PACIFIC RIM PROPERTY RESEARCH JOURNAL, 2018
VOL. 24, NO. 1, 85–103
https://doi.org/10.1080/14445921.2018.1436323

Routledge
Taylor & Francis Group

Australian interest rate movements and A-REITs performance: an analysis by industry sector

Wejendra Reddy and Woon-Weng Wong

School of Property, Construction and Project Management, RMIT University, Melbourne, Australia

ABSTRACT

Investment managers have traditionally resorted to the Australian real estate investment trusts (A-REITs) as a means to growing portfolio return. The A-REITs have been popular for yielding some of the best returns until 2007, when the global financial market (GFC) collapse led to major fall in values. Since the GFC, with low interest rates the A-REITs have performed well compared to the broader stock and bond markets. Given low expectations of additional monetary easing, future rising interest rate environment can significantly impact A-REIT performance mainly in industry sectors with greater reliance on debt funding. Thus, this research explores the sensitivity of A-REITs performance to changes in short- and long-term interest rates across five sectors: diversified, industrial, retail, office and specialised (non-core) funds. The analysis covers a 21-year period (1995–2016) using the capital asset pricing model. In doing so, the research allows comparison of A-REITs performance at sub-sector level and over different market cycles. Findings indicate that both the diversified and retail sector exhibit strong relationship to market risk, short- and long-term interest rates. Rising short-term interest rates contribute to positive returns while rising long-term interest rates result in lower returns. However, the impacts of movements in interest rates on industrial, specialised (non-core) and office sectors were not well explained by the asset pricing model. This could be due to the relatively small sample size of these funds. Overall, the results suggests that gearing levels and by extension costs of debt, do play a significant role in the returns generating process. The paper offers a well-defined practical implication by suggesting that investors may hedge against interest rate risk by selecting A-REITs sub-sector funds with less leverage and large market capitalisation.

ARTICLE HISTORY
Received 29 July 2017
Accepted 31 January 2018

KEYWORDS
REITs; interest rate; property investments; bonds; capital asset pricing; leverage

Introduction

Australian real estate investment trusts (A-REITs) formally known as Listed Property Trusts (LPTs), have a long established history in the Australian stock market since 1971. Since their inception, A-REITs have grown in size and popularity due to their strong performance relative to other equities. A-REITs are popular investment options for both institutional and retail investors seeking regular income and capital growth. By definition, A-REITs are

CONTACT Wejendra Reddy wejendra.reddy@rmit.edu.au

professionally managed vehicles that, in return for a fee, specialise in investing in properties and the management of the portfolio on behalf of investors. Initially, A-REITs almost exclusively owned properties only. However, from the late 1990s, some trusts have diversified into other activities, such as funds management and property development (Rowland, 2010).

Each A-REIT will have its own fund characteristics, that is, the trust properties selected are usually diversified across regions (inter-state, global), lease lengths and tenant types. Traditionally, the A-REITs markets were divided into office, retail, industrial and diversified. From an institutional investor context, the retail, office and industrial sectors are classified as "core" property markets. However, in recent years, the investment choices of A-REITs have expanded to include specialised or "non-core" property sectors such as agricultural land, healthcare, retirement, storage, childcare, educational, data centres, petroleum, residential and hotel properties. Newell and Wen Peng (2008) found that the growth of the specialised REITs sector is driven by an increased appetite for property investment by pension funds and the growing mismatch between available funds and available good quality core property assets. In addition, there are also demographic changes favouring the retirement and healthcare property sectors. As a result, A-REITs now hold property interest across five particular sectors:

- *Diversified trusts* – invest in a mixture of industrial, offices, hotels and retail properties.
- *Office trusts* – include medium to large-scale office buildings in and around major cities.
- *Retail trusts* – invest in shopping centres and similar assets.
- *Industrial trusts* – invest in warehouses, factories and industrial parks.
- *Specialised trusts* – invest in non-core property sectors such as hotel and leisure, healthcare, residential and childcare (ASX, 2017c).

