1496.06	17.16	0.97	70	–903.92*
7	1644.44	18.87	0.96	71	–1051.19*

1- Root Mean Squared Error, 2-Mean Absolute Percentage Error, 3-Theil's U

The absolute values of the RMSE statistics are not easily interpretable. However, the relative values show that the forecasts become less accurate as the forecast horizon increases. This is to be expected, as it is more difficult to forecast further into the future. The same conclusion follows from the MAPE statistics – the average percentage error is 6.11% when forecasting one quarter ahead and 18.87% when forecasting seven quarters ahead.

The *U* statistic for one and two-quarter ahead are much greater than one This is not a good result because it shows that using the naive forecast would have been more accurate. Naive forecasts are very simple and cheap to calculate and perform about as well or better than the HIA forecasts for two-quarter horizons. The three-quarter-ahead forecasts have *U* almost equal to one, and the longer horizon forecasts have *U* values slightly less than one, which indicates slightly better forecasting.

The Correct Direction statistics are all greater than 50%, and the bias statistics are all negative. Since the forecast errors are calculated as $e_{j,t} = a_t - f_{j,t}$, this means that the HIA forecasts have a tendency to be too large. However, this tendency is statistically significant for the six and seven-quarters-ahead forecasts only.

The results for forecasting efficiency are summarised in the following estimated regressions.

$$\hat{e}_{4,t} = -336.1 + \underset{(2.60)}{0.34} e_{4,t-4},$$

$$\hat{e}_{5,t} = -645.5 + \underset{(2.08)}{0.45} e_{5,t-5} - \underset{(-1.76)}{0.37} e_{5,t-6}.$$

These equations are simple autoregressions with the order selected using Akaike Information Criterion (AIC). The figures in brackets are *t* statistics, which if greater than two indicate that the corresponding coefficient is significantly different from zero. A significant coefficient on a lagged forecast error indicates forecast error autocorrelation.

The first equation, for the four-quarter-ahead prediction errors, shows significant autocorrelation because of the significant first lags. Therefore, the four-quarter-ahead forecasts are inefficient. The other equation shows significant inefficiency exists for forecasts five-quarters ahead. Equations for the one, two, three, six and seven-quarters-ahead forecasts are not presented because no significant autocorrelation was found.

For further visual inspection, graphs of the forecasts and forecast errors are given for the two up to seven-quarters-ahead forecasts. In each graph, the errors are scaled on the left axis and the forecasts and actual values on the right axis.

