Forecasting Short-term

Listed Property Trust Returns

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The structure of securitised property markets offers investors the opportunity for short-term gains compared with the long-term horizon for direct property investments. These potential financial benefits can be exploited by using forecasting techniques which can provide regular superior short-term forecasts.

This research utilises the Australian accumulative Listed Property Trust (LPT) index, to critically evaluates weekly out-of-sample forecasts from three basic, and two advanced, forecast methods over a six-year period from 1998 to 2003. The forecast accuracy of the models yielded similar results, showing poor indication of future short-term accumulative LPT index performance. The forecasts were unable to predict, one week in advance, the direction of the accumulative LPT index. The advanced Holt-Winters Exponential Smoothing model was the preferred forecast model by a small margin.

A better understanding of the short-term movement in LPT performance will lead to improved accuracy of forecasting models and provide added value to an area of property research which should form an integral part of the decision-making process in the securitised property markets.

Introduction

The importance of commercial real estate as an asset class is well documented in investment and portfolio literature. Investment in real estate can be by direct ownership and through indirect (securitised) property vehicles. The structure of securitised property

offers investors the attraction of cost effective exposure to commercial property while maintaining liquidity, a central trading place and low transaction costs. This advantageous investment environment has provided a platform for securitised property to develop into a major investment class that can offer short-term gains compared with the long-term investment needed in direct property investments.

The increase in Australian managed (includes superannuation) funds and the allocation to securitised property demonstrates the changing property ownership structure and the growth in the securitised property market. In December 1989, of the AU$144 billion in Australian managed funds, approximately 5 percent was allocated to direct property and to securitised property. The property allocation has now (December 2004) changed with the average

Australian managed balanced fund primarily allocating 6 percent to securitised property and 1 percent to direct property in an environment where AU$767 billion (September 2004) is in Australian managed funds (ABS 2004 and Intech 2005).

Figure 1 illustrates the change in property allocation overtime for the average Australian managed balanced fund.

The development of property securities as an investment vehicle has provided another layer to property research. Fundamentally, securitised property research is similar to the analysis requirements of direct property ownership, with a focus on the long-term performance of the space, property and capital markets. In addition, the benefit of a liquid investment means further property research is needed to develop short-term strategies to effectively monitor and predict the movements in LPT prices in order to gain superior returns.

Formal modelling and forecasting for direct property has developed over the last 25 years and is now an essential part of the commer-

Figure 1: Average Australian Balanced Fund Allocation to Property

Direct Property — Securitised Property — Property allocation

Source: Intech 2005

cial property decision tool kit. However a major concern is the accuracy of these property forecast models. There is recent research on the accuracy of property forecast models, for example: Chaplin (1999), and Higgins (2001), have tested for short-term, out-of-sample forecast accuracy relative to direct property forecast models. The mixed results highlighted that out-of-sample forecast accuracy tests should follow general forecast theory (Makridakis et al 1998) and be based on the actual forecast requirements.

Furthermore, there has been extensive research (for example: Granger and Pesaran 2000, Gitman et at 2004) on the stockmarket and efficient market issues. Overall the research outcomes have emphasised how different asset markets react to the flow of information and the importance of forecast model evaluation particularly for short-term predictions.

With the focus on short-term movements in the LPT market, this research critically evaluates a variety of statistical methods to predict 'one step ahead' forecasts. Using an Australian LPT accumulative index, the research examines six years of weekly out-of-sample forecasts from three basic, and two advanced, forecast techniques. The success of each forecast method in predicting the actual index movement is then computed and the comparisons reported, along with a benchmark naïve (simple) forecast approach. Factors influencing performance are also examined and discussed.

Following this introduction, section two examines the Australian securitised property market. Section three details the data and selected forecast methods with the measurements of forecast error. Empirical findings are then analysed in section four, with the last section providing concluding comments.

Australian Securitised Property Market

PIR (2003) reported that total assets under Australian property management as of August 2003 are AU$163 billion with AU$104 billion held directly in Australian properties. During the past two years property investment has grown at a compound

rate of 15 percent. Influencing factors include a low interest rate environment, superannuation contributions, and a flood of investment funds to defensive assets due to global instability and underperforming equities The main contributions to the Australian securitised property market are as follows:

Listed Property Trusts

The success of Australian securitised property can be attributed to the strong performance of listed property trusts (LPTs). In the past few years, LPTs have consistently been one of the best performing asset classes (see Table 1) and have enjoyed a significant growth in market capitalisation, rising from AU$6 billion in 1993 to AU$82 billion as at December 2004 (ASX 2005). LPTs are now the fourth largest sector on the Australian Stock Exchange with 8 percent coverage (ASX 2005). The liquidity of LPT's can be demonstrated by the 640,000 LPT transactions on the ASX in 2003. This represented a turnover of 21 billion units for AU$24 billion compared with 336 direct commercial property transactions (above AU$5 million) for AU$12 billion (ASX 2005, CB Richard Ellis 2004).

