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Evaluation of Australian REIT Performance and the Impact of Interest Rates and Leverage

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This study explores the sensitivity of the performance of Australian real estate investment trusts (A-REITs) to changes in short and long term interest rates. Based on the intertemporal capital asset pricing model in Merton (1973), we propose an asset pricing model that consists of market returns, macroeconomic indicators, and short and long term interest rates. The effect of market capitalisation is also explored. High debt funds show greater sensitivity to adverse movements in long term interest rates compared to low debt funds. This suggests that gearing levels play a significant role in the returns generating process. All size based portfolios exhibit strong exposure to market risk with medium size A-REITs displaying greater sensitivity to movements in both short and long term interest rates. Although market risk became a stronger driver of returns during the Global Financial Crisis (GFC), the impact was less prominent post-GFC possibly due to already low levels of interest which created an environment of cheap credit. The implications for asset allocation strategies are that portfolio managers and other investors can reduce exposure to interest rate risk by selecting funds with less leverage and are large in size. High debt funds benefit more during periods of low interest but this may be offset when there is a corresponding increase in long term interest rates.

Keywords
Property Investments, REITs, Interest Rates, Leverage, Capital Asset Pricing, Bonds.

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1. Introduction

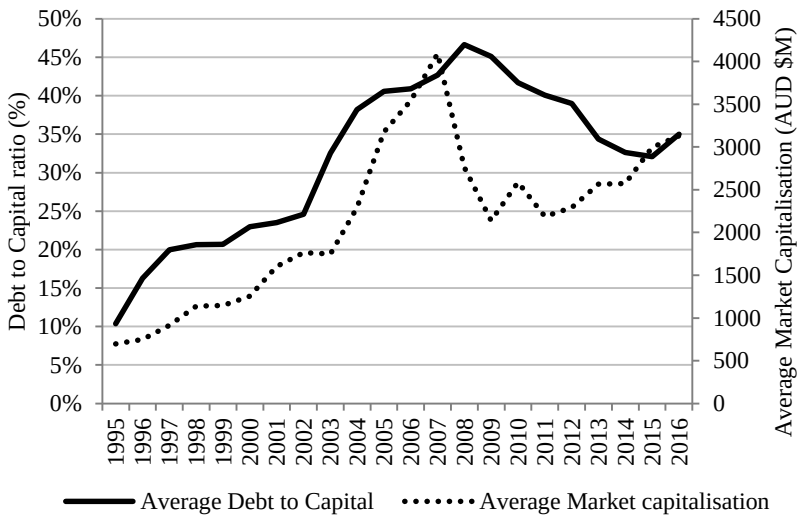
Real estate investment trusts (REITs) first emerged in the Australian share market in the early 1970s. Prior to 2008, they were known as listed property trusts but renamed as REITs to align with international classifications. Higgins (2007) describes Australian REITs (A-REITs) as tax transparent, open-ended property investment vehicles that primarily hold, manage and maintain properties for investment. A-REITs operate in a well-established regulatory environment and are traded on the Australian Securities Exchange (ASX), providing liquidity and governance that are typically not offered in the direct property investment market. In addition to allowing private investors access to large scale commercial properties, which have a size and value that place them beyond the reach of most investors, A-REITs offer investors enhanced liquidity, low entry costs and diversification as an alternative to direct property investing.

Since their inception, A-REITs have grown in size and popularity due to their strong performance relative to other equities. The number of A-REITs increased from 17 in June 1988 to 71 in December 2006, mainly due to the significant amount of money flowing into the sector from institutional investors, such as superannuation funds, and the higher demand for quality real estate. The onset of the Global Financial Crisis (GFC) however, had a devastating impact on the sector. The total market value of A-REITs peaked at A$148 billion (£81 billion) in 2007 before plummeting to a low of A$38 billion (£21 billion) in February 2009 (74% reduction). These devaluations have been attributed in part to high levels of debt financing over the high growth phase of A-REITs from 2001 to 2007. The gearing levels in the A-REIT sector increased strongly in 1995 from 10% to around 45% in mid-2008 (see Figure 1). Most A-REITs have gradually increased their debt exposure with the expectation that positive financial leverage would increase returns to unit-holders. At times, this was done by using complex ownership structures which disguised the liabilities of the parent trust (Australian Securities Exchange, 2017b; Newell and Peng, 2009). De Francesco (2007) highlights that risk increases with increasing gearing levels and that risk-adjusted returns fall with increased gearing. Furthermore, the gearing-risk relationship is influenced by not only the cost of the debt structure but also the interdependence between ungeared returns and interest rates. Historical gearing levels (measured by the average debt to capital ratio) and the average fund size (measured by market capitalisation) are shown in Figure 1.

Figure 1 depicts a steady increase in the leverage ratio from 1995 through to the onset of the GFC. Newell (2006) argues that this steady increase is due to a low interest rate environment and increased exposure to international properties. There is also a strong correlation with market capitalisation over this period as the additional capital was used to expand the range of operating activities. Much of this growth however was cut short by the events of the GFC,

which resulted in significant losses to the sector. Dimovski (2009) finds that the systematic risk of REITs changes dramatically from being more conservative investments than the market on average, to becoming more risky investments than the market on average during periods of financial crises. This is because the sector relies very much on debt. Consequently, funds with higher debt levels were significantly affected during the GFC, which led to the collapse and re-capitalisation of several leading A-REITs. Zarebski and Dimovski (2012) find that these changes to the capital structure mainly came about because most A-REITs during the GFC primarily moved towards survival mode, rather than managerial opportunism. Since the GFC, A-REITs have once again thrived under a low interest environment, outperforming broader stock and bond markets with average returns of 21%, which almost doubled that of the Australian listed equities on the All Ordinaries Index. As a result, the market value has recovered strongly to an estimated A$137 billion (£75 billion) in April 2016 (Australian Securities Exchange, 2016b).

Figure 1 Average Leverage Ratio and Market Capitalisation for A-REITs: 1995 – 2016



Source: Australian Securities Exchange (2017a)

This study seeks to explain the performance of A-REITs as a function of interest rate movements while controlling for general macroeconomic conditions. The relationship between interest rates and REIT performance has been well documented. The expectation that REIT performance is linked to interest rate movements is based on several considerations. First, higher interest rates lead to higher costs of debt, thus reducing company earnings and consequently returns. This is especially true for highly leveraged funds. Secondly, Chen and

Tzang (1988) argue that REITs command a premium for high rates of distribution payments. If this premium was based on the present value of distributions, then a rise in interest rates would reduce the present value of REIT distributions more than other low distribution yielding securities. Thus one would expect a negative relationship to exist between interest rates and REIT returns. Conversely, Yong and Singh (2015) note that rising interest rates may be a signal of a strengthening economy. In principle, higher economic growth increases the demand for commercial property, thus improving occupancy rates and rental income. Therefore, rental yields and inflationary expectations may offset any increases in cost of borrowings, flowing through as higher distributions to investors.

