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INTEREST RATE EFFECTS ON LISTED PROPERTY TRUST PERFORMANCE

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Abstract: *In this study an Ordinary Least Squares (OLS) regression procedure was used in conjunction with daily and quarterly returns data to address the issue of whether Australian Listed Property Trusts (LPTs) are sensitive to changes in short-term and long-term interest rates over five-year and ten-year periods. At an aggregate level there is a weak inverse relationship evidenced between LPT returns and short-term interest rate fluctuations, whereas at a sector-level, a stronger relationship was found when using long-term interest rate data. LPTs are viewed as long-term assets, thus it makes sense that they show a stronger relationship with long-term investment indicators. This relationship was further examined and results indicate that the sensitivity to interest rate changes was partially due to the LPT's varied debt-to-equity levels. In addition, the study makes an attempt to investigate the determinants contributing to the LPT/interest rate relationship, by portraying LPTs as typically holding a combination of property, stock and bond factors. Thus, the reactions of these asset classes to interest rate fluctuations are examined in order to account for the previously determined inverse relationship between LPT returns and long-term interest rate fluctuations.*

1. Introduction

Listed Property Trusts (LPTs) are pooled real estate funds that provide individuals as well as institutional investors, the opportunity to invest in income-producing real estate properties and other property assets. Over 2006 the Australian economy experienced a series of interest rate rises, warranted by increasing inflationary pressures and strong economic growth. Rises in fruit and oil prices have largely contributed to the CPI rise. Also the demand for finance at attractive borrowing rates and the strengthening of domestic demand and output has contributed to an increase in inflationary risk.

The LPT sector has undergone considerable structural change in recent years, including increased levels of international property, increased levels of debt, incorporating property development activities via the use of stapled securities structures and a reduced number of LPTs via mergers and acquisitions. The potential impact of these structural changes could increase LPT risk and affect performance and could also see LPTs as more sensitive to interest rate changes and less reflective of property market conditions (Newell and Keng (2005a)).

A noticeable trend is the continuous rise in the use of debt as can be seen in Appendix 1, which shows the average annual debt-to-equity ratio of all of LPTs that have existed since 1998[1]. While these debt levels are still low in comparison to US REITs and the overall stock market (Newell and Keng (2005a)), they are largely attributable to a low interest rate environment and increased international property exposure.

So what does our rising interest rate environment imply, if anything, for the Australian property market, in particularly the LPT market? Traditionally, it has been argued that higher interest rates adversely affect property values, which in turn has a similar but more immediate affect on LPTs. This study analyses the relationship between LPT returns and percentage changes in the Australian short- and long-term interest rate, using a combination of daily and quarterly data in OLS regressions over five and ten year periods.

[1] Debt-to- equity ratios have not been weighted by the market capitalization of the individual property trusts.

The relationship was further examined by investigating whether or not the sensitivity to interest rate changes was intensified as LPTs were increasingly levered. This would imply that a higher debt ratio may increase the negative LPT return exposure to fluctuations in the interest rate.

The study also attempts to determine the contributing factors to the LPT/interest rate relationship, by viewing LPTs as providing returns that combine property, stock and bond attributes. Property, stocks and bonds all have features that are common in LPTs. This study explores how the reactions from direct property, stocks and bonds to interest rate fluctuations, are reflected in LPT returns.

The rest of the paper is outlined as follows. Section 2 provides a review of the past literature concerning both Australian LPTs, and U.S. Real Estate Investment Trusts (REITs). The methodology is outlined in Section 3 and the corresponding results in Section 4. Lastly, Section 5 holds the conclusions of the study.

2. Literature Review

Within the last two decades, there has been a growing interest in LPTs as the awareness of their benefits has expanded globally and the market increasingly maturing over that time. This section details two major areas of study concerning LPTs and REITs; effects of macroeconomic variables on securitised property, and the relationship between property trusts and their underlying property assets.

A number of studies have evaluated REIT and LPT performance in relation to the influence of economic factors such as interest rates, inflation, and the stock and bond markets. Such information is valuable in providing an improved understanding of property investment risk factors and yielding more accurate return forecasts. Chen and Tzang (1988) addressed the issue of whether REITs are sensitive to changes in short-term and long-term interest rates by using return data on equity and mortgage REITs. Their results indicated that REITs were found to be sensitive to changes in the long-term interest rate in 1973-1979, but in 1980-1985, REITs were sensitive to changes in both short-term and long-term rates. This is consistent with the theory that real estate is viewed as a long-term investment asset therefore it should have a higher correlation with longer-term investment indicators.

In 1994 Mueller and Pauley conducted a similar study, which was a result of the rising interest-rate environment in the US. The study analyzed the movement of REIT price changes during past interest-rate cycles and found different results to the earlier study, indicating that REIT price movements have a low correlation with changes in interest rates and a lower correlation with interest rates than with movements in the stock market as a whole. The study also tested interest rate influences on direct property returns and found that rising interest rates may have little impact on real estate but may be more of a coincidence that is better explained by general economic and real estate fundamentals associated with the supply and absorption of property at the time interest rates are moving. Here low negative correlations were observed during rising interest rate time periods, which implies that underleveraged real estate is not affected greatly by interest rate movements.

While many past studies have investigated whether REITs are systematically exposed to general stock-market risk and interest-rate risk, Allen, Madura and Springer (2000) examined how the sensitivity of REIT returns to these factors may be influenced by various REIT characteristics through the use of a multi-factor model of REIT returns. Such characteristics include asset structure, financial leverage, management strategy, and degree of specialisation. They found strong evidence suggesting that REIT returns are sensitive to long- and short-term interest rate changes, which is consistent with Chen and Tzang (1988). The study outlines three reasons as to why REITs may be affected by interest-rate movements which include: (1) Because investment in real estate relies heavily on borrowed funds, the general value of real estate can be influenced by the cost of financing, which affects affordability and demand. Thus, an upward movement in interest rates may result in reduced aggregate demand for real estate and lower valuations. (2) An increase in interest rates may also cause a higher cost of debt financing. (3) To the extent that real estate investors derive their required return on investments from a risk-free rate and a risk premium, a rise in interest rates could result in a higher required rate of return by real estate investors, which leads to lower valuations. A more recent study by Swanson, Theis and Casey (2002) investigates several aspects of the relationship between daily REIT stock risk premiums and various interest rates. Consistent with Allen, Madura and Springer (2000), the findings indicate that interest rates do impact REIT returns. A more recent analysis of the impact of gearing levels on the interest rate/LPT relationship was conducted by Papadakos (2004). It was found that debt levels of individual LPTs had insignificant contributions to their correlations with interest rates.