Fig 1b. Two-quarters-ahead forecasts

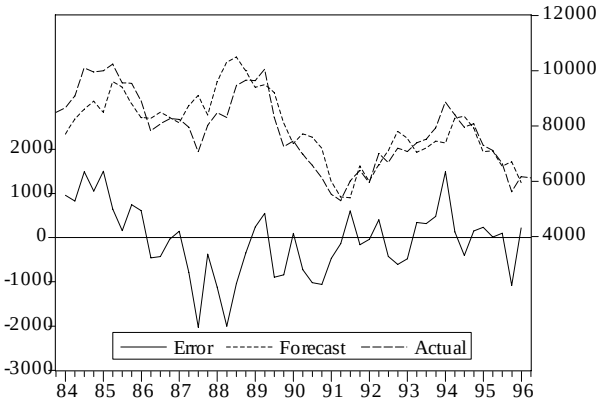


Fig 2c. Three-quarters-ahead forecasts

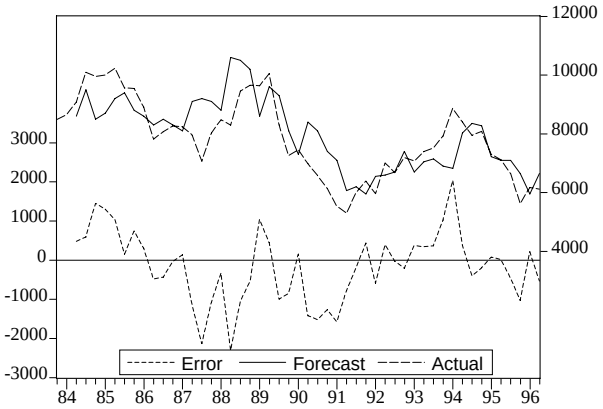


Fig 3d. Four-quarters-ahead forecasts

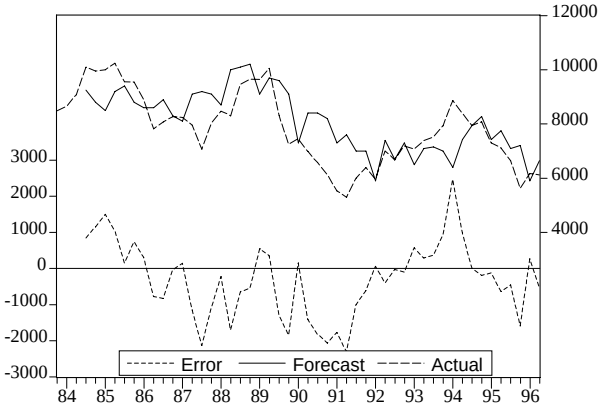


Fig 3e. Five-quarters-ahead forecasts

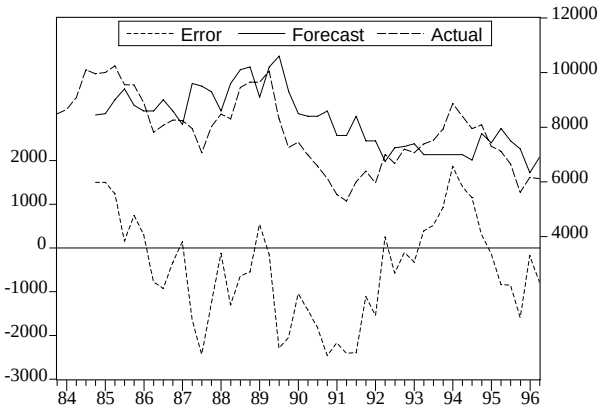


Fig 3f. Six-quarters-ahead forecasts

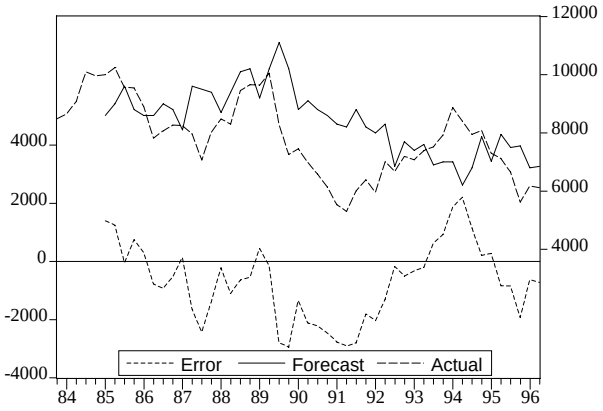
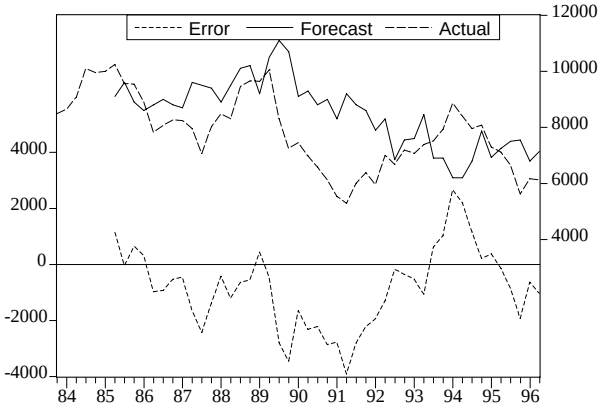


Fig 3g. Seven-quarters-ahead forecasts



The Indicative Planning Council for The Housing Industry (IPC)

The IPC was a government-sponsored organisation that produced half-yearly forecasts, for each Australian State and nationally. Forecasts were collected for the period 1985 to 1998. The IPC used a combination of sophisticated econometric models with an adjustment based on subjective inputs.

National forecasts

The summary statistics for the IPC national forecasts are given in Table 2.

Table 2. Evaluation of the IPC Australian forecasts

Quarters ahead	RMSE[1]	MAPE[2]	U[3]	Correct direction (%)	Bias
1	1131	2.6	0.49	85	318
2	1868	4.4	0.46	77	676
3	2678	5.8	0.46	77	1227
4	4652	10.2	0.64	62	2364*
5	4969	9.6	0.59	67	1714
6	5225	10.8	0.56	83	1213
7	4912	11.3	0.50	92	618
8	5874	14.9	0.59	92	-48

1- Root Mean Squared Error, 2-Mean Absolute Percentage Error, 3-Theil's U

As is expected, the RMSE and MAPE statistics increase with the forecast horizon. As mentioned earlier, not too much should be made of comparisons across forecast horizons. For example, because all forecasts are made in June each year, the one-quarter-ahead forecasts are always forecasting the September quarter while the two-quarters- head forecasts are forecasting the December quarter. While the data are

seasonally adjusted, it is still possible that the September quarter is inherently easier to forecast than the December quarter, or *vice versa*.