There are currently 52 A-REITs trading across these identified sectors valued at A$130 billion. Figure 1 provides the sector diversity for A-REITs based on market capitalisation. Retail (44%) dominates the A-REITs market followed by diversified (34%), industrial (11%), specialised (6%) and office (4%) funds.

The top ten leading A-REITs accounted for approximately 80% of the A-REIT sector total market capitalisation, as at 30 June 2017. Table 1 details the list of top 10 A-REITs funds based on market capitalisation value. Westfield's retail funds: Scentre Group (A$21.6 billion) and Westfield Corporation (A$16.7 billion) are the largest A-REITs listed on the ASX,

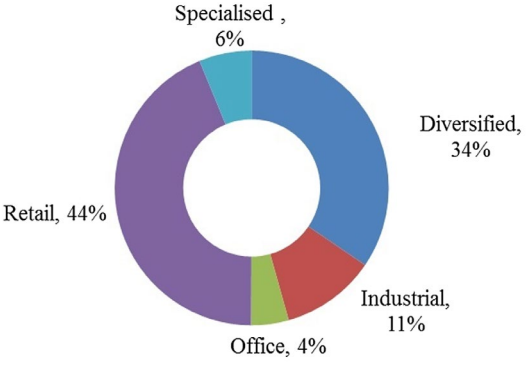

Figure 1. A-REITs Market Size by Industry Sector: 30 June 2017. Source: ASX (2017c).

Table 1. Top Ten A-REITs by Market Capitalisation: 30 June 2017.

Fund name	Sector	Market capitalisation (A$m)	Rank
Scentre Group	Retail	21563.40	1
Westfield Corporation	Retail	16687.06	2
Goodman Group	Industrial	14080.38	3
Stockland	Diversified	10592.59	4
Vicinity Centres	Retail	10173.73	5
Dexus Property Group	Diversified	9640.85	6
GPT Group	Diversified	8629.80	7
Mirvac Group	Diversified	7892.84	8
Investa Office Fund	Office	2695.67	9
Charter Hall Group	Diversified	2561.77	10
Viva Energy REIT	Specialised	1645.26	17

Source: ASX (2017c).

with a combined market capitalisation of approximately A$38 billion. Another retail fund, Vicinity Centres (A$10.2 billion), formerly Federation Centres is the third largest A-REIT. Industrial sector-based Goodman Group ($A14.1 billion) and diversified fund, Stockland ($A10.6 billion) round up the top five largest A-REITs. Investa Office Fund Group ($A2.7 billion) and Viva Energy REIT (A$1.7 billion) are the largest office and specialised sector A-REITs, respectively (ASX, 2017c).

The A-REITs investment cycles have moved through periods of boom-bust in the early 1990s and late 2000s. The number of A-REITs increased from 17 in 1990 to 71 as at December 2006, due mainly to the significant amount of money flowing into the sector from institutional investors, such as superannuation funds. However, the onset of the Global Financial Crisis (GFC), had a devastating impact on the sector. The A-REITs sector measured by the S&P/ASX 200 A-REIT Index declined from a peak of approximately A$148 billion (August 2007) in market capitalisation to a low of approximately A$38 billion in February 2009. The more severe collapse in the A-REITs sector during GFC has been attributed to structural alteration in recent years, including increased gearing levels. A-REITs average debt level during this period was 45%, with some trusts recording gearing levels above 60%. Historical gearing levels (measured by the average debt to capital ratio) and the average fund size (measured by market capitalisation) is shown in Figure 2.