In Australia, studies on the performance of REITs relative to changes in interest rates are limited. A study by Ratcliffe and Dimowski (2007) notes that A-REITs have a significantly negative relationship with long term interest rates but an insignificantly positive relationship with short term movements in interest rates. Yong and Singh (2015) find that the negative impact of interest rate risk only affects A-REITs during stable and expanding market conditions. Given the volatility of A-REIT performance and the historical reliance of the sector on debt driven capital, investors and other market participants would benefit from further investigation into the nature of A-REIT returns and their relationship with interest rates.

The interest rate is a variable of key importance in the analysis of capital markets. As a policy variable, it is a vital tool in the implementation of monetary policy. In financial analysis, it holds particular importance in the portfolio and capital theories in general as it exerts a significant impact on the opportunity set of investors. In Australia, the overnight cash rate (OCR) typically fluctuated between 4 to 8 percent throughout the 1990s and much of the early 2000s. Since 2007, Australia has transitioned into a low interest environment with the cash rate dropping to below 2 percent[1] (while the real cash rate is approximately 0 percent). Whether this trend of low interest rates in Australia continues in the future remains uncertain as other global central banks, including the Federal Reserve, have raised interest rates. Given the effective functioning of financial markets, there is no longer an expectation of additional monetary easing in other major economies. These changes will have a significant impact on capital and property markets. Therefore, the aim of this study, which is to examine the relationship between interest rates and A-REIT performance, is both timely and relevant given the current shifts in interest rate policy.

Literature on the impact of interest rates on REIT performance is discussed in the next section. Sections Three and Four provide an explanation of the research method and data, respectively. Section Five examines the empirical research findings and industry implications. Section Six concludes.

[1] The cash rate was 1.50 percent at the time of writing.

2. Literature Review

The A$137 billion (£75 billion) A-REITs are popular investment options for both institutional and retail investors who are seeking regular income and capital growth. A-REITs are professionally managed vehicles that, in return for a fee, specialise in investing in properties and the management of the portfolio on behalf of investors. Since they are publicly traded, REIT share values reflect the functioning and valuation of stock markets and so provide more liquidity than direct investment in privately traded underlying real estate assets. Another distinguishing feature of A-REITs is their relatively high rate of distribution payments. In the United States (U.S.), REITs are exempt from corporate income taxes if they distribute at least 95% of the net income in the form of distributions to shareholders. In Australia, no formal distribution requirements exist; however, undistributed income is taxed at the highest marginal rate (47%) thus creating an incentive for full distribution. In addition, flow through depreciation benefits make the investments more aligned with property ownership (Chen and Tzang, 1988; EPRA, 2013; Rowland, 2010).

The modern portfolio theory states that the risk factors that affect the return of an asset can be divided into two components: systematic and non-systematic (idiosyncratic) risks. Standard representations of this theory typically identify market risk as a source of systematic non-diversifiable risk. Other common factors include size, value and general macroeconomic conditions. As REITs are a part of the general stock market; their expected return is subject to the same set of non-diversifiable risks borne by any investment captured by the market beta. Empirical evidence shows a positive relationship with higher beta and REIT volatility (Li, 2012). Allen et al. (2000) find that sensitivity to stock-market and interest-rate changes may vary across REITs as a function of their asset structure, financial leverage, management strategy, and/or the degree of specialization in their investment portfolios. Similarly, Delcoure and Dickens (2004) and Li (2012) attribute related changes in REIT stock volatility to a variety of time varying economic and market variables, namely market risk, firm level economic activities, financial leverage, inflation shocks and trading activities.

The Modigliani-Miller (M&M) theorem indicates that in a tax-free environment, all firms should be equity-financed. However, REITs have been found to be historically highly leveraged despite having no tax shield due to its tax-exempt status. Their motivation of debt financing is to increase investment opportunities which require large capital outlays. From the M&M theorem, the volatility of equity REITs can be expressed as a combination of debt price volatility, and volatility of the total value of a firm. This establishes a direct link between financial leverage and the volatility of the equity return of a firm. Financial leverage can magnify the investment returns of a firm when the return on the portfolio is adequately positive. However, leverage can also magnify a negative return on an investment portfolio, thus creating more pronounced

losses. Therefore, the risk of a REIT is expected to be positively related to its degree of financial leverage (Allen et al., 2000; Chaudhry et al., 2004; Devaney 2001; Li, 2012; Lee et al. 2008).

According to Ratcliffe and Dimowski (2007), the degree of financial leverage has drawn attention to interest rates as an important macroeconomic indicator that influences the performance of A-REITs. In a U.S. based study, Swanson et al. (2002) find that interest rates have a greater impact on REITs than other listed corporations and may thus exert an investment advantage/disadvantage given the state of interest rates in the U.S. An earlier study by McCue and Kling (1994) finds that movements in nominal interest rates account for almost half of the variation in REIT returns. Thus, interest rates along with market beta have been consistently found to drive REIT stock prices and returns. This suggests, consistent with the finance theory, that increased debt levels result in higher market risk.

Allen et al. (2000) find strong evidence to suggest that REIT returns are more sensitive to long-term interest rates than short-term rates. For REITs, short-term and variable-rate debt ratios return a significantly negative coefficient to systematic risk. These results support the idea of lower interest rate risk which leads to lower systematic risk. On the other hand, long-term debt has a significantly positive relationship with REIT systematic risk (Delcoure and Dickens, 2004). However, Ratcliffe and Dimowski (2007) find that leverage has a positive and significant impact on the market coefficient irrespective of short-term or long-term interest rate models.

Many of these studies include periods of economic expansion, recession and recovery, thereby encompassing significant economic swings and changes in trading volume. Liow and Huang (2006) investigate the impact of interest rates on three major Asian listed property markets (Japan, Singapore and Hong Kong) and the UK REIT market within a time-varying risk framework. Their study finds that property stocks are generally sensitive to changes in long and short term interest rates and to a lesser extent, their volatility. Further to this issue, Chen and Tzang (1988) find that changes to long term interest rates significantly affect the stock price of REITs. Long term reductions of interest rates are correlated with stock price increases while long term increases in interest rates have a negative impact on stock prices. Conversely, Stunda (2015) divides the study period into high and low interest rate periods in the U.S. and find that smaller firms have significantly positive stock price changes during periods of relatively low interest rates and significantly negative stock price changes during periods of high interest rates, whilst larger funds seem unaffected by movements in interest rates. Other similar studies on U.S. data (Laopodis 2009; Liang & Webb 1995) have demonstrated mixed results when evaluating the impact of interest rate movements on sector performance.

With respect to movements in interest rates, current research specific to A-REITs is limited. Newell (2005) investigates the performance of A-REITs at

both the sectoral and individual levels to measure the proportion of return variability that is attributed to stock market movements, interest rates and direct property factors. Consistent with this previous research, Ratcliffe and Dimowski (2007) also find conclusive evidence of a negative coefficient on long-term interest rates. Furthermore, their study reveals an insignificantly positive relationship with short term interest rate movements and A-REIT performance. Chikolwa (2011) finds a significantly positive relationship between size and leverage of REITs, and states that larger A-REITs are likely to take on more debt. Yong and Singh (2015) suggest that sensitivity to interest rates varies during upward and downward market conditions whereas the impact of long-term financing costs undermining A-REIT returns is evident only during robust market conditions.