The *U* statistics are good, showing that the forecasts are approximately twice as accurate as the naive forecasts in RMSE terms. Therefore, the IPC forecasts do have some benefit over the naive forecasts. In addition, the forecasts quite often predict the change to be in the correct direction, as much as 92% of the time.

The bias statistics are mostly positive, which means that there is a slight tendency to under-forecast. This is particularly the case for the four-quarters-ahead forecasts where the bias is statistically significant. This is likely to be due to a one-off large error for the June quarter of 1994 of 11088, or 23%, compared with the average percentage error of 10.2%.

No statistically significant evidence of inefficiency was found in these forecasts so no autocorrelation equations are reported.

State forecasts

The summary forecast statistics for the IPC forecasts for New South Wales, Victoria, Queensland and Western Australia are given in Tables 3 to 6.

Table 3. Evaluation of the IPC New South Wales forecasts

Quarters ahead	RMSE[1]	MAPE[2]	U[3]	Correct direction (%)	Bias
1	1614	5.1	0.72	73	901*
2	2830	11.5	0.77	82	1022
3	3275	9.7	0.71	91	1378
4	3480	12.7	0.71	82	1400

1- Root Mean Squared Error, 2-Mean Absolute Percentage Error, 3-Theil's U

Table 4. Evaluation of the IPC Victoria forecasts

Quarters ahead	RMSE[1]	MAPE[2]	U[3]	Correct direction (%)	Bias
1	1447	7.2	0.89	73	-836*
2	2083	11.6	0.76	82	-396
3	2807	16.8	0.81	64	-1246
4	3713	21.4	0.99	73	-1074

1- Root Mean Squared Error, 2-Mean Absolute Percentage Error, 3-Theil's U

Table 5. Evaluation of the IPC Queensland forecasts

Quarters ahead	RMSE[1]	MAPE[2]	U[3]	Correct direction (%)	Bias
1	1395	4.9	0.50	82	582
2	3164	11.8	0.65	82	1533
3	6065	20.5	0.97	73	2364
4	3983	16.1	0.56	91	1465

1- Root Mean Squared Error, 2-Mean Absolute Percentage Error, 3-Theil's U

Table 6. Evaluation of the IPC Western Australia forecasts

Quarters ahead	RMSE[1]	MAPE[2]	U[3]	Correct direction (%)	Bias
1	950	7.8	0.61	73	261
2	2090	12.7	0.80	73	1030
3	2217	14.8	0.66	82	668
4	2343	17.4	0.61	91	784

1- Root Mean Squared Error, 2-Mean Absolute Percentage Error, 3-Theil's U

The IPC state forecasts generally share the same properties as the Australian forecasts. That is, they are mostly a considerable improvement on naive forecasts, predict in the correct direction and have mainly insignificant biases. No evidence of

forecast inefficiency was found. One interesting point was that the IPC generally under-predicted for all states except Victoria, where they generally over-predicted.

The HIA and IPC forecasts are for different time series over different but overlapping time periods. Therefore, only general qualitative comparisons can be made between the accuracy of the two sets of forecasts. It is clear, however, that the IPC forecasts have superior summary statistics to the HIA forecasts. It is not possible though to say by how much they are superior.

BIS-Shrapnel

The models were estimated on quarterly data from December 1959 to September 1980 using multiple-regression. Two approaches were used to test the forecasting ability of the models. Firstly, the models' short term forecasts were prepared with forecasts based on an analysis of the market information and short-term indicators of movements in building activity eg. real estate prices and vacancy rates.

Where necessary, trend forecasts of the model were then adjusted by a constant amount upward or downward to provide a link with the short-term deviation from the trend. Secondly, the model outputs were reconciled with the results of a demographic based approach. If the two approaches yielded significantly different results, a detailed examination of both the econometric and demographic approaches would be undertaken.

Table 7. BIS-Shrapnel forecasts (Indicators of performance only)

Quarters ahead*	RMSE[1]	MAPE[2]	U[3]	Bias
1	11,823	6.82	0.83	6,151

1- Root Mean Squared Error, 2-Mean Absolute Percentage Error, 3-Theil's U
* Forecast of annual housing commencements, Australia one year ahead.

The results of their forecasts show that BIS-Shrapnel performed quite well compared to the naive approach. Forecasts covered the period from 1979 to 1998. However, the results above can only be considered as an indication of forecasting performance. This is because a complete set of their forecasts could not be obtained.