Figure 2 depicts a steady increase in the leverage ratio[1] from 1995 through to the onset of the GFC. Newell (2006) argued that this steady increase was due to a low interest rate environment and increased exposure to international properties. Most A-REITs had gradually increased their debt exposure with the expectation that positive financial leverage would increase the returns to unit holders. At times this was done using complex ownership structures which disguised the liabilities of the parent trust (Newell & Wen Peng, 2008). Dimovski (2009) identified that 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 period of financial crisis. This is because of the sector's greater reliance of debt. Consequently, those A-REITs with higher debt levels were significantly affected and lead to the collapse and recapitalisation of several leading trusts. Zarebski and Dimovski (2012) found that these changes to capital structure mainly come 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

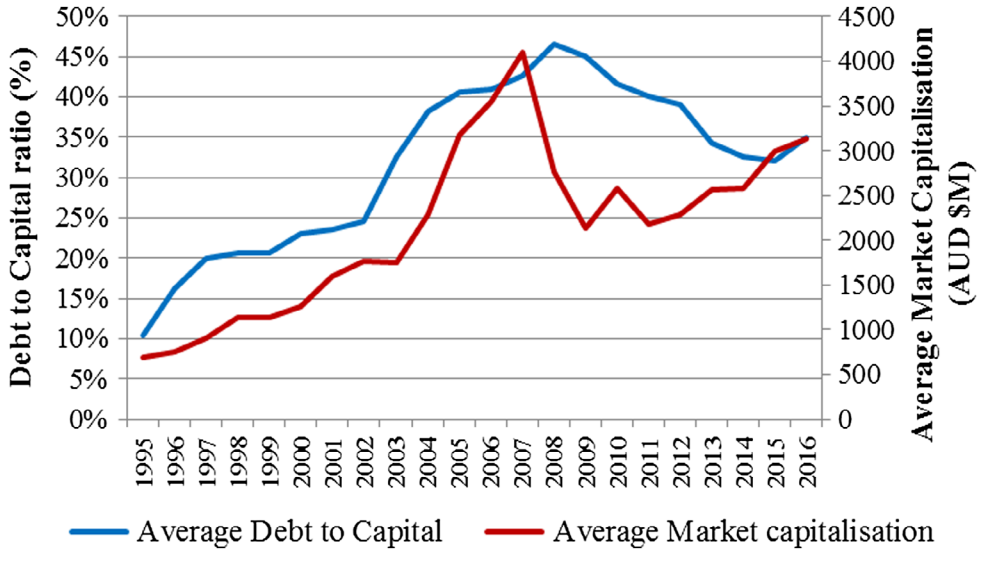

Figure 2. Average Leverage Ratio and Market Capitalisation for A-REITs: 1995–2016. Source: ASX (2017b).

under a low interest environment outperforming broader Australian listed equities markets (see Figure 3).

De Francesco (2007) highlighted that risk rises with rising gearing levels and that risk-adjusted returns fall with rising gearing. Furthermore, the gearing-risk relationship is influenced by not only the cost of debt structure but also the interdependency between ungeared returns and interest rates. For the A-REITs sector, the current low interest rate environment mean a lower cost of debt partially driving earnings, while making the sector look more attractive than stocks and bonds. Going forward, although a rise in interest rates