For the A-REIT sector, the current falling interest rates mean a lower cost of debt has partially driven earnings, while making the sector look more attractive than stocks and bonds. Going forward, although a rise in interest rates will increase borrowing costs, this does not necessarily translate into a decline in A-REIT returns. Yong and Singh (2015) argue that rising interest rate signals a strengthening economy. In theory, higher economic growth increases demand for commercial property, thus improving occupancy rates and rental income. Therefore, rental yields and inflationary expectations may offset any increase in cost of borrowings, flowing through as higher distributions to investors.

The literature review highlights that detailed analyses of the impact of movements in short-term and long-term interest rates on A-REIT performance over specific economic cycles are limited. This research will thus quantify the impact of movements in interest rates on A-REIT performance over different time periods applied to portfolios constructed with varying degrees of leverage and fund size. The research data and method are discussed in the next section.

3. Research Method

The intertemporal capital asset pricing model (ICAPM) in Merton (1973) proposes that investors receive a premium for bearing market (systematic) risk as well as additional risk in the form of unfavourable shifts in the investment opportunity set, represented by a series of state variable(s). The ICAPM therefore has the following specification:

$$E(R_t) - \alpha = \beta_1 \left[E(R_{mt}) - \alpha \right] + \beta_2 \left[E(R_{ht}) - \alpha \right] \quad (1)$$

where

$E(R_t)$ = expected return on an asset in period *t*

$E(R_{mt})$ = expected return on the market portfolio in period *t*

$E(R_{ht})$ = expected return on a hedge portfolio constructed with covariance on the return of each asset which is identical to the covariance between the changes in the state variable of interest and the return of the asset

α = the risk free rate

To test the ICAPM, Gibbons (1980; 1982) suggests the following market model with the addition of a changing state variable:

$$R_t = \beta_0 + \beta_1 R_{mt} + \beta_2 \Delta S_t + \varepsilon_t \quad (2)$$

where ΔS_t = changes in the state variable, S, in period *t*

The selection of an appropriate state variable is therefore an important empirical issue. Merton (1973) suggests the use of long term interest rates, stating (p. 873):
The interest rate has always been an important variable in portfolio theory, general capital theory, and to practitioners. It is observable, satisfies the condition of being stochastic over time, and while it is surely not the sole determinant of yields on other assets, it is an important factor. Hence, one should interpret the effects of a changing interest rate ... as a single (instrumental) variable representation of shifts in the investment opportunity set.

Previous studies that have evaluated the impact of movements in interest rates on A-REIT performance have found a negative relationship with long-term interest rates but an insignificantly positive relationship with short-term movements in interest rates. However, these studies on Australia, such as Ratcliffe and Dimowski (2007) and Yong and Singh (2015), have used the panel method and quantile regression method for panel data. Similar studies overseas on Asian and UK REIT markets have used generalized autoregressive conditional heteroskedasticity in mean (GARCH-M) analysis (Liow and Huang 2006). Based on Merton's suggestion, we propose the following CAPM formula:

$$E(R_t) = \beta_0 + \beta_1 STOCK + \beta_2 BILL + \beta_3 BOND + X_t^{'}\beta \quad (3)$$

The variable *STOCK* is computed as the monthly logarithmic returns for the ASX stock market index. *BILL* and *BOND* represent the changes in yields of 90-day bank accepted bills and 10 year treasury bonds respectively. The 90-day bank accepted bill and 10 year treasury bond rates are commonly accepted measures of short and long term interest rates respectively. Lastly, X_t is a vector of macroeconomic indicators including inflation, gross domestic product (GDP) growth rates and default risk premiums.

To accommodate the possibility of leading and lagging effects, leads and lags of up to 2 periods in the explanatory variables were tested with the preceding equation.

To examine the effect of leverage on A-REIT performance, funds were divided into two portfolios: low debt (LD) and high debt (HD); based on gearing levels. A fund was considered LD if its debt to capital ratio is smaller than the cross sectional average in the prevailing period and HD otherwise. To estimate the

impact of size risk, funds were separated into three portfolios: *Small*, *Medium* and *Large* based on their market capitalisation. Funds with less than A$1 billion in market capitalisation were classified as 'Small'. Funds with a market capitalisation between A$1 billion and A$3 billion were classified as 'Medium'. Funds in excess of A$3 billion in market capitalisation were classified as 'Large'. Average portfolio returns were used in cross sectional asset pricing tests via Equation 3.

While exposure to market risk (so called market 'beta') has been well documented, the relationship between asset returns and inflation is not immediately clear. The Fisher equation states that the real rate of return on an asset is equal to its nominal rate less inflation. That is, any increases (reductions) to inflation must be met with a commensurate increase (reduction) to nominal returns if the real rate of return is to be maintained. However, previous studies have found evidence of the opposite (Jaffe and Mandelker, 1976; Bodie, 1976; Nelson, 1976; and Fama and Schwert, 1977) thus suggesting that common equities are not an effective hedge against inflation. Unsecuritised real estate on the other hand, has been found to serve this purpose well (Sirmans and Sirmans, 1987; Hoag, 1980; Brueggeman et al., 1984; Miles and McCue, 1984; Hartzell et al., 1987; Gyourko and Linneman, 1988). As underlying REIT assets are primarily real estate, REITs should also possess such inflation hedging properties. However, evidence from the literature indicate they do not (Gyourko and Linneman, 1988; Goebel and Kim, 1989; Titman and Warga, 1989; Park et al., 1990; Chen et al., 1990; Liu et al., 1997) thus suggesting that REITs behave more like common stocks as perverse inflation hedges.

Glascock et al. (2002, p. 302) argue that "(t)he observed negative relationship between REIT returns and inflation is merely a manifestation of the effects of changes in monetary policy". Glascock and Lu-Andrews (2014) further demonstrate that changes to funding liquidity, which may be brought about by changes to monetary policy significantly affects market-wide liquidity flowing through as negative shocks to stock returns. The authors find that among the various macroeconomic indicators, default risk premium is the most consistent indicator of funding liquidity. As Glascock et al. explain (p. 30), "when default premium is higher, funding liquidity tends to be lower ... because when default premium becomes higher, it indicates that the probability of default is higher. Hence, funding liquidity decreases, making it harder for borrowers to obtain loans". Therefore, default risk premiums, calculated as the difference in yield between low grade long corporate bonds (BBB) and long government bonds (AAA) were included in the current asset pricing tests.

Common risk factors such as size, value (book-to-market) and momentum were considered but ultimately not explored for several reasons. The first relates to issues of sample size. In their seminal work, Fama and French (1992; 1993) divide the universe of stocks into size *and* value sorted portfolios (based on quintile, and later decile breakpoints) which result in 5 x 5 = 25 size-value

sorted portfolios[2] for 'pre-ranking' and apply the cross sectional asset pricing tests to the resultant portfolios. Given that the A-REIT market consists of only approximately 50 listed funds, such portfolios would invariably suffer from small sample size bias.