DISCUSSION

The research concentrated on documenting the relative performance of forecasting housing commencement forecasts. So it makes sense to attempt to summarise the forecasting accuracy of the various organisations. However, it is important to note that each forecasting attempt was produced to meet a range of needs. All the IPC forecasts are comparable because they were all published at the same time. However, the other forecasts were produced at different economic times, therefore are strictly comparable. Nevertheless, the Table below (Table 8) outlines the Mean Absolute Percentage Errors of one-year housing commencement forecasts.

The results show that forecasting by the IPC had different levels of accuracy for forecasts at a national level compared to state based forecasts. The results seem to indicate that it is easier (lower forecasting error MAPE) to produce national forecasts

than forecasts for individual states. All the state-based forecasts produced by the IPC have MAPE within the range of 11.5% to 12 %. This is significantly different to the national forecast MAPE for the same period of 4.4%.

This conclusion seems to be validated by the results of the HIA forecasts. Table 8 shows that although the HIA forecasts cover a different time period to that of the IPC, the level of accuracy is similar. (i.e. 11.6% for HIA compared to 11.4 % IPC, Vic) Consequently, it is likely that housing commencements are more difficult to predict at a state level than they are at a national level.

Table 8. Comparative Performance of One-Year Residential Forecasts

Organisation & Location	Economic Period (3)	Forecast Variable	Error (MAPE)
Chase, USA	1976-1983	Investment in residential studies (Real), USA (1)	13.5%
DRI, USA	1976-1983	Investment in residential studies (Real), USA (1)	10.9%
WEFA, USA	1976-1983	Investment in residential studies (Real), USA (1)	10.5%
IPC, Aust	1985-1998	No. of Dwelling Commencements Aust (2)	4.4%
BIS-Shrapnel, Aust	1978-1998	No. of Dwelling Commencements Aust (2)	6.8%
IPC, NSW	1985-1998	No. of Dwelling Commencements NSW (2)	11.5%
IPC, Qld	1985-1998	No. of Dwelling Commencements QLD (2)	11.8%
IPC, WA	1985-1998	No. of Dwelling Commencements WA (2)	12.7%
IPC, VIC	1985-1998	No. of Dwelling Commencements VIC (2)	11.6%
HIA, Vic	1983-1996	No. of Dwelling Commencements VIC (2)	11.4%

(1) Adams, F. G. (1986) "The business forecasting revolution: Nation-Industry-Firm, Oxford University Press, New York p 143

(2) Indicative Planning Council and ABS Cat 8750/8752

(3) Forecast covers different time periods and so are not directly comparable

Representatives of the organisations interviewed suggested that if more current demographic and financial data were available it would increase the accuracy of the assumptions used in their models. In particular, it was suggested that if the forecasting variables were available at a regional level it would substantially improve their ability to estimate demand outside major state capital cities.

In addition, the Australian Bureau of Statistics (ABS) series related to housing finance also includes a variety of other loans that may not relate to the construction of new

homes, further adding to the difficulties associated with determining the link between Finance, Approvals and Commencements. According to one HIA interviewee, "The problem with housing finance is that the series is too volatile and therefore statistically unreliable when used for forecasting purposes". Nevertheless, the housing finance series remains an important data source which is relied upon by forecasting organisations.

Building Approvals produced by the ABS is another series that was considered a problem by the forecasters interviewed. Again, the interviewees suggested that it was becoming statistically unreliable for forecasting purposes. According to the respondents the difficulty was that the ABS makes many revisions to the data and that this makes it more difficult to use for forecasting purposes. The ABS current procedure is only to produce estimated data, so monthly statistics can fluctuate quite significantly. To quote one interviewee, "Sometimes you have to go to the data on quarterly basis in order to get the information that is needed. In other words, approvals and finance are less useful than they once were, and are becoming less reliable for forecasting purposes. This is making housing forecasting an even more difficult task".

In addition, the MBA interviewee suggested that business sentiment surveys are an important indicator of future prospects for housing. He suggested that if more extensive surveys of business attitude and consumer confidence were available it would very be beneficial to forecasters, especially for short to medium-term forecasts. This seems to support the research done by Weber (1996) where sentiment indicators significantly improved the accuracy of housing forecasts in the USA.

Past research has showed that different forecasting methods had different levels of performance (Adams 1986). According to the MBA interviewee, the problem with econometric forecasting methods is that there is no guarantee that the exogenous variable assumptions that underlie the forecast are correct. This issue was commented on extensively by all the forecasters interviewed. The HIA senior economist suggested that many of his forecasts have been "correct for the wrong reasons, and at other times incorrect but for the right reasons".