In another study by Newell and Keng (2005a) a variance decomposition procedure is used to assess the proportion of LPT volatility that is attributable to stock, bond, and property factors over 1985-2004. This was assessed at an LPT sector, LPT sub-sector and individual LPT level.. They found that property only makes a small contribution to LPT volatility. The influences of stocks on LPT performance has decreased significantly, while bonds remaining a strong factor of performance in recent years. In addition the results evidenced that there is still high and increasing levels of idiosyncratic risk, which is unexplained by property, bonds and shares, which is consistent with results from other studies on US REITs (Clayton and MacKinnon, 2000, 2003).

The question of whether or not the behavioural characteristics between LPT's and direct property are similar has been a popular area of past research and most results have evidenced some sort of relationship between securitised and unsecuritised real estate. However the magnitude of this relationship and methodology used has differed among several studies. Most of the research concerning this topic involves the analysis of an LPT and stock/bond relationship, which leads onto the question of whether or not LPTs can be used as a diversification asset in a mixed portfolio. Giliberto (1990) finds that the residuals from regressions of both real estate series (direct property and REITs) on financial asset returns are significantly correlated, although the correlation between equity REITs and property returns is insignificant.

Gyourko and Keim (1992) analysed the relationship between the NC (property index) Index returns and ERIET returns and found that EREIT returns did correlate on a lagged basis with the NC index returns while noting the problems with volatility, appraisal timing and appraisal smoothing in the NC index returns. Gyourko and Keim argue that due to infrequent appraisals the NC index is slow to react to macro economic information, while EREIT returns react quickly to new information and should therefore lead the NC index.

Similarly to the above study, Moss, Howard and Schneider (1996) also test for correlations between the NCREIF and EREIT Index. The results indicated that cash flows produced by the NCREIF index properties and EREIT dividends are correlated on a lagged basis. This is consistent with the theory that if securitised and unsecuritised property index returns are both valid measures of real estate returns then the two series should correlate with one another.

The main focus of Clayton and Mackinnon (2003) found that over the entire sample period, which ran from 1978-1998, large capitalisation stocks account for the greatest proportion of REIT

market volatility, followed by small cap stocks and then bonds. They found that direct property had an insignificant impact on REIT return volatility. However they conduct sub-period analysis, which provided contradicting results. Overall the results are consistent with the returns to securitised real estate gradually beginning to reflect the nature of underlying, unsecuritised assets. Studies, which have evidenced LPTs being more integrated with the stock market, include Li and Wang (1995), Mull and Soenen (1997) and Ling and Naranjo (1999).

In this paper an attempt is made to examine the impact of interest-rate fluctuations on the performance of LPTs in Australia, using OLS regression techniques. It contributes to past literature by firstly providing a current analysis which either supports or contradicts past theories and empirical findings, which will in turn help to establish a guide to new trends in the market. In addition, individual LPT characteristics such as capital structure and property-type sector will be examined, as they may be able to affect the exposure of LPTs to interest rates. Australia's current rising interest rate environment is the main underlying reason for the study, but in order to determine the links between the LPT sector and interest rates, an analysis of the behavior of property, stocks and bonds is necessary as they share similar characteristics to LPTs.

3. Methodology

3.1 The Data

The data tested in the study is derived from the following sources:

- Debt Structures: LPT D/E ratios from *Aspect Huntley Fin Analysis.* This data is represented by percentages of debt to equity for each of the LPTs within the LPT300 index. Refer to Appendix 1.

- LPT Returns: S&P/ASX 300 Property Trust Index from *Datastream.* Daily returns covering the 5-year period from July 2001 to July 2006. Quarterly returns covering the 10-year period from quarter 3 1996 to quarter 2 2006.

- LPT sub-sector indexes (Retail, Commercial, Industrial and Diversified) derived from *UBS Warburg* and converted to returns. Covering the 10-year period from quarter 3 1996 to quarter 2 2006.

- Direct Property Returns: Sub-sector and composite returns from *IPD Investment Performance Index.* Covering the 10-year period from quarter 3 1996 to quarter 2 2006.

- Stock Returns: S&P/ASX 300 price indices converted to returns from *Datastream.* Daily returns covering the 5-year period from July 2001 to July 2006. Quarterly returns covering the 10-year period from quarter 3 1996 to quarter 2 2006.

- Bond Returns: Australian All Maturities price indices converted to returns from *Datastream.* Daily returns covering the 5-year period from July 2001 to July 2006. Quarterly returns covering the 10-year period from quarter 3 1996 to quarter 2 2006.

- Interest Rates: 10-year Commonwealth Bond (long-term) & 90-day dealer bill (short-term) price indices converted to percentage changes from *Datastream.* Daily percentage changes covering the 5-year period from July 2001 to July 2006. Quarterly percentage changes covering the 10-year period from quarter 3 1996 to quarter 2 2006.

3.2 Limitations to the Data

The study has encountered certain data limitations, which could possibly influence the overall results in some way. Firstly the availability of the data was somewhat restricted. LPT daily data only goes back as far as the year 2000, which limits the study by a number of years, and thus a more historical investigation could not be conducted. Australian direct property data is only available on a few national databases to which there is restricted access and through these databases only quarterly data is available which may water down the significance in the regression results. Obtaining this data was a difficult and time-consuming process, it was necessary to approach IPD and UBS Warburg in Melbourne and Sydney respectively. (Many thanks to those who provided assistance). Thirdly, using returns data to identify significant relationships between macroeconomic variables and investment returns is no easy task as previous attempts have shown.

4.3 Hypotheses Tested

There are two hypotheses examined in this study, which relate to a number of macroeconomic fundamentals possibly affecting the performance of LPTs.