Property Securities Funds

Property investment instruments have evolved with the LPT sector. Foremost are the property securities funds (PSFs), which are managed investment funds offering investors the opportunity to invest in a portfolio of property securities, particularity LPTs. Managed by professional fund managers, PSFs allow investors the opportunity to gain cost effective exposure to a number of listed property securities (Keng 2004).

Table 1 shows PSF returns for the last five years, with the long-term performance, as expected, being similar to the LPT sector and direct property market. According to the Intech (2004) survey of 24 PSFs, the one-year 9.0 percent return to December 2003 had a low standard deviation of ? = 1.0 percent. This supports the Keng (2004) study, which suggests PSFs mainly move together suggesting that more emphasis should be placed on tactical allocation decisions.

Property Trust Futures

Futures markets are well established in Australia for commodities, interest rates and the general share market. In August 2002, the ASX established a listed property trust futures market based on the underlying S&P/ASX 200 Property Trusts Sector Index. This allowed Australian fund managers to use LPT futures contracts to facilitate tactical (including short-term) asset allocation to protect the value of their LPT portfolios. By using a property futures contract, cash flows can be managed more effectively, through hedging LPT exposures, and reducing associated holding and transaction costs (ASX 2002, Newell and Keng 2004).

In summary, the Australian securitised property market is a successful financial product. Anchored by the LPT's, the sector has provided high yields, capital growth and relatively low levels of volatility. As the sector matures, the benefits of more liquidity will provide an opportunity to improve returns using analysis of short-term movements. The first step is to critically evaluate a range of forecast methods which can provide short-term forecasts.

Table 1: Performance of Australian Property Investments: December 2003

	3 Months	6 Months	1 Year	3 Year (average)	5 Year (average)
Property Securities Funds	7.6%	3.5%	9.0%	12.6%	10.2%
Listed Property Trusts	8.0%	3.5%	8.8%	11.9%	9.4%
Direct Property	2.7%	5.4%	11.9%	10.5%	10.6%
Shares	3.2%	7.0%	12.4%	3.2%	6.1%
Bonds	0.3%	0.0%	2.8%	6.8%	5.4%

Source: Property Council of Australia 2004 and InTect 2004

Data and Methodology

Data for this study covered a six year period: 1998 to 2003. The accumulative LPT index, constructed by Datastream International was available weekly from 6 January 1998 to 31 December 2003 and provided 319 data points.

There is extensive literature defining forecasting techniques and advanced forecasting methods and applications (for example: DeLurgio 1998, Makridakis et al 1998, Pindyck and Rubinfeld 1991). A common theme for short-term forecasts is the inertia (momentum) in the time series data which may exist to provide accurate and reliable forecasts. Makridakis et al (1998) outlines overwhelming empirical evidence of the benefits obtained by using statistical methods (often simple ones) to make short-term forecasts and to establish the uncertainty involved.

As a test, this research employed three straightforward forecast methods available on Microsoft Excel software, and two advanced forecast models accessible on E-Views software. The selected forecast techniques are as follows:

Basic Forecast Models

- Moving Average – projects a forecast value based on the average value of the variables over a specific number of preceding periods.

- Weighted Moving Average – projects a forecast value based on weighted variables over a specific number of preceding periods. As the most recent variable will usually provide the best guide to the future, the weights were decreased as the preceding variables got older.

- Simple Exponential Smoothing – projects a forecast value based on averaging (smoothing) past values of a series in a decreasing (exponential) manner. The forecast model uses the smoothing constant a, the magnitude of which determines how strongly the forecast value responds to the most recent period.

Advanced Forecast Models

- Holt-Winter Exponential Smoothing – projects a forecast value based on three smoothing equations (one for the level, one for trend and one for seasonality) on variables over a specific number of preceding periods (Makridakis et al 1998). The E-Views software automatically estimates the smoothing parameters (constants) by minimising the sum of past squared errors.