The second reason is that REITs may have characteristics that differentiate them from ordinary stocks and presumably do not experience the same degree and type of exposure to common risk factors. In fact, Fama and French (1992; 1993) specifically omit financial firms and REITs on the basis that such firms typically have higher degrees of leverage which may not indicate financial distress. As Fama and French (1993, p.9) state: "Only firms with ordinary common equity (as classified by CRSP) are included in the tests. This means that American Depository Receipts (ADRs), Real Estate Investment Trusts (REITs) and other units of beneficial interest are excluded".

4. Data

The research covers a 21 year timeframe (1995-2016), and uses ex-post benchmark data of total monthly return asset and macroeconomic data. In addition, three distinct segments of the economic cycle were observed over the sample period: pre-GFC (prior to September 2007), GFC (September 2007 – August 2009)[3] and post GFC (after August 2009). The asset data and economic benchmark representations for the research include:

- Australian equities (STOCK) = S&P/ ASX 200 Accumulation Index or All Ordinaries Index;
- Listed property (A-REITs) = S&P/ASX 200 A-REIT Index;
- Australian fixed income (BOND & BILL) = Reserve Bank of Australia (Interest rate 'chart pack'); and
- Australian inflation and GDP = Australian Bureau of Statistics (Cat. 1345.0 – Key economic indicators).

All financial variables including: adjusted closing prices[4], number of shares outstanding, debt to capital ratios[5], and capitalisation and market price indices were obtained from a relevant benchmark source, Australian Bureau of Statistics (2017), Australian Securities Exchange (2017a,b) and Reserve Bank of Australia (2017). Returns were calculated as the natural logarithm of price ratios in sequential periods. All financial variables were available at monthly frequency. Macroeconomic variables such as GDP, inflation, 90 day bank accepted bill rates and 10 year treasury bond rates are widely available from

[2] Decile breakpoints would result in 10 x 10 = 100 size-value sorted portfolios

[3] Note that this definition of the crisis period is consistent with that used in other studies (Yong and Singh, 2015)

[4] Adjusted for distribution payments, stock splits and so on and so forth.

[5] Defined as (Long Term Debt + Short Term Debt & Current Portion of Long Term Debt) / (Total Capital + Short Term Debt & Current Portion of Long Term Debt).

official public sources. GDP and inflation were only available at quarterly frequency but converted to monthly frequency via cubic spline interpolation[6] (Encyclopaedia of Mathematics, 2015).

In total, there were 55 A-REIT entities available for analysis. To be included in the sample, A-REITs must satisfy size and data availability requirements. Funds with less than 24 months of available data were removed from the sample. Also, funds with less than A$100m in market capitalisation were not considered. Lastly, the Scentre fund was recombined with Westfield[7], and the Centro fund was recombined with Federation (now known as Vicinity). The recombined returns were calculated as value weighted averages by using market capitalisation as weights. In total, 25 funds were removed/incorporated via these filters.

Descriptive statistics for all variables are reproduced in Table 1. The columns *ALL*, *LD* and *HD* are based on monthly return data for A-REITs and represent a portfolio that contains ALL, LD and HD funds respectively. Similarly the columns, *Small*, *Medium* and *Large* are constructed from portfolios that contain small, medium and large sized funds respectively. The variable *STOCK* represents returns based on the ASX200 price index. *BILL* and *BOND* represent changes in the short and long term interest rates respectively. Lastly, *Inflation* represents the inflation rate and *%ΔGDP* represents the percentage change in GDP. For ease of interpretation, monthly returns data are annualised[8].

HD funds generate higher returns than LD funds (3.86% vs. 1.28%) but also exhibit greater risk (as measured by the standard deviation in returns) thus suggesting a risk premia associated with financial leverage. As defined, HD funds are more highly leveraged than LD funds as indicated by the average debt to capital ratio (45.23% vs. 21.33%). This is expected given that these funds borrowed aggressively to fund expansion in the years prior to the GFC of 2007-2009.

[6] This is implemented in Matlab with the 'spline' function.

[7] The Scentre group was created in June 2014 when the Westfield Group separated its U.S. and European businesses from its operations in Australia and New Zealand.

[8] $Annual\ Ret = \prod_{i=1}^{12}(1 + R_i) - 1$

Table 1 Descriptive Statistics - Annualised Asset Return and Macroeconomic Variables: 1995 to 2016.

	A-REITs						STOCK	BILL	BOND	Inflation	%ΔGDP
	ALL	LD	HD	Small	Medium	Large					
Mean	4.19%	1.28%	3.86%	3.93%	-0.25%	6.23%	4.81%	4.91%	5.43%	2.62%	3.28%
Median	10.86%	6.55%	9.29%	11.13%	5.87%	8.58%	6.72%	4.95%	5.50%	2.63%	3.63%
Std. Dev	24.39%	23.77%	24.63%	27.03%	26.72%	20.75%	14.86%	1.63%	1.75%	1.13%	0.91%
Min	-82.81%	-79.91%	-85.79%	-86.59%	-82.07%	-69.22%	-47.13%	1.74%	1.91%	0.23%	1.82%
Max	74.72%	78.78%	58.09%	78.37%	64.05%	54.39%	36.89%	8.27%	10.55%	4.45%	5.01%
Skew	-1.7231	-1.1846	-1.9289	-1.4355	-1.4729	-1.4872	-0.9866	-0.0015	0.0045	-0.1413	-0.1119
Kurtosis	3.8728	2.3384	4.3007	2.5768	2.2226	3.6417	1.6917	-0.0065	0.0058	0.0953	-0.9880
DCR*	32.43%	21.33%	45.23%	35.11%	24.48%	28.35%					
N	30	16	14	21	2	7					

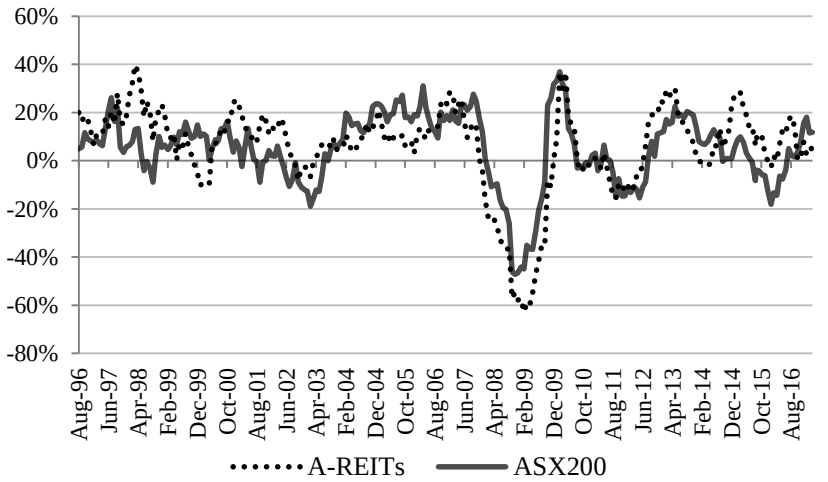
Note: *Average Debt to Capital Ratio

Surprisingly, small cap funds generate lower average returns than Large sized funds (3.93% vs. 6.23%). Furthermore, Medium sized funds exhibit overall negative average returns over the sample period (-0.25%). However, these results are likely due to a concentration of negative outliers during the crisis episode thus resulting in negative bias. When median returns (which are relatively more robust to outliers) are considered, small cap funds generate higher overall returns than Medium and Large sized funds (11.13% vs. 8.58%). Small cap funds also exhibit higher levels of risk than Large sized funds as indicated by the standard deviation (27.03% vs. 20.75%) thus suggesting a size-risk premium, which is consistent with the portfolio theory (Fama and French, 1992; 1993).