- *H1a): A rise in interest rates will negatively affect LPT performance.*

Here both short and long-term interest rates will be taken into account as they could have different implications. The majority of past literature suggests an inverse relationship between interest rates and REIT/LPT performance, and such evidence is found in Chen and Tzan (1998), Mueller and Pauley (1994), Allen, Madura and Springer (2000), Swanson, Theis and Casey (2002), and Papadakos (2004). This hypothesis is tested using both daily and quarterly returns in a multiple regression in which the return on the LPT index, r_{LPT}, is specified as a linear function of short and long-term interest rates as follows:

$$r_{LPT} = \beta_o + \beta_1 r_{Li} + \beta_2 r_{Si} + \nu_t \quad (1)$$

where, r_{Li} is the long-term interest rate return, r_{Si} is the short-term interest rate return in period *t*. The βs measure the sensitivity of LPT returns to the various factors and ν represents the unexplained portion of LPT returns, or idiosyncratic factors. One very logical way in which interest rates may affect LPT performance is through the underlying property assets held in the trusts. This necessitates the examination of sector specific LPTs. Thus we conduct a series of simple regressions in order to specify which LPT sectors are influenced by interest rates more than others. As the LPT sector data is only available on a quarterly basis, the sample uses quarterly returns over the 1996 to 2006 period. The simple regression equations are as follows:

$$r_{DIV} = \beta_o + \beta_1 r_{Li} + \nu_t \quad (2)$$

$$r_{IND} = \beta_o + \beta_1 r_{Li} + \nu_t \quad (3)$$

$$r_{COMM} = \beta_o + \beta_1 r_{Li} + \nu_t \quad (4)$$

$$r_{RET} = \beta_o + \beta_1 r_{Li} + \nu_t \quad (5)$$

where, r_{DIV}, r_{IND}, r_{COMM}, and r_{RET} represent quarterly percentage returns of the LPT300 Diversified, Industrial, Commercial and Retail Indexes respectively. Long-term interest rates are used rather than short-term because the sample is taken over a longer period using quarterly data, thus using a long-term rate was deemed more appropriate.

H1b): The inverse relationship between LPT returns and interest rate fluctuations is enhanced as the LPT is increasingly levered.

In regards to part (b) of H1, we take a sample of the 11 LPT's that have existed in the 10-year period from 1996 to 2006. One could argue that what is driving the predicted negative correlations between the trusts and interest rates, is not so much the effect that short- or long-term interest rate levels have on property valuations, but the level of debt each trust has. Thus one would expect to see returns from trusts with higher debt levels exhibiting closer co-movements with interest-rate movements than trusts with low debt levels (Papadakos, 2004). However Papadakos (2004), found that returns from LPTs with higher debt levels did not exhibit closer co-movements with interest rate movements than trusts with low debt levels.

- *H2: The effects of interest rate fluctuations on LPT performance are attributable to the combination of characteristics they share with their underlying property assets, and also, stocks and bonds.*

This study goes beyond simply testing for a relationship between LPT returns and interest rate fluctuations by attempting to establish some reasoning behind the relationship. Since one hopes that H1 is evidenced in the empirical analysis as changes in the interest rates are inversely related to LPT performance, the correlation may be linked to the behavioral characteristics of LPTs which reflect a combination of characteristics from direct property, stocks and bonds. Firstly an LPT is simply a portfolio of physical property assets, thus interest rate influences on the Australian property market may logically flow through to the LPT market. Secondly, because they are a listed asset, LPTs should react to interest rate fluctuations in a similar fashion to the stock market. Thirdly, the relatively fixed nature of the cash flows derived from income-producing property with long-term leases and high-credit quality tenants, together with the high dividend yield LPTs provided to investors, imply that LPT returns should be affected by interest rates in similar ways to bonds. Based on these interpretations the relationships between LPTs and property, stocks and bonds are analysed, followed by an analysis of the relationship between those three assets and interest rate fluctuations. Here a series of multiple regression models are constructed, which are as follows:

$$r_{LPT} = \beta_o + \beta 1 r_B + \beta_2 r_S + \beta_3 r_P + \nu_t \quad (6)$$

$$r_{LPT} = \beta_o + \beta 1 r_B + \beta_2 r_S + \beta_3 r_{Si} + \nu_t \quad (7)$$

$$r_B = \beta_o + \beta_1 r_{Li} + \beta_2 r_{Si} + \nu_t \quad (8)$$

$$r_S = \beta_o + \beta_1 r_{Li} + \beta_2 r_{Si} + \nu_t \quad (9)$$

$$r_P = \beta_o + \beta_1 r_{Li} + \beta_2 r_{Si} + \nu_t \quad (10)$$

Equation 6 measures whether LPT returns are a linear function of bond returns r_B, stock returns r_S, and property returns r_P, with an unexplained portion represented by idiosyncratic factors v_t. Quarterly data over the 1996 to 2006 period was used, because daily data is not available for the Australian property index. This regression attempts to establish some behavioral characteristics of LPTs in order to explain any sensitivity in returns to fluctuations in interest rates. To further explain the relationships between LPT returns, stock returns and bond returns, Equation 7 has been included, which tests whether LPT returns are a linear function of stocks returns, bond returns, and short-term interest rate, r_{SI}, fluctuations. According to the above notion that LPTs are similar in structure and also in the way they derive their income to bonds, we should therefore expect to find that LPT returns have a similar effect to fluctuations in interest rates as bond returns do. Equation 8 implies that bond returns r_B, are a linear function of long-term r_{LI}, and short-term r_{SI}, interest rate fluctuations. Equations 9 and 10 imply the same, but for stocks and direct property respectively.

5. Results & Discussion

H1a) A rise in interest rates will negatively affect LPT performance.

By referring to Table 5.1 it can be seen that there is a statistically significant, weak inverse relationship between short-term interest rates and LPT returns, thus a percentage increase in the interest rate may cause a percentage decrease in LPT prices. Here, short-term rates appear to have a greater effect because the sample uses daily data, over a relatively short period of 5 years. The same regression was tested with quarterly data over a 10-year period, but results showed no statistical significance. It is also important to note that the short- and long-term interest rates were regressed against each other and evidence suggested no presence of multi collinearity (refer to Appendix 2).

Table 5.1. Regression results for (1): $r_{LPT} = \beta_0 + \beta_1 r_{Li} + \beta_2 r_{Si} + v_t$. Using daily data from the 2001-2006 sample period.