- Regression Model – projects a forecast value based on an econometric equation by using the "ordinary least squares" method to fit a line through a set of past observations. To confirm the validity of the data and forecast model, four key statistical tests were carried out.

- The regression model predicted a one-step ahead forecast based on up to four lagged periods, the independent determinants being short-term (90 day bank bills) and long-term (10-year bonds) interest rates, and the accumulative ASX index. In addition, the dependent (accumulative LPT index) was lagged for inclusion as an integral independent determinant. A stepwise multiple regression analysis detailed the preferred inter-relationship of the independent determinants. For the weekly dependent values (accumulative LPT index), the independent determinants were 10-year bonds and accumulative LPT index both lagged by one period.

A summary of the forecast models is exhibited in Table 2.

For the advanced forecast models, the E-Views "static forecasting" application permits, over the forecast period (1998 to 2003), a sequences of one-step ahead forecasts, using the actual variables rather than forecasted values.

Measures of Forecast Error

Forecast accuracy can be measured by the direction of forecast error, and by how close the forecast values are to actual values. The forecast error can be measured by Mean Error (ME) and Mean Percentage Error (MPE). More advanced methods for measuring forecast accuracy generally embody either the absolute values of the error, or the square of the errors, to prevent positive and negative forecast errors cancelling each other out. To evaluate the accuracy of the property performance forecasts, both systems were applied with the Mean Absolute Percentage Error (MAPE) and Root Mean Square Error (RMSE) tests.

Evaluating forecast models can relate to their effectiveness compared with alternative forecast methods. Comparisons can be made to a simple naïve model. In this instance, it is the most recent observation available prior to the forecast period. The Theil's (1966) U coefficient test indicates whether the errors in the forecast models are significantly smaller than those of the simple naïve model. Comparing the RMSE (standard error) of the forecast model values with naïve model values, Theil's equation provides a U value, which can be summarised as follows:

Table 2: Summary of Forecast Methods

	Forecast Parameters	Software Applications
Basic Forecast Methods		
Moving Average	four periods	Microsoft Excel
Weighted Moving Average	four periods	Microsoft Excel
Exponential Smoothing	smoothing constant a = 0.3	Microsoft Excel
Advanced Forecast Methods		
Holt-Winters Exponential Smoothing	smoothing parameters automatically estimated	E-Views
Regression Model	lagged independent determinants up to four periods	E-Views

(i)   U = 1 the naïve model is as good as the forecast model.

(ii) U < 1 the forecast model is better than the naïve model.

(iii) U > 1 the naïve model is better than the forecast model.

Applying the forecast error tests provides an easily interpreted, straightforward statistical application, yielding a good indication of the accuracy of the forecast models.

Results

Before investigating the predictive powers of the forecast models, preliminary visual analysis and descriptive statistics of the accumulative LPT index illustrated the structure of the weekly returns. Figure 2 shows the weekly returns of the aggregated LPT index.

Figure 2 shows the variations in weekly returns from the accumulative LPT index. This can be further illustrated by examining the descriptive statistics as displayed in Table 3.

Table 3 highlights the average aggregated LPT index return of nearly 0.2 percent per week. The standard deviation of +/- 1.8 percent and the data range of 12.3 percent illustrate the relative broad data distribution, which is supported by the low 1.4 Kurtosis reading. The shape of the data distribution reveals a widespread movement in aggregated LPT index, compared with the more constant total returns of a direct appraisal based property index. Performance persistence in property returns has been discussed widely in property

research literature (for example: Young and Graff 1997, Geltner et al 2003).

The movement in the aggregated LPT index was analysed for serial correlation. To achieve this, each year of the time series was lagged: weekly, monthly (four weeks), quarterly (13 weeks) and on an annual basis. Table 4 shows the correlation range over the six-year period: 1998–2003.

Table 4 shows that there is limited evidence of a regular pattern in the data, with the annual serial correlation being the most prominent at a low 0.31 to -0.30 correlation range. This supports the preliminary visual and descriptive statistics, which indicated the data's random nature.

The forecast models' success can be evaluated by testing their ability to predict, one week ahead, the direction of the accumulative LPT index. As the average return of the accumulative LPT index was close to zero (0.2 percent), the ability of the forecast models to predict the movement in the accumulative LPT index less and more than one standard deviations (-1.65 percent to 2.03 percent) was also measured. The results are shown in Table 5.