In terms of the overall A-REIT sector, the performance is marginally lower than general equities with mean returns of 4.19% vs. 4.81%. However, when median returns are considered, the A-REIT sector outperforms general equities (10.86% vs. 6.72%) with higher levels of risk as indicated by the standard deviation (24.39% vs. 14.86%).

The large disparity between the mean and median returns suggest the presence of outliers. This is confirmed by the large negative coefficients of skewness. A cursory inspection of the returns time series depicted in Figure 2 indicates a concentrated period of negative returns which correspond to the GFC of 2007-2009.

Figure 2 Annualised Historical Returns for A-REITs and Equities: 1995 – 2016



Source: Australian Securities Exchange (2017a, 2017b)

It is clear that, over the sample period, Australian equities experienced three distinct phases of the economic cycle characterised by expansion (prior to September 2007), recession (September 2007 – August 2009) and recovery (August 2009 onwards). The years prior to the GFC were characterised by strong economic growth and relative prosperity. This was punctuated by several spikes in inflation and overall high interest rates. In contrast, the onset of the GFC saw falling economic growth, rising volatility in inflation and sharp reductions in interest rates. This led to significant falls in the performance of both A-REITs and Australian equities. As the economy entered its post GFC recovery phase, there was a partial restoration of GDP growth and further reductions in interest rates, which translated into recovery for both A-REITs and Australian equities.

Figure 3 depicts the historical performance of LD vs. HD funds over the sample period. Throughout much of the early periods, HD funds outperformed LD funds by a margin of approximately 10 – 20 percent (annualised) reaching a peak outperformance of 41 percent in May 2001. However, by the onset of the GFC, this pattern was reversed with HD funds underperforming LD funds by a margin of approximately 10 – 20 percent. Since the GFC however, performance between the two groups has been roughly at parity. Table 2 provides an analysis of A-REITs and Australian equities over the pre-GFC, GFC and post-GFC periods.

Figure 3 Annualised Historical Returns – LD vs. HD Funds: 1995 – 2016

Table 2 Annualised Asset Performance Statistics by Economic Cycle: 1995 to 2016.

	Pre-GFC		GFC		Post-GFC	
	A-REITs	STOCK	A-REITs	STOCK	A-REITs	STOCK
Mean	11.89%	9.11%	-34.00%	-18.23%	7.20%	4.51%
Median	11.23%	9.40%	-35.77%	-19.88%	6.49%	3.11%
Std. Dev	9.24%	10.15%	23.26%	22.67%	13.23%	12.51%
Avg. Sharpe Ratio	1.1097	0.8523	-2.8161	-1.2583	0.2558	-0.0772
Min	-10.23%	-18.91%	-62.84%	-47.13%	-35.09%	-18.12%
Max	39.65%	31.03%	15.80%	27.68%	36.84%	36.89%

Prior to the GFC, A-REITs generated higher returns with lower standard deviations. Risk adjusted returns in the A-REIT sector (represented by the Sharpe ratio) were superior to the overall stock market (1.1097 vs. 0.8523). This period was characterised by phenomenally high total returns in the A-REIT sector. This attracted significant institutional money in what is now regarded as the 'golden era' for A-REITs. This outperformance was the result of a mixture of active portfolio selection and a wider range of operating activities, which were financed largely through debt. The average gearing levels in the A-REIT sector increased substantially from approximately 10 percent in 1994 to 45 percent at the height of the GFC (see Figure 1). Eventually the collapse of stock prices, including A-REITs, widening credit spreads, and the freeze-up of the private equity real estate market in late 2007, resulted in a significant decline in returns.

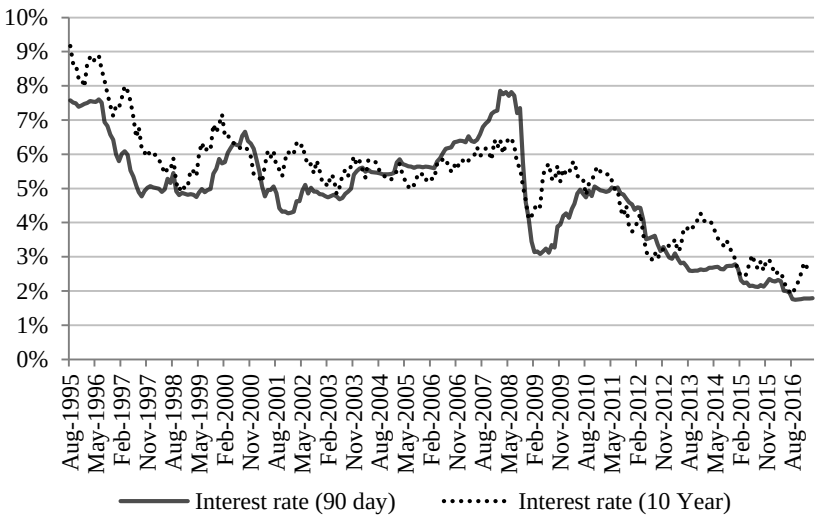
During the GFC, A-REITs and equities in general recorded substantially negative returns. However, the effects of the GFC were more strongly felt in the A-REIT sector. Average returns in the sector was -34.00% compared to -18.23% for general equities (a factor of approximately 1.8). Volatility in the sector also reached record highs (23.26% for A-REITs and 22.67% for general equities) which resulted in strongly negative risk adjusted returns as indicated by the Sharpe ratio.

Much of these losses were recovered in the post-GFC period. Although performance did not return to pre-crisis levels, A-REITs once again outperformed general equities on average (7.20% vs. 4.51%). Volatility levels were moderate and comparable across both sectors thus resulting in modest improvements to risk adjusted returns. Much of the recovery in the A-REIT sector was the result of debt restructuring (see Figure 1) and changes to management structure with several funds reverting to internal management (stapled structure). The growing shift towards internal management structure is supported by recent studies on interval vs. external management. Ambrose and Linneman (2001) and Yong and Singh (2015) find that for some funds, the selection of an external management structure is based on the notion that external management may enjoy scale economies and superior expertise, which alternately benefit the trust. However, external managers are remunerated both

on a base fee computed from assets under management and an incentive fee based on achieving performance targets. Therefore, the conscious is that external managers may prioritise growing the asset base of the firm rather than optimising profitability, that is, high return investments. In contrast, an internal management structure would not suffer from this problem.

In terms of the general macroeconomic environment in Australia, interest rates have transitioned from a high of approximately 7 percent in the mid 1990s to historic lows of approximately 2 percent in more recent times. During the GFC, Australia's central bank (the Reserve Bank of Australia) lowered the cash rate dramatically with bond rates falling accordingly. For much of the past decade, Australia has been operating in a low interest environment (see Figure 4).