Dependent Variable: LPT300
Sample: 1 1668

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ST Interest	-0.086999	0.033250	-2.616484	0.0090
LT Interest	-0.005860	0.010056	-0.582699	0.5602
C	0.032040	0.015627	2.050274	0.0405

R-squared	0.005371	Mean dependent var	0.031923
Adjusted R-squared	0.004175	S.D. dependent var	0.639369
S.E. of regression	0.638032	Akaike info criterion	1.940943
Sum squared resid	677.3900	Schwarz criterion	1.950694
Log likelihood	-1614.776	F-statistic	4.492550
Durbin-Watson stat	2.010971	Prob(F-statistic)	0.011328

The results are consistent with Mueller and Pauley (1994) who conclude that interest rates have a small impact on listed real estate but this may be more of a coincidence that is explained by general economic and real estate fundamentals associated with the supply and absorption of property at the time interest rates are moving. However a test for leads and lags of the long-term interest rate and LPT returns was performed, leading interest-rate movements by one monthly period. This produced a –0.29 correlation significant at the 5% level as evidenced in Appendix 3. This indicates that LPT prices take some time to react to a change in the interest rate, in other words it takes a certain amount of time for the information to reach the market. This result is consistent with Chen and Tzang (1988), Allen, Madura and Springer (2000) and Swanson, Theis and Casey (2002) where it was evidenced that interest rates do have some negative impact on REIT performance.

When simple regressions are tested for long-term interest rates and sector-specific LPT returns (Table 5.3), the majority of the results are significant at the 5% level. The regression tables can be viewed in Appendix 4. This could imply that since this is over a 10-year period and based on quarterly data (instead of daily data), changes in long-term rates have significant relationships with changes in LPT price indices. Also, if we assume that real estate is viewed as a long-term investment asset, it would be logical to conclude that it should have a higher correlation with longer-term investment indicators such as long-term interest rates.

Table 5.3. Correlation matrix summarizing the LPT sector relationship with the long-term interest rate.

	LT Interest	Diversified	Retail	Industrial	Commercial
LT Interest	1				
Diversified	-0.51	1			
Retail	-0.48	0.71	1		
Industrial	-0.20	0.72	0.54	1	
Commercial	-0.33	0.67	0.47	0.83	1

The correlations and regressions show that the relationships between interest-rate changes and LPT returns are weak to medium. It appears that if changes in interest rates do impact LPT prices, the relationship is likely to be complex and a number of other factors must affect LPT returns as well.

As can be evidenced in the above table, diversified trusts are the most affected by fluctuations in the long-term interest rates, followed by retail, industrial and commercial. Diversified trusts being mostly affected was an interesting result. But when we look at the average debt ratio for each sector over the 2001-2006 period, it starts to make more sense. From Appendix 1 it was calculated that the diversified trust sector has the highest average debt ratio for the period, followed by the retail trust sector, then the commercial sector and lastly the industrial sector. This indicates that the level of debt can enhance the sensitivity of LPT returns to fluctuations in interest rates but further analysis is needed here, which leads us into the next hypothesis.

H1b): The inverse relationship between LPT returns and interest rate fluctuations is enhanced as the LPT is increasingly levered.

Below in Table 5.4 the average debt ratios of 11 LPTs that have been running over the last 10 years and their correlations with the long-term interest rate are compared. Through plain observation, the data indicates that higher debt ratios have only a small effect on the inverse relationship between the return of the LPT and the percentage change in the long-term interest rate. This implies that the level of debt-to-equity is not necessarily the most important factor in assessing the impact of interest rate movements on LPT returns.

Table 5.4. Affects of leverage ratio on LPT return sensitivity to interest rates. Using quarterly data from 1996-2006 sample period.

LPT	Correlation with Long-term Interest Rate	Average Debt Ratio (1996-2006)
AVJ	0.26	42.07%
CNP	-0.40	72.45%
FKP	0.06	39.84%
GPT	-0.55	38.88%
IIF	-0.38	37.35%
IPG	-0.34	42.36%
LLC	0.03	37.74%
MOF	-0.34	47.71%
SGP	-0.59	32.10%
THG	-0.07	77.32%
VWD	-0.18	110.67%

In Table 5.5 we have allocated rankings to the 11 trusts based on the above criteria (a similar method used in Papadakos, 2004). The LPT returns have been ranked according to how strongly they correlate with the long-term interest rate returns as well as assigning rankings according to their debt levels. A simple way to establish if debt levels are responsible for the LPT's sensitivity to interest rate movements is to see how similar or dissimilar the rankings for these two factors are. The correlation co-efficient between the two sets of observations is -0.28, which indicates that a higher debt ratio could increase the negative sensitivity of LPT returns to fluctuations in the interest rate. However since the correlation is quite small we conclude that the level of debt is not necessarily the most important factor in assessing the impact of interest rate movements on LPT prices. The method used here is questionable since statistical significance is an issue in the correlations, thus analyzing sector-by-sector rather than trust-by-trust may well be the more reliable method.

Table 5.5. Correlation ranks.

LPT	Correlation with Long-term Interest Rate	Average Debt Ratio (1996-2006)
AVJ	11	6
CNP	3	3
FKP	10	7
GPT	2	8
IIF	4	10
IPG	5	5
LLC	9	9
MOF	6	4
SGP	1	11
THG	8	2
VWD	7	1

H2: The effects of interest rate fluctuations on LPT performance are attributable to the combination of characteristics they share with their underlying property assets, and also stocks and bonds.

Looking firstly at direct property assets, it is logical to think that the inverse interest rate/LPT relationship would largely be explained by the effect of interest rate fluctuations on the property assets held within the trust portfolio.