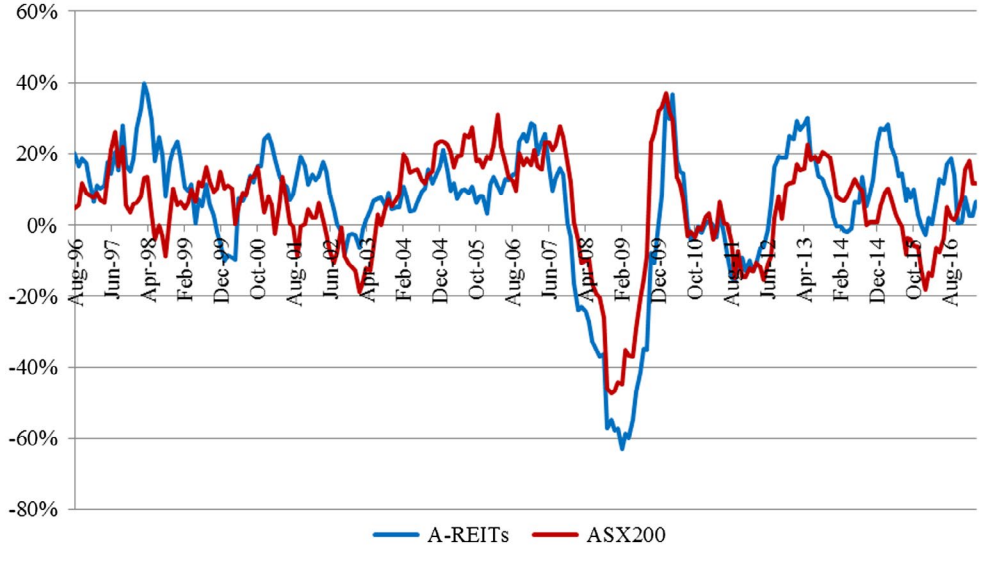

Figure 3. Australian Equities and A-REITs Performance: 1995–2016. Source: ASX (2017a,b).

will increase borrowing costs, it may not mean a decline in REIT returns. Yong and Singh (2015) argue that rising interest rates signal a strengthening economy. In theory, higher economic growth increases demand for commercial property, 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.

Given the volatility of A-REIT performance and the sector's historical reliance on debt driven capital, investors and other market participants would benefit from further investigation into the nature of A-REIT returns and their relationship to a key capital market determinant: interest rates. In particular, this research aims to quantify the relationship over time between different A-REITs sectors and interest rates using an intertemporal capital asset pricing model (ICAPM) motivated by Merton (1973). Given current expanding investment choices, such analysis allows comparison of A-REITs performance both at sub-sector level and over different market cycles. In doing this, the paper offers a well-defined practical implication by suggesting that investors may hedge against interest rate risk by selecting A-REITs sub-sector funds with less leverage and large market capitalisation.

This study is both relevant and timely given the current shifts in interest rate policy. Since the GFC, Australia has transitioned into a low interest environment with the cash rate dropping to below 2%[2] (RBA, 2017). Whether this trend of low interest rates in Australia continues in the future remains uncertain as other global central banks including the US 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. Literature on the impact of interest rate on REIT performance is discussed in the next section.

Literature review

Higgins (2007) described 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 is typically not offered in the direct property market.

The A-REITs sector experienced phenomenally high total returns in the early to mid-2000s, averaging 20% per annum in the four years to June 2007 (see Figure 3). Various studies (De Francesco & Hartigan, 2009; Newell, 2005, 2006; Rowland, 2010) found that this performance was a mixture of active portfolio selection and trusts taking on additional risk exposure, such as growing offshore property assets, diversification in funds management and property development and increased debt/gearing levels. Eventually, the collapse of stock prices, including REITs, widening credit spreads, insufficient bank liquidity and the freeze-up of the private equity real estate market in late 2007, resulted in a significant decline in returns.

Studies by De Francesco and Hartigan (2009) and Newell and Najib Razali (2009), found that in the post-GFC period investors have become more risk averse, refocusing on A-REITs that cater for defensive style investments with low to moderate gearing. Thus, several trusts have reduced their debt levels and are attempting to change their management structures. In addition, the declining interest rate environment, coupled with strong demand for income

has led to strong recovery of A-REIT sector, with the sector constantly outperforming the broader equities market.

Therefore, the interest rate is an important macroeconomic indicator that influences both A-REITs and the wider financial market. As a policy variable, it is a vital tool in the implementation of monetary policy. In financial analysis, it holds particular importance in portfolio theory and capital theory in general as it exerts a significant impact on the investor's opportunity set. An expectation that REIT performance be linked to interest rate movements is based on several considerations. Firstly, higher interest rates lead to higher costs of debt 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 dividend payment. If this premium were based on the present value of dividends, then a rise in interest rates would reduce the present value of REIT dividends more than other low dividend 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 demand for commercial property, thus increasing rental income which offsets any increase in borrowing costs, resulting in higher distributions to investors.