The forecast models' capabilities to predict the direction one week ahead of the accumulative LPT index was disappointingly low, being in a narrow 45 percent to 49 percent success range. There was no real improvement with the forecast models predicating the direction of returns with those data points less and more than one standard deviation. In all instances, the Regression model provided the best forecast method to

Table 3: Descriptive Statistics

Aggregated Listed Property Trust Index. Weekly Returns 6 January 1998 to 31 December 2003

Mean	0.19%
Median	0.10%
Standard Deviation	1.84%
Kurtosis	1.44
Skewness	-0.01
Minimum	-6.23%
Maximum	6.04%

Table 4: Serial Correlation per Annum 1998–2003

|	Serial Correlation Range 1998–2003
Weekly	-0.07 to -0.31
Monthly	0.04 to -0.22
Quarterly	0.02 to -0.27
Annual	0.31 to -0.30

predict the weekly direction of the accumulative LPT index.

The irregular nature of the accumulative LPT returns is highlighted by the limited success of the forecast models in predicting the direction of the accumulative LPT index and the low readings from the serial correlation analysis in Table 4.

The accuracy of each forecast model can be measured by ranking in order their forecast errors for each period to the actual accumulative LPT index. Table 6 illustrates the ranking frequency of each forecast model with percentage from first to fifth selection and with an average ranking.

Table 6 shows the ranking frequency of each forecast model. The Regression model provided both the best and worst ranked forecast. In contrast, the Holt-Winters Exponential Smoothing model was consistent with an average 2.68 ranking over the six-year forecast period. This suggests the regression model was more inconsistent than the time series based models, which can, in part, relate to the selected independent variables' volatility (10-year bonds and accumulative LPT index lagged by one week).

Figure 2: Aggregated Listed Property Trust Index – Weekly Returns 1998–2003
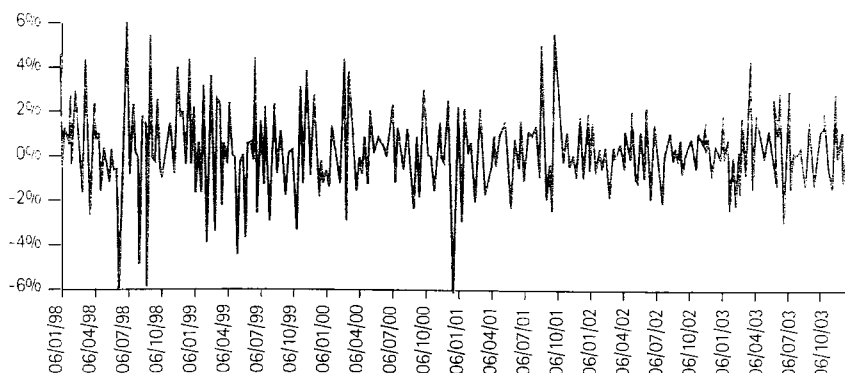
Source: Datastream 2004

Table 5: Forecasts Models Predicting the Direction of the Accumulative LPT Index

	Moving Average	Weighted Moving Average	Simple Exponential Smoothing	Holt-Winters Exponential Smoothing	Regression Model
Complete sample (1998-2003)	46%	46%	46%	45%	49%
Movement more than +/- 1 SD	44%	41%	42%	39%	47%
Movement less than +/- 1 SD	46%	47%	47%	46%	50%

Table 6: Ranking of the Forecasting Models

	Moving Average		Weighted Moving Average		Simple Exponential Smoothing		Holt-Winters Exponential Smoothing		Regression Model	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
1st selection	46	15%	39	12	3	11	93	30	101	32
2nd selection	73	23	52	17	81	26	78	25	29	9
3rd selection	78	25	79	25	100	32	30	10	26	8
4th selection	64	20	85	27	73	23	59	19	32	10
5th selection	52	17	58	19	25	8	53	17	125	40
Average	3.01		3.23		2.92		2.68		3.16	

The forecast accuracy and effectiveness tests for the one week ahead forecasts to actual accumulative LPT index returns are shown in Table 7.

Table 7 highlights the relatively narrow result range on each test across the simple and advanced forecast models. The Theil U value test showed that despite the relatively irregular movements in the accumulative LPT index, the forecast models were better at predicting the weekly accumulative LPT index movements than the naïve forecast model. Overall, the poor forecast accuracy and effectiveness test results indicated a slight preference for the Holt-Winters Exponential Smoothing model with the Regression model in most instances being the least accurate. A visual examination between these two can further illustrate the difference between weekly forecast values.