Here the securitised and unsecuritised property relationship is examined by firstly referring to Table 5.6 where a relatively weak positive correlation is evidenced, using quarterly data over the 1996-2006 period. However, when we look at the regressions in Table 5.7 (and in Appendix 5), no statistical significance is evidenced. Thus we need to go a step further and examine this relationship at a sector-level. The correlation matrix in Table 5.8 indicates no significant relationship between the LPT sectors and their corresponding property sectors. This obviously defies logic and it is likely that the main problem is the availability of Australian property data, as it is only available on a quarterly basis, which makes regression analysis using time series data very difficult. Lagging the property data was also conducted but results evidenced no difference in the relationship. Thus the question of whether or not LPTs reflect the performance of their underlying property assets at an aggregate level is still disputable, as past literature has failed to confirm any solid relationship either (Newell and Keng (2005a), Gilberto (1990), Moss Howard and Schneider (1996), Gyourko and Keim (1992). But at the end of the day we can conclude that LPTs will obviously be affected by the performance of the property assets within their portfolios because essentially, that's what an LPT is. Since past literature has produced results which indicate that interest rate fluctuations both positively and negatively affect the property market, we conclude that the Australian property market does not help to explain the negative relationship between LPT returns and interest-rate fluctuations.

Table 5.6. Correlation matrix between long-term interest rates and different asset classes.

	LPT300	LT Interest	Property	All Mats	ASX300
LPT300	1.00				
LT Interest	-0.18	1.00			
Property	0.17	-0.02	1.00		
All Mats	0.22	-0.82	-0.05	1.00	
ASX300	-0.01	0.23	0.24	-0.17	1.00

Table 5.7. Regression results for (6): $r_{LPT} = \beta_o + \beta 1 r_B + \beta_2 r_S + \beta_3 r_P + \nu_t$

Dependent Variable: LPT300 Sample: 1 40				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Property	1.328958	1.155200	1.150414	0.2576
All Mats	0.385749	0.281511	1.370282	0.1791
ASX300	-0.012935	0.148446	-0.087139	0.9310
C	-0.673941	3.031511	-0.222312	0.8253
R-squared	0.081073	Mean dependent var		3.415052
Adjusted R-squared	0.004496	S.D. dependent var		3.941131
S.E. of regression	3.932262	Akaike info criterion		5.670946
Sum squared resid	556.6566	Schwarz criterion		5.839834
Log likelihood	-109.4189	F-statistic		1.058709
Durbin-Watson stat	2.562623	Prob(F-statistic)		0.378668

Table 5.8. Correlation matrix for property- and LPT-type sectors.

	Commercial LPT	Commercial Property	Industrial LPT	Industrial Property	Retail LPT	Retail Property
Commercial LPT	1.00					
Commercial Property	0.03	1.00				
Industrial LPT	0.83	0.05	1.00			
Industrial Property	0.06	0.11	-0.03	1.00		
Retail LPT	0.47	0.06	0.54	-0.16	1.00	
Retail Property	0.10	-0.04	0.18	0.38	0.02	1.00

In regards to bonds, LPTs derive a relatively fixed cash flow in the form of rent from tenants with long-term leases and often high-quality credit ratings, similar to the situation faced by a bond holder. As evidenced in the regression tables in Appendix 6 (Equation 8), an important factor in bond pricing is interest rates and given similarities outlined above, we should see a similar impact on LPTs. This is evidenced by the positive correlations between LPT and bond returns (Table 5.7), and negative correlations between bond and long-term interest rate returns.

The presence of property and bond characteristics in LPTs might explain why LPT returns should correlate negatively with interest rate fluctuations. However only mild negative correlations were experienced in H1, which may well be due to the presence of stock characteristics in LPTs.

In regard to the LPT/stock relationship, being a listed asset, an LPT should be affected by similar fundamentals that affect the equity market. Thus we see a positive relationship between the fluctuations in LPT and stock indices evidenced in Table 5.9. This supports the view of past literature on this issue, where REIT or LPT returns show a positive correlation with stocks and there is significant co-movement between REIT or LPT and stock market indices (Clayton and MacKinnon (2003), and Gyourko and Keim (1992). As the prices of LPTs and stocks change daily, a regression model is constructed using daily data over the 2001 – 2006 period. As evidenced by the correlations in Table 5.6 and Appendix 7, there is a weak-positive relationship between stock returns and fluctuations in the interest rate. This also indicates that daily returns reflect market sentiment more than quarterly, which reflects fundamentals. As pointed out above, the positive relationship between the LPT300 and ASX300 indexes could be the likely reason as to why we are not seeing more significant negative relationships between LPT and interest rate returns.

Table 5.9. Regression results for (7): $r_{LPT} = \beta_0 + \beta 1 r_B + \beta_2 r_S + \beta_3 r_{Si} + \nu_t$. Using daily data from the 2001-2006 period.

Dependent Variable: LPT300 Sample: 1 1668				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ASX300	0.399001	0.020470	19.49208	0.0000
All Mats	0.318791	0.066472	4.795857	0.0000
ST Interest	-0.059489	0.034490	-1.724805	0.0847
C	0.013602	0.014181	0.959145	0.3376
R-squared	0.193275	Mean dependent var		0.031923
Adjusted R-squared	0.191820	S.D. dependent var		0.639369
S.E. of regression	0.574785	Akaike info criterion		1.732755
Sum squared resid	549.4184	Schwarz criterion		1.745758
Log likelihood	-1440.252	F-statistic		132.8069
Durbin-Watson stat	1.946819	Prob(F-statistic)		0.000000

6. Conclusion

At an aggregate level there is a weak inverse relationship evidenced between LPT returns and short-term interest rate fluctuations, whereas at a sector-level, a stronger relationship was found when using long-term interest rate data. LPTs are viewed as long-term assets, thus it makes sense that they show a stronger relationship with long-term investment indicators. This relationship was further examined by investigating whether or not the sensitivity to interest rate changes was intensified as LPTs were increasingly levered. It was found that higher debt ratios may have some effect on the negative correlation between the return of the LPT return and the percentage change in the long-term interest rate. This implies that a higher debt ratio may increase the negative exposure of the return of an LPT to fluctuations in the interest rate. However there is a large portion of the relationship unexplained by debt levels. The unexplained portion would refer to other factors specific to the trusts, as well as overall market sentiment and significant events within the sector as well as in the wider equities market.