There are several international studies that have investigated the impact of interest rate movements on REIT performance. Hiang Liow and Huang (2006) examined 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 found that property stocks are generally sensitive to changes in the long-term and short-term interest rates. However, Su, Huang, and Pai (2010) examined the effect of a change in short-term interest rates on US and Japanese REITs and found that increase/decreases in interest rates have limited effect on REIT prices owing mainly to different market conditions. Akimov, Stevenson, and Zagonov (2015) study examined six leading global REITs market including Australia and US that were unable to provide definitive evidence as to whether listed property markets display major sensitivity to changes in interest rates. Similar studies (Laopodis, 2009; Liang & Webb, 1995; McCue & Kling, 1994) on US, Asian and UK REIT markets have demonstrated mixed results when evaluating the impact of movements in interest rates on the REIT sector's performance. In Australia, studies on the performance of REITs relative to changes in interest rates are limited. A study by Ratcliffe and Dimovski (2007) noted that A-REITs have a significant negative relationship with long-term interest rates but an insignificant positive relationship with short-term movements in interest rates. Yong and Singh (2015) found that the negative impact of interest rate risk only affects REITs during stable and expanding market 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 market beta. Empirical evidence shows that when the stock market is more volatile, REIT volatility is also higher (Li, 2012). The sensitivity of REIT returns to stock market and interest rate changes is influenced by various REIT characteristics and specialisation. Allen, Madura, and Springer (2000) explains that the relationship between risk and degree of specialisation in the firm's investment portfolio may in fact depend on whether an individual REIT has sufficient expertise in the property types it holds and whether expansion across property types generates additional diversification benefits.

Ambrose and Linneman (2001) found diversified REITs had the lowest profit margin, the lowest rental income to total income, the highest average general and administration expenses and the highest market betas. In the Australian context, the evidence showed a statistically significant positive relationship between property type and value (Hedander, 2005). In addition, West and Worthington (2006) examined the impact of macroeconomic risk factors on Australian commercial real estate and found that interest rates are a significant risk factor across all types of listed property portfolios. Chikolwa (2011) also found mixed results when evaluating the impact of leverage on various property sectors, highlighting that those assets that yield high levels of predictable cash flows, such as retail and industrial assets, are more likely to support higher levels of debts. The findings from the literature appear to provide a consistent conclusion that the diversification across different property types is a naive strategy. In contrast, Ratcliffe and Dimovski (2007) found that A-REITs that diversify across different property types are able to smooth the cyclicality of property sector returns; however, the findings were constrained due to the selected sample. Their study consisted of larger A-REITs with advantages from scale economies that give them sufficient expertise to manage different property types.

The review of literature highlights that detailed analysis of the impact of movements in short-term and long-term interest rates on REIT performance over specific economic cycles by industry sector are limited in both Australia and globally. This research thus aims to quantify the impact of movements in interest rates on A-REITs performance by industry sector. The research data and methodology are discussed in the next section.

Data and methodology

Data

This research aims to quantify the relationship over time between interest rates and different A-REITs sectors, namely: diversified, industrial, retail, office and specialised (non-core) REITs. To do this, the research covers a 21-year timeframe (31 August 1995 to 31 August 2016), and uses ex-post monthly total return asset benchmark data and macroeconomic data. In addition, three distinct segments of the economic cycle were observed over the sample period: pre-GFC (prior to 31 August 2007), GFC (01 September 2007 to 31 August 2009) and post-GFC (01 September 2009 onwards). All financial variables including: adjusted closing prices,[3] number of shares outstanding, debt to capital ratios,[4] capitalisation and market price indices were obtained from relevant benchmark source:

- Australian Equities (STOCK) = S&P/ ASX 200 Accumulation Index or All Ordinaries Index;
- Listed Property (A-REIT) = S&P/ASX 200 A-REIT Accumulation 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).