Many experts interviewed suggested that users of their forecasts had different needs anyway. The benefit to users is that it produces a picture of the future direction of the industry from which business planning becomes clearer. If this is so, accuracy is important, but so is a well-argued justification of the forecast and its underlying assumptions. This seems to support extensive research undertaken in the US by Adams (1986) where it is demonstrated that many organisations use extensive econometric models because of their ability to explain an entire system. This allows a structured model to be created, representing a certain paradigm of economic thinking. Once the paradigm is built it remains the task of individual firms to interpret their own reaction to it in the form of a business plan.

Furthermore, the survey undertaken by the American Statistical Society of major economic variables uses an average of a range of individual forecasters and thereby, according to Adams (1986), producing successful forecasts. However, the issue of averaging forecasts has the capacity to polarise opinions.

There has been considerable debate by Adams (1986) and Winkler and Makridakis (1993) about the merits or otherwise of simply averaging or combining point forecasts. The supporters of the concept suggest that it brings to bear different perspectives that are not explained in an individual model. In addition, research undertaken by Mills (1997) showed that time-series forecasts averaged with opinion-based forecasts out-performed the individual forecasts of building price movements.

Another perspective was also given by a MBA interviewee, who suggested that one of the advantages of averaging was that it allowed a group of forecasters to know what others have been thinking. In that way, it may lead them to modify their forecasts in the light of other alternative views. The other MBA interviewee, however, believed that a broad based consensus of different forecasts could discount the quality of the best forecast in the group, and therefore will not improve the understanding of the variable under consideration.

Consequently, it may be reasonable to suggest that predicting the future level of any economic variable is likely to remain "art form". Nevertheless, as McNees (1981) has pointed out, "To adopt perfection as the appropriate standard for forecast evaluation would not only be naive, but counterproductive. Naive because we know that the future cannot be predicted perfectly, and counterproductive because experience has shown that less than perfect forecasts provide valuable information about the future".

CONCLUSIONS

This research has been limited to publicly available published information on housing forecasts, of which little actually exists. Consequently, it has been difficult to gather sufficient data to fully explore the range of statistical measures necessary to conclusively identify either very good or very poor forecasting.

The *U*-statistics results indicate that the IPC method is an improvement over simply using a naive approach. In other words, the forecasting did add value by improving the accuracy of forecasts compared to what could have been achieved by simpler and less costly approaches. In addition, the forecasts did not display any significant inaccuracy. The IPC forecast for Australia predicted the correct direction of the time-series between 62% and 92% of the time, a result that seems appropriate under the circumstances, and better than chance alone.

The IPC's own review of its forecasting (IPC 1996) suggested that determining the direction of the time-series may be more important than the accuracy of the single point estimates. This introduces the notion that forecasting bias can be an important indicator of quality. The results of the IPC forecasts do not display any consistent bias overall but by their own analysis of the events (IPC 1996), there were circumstances when their forecasting underestimated the length of downturns and predicted recoveries in advance of their actual occurrence. In other words, the IPC admitted that a degree of optimism had crept into their forecasts at certain periods.

It was not surprising that both the HIA and MBA interviewees suggested that their members would prefer to see housing activity rise than fall. There was some evidence of forecasting inefficiency for forecasts four-to five quarters-ahead, but the effects are small and should not be significant to individual HIA members using the information for business planning purposes.

As has been already reported, many of the industry experts interviewed believed that improving the accuracy of housing forecasting would be a desirable goal. However, it should be said that they were less clear about how that goal should be achieved. This research did not attempt to quantify the economic value of improved forecasting, nor was any attempt made to determine the cost of producing the forecasts. Consequently, it was not possible to determine if the benefits of improved forecasting outweigh the cost of producing the forecast. It is also worth noting that the HIA or the IPC did not recover the full cost of producing housing forecasts. Instead, these organisations produce forecasts as part of a marketing and information service.

The long term planning of the community's need for housing must be high in the minds of both government policy makers and private sector firms. It may be reasonable to suggest that Governments have an interest in understanding the ongoing development of housing and for self-interest alone may derive benefit in encouraging better forecasting from the industry.

In conclusion, it may be useful for organisations with an interest in housing forecasts to keep a record of accomplishment of their own forecasting, or alternatively support a register which monitors the track record of forecasting performance. This could be

similar to the work undertaken by Stephan McNees at the Federal Reserve Bank in Boston, USA.

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