In regards to the second hypothesis (H2), we found no evidence that interest rates affect the property market, and no evidence of any relationship between property and LPT returns. No evidence of a significant correlation was found, even when the property data was lagged. Bond returns are negatively correlated to interest rates and stock returns were positively correlated, however the bond/interest rate correlation was stronger. In regard to the stock and LPT relationship, statistically significant correlations were evidenced when using the short-term rate with daily data, which may indicate that daily returns reflect market sentiment more than quarterly returns, which may more closely reflect fundamentals. Both of these assets had medium positive relationships with LPT returns. If the above three asset/interest rate relationships together were combined, an overall weak-inverse relationship would be the result. Since LPT's were evidenced to also have a weak-inverse relationship with interest rates, the above analysis provides evidence that LPTs are partly a combination of property, stock, and bond factors. However it is important to note that the correlations in the study are not substantially high, thus the results could not be used for predictive purposes.

Importantly, the idiosyncratic factor (the error term) remains high, and past studies indicate that it is increasing. Newell and Keng (2004a) identified a few reasons why this is happening. Firstly, increased institutionalism of stock ownership has been identified as a major cause. This has seen institutional investors dominate the stock market, generating increased turnover. This has been

evident in LPTs where institutional investors account for approximately 70% of LPT stocks, with high levels of LPT liquidity evident in recent years. A second cause has been developments in information technology, with information from LPT analysts becoming more detailed and increasingly available to institutional investors to use for their decision-making. This is quite an important issue in the Australian LPT market as idiosyncratic factors account for a major portion in explaining fluctuations in LPT returns, thus this should be an area of more focus for further research.

Looking ahead, the impact of higher interest rates on the LPT sector may depend on the magnitude of the increase in rates and should vary from company to company, based on portfolio composition and possibly capital structure. Investors should be aware of changing interest rates in the future, but they do not appear to be the dominant cause of fluctuations in LPT returns because of the complexity of the relationship between the two variables.

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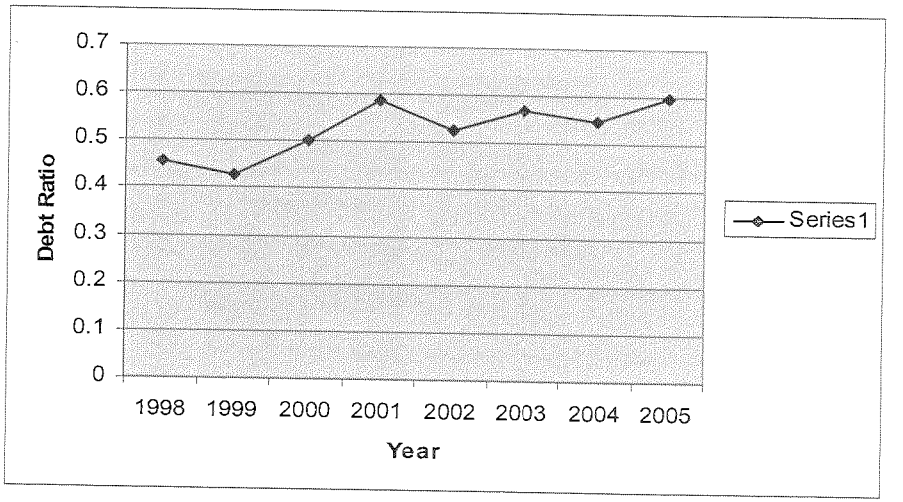
Appendix 1
LPT Debt Ratios

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
UBS LEADERS										
WDC	-	-	-	-	-	-	-	-	75.98%	99.79%
SGP	0.00%	14.88%	14.12%	6.19%	24.47%	31.93%	17.01%	37.15%	33.25%	41.16%
GPT	13.10%	14.05%	12.11%	20.05%	16.84%	26.31%	26.83%	40.02%	44.29%	56.93%
MGQ	-	-	-	-	-	-	-	-	-	60.24%
CNP	-	-	62.04%	66.53%	51.45%	107.03%	93.02%	56.37%	29.85%	75.99%
MGR	-	-	39.72%	36.71%	26.48%	30.83%	46.21%	60.41%	73.85%	69.93%
UBS DIVERSIFIED 300										
SGP	0.00%	14.88%	14.12%	6.19%	24.47%	31.93%	17.01%	37.15%	33.25%	41.16%
GPT	13.10%	14.05%	12.11%	20.05%	16.84%	26.31%	26.83%	40.02%	44.29%	56.93%
DRT	-	-	-	-	-	-	-	-	-	71.55%
MGR	-	-	39.72%	36.71%	26.48%	30.83%	46.21%	60.41%	73.85%	69.93%
MXG	-	-	-	-	-	-	-	64.90%	68.02%	71.02%
VPG	-	-	-	-	-	-	35.52%	48.50%	50.02%	25.35%
BJT	-	-	-	-	-	-	-	-	-	105.02%
MLE	-	-	0.00%	17.32%	26.78%	38.33%	42.57%	40.14%	28.15%	43.05%
THG	76.62%	71.97%	68.66%	61.09%	68.92%	84.65%	79.41%	69.70%	59.52%	93.34%
CHCCA	-	-	-	-	-	-	-	-	-	-
AEU	-	-	-	-	-	-	-	43.03%	81.08%	86.09%
GHG	-	19.96%	48.80%	59.20%	60.42%	113.31%	156.78%	163.08%	116.48%	103.95%
UBS RETAIL 300										
WDC	-	-	-	-	-	-	-	-	75.98%	99.79%
CNP	-	-	62.04%	66.53%	51.45%	107.03%	93.02%	56.37%	29.85%	75.99%
GAN	8.50%	30.87%	23.67%	25.40%	25.82%	23.11%	26.30%	27.70%	38.69%	37.82%
MCW	29.00%	41.69%	40.18%	40.71%	49.00%	50.20%	49.01%	34.35%	28.18%	20.96%
MDT	-	-	-	-	-	-	-	-	105.69%	109.00%
GSA	-	-	-	-	-	-	-	-	0.00%	0.00%
BWP	-	-	32.27%	39.40%	36.63%	49.87%	31.63%	44.79%	39.26%	38.41%
CER	-	-	-	-	-	-	-	-	-	133.88%
UBS COMMERCIAL 300										
IPG	14.16%	19.00%	19.34%	40.51%	37.21%	27.39%	29.31%	51.20%	59.57%	44.35%
MOF	26.09%	35.85%	44.42%	43.30%	49.74%	40.65%	43.47%	43.45%	60.14%	50.84%
CPA	-	-	18.76%	18.76%	19.70%	24.66%	30.11%	27.83%	52.26%	41.19%