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 official public sources such as ABS (2017), ASX (2017a, 2017b) and RBA (2017). Note that industrial production was initially included in the cross sectional asset pricing tests but ultimately omitted owing to a lack of explanatory power. GDP and inflation were only available at quarterly frequency but converted to monthly frequency via a cubic spline interpolation[5] (Encyclopaedia of Mathematics, 2015).

In terms of the general macroeconomic environment in Australia, interest rates have transitioned from a high of approximately 7% in the mid 1990s to historic lows of approximately 2% in more recent times. During the financial crisis, 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 since been operating in a low interest environment (see Figure 4).

As Figure 4 indicates, it is evident that both the 90-day and 10-year interest rates are at historical lows, providing an advantageous investment environment for A-REITs. Low interest rates mean that A-REITs improve their cost of borrowing and also increase demand for, and therefore the valuation of, their properties. However, cheap debt provides added incentive for A-REITs to take on more risky investments. Any increase in short- or long-term interest rates could have significant implications on the fund's debt serviceability, which is especially true for A-REITs that are highly leveraged. Selected A-REITs debt-to-capital ratio, which is the proportion of a company's total capital that is debt, is detailed in Figure 5.

Figure 5 shows that the historical average debt-to-capital ratio (gearing) for the A-REITs sector over the 1995–2016 study period was 40%. As demonstrated earlier in Figure 2, the average gearing ratio of the A-REITs sector was around 10% in the mid-1990s, increasing to 45% by the end of 2007. In the post-GFC period, many funds have improved capital management, with the sector average gearing level reducing to 33%. Attaining a like-for-like comparison for most funds is difficult given mergers, acquisitions, re-branding and

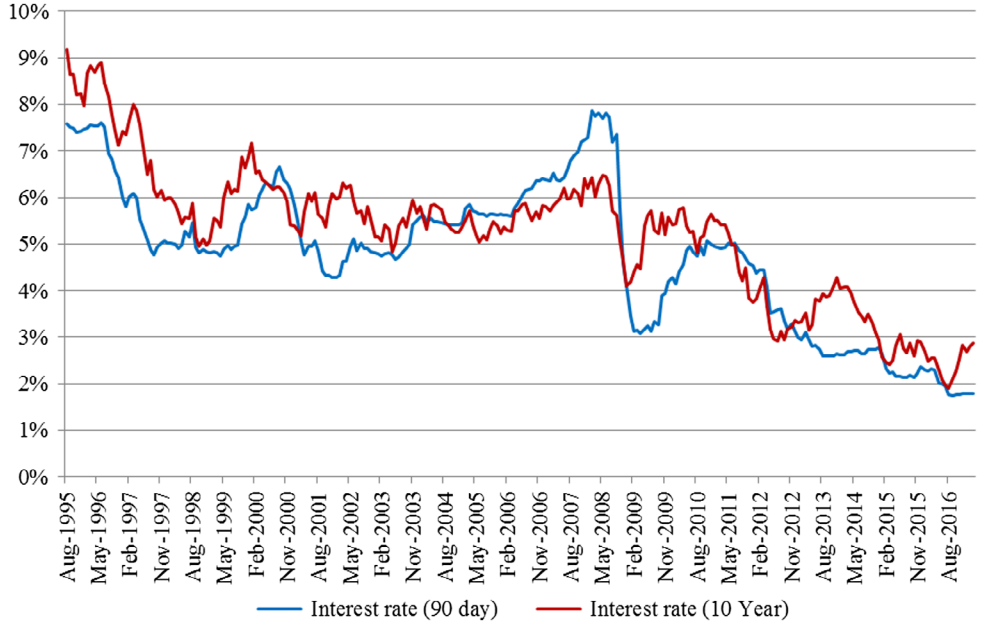

Figure 4. Australian Short- and Long-Term Interest Movements; 1995–2016. Source: RBA (2017).