Figure 4 Historical Interest Rates in Australia, Short and Long Term Bonds: 1995 – 2016

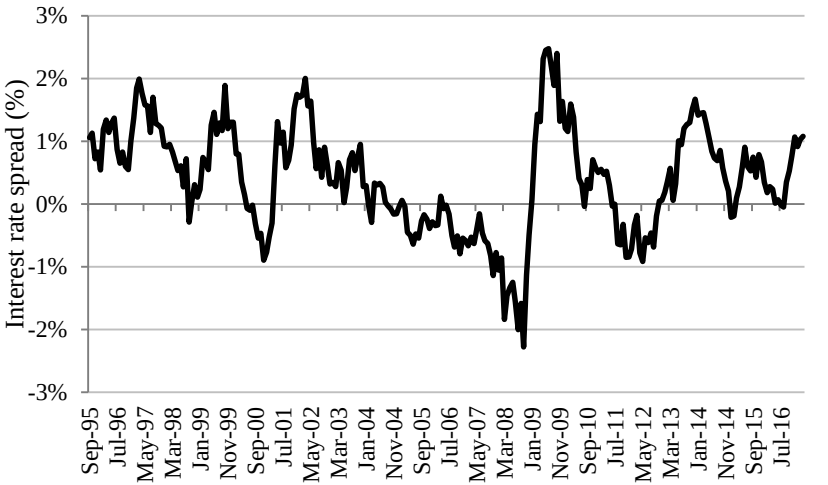


Source: Reserve Bank of Australia (2017)

As Figure 4 indicates, long term interest rates for the majority have remained above short term rates. This results in an 'upward' or normal yield curve and represents the so called time value of money. However, during periods of impending economic stress, short term interest rates may rise above long term rates, thus resulting in an 'inverted' yield curve. Yield curve inversion is sometimes, although not always, a precursor to an economic crisis. During crisis periods, central banks are expected to lower interest rates. In such an environment, investors may prefer the steady flow of income offered by longer term bonds. The resultant increase in demand places upward pressure on prices

thus compressing yields which causes long term interest rates to fall. The term structure of interest rates (computed as the difference between the long and short term interest rates) captures this effect as shown in Figure 5.

Figure 5 Yield Spreads, Australian Long and Short Term Bonds 1995 – 2016



Source: Reserve Bank of Australia (2017)

As Figure 5 indicates, term spreads for the most part have remained positive. The events of the GFC resulted in a negative term spread and yield curve inversion. This returned to normality in 2009. Term spreads once again entered negative territory in 2011-2013 amid fears of a second financial crisis, but have since returned to a positive value.

5. Results

As the literature review (Section II) explains, a significant body of work exists that link REIT performance with known risk factors such as market exposure, macroeconomic conditions and interest rate movements. Table 3 contains a correlation matrix between portfolio returns formed on the basis of leverage and size, and the proposed set of risk factors.

Table 3 Correlation Matrix Between Dependent Variables and Proposed Set of Explanatory Variables: 1995 to 2016

		Average Return	Average Return - LD	Average Return - HD	Average Return - SM	Average Return - MED	Average Return - LRG
STOCK	Pearson's Correlation	.573**	.601**	.550**	.467**	.476**	.675**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	259	250	235	259	259	236
GDP	Pearson's Correlation	-.015	-.009	.002	-.016	.061	-.085
	Sig. (2-tailed)	.818	.884	.981	.797	.329	.195
	N	255	250	235	255	255	232
Inf (t + 1)	Pearson's Correlation	-.226**	-.238**	-.261**	-.220**	-.116	-.221**
	Sig. (2-tailed)	.000	.000	.000	.001	.078	.001
	N	233	233	219	233	233	211
BILL	Pearson's Correlation	.298**	.265**	.342**	.284**	.228**	.193**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.003
	N	259	250	235	259	259	236
BOND	Pearson's Correlation	.143*	.046	.076	.199**	-.027	-.034
	Sig. (2-tailed)	.021	.473	.249	.001	.662	.602
	N	259	250	235	259	259	236

Notes: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

All returns series bear a strongly statistically significant correlation with market returns (STOCK), one period ahead inflation[9] and changes to short term interest rates (BILL). Returns however are not significantly correlated with GDP growth, and although the average returns for the A-REIT sector as a whole are significantly correlated with changes in long term interest rates (BOND), the average returns for LD and HD funds are not significantly correlated. The economic theory states that GDP and inflation are themselves related. The rationale for including these indicators is to control for general macroeconomic conditions; therefore, including both in the model may result in over-fitting of the data given the systematic relationship between them. The variable GDP was thus removed from the model.

In terms of size, all funds exhibit a strongly significant correlation with market returns (STOCK). Both Small and Large sized funds are strongly correlated to one period ahead inflation. Small, Medium and Large sized funds have a strong positive correlation with changes in short term interest rates but only Small sized funds are affected by changes to long term rates. Table 4 contains a summary of the regression analysis based on Equation 3.

5.1 Cross Sectional Asset Pricing Tests

The results of the cross sectional asset pricing tests are summarised in Table 4.

Table 4 indicates that market returns (STOCK) are strongly statistically significant for all portfolios, thus indicating strong exposure to market risk, which is consistent with the portfolio theory. LD funds however are more sensitive to market risk than HD funds as indicated by the estimates of the market beta (1.1833 vs. 0.8870)..

Short term interest rates (BILL) are significant in all models (except Large sized funds). The coefficient estimates are positive and greater for HD funds (6.9130) than LD funds (4.1454) thus indicating that higher gearing levels lead to increased exposure to movements in short term interest rates. The positive coefficient may at first appear counterintuitive. However, rising short term interest rates may be an indication of economic prosperity as central banks tend to raise interest rates during periods of robust economic growth. This may in turn translate to higher rental yields which benefit REITs.

Long term interest rates (BOND) are strongly significant in all models. Coefficient estimates are negative and greater for HD funds (-5.1809) than LD funds (-4.9575) thus indicating that higher gearing levels lead to increased exposure to movements in long term interest rates. The negative coefficient might suggest that fund performance is adversely affected by rising costs of debt. Furthermore, the increased sensitivity of HD funds implies that highly leveraged funds are more exposed to this source of risk. Another explanation as

[9] With the exception of medium sized funds.

proposed by Chen and Tzang (1988) lies in the fact that investors pay a premium for the relatively high distribution yields that REITs offer. If this premium is based on the present value of distributions, then higher interest rates would reduce the present value of such distributions.

Inflation is significant in the ALL, LD and HD models funds thus suggesting that fund performance is negatively affected by rising rates of inflation. Default risk premiums are strongly significant in all models. Coefficient estimates are negative and greater for HD funds (-1.2497) than LD funds (-0.7843) which indicates that higher gearing levels lead to greater default risk exposure, which in turn, is a proxy for funding liquidity risk.

To estimate the impact of size, funds were separated into three portfolios (Small, Medium and Large) on the basis of market capitalisation. All size sorted portfolios exhibit a strong exposure to market risk with Medium sized funds having the strongest exposure. Medium and Large sized funds however do not have a statistically significant relationship to inflation, thus suggesting that these funds are less exposed to general macroeconomic conditions while Small sized funds are more exposed. Small and Medium sized funds show a positive relationship with changes in short term interest rates All portfolios exhibit a negative relationship to changes in long term interest rates with Medium sized funds having the greatest exposure.