IOF	37.00%	55.12%	43.57%	39.29%	43.89%	38.76%	47.96%	57.07%	49.60%	66.60%
TSO	-	-	-	-	-	-	-	-	-	0.02%
REU	-	-	-	-	-	-	-	-	-	-
RNYCA	-	-	-	-	-	-	-	-	-	-
RAT	-	-	-	-	-	-	-	-	-	-
UBS INDUSTRIAL 300										
MGQ	-	-	-	-	-	-	-	-	-	60.24%
IIF	4.78%	14.20%	26.89%	25.75%	29.29%	30.26%	30.63%	46.41%	36.87%	37.59%
MPR	-	-	-	-	-	0.40%	0.00%	15.36%	0.00%	0.00%
JUI	-	-	-	-	-	-	-	-	-	-
UBS RE MGRS & DVLPS 300										
LLC	9.59%	22.01%	47.70%	44.42%	26.50%	38.93%	32.98%	37.95%	38.93%	24.91%
ALZ	-	50.97%	39.12%	66.20%	71.39%	61.99%	53.57%	62.48%	60.10%	82.42%
FKP	15.99%	43.91%	74.51%	48.55%	79.94%	61.21%	28.96%	15.63%	59.10%	34.28%
SDG	47.72%	117.92%	253.35%	96.31%	252.51%	191.26%	182.76%	154.84%	113.32%	124.94%
AVJ	94.68%	54.47%	62.83%	59.17%	42.72%	43.46%	18.68%	41.73%	40.55%	65.95%
VWD	17.95%	38.41%	36.70%	76.28%	93.50%	148.98%	68.37%	116.37%	122.40%	97.25%
VLL	-	-	-	-	-	-	-	82.87%	0.46%	0.40%

Figure 2.3. LPT300 Average Debt Ratios



Appendix 2

Regressions between Short- and Long-Term Interest Rates (Daily and Quarterly Respectively)

Dependent Variable: ST Interest
Sample: 1 1668

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	0.093434	0.007049	13.25432	0
C	0.002343	0.011518	0.20344	0.8388

R-squared	0.095441	Mean dependent var	0.001767
Adjusted R-squared	0.094898	S.D. dependent var	0.494302
S.E. of regression	0.470264	Akaike info criterion	1.330153
Sum squared resid	368.2113	Schwarz criterion	1.336654
Log likelihood	-1106.682	F-statistic	175.6769
Durbin-Watson stat	2.023771	Prob(F-statistic)	0

Dependent Variable: ST Interest
Sample: 1 40

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	0.21222	0.147441	1.439358	0.1582
C	-0.483309	0.966702	-0.499956	0.62

R-squared	0.051701	Mean dependent var	-0.72701
Adjusted R-squared	0.026746	S.D. dependent var	6.101611
S.E. of regression	6.019461	Akaike info criterion	6.476579
Sum squared resid	1376.889	Schwarz criterion	6.561023
Log likelihood	-127.5316	F-statistic	2.071751
Durbin-Watson stat	1.255278	Prob(F-statistic)	0.158236

Appendix 3

Regression Results for $r_{LPT(t-1)} = bo + b_1 r_{Lt} + v_t$ Using quarterly data from the 1996-2006 period

Dependent Variable: LPT300(-1)
Sample(adjusted): 2 40

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	-0.293569	0.088277	-3.325535	0.002
C	3.063156	0.579443	5.286377	0

R-squared	0.230116	Mean dependent var	3.456057
Adjusted R-squared	0.209308	S.D. dependent var	3.983997
S.E. of regression	3.542604	Akaike info criterion	5.417522
Sum squared resid	464.3517	Schwarz criterion	5.502833
Log likelihood	-103.6417	F-statistic	11.05918
Durbin-Watson stat	2.583038	Prob(F-statistic)	0.002001

Appendix 4
Regression Tables for Equations 2 - 5

Regression results for (2): rRET = βo + β1 rLi + νt. Using quarterly data from the 1996-2006 sample period.

Dependent Variable: LPT300 Retail
Sample: 1 40

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	-0.289393	0.085197	-3.396754	0.0016
C	3.440894	0.558598	6.159878	0

R-squared	0.232911	Mean dependent var	3.77321
Adjusted R-squared	0.212725	S.D. dependent var	3.920131
S.E. of regression	3.478275	Akaike info criterion	5.379657
Sum squared resid	459.7392	Schwarz criterion	5.464101
Log likelihood	-105.5931	F-statistic	11.53794
Durbin-Watson stat	2.098939	Prob(F-statistic)	0.001611

Regression results for (3): $rIND = \beta o + \beta 1\ rLi + vt$. Using quarterly data from the 1996-2006 sample period.

Dependent Variable: LPT300 Industrial
Sample: 1 40

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	-0.15552	0.089389	-2.187301	0.0349
C	3.91889	0.586081	6.686602	0

R-squared	0.111823	Mean dependent var	4.14341
Adjusted R-squared	0.08845	S.D. dependent var	3.822366
S.E. of regression	3.649408	Akaike info criterion	5.475714
Sum squared resid	506.0908	Schwarz criterion	5.560158
Log likelihood	-107.5143	F-statistic	4.784287
Durbin-Watson stat	1.891332	Prob(F-statistic)	0.034944

Regression results for (4): $rDIV = \beta o + \beta 1\ rLi + vt$. Using quarterly data from the 1996-2006 sample period.

Dependent Variable: LPT300 Diversified
Sample: 1 40

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	-0.301865	0.083332	-3.62245	0.0009
C	2.811137	0.546368	5.145132	0

R-squared	0.256682	Mean dependent var	3.157775
Adjusted R-squared	0.237121	S.D. dependent var	3.895135
S.E. of regression	3.402125	Akaike info criterion	5.335384
Sum squared resid	439.8292	Schwarz criterion	5.419828
Log likelihood	-104.7077	F-statistic	13.12214
Durbin-Watson stat	2.282751	Prob(F-statistic)	0.00085

Regression results for (5): $rCOMM = \beta o + \beta 1\ rLi + vt$. Using quarterly data from the 1996-2006 sample period.