Figure 3 clearly demonstrates the different forecast patterns between the Holt-Winters exponential smoothing model and the Regression model. The more stable weekly forecasts from the Holt-Winters exponential smoothing model depended upon the internal patterns in the historical data to forecast the future. The more variable weekly forecasts from the Regression model were subject to the relationship between the dependent and independent data series. This can be further

Figure 3: Holt-Winters Exponential Smoothing vs Linear Regression One Week Ahead Forecasts
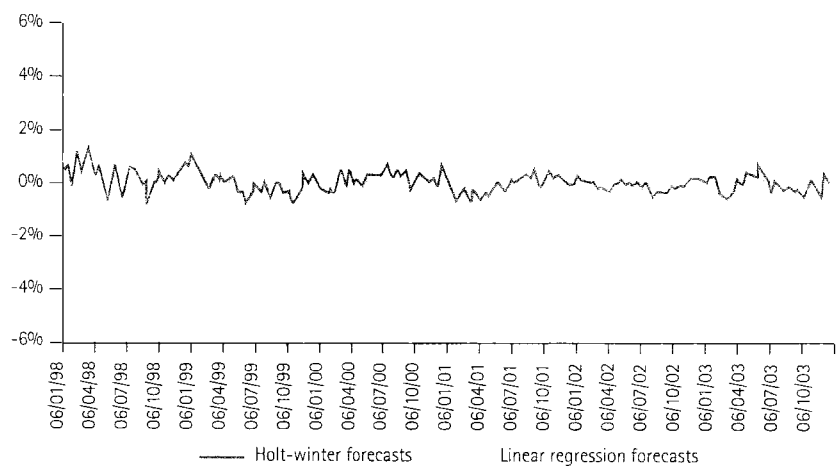
highlighted by comparing the standard deviation of Holt-Winters exponential smoothing forecasts ? = 0.4 percent with the Regression models ? = 1.2 percent.

The relatively low forecast accuracy recorded for the five models would restrict their application in any securitised property investment decision process. Nevertheless, to provide superior investment returns, there is a need by institutions to develop short-term strategies to predict the movement in LPT prices. Further research to better understand the key drivers underpinning LPT returns could lead

to alternative short-term forecast techniques for this major property investment class.

Conclusion

The structure of securitised property markets offers investors the opportunity for short-term gains compared with the long-term investment required for direct property investments. The potential financial benefits can be exploited by accurate regular short-term forecasts. Based on the Australian accumulative LPT index, this research examines the accuracy over six years

Table 7 Forecast accuracy and effectiveness tests

	Moving Average	Weighted Moving Average	Simple Exponential Smoothing	Holt–Winters Exponential Smoothing	Regression Model
Mean Error	0.05	0.04	0.04	-0.03	-0.04
Mean Percentage Error	0.03%	0.04%	-0.01%	0.01%	-0.07%
Mean Absolute Percentage Error	1.58%	1.63%	1.54%	1.47%	1.68%
Root Mean Squared Error	2.84	2.93	2.77	2.66	3.04
U Value	0.74	0.76	0.72	0.69	0.79

(319 data points) of weekly out-of-sample forecast values from three basic, and two advanced forecast methods.

The analysis on a range of statistical tests shows that the selected forecast methods provided poor indicators of future accumulative LPT index performance. The forecast models demonstrated similar forecast accuracy and effectiveness test results, and were unable to predict by one week the direction of the accumulative LPT index. The more advanced forecast models provided the greatest contrast, with the Holt-Winters Exponential Smoothing model giving marginally better overall results, although the relatively poorly performing Regression model did succeed in being the top ranked model on a first selection basis.

While all property forecasting is subject to some degree of uncertainty, the accumulative LPT index highlighted the short-term random movement in securitised property markets when compared with the more constant direct property market performance. More research on the short-term securitised property market performance could have significant practical implications on the Australian securitised property market. This can include the affect of publication dates for financial and economic indicators, and variations in the volumes of LPT transactions. More advanced forecast analysis could examine the possibility of combined and regime switching forecast models to improve the low accuracy record of the presented forecast methods.

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• **Presentation on Application of International Valuation Standards**
  John Dunckley (NZ) Chris Thorne (UK) Bob Connolly (AUS)
• **Presentation on Plant and Machinery Valuations** Roy Farthing (AUS)
• **Presentation on Business Valuations** Vern Blair (USA)
• **International Panel** John Edge (Moderator)
• **Closing Presentation** Clyde Eastaugh (API National President)

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