Note the discussion in Section 3 highlights a relationship between inflation and monetary policy to the extent that inflation is acting as a proxy for changes to monetary policy which in turn has an impact on funding liquidity. The effect of the latter was captured by the default risk premium. Some experimentation with omitting inflation from the asset pricing models was performed but this proved somewhat detrimental to the overall model fit.

5.2 Effects of Financial Crisis 2007-2009

Repeating the analysis over the pre, during and post GFC periods yields another set of insightful results. This is shown in Table 5.

In terms of leverage sorted portfolios, funds prior to the GFC did not exhibit much sensitivity to changes in interest rates and default risk premiums. However, inflation had a significantly positive impact on fund returns. During the GFC, market risk increased sharply both in magnitude and significance. The market beta for LD stocks rose to 1.7299 during the GFC compared to 0.5392 in the years prior while the market beta for HD stocks rose to 1.3954 during the GFC compared to 0.5850 prior. No other variables in the dataset had a significant effect on fund returns. In the post GFC recovery phase, market risk diminished in magnitude while interest rates became a less significant driver of fund returns possibly due to already low levels of interest rates which created an environment of cheap credit. This may also be due in part to efforts by the

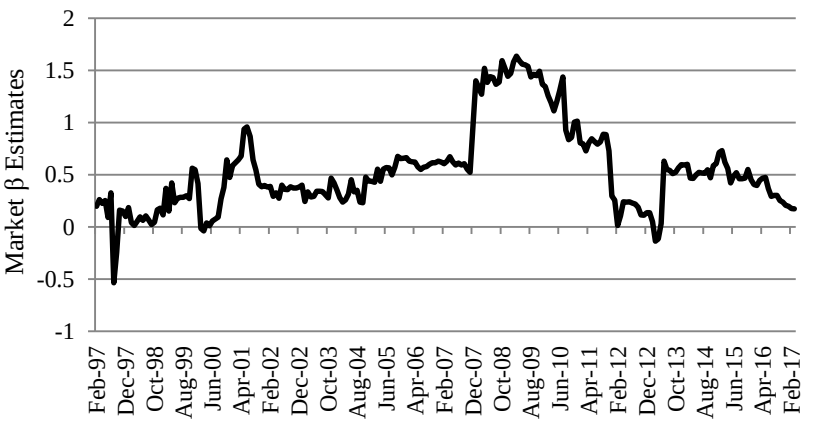
A-REIT sector to reduce debt as discussed earlier in Section I, which would obviously reduce the exposure to interest rate risk.

Similar patterns were observed in size-sorted portfolios. During the GFC, market risk became a much stronger driver of fund returns but dropped in prominence in the years after the GFC. Interest rate risk also diminished in significance for Small and Medium sized funds. Large sized funds however remained sensitive to changes to long term rates

5.3 Dynamic Exposure to Market Risk

The sharp rise in market beta during the GFC is suggestive of dynamically changing exposure to market risk. To investigate the variation in beta over time, a *rolling regression* was performed with an 18 month fixed window and step size of 1. The results are shown in Figure 6.

Figure 6 Estimated Market β (rolling regression: 18 month window)



During the early parts of the modelling period (c.1997), market beta for A-REITs fell sharply possibly in response to the Asian currency crisis. This pattern was again observed around 2000 which coincided with the collapse of the information technology bubble over the early 2000s. Such procyclical behaviour is consistent with findings from Glascock (1991) who demonstrate that REIT portfolios experience lower (higher) market betas during periods of economic contractions (growth). The evidence from the current study suggests that A-REITs represented defensive options for investors during the early periods. However, these defensive properties dissipated during the onset of the GFC as the market beta increased sharply in late 2007. In the years prior to the GFC, many A-REITs had begun to borrow aggressively to fund expansion followed by changes to management structure which allowed for an increased range of operating activities thereby compounding financial risk.

Table 4 Summary of Regression Analysis: 1995 to 2016

	ALL Funds	*LD*	*HD*	*Small*	*Medium*	*Large*
Constant	0.0576***	0.0358**	0.0666***	0.0746***	0.0241	0.0281*
STOCK	1.0573***	1.1833***	0.8870***	1.0078***	1.1426***	0.9971***
Inflation	-1.7112***	-0.9812**	-1.9311***	-2.1985***	-0.6413	-0.7053
BILL	5.0203***	4.1454**	6.9130***	4.9576**	6.8502*	1.3083
BOND	-5.3098***	-4.9575***	-5.1809***	-4.2255**	-7.5482**	-5.4401***
Risk Premium	-1.034***	-0.7843**	-1.2497***	-1.2307***	-1.0098	-0.748**
Adjusted R^2	0.688	0.641	0.594	0.636	0.306	0.572

Notes: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels of significance respectively.

Table 5 Summary of Regression Analysis (pre, during and post GFC periods)

		ALL Funds	LD	HD	Small	Medium	Large
Pre-GFC	*Constant*	-0.0433*	-0.0513**	-0.0239	-0.0272	-0.0929**	-0.0571
	STOCK	0.5481***	0.5392***	0.5850***	0.5829***	0.3353	0.5938**
	Inflation	1.4529***	1.3987***	1.3711*	1.2253**	1.6179**	1.8652**
	BILL	-5.2143	-7.7316**	-1.2991	-1.095	-16.8104***	-8.2597
	BOND	-3.9024*	-3.3682	-5.2705	-4.6523*	-3.0601	-3.1819
	Risk Premium	1.0358	2.3763	-1.2711	0.0632	5.6041**	1.0822
	Adjusted R^2	0.491	0.528	0.229	0.367	0.382	0.285
GFC	*Constant*	0.0236	-0.0064	0.0513	0.0279	-0.0259	0.0355
	STOCK	1.5065***	1.7299***	1.3954***	1.4313***	2.2204***	1.3161***
	Inflation	-1.2465	0.2563	-1.6849	-1.8748	1.8631	-0.5553
	BILL	2.8593	0.5404	3.8927	3.7999	-0.7839	-2.586
	BOND	-3.7259	-0.0518	-5.9362	-3.8279	-4.4436	-2.0357
	Risk Premium	-0.5714	-0.6373	-1.1979	-0.3431	-1.59	-1.1918
	Adjusted R^2	0.761	0.693	0.668	0.688	0.686	0.553
Post-GFC	*Constant*	0.0473**	0.0405**	0.0493**	0.0615***	0.0801	0.01
	STOCK	0.5935***	0.7792***	0.305**	0.4824***	0.3533	0.7897***
	Inflation	-1.4241**	-1.0966*	-1.4961**	-1.8446***	-1.7364	-0.3352
	BILL	-1.9315	-2.0525	-0.888	-3.2004	-0.919	-0.9745
	BOND	-1.2039	-3.4274*	1.4211	1.6119	-2.3155	-5.6885***
	Risk Premium	-0.4766	-0.7219	-0.3115	-0.5262	-2.3942	-0.043
	Adjusted R^2	0.461	0.522	0.225	0.386	0.054	0.604

Notes: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels of significance respectively.