Dependent Variable: LPT300 Commercial
Sample: 1 40

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	-0.192787	0.079774	-1.288471	0.2054
C	2.480997	0.523046	4.743368	0

R-squared	0.04186	Mean dependent var	2.59903
Adjusted R-squared	0.016645	S.D. dependent var	3.284348
S.E. of regression	3.256899	Akaike info criterion	5.248135
Sum squared resid	403.0809	Schwarz criterion	5.332579
Log likelihood	-102.9627	F-statistic	1.660158
Durbin-Watson stat	2.257437	Prob(F-statistic)	0.205372

Appendix 5

Regression Results for (10): $r_P = b_o + b_1 r_{Li} + b_2 r_{Si} + v_t$. Using quarterly data from the 1996-2006 period.

Dependent Variable: Property
Sample: 1 40

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	-0.00093	0.014378	-0.064378	0.949
ST Interest	0.012563	0.015405	0.815497	0.42
C	2.575072	0.092102	27.9588	0

R-squared	0.018059	Mean dependent var	2.567001
Adjusted R-squared	-0.03502	S.D. dependent var	0.561873
S.E. of regression	0.571626	Akaike info criterion	1.791375
Sum squared resid	12.08998	Schwarz criterion	1.918041
Log likelihood	-32.8275	F-statistic	0.340244
Durbin-Watson stat	1.881658	Prob(F-statistic)	0.7138

Appendix 6
Regression Results for Equations 8

Regression results for (8): $rB = \beta o + \beta 1\ rLi + \beta 2\ rSi + vt$. Using daily data from the 2001-2006 period.

Dependent Variable: All Mats
Sample: 1 1668

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	-0.081962	0.002692	-30.44923	0
ST Interest	-0.209871	0.0089	-23.58047	0
C	0.0227	0.004183	5.426697	0

R-squared	0.561428	Mean dependent var	0.022834
Adjusted R-squared	0.560901	S.D. dependent var	0.257731
S.E. of regression	0.170784	Akaike info criterion	-0.695035
Sum squared resid	48.53425	Schwarz criterion	-0.685283
Log likelihood	582.3116	F-statistic	1065.067
Durbin-Watson stat	2.256725	Prob(F-statistic)	0

Regression results for: $rB = \beta o + \beta 1\ rLi + vt$. Using quarterly data from the 1996-2006 period.

Dependent Variable: All Mats Sample: 1 40				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	-0.284653	0.032319	-8.807656	0
C	1.496813	0.2119	7.063781	0
R-squared	0.671209	Mean dependent var		1.823686
Adjusted R-squared	0.662556	S.D. dependent var		2.271404
S.E. of regression	1.319457	Akaike info criterion		3.441024
Sum squared resid	66.15669	Schwarz criterion		3.525468
Log likelihood	-66.82047	F-statistic		77.57481
Durbin-Watson stat	2.825663	Prob(F-statistic)		0

Table 6.6. Regression Results for (9): $rS = \beta o + \beta 1\ rLi + \beta 2\ rSi + vt$. Using daily data from the 2001-2006 period.

Dependent Variable: ASX300 Sample: 1 1668				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	0.017299	0.010899	1.587169	0.1127
ST Interest	0.132953	0.036038	3.689226	0.0002
C	0.027808	0.016938	1.641795	0.1008
R-squared	0.01295	Mean dependent var		0.027937
Adjusted R-squared	0.011763	S.D. dependent var		0.695637
S.E. of regression	0.691533	Akaike info criterion		2.101987
Sum squared resid	795.755	Schwarz criterion		2.111739
Log likelihood	-1749.006	F-statistic		10.91549
Durbin-Watson stat	2.076536	Prob(F-statistic)		0.00002

Table 6.7 Regression Results for (9): rS = $\beta o + \beta 1\ rLi + \beta 2\ rSi +$ vt. Using quarterly data from the 1996-2006 period.

Dependent Variable: ASX300
Sample: 1 40

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	0.168889	0.11102	1.521241	0.113
ST Interest	-0.067228	0.11895	-0.565177	0.5754
C	2.149601	0.711172	3.022618	0.0045

R-squared	0.060076	Mean dependent var	2.004537
Adjusted R-squared	0.009269	S.D. dependent var	4.434431
S.E. of regression	4.413831	Akaike info criterion	5.879401
Sum squared resid	720.8304	Schwarz criterion	6.006067
Log likelihood	-114.588	F-statistic	1.18244
Durbin-Watson stat	2.036823	Prob(F-statistic)	0.317846

Appendix 7
Regression Results for Equation 9

Table 6.6. Regression Results for (9): $rs = \beta_0 + \beta_1 r_{Li} + \beta_2 rs_i + v_t$. Using daily data from the 2001-2006 period.

Dependent Variable: ASX300
Sample: 1 1668

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	0.017299	0.010899	1.587169	0.1127
ST Interest	0.132953	0.036038	3.689226	0.0002
C	0.027808	0.016938	1.641795	0.1008

R-squared	0.01295	Mean dependent var	0.027937
Adjusted R-squared	0.011763	S.D. dependent var	0.695637
S.E. of regression	0.691533	Akaike info criterion	2.101987
Sum squared resid	795.755	Schwarz criterion	2.111739
Log likelihood	-1749.006	F-statistic	10.91549
Durbin-Watson stat	2.076536	Prob(F-statistic)	0.00002

Table 6.7 Regression Results for (9): $rs = \beta_o + \beta_1 r_{Li} + \beta_2 r_{Si} + v_t$. Using quarterly data from the 1996-2006 period.

Dependent Variable: ASX300
Sample: 1 40

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LT Interest	0.168889	0.11102	1.521241	0.113
ST Interest	-0.067228	0.11895	-0.56518	0.5754
C	2.149601	0.711172	3.022618	0.0045

R-squared	0.060076	Mean dependent var	2.004537
Adjusted R-squared	0.009269	S.D. dependent var	4.434431
S.E. of regression	4.413831	Akaike info criterion	5.879401
Sum squared resid	720.8304	Schwarz criterion	6.006067
Log likelihood	-114.588	F-statistic	1.18244
Durbin-Watson stat	2.036823	Prob(F-statistic)	0.317846