5.4 Foreign Risk

Given that certain funds in the sector had overseas investments and operations, exposure to several key foreign markets was also explored. Market indices for the U.S. (S&P500), Japanese (Nikkei), Hong Kong (Hang Seng) and Chinese (Shanghai Stock Exchange (SSE) composite) markets were included in the cross sectional asset pricing tests. The results are shown in the following table.

Table 6 REIT Exposure to Foreign Risk (pre, during and post GFC Periods)

	ALL periods	Pre GFC	GFC	Post GFC
Constant	0.0514***	-0.0557**	0.0148	0.0488**
STOCK	0.8103***	0.7769***	0.8159*	0.543***
Inflation	-1.5574***	1.5735***	-1.1055	-1.4868**
BILL	4.7428**	-4.0392	2.6179	-1.8706
BOND	-5.3705***	-2.9781	-1.5333	-1.4556
Risk Premium	-0.9762***	1.6477	-0.3925	-0.5125
S&P 500	0.3732***	-0.4060*	0.8693*	0.0891
Nikkei	0.0145	0.1318	-0.2641	-0.0241
Hang Seng	0.0289	0.0094	0.0276	0.0061
SSE Composite	-0.0219	0.0024	0.093	-0.0041
Adjusted R^2	0.704	0.508	0.771	0.429

Notes: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels of significance respectively.

Of the foreign markets, only exposure to the U.S. market is statistically significant. During the pre-GFC period, the coefficient for the S&P 500 was negative (-0.4060) which suggests that U.S. operations serve a defensive purpose and is an important source of diversification benefits. However, the events of the crisis reversed this trend and added to financial risk. In the post GFC phase, exposure to the S&P 500 was no longer a significant driver of REIT returns in Australia. Further experimentation with foreign exchange rate risk was conducted but ultimately not fruitful. Conventional approaches to measuring this source of risk typically involve some form of value at risk (VaR) analysis which requires detailed firm level data that were generally unavailable, specifically foreign asset holdings, transactions and cash flows.

6. Conclusion

This study has examined the impact of short and long term interest rate movements on A-REIT returns. The asset pricing method employed in this study is motivated by the ICAPM per Merton (1973). As Merton (1973) suggests, the interest rate holds particular importance in the portfolio and capital

theories in general as it exerts a significant impact on the opportunity set of investors. Gearing has the potential to magnify returns but also compounds financial risk due to the greater range of associated operating activities. In Australia, the REIT sector borrowed aggressively to fund expansion but suffered heavy losses during the GFC, which is reflected by the data period that spans the majority of the life cycle of the sector from its early emergence in the 1990s to its boom phase (circa 2001-2007), decline over the GFC (2007-2009) and subsequent recovery (2009-2016).

To examine the effect of leverage on A-REIT performance, funds are divided into two portfolios: LD and HD, based on gearing levels. To estimate the impact of size risk, funds are separated into three portfolios: *Small*, *Medium* and *Large* based on their market capitalisation. The results indicate that HD funds generate greater median returns than LD funds but also show greater variance in returns thus suggesting a risk premium associated with financial leverage. As expected, HD funds are approximately twice as heavily geared as LD funds with an average debt to capital ratio of 45.23% vs. 21.33%. In terms of size, which is another commonly recognised risk factor, Small sized funds outperform Medium and Large sized funds but also show a higher standard deviation in returns than Medium and Large sized funds, thus suggesting a risk premium associated with size risk. Small sized funds also have higher average gearing ratios than Medium and Large sized funds, thus indicating that they are more reliant on debt than equity financing.

Not surprisingly, the events of the GFC were felt more strongly among those with greater risk exposure. Prior to the crisis, the A-REIT sector as a whole outperformed general equities with higher median returns and slightly lower variance which resulted in superior risk adjusted returns (as measured by the Sharpe ratio). During the GFC, this pattern was reversed with the A-REIT sector which recorded extremely poor performance and higher returns variance relative to general equities thus resulting in very poor risk adjusted returns. In the post GFC recovery phase, the A-REIT sector rebounded with higher median returns but slightly higher returns variance. Despite this, the sector still managed to outperform general equities in terms of risk adjusted return. Much of the recovery efforts were focused on balance sheet restructuring, debt reduction and capital raisings which were aided by the general recovery of the equities market.

The empirical results indicate that A-REITs have a statistically significant relationship with market risk, inflation, interest rates and default risk. Exposure to market risk is found to vary inversely with gearing level. LD funds are more sensitive to market risk than HD funds. Both LD and HD funds are affected by inflation and default risk with HD funds exhibiting greater exposure. Default risk (as measured by the difference between low grade long corporate bonds and long government bonds) may be a proxy for funding liquidity. HD funds have greater sensitivity to both short and long term interest rates than LD funds. This is expected given the higher levels of gearing found among the HD funds.

Interestingly, performance is found to vary positively with rising short term interest rates. One possible explanation is that rising short term interest rates may be indicative of a strengthening economy as central banks usually raise interest rates to ease inflationary pressure during periods of strong economic growth. A strong economy would in turn generate higher rental yields which have a positive effect on REIT returns. This finding is consistent with other studies of the Australian market. Fund performance however, is found to vary negatively with rising long term interest rates. This could be due to the rising cost of debt.

When testing the impact of the GFC, both LD and HD funds are found to have a statistically significant relationship with market risk and negative relationship with rising long term interest rates prior to the GFC. During the GFC however, exposure to market risk roughly tripled in magnitude. Post GFC, market risk diminished in effect and long term interest rates were only significant for LD funds. The lack of an observable interest rate effect is attributable to the low interest rate environment that prevailed in the years after the GFC (see Figure 4) as well as less reliance on debt within the sector, thereby minimising exposure to interest rate risk (see Figure 1).

Regarding size risk, the empirical tests indicate that market risk varies positively with size. That is, larger sized funds have greater exposure to market risk than smaller sized funds. This is expected given the higher ratio of equity in the capital structure of Large sized funds. In the pre-GFC phase, Small sized funds had a negative exposure to long term interest rates. During the GFC, market risk was the only significant risk factor in the asset pricing tests. Post GFC, interest rate risk was only significant in Large sized funds. Once again, this may have been the result of a general reduction to interest rate risk through debt restructuring efforts by the majority of funds and reduced foreign investment exposure.

The implications for asset allocation strategies are that portfolio managers and other investors who are seeking to reduce exposure to interest rate risk may do so by selecting funds with less leverage. Funds with higher debt benefit more when there is a rise in short term interest rates but this may be offset when there is a corresponding increase in the long term interest rates. This source of downside risk may be compounded during crisis episodes such as the GFC. On the other hand, highly leveraged A-REIT funds offer the potential for greater returns due to a wider range of operating activities and asset diversification.

Smaller A-REIT funds offer potentially greater returns than Large sized funds with interest rate risk being somewhat mitigated during the post GFC era as the result of general reductions in debt and a low interest environment. However, whether this trend continues in the foreseeable future is uncertain given recent indications by central banks for potential rate increases. Future studies would benefit as the sector continues to undergo transformation and reform, and more data become available.

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