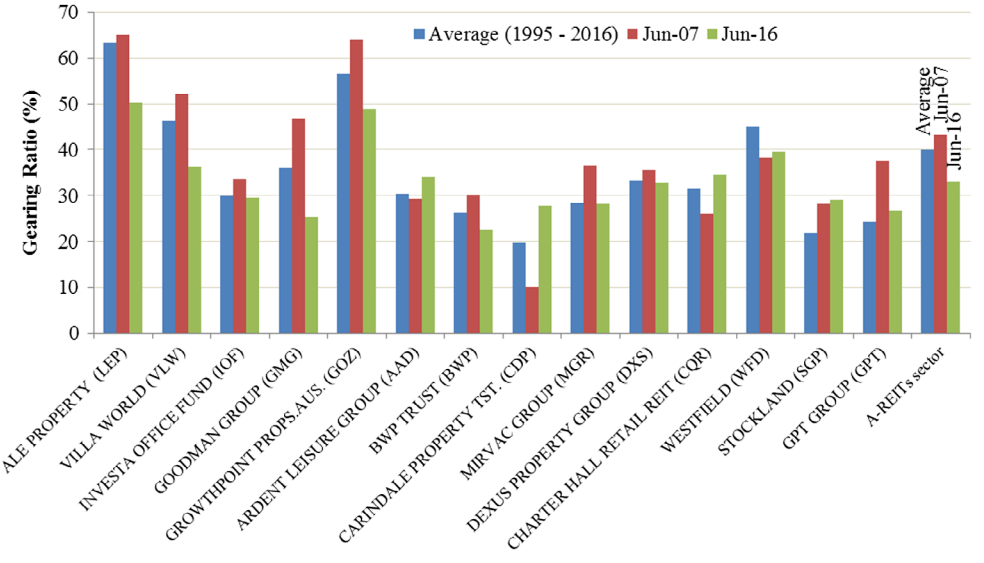

Figure 5. A-REITs Sector and Selective Individual Fund Gearing Ratios: 1995–2016. Source: ASX (2017b).

corporation spin-off activities. Looking across the 14 individual A-REITs displayed in Figure 5, with the exception of ALE Property Group, Villa World Limited, Goodman Group, Growthpoint and Westfield Corporation, all funds have generally recorded gearing levels below the A-REITs sector averages at different time periods.

In total, there were 55 A-REIT entities available for analysis. To be included in the sample, 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$100 million in market capitalisation were not considered. Lastly, the Scentre fund was recombined with Westfield[6]; and Centro fund was recombined with Federation (now known as Vicinity). The recombined returns were calculated as a value weighted averages using market capitalisation as weights. In total, 25 funds were removed/incorporated via these filters.

Descriptive statistics for all variables in annualised form are produced in Table 2. The variable STOCK represents returns based on the ASX200 price index. BILL and BOND represent changes in short- and long-term interest rates, respectively. Lastly Inflation represents the inflation rate and %ΔGDP represents the percentage change in Gross Domestic Product. For ease of interpretation, monthly returns data were annualised.[7]

Table 2. Descriptive Statistics (annualised rates): August 1996–August 2016.

	A-REITs	STOCK	BILL	BOND	Inflation	%ΔGDP
Mean	4.19%	4.81%	4.91%	5.43%	2.62%	3.28%
Median	10.86%	6.72%	4.95%	5.50%	2.63%	3.63%
Std dev.	24.39%	14.86%	1.63%	1.75%	1.13%	.91%
Min	−82.81%	−47.13%	1.74%	1.91%	.23%	1.82%
Max	74.72%	36.89%	8.27%	10.55%	4.45%	5.01%
Skew	−1.7231	−.9866	−.0015	.0045	−.1413	−.1119
Kurtosis	3.8728	1.6917	−.0065	.0058	.0953	−.9880

Source: Author.

These statistics indicate that over the sample period, A-REITs performance was marginally lower than general equities with mean returns of 4.19% vs. 4.81%. However, when median returns are considered, the A-REIT sector outperformed general equities (10.86% vs. 6.72%) with higher levels of risk as indicated by the standard deviation (24.39% vs. 14.86%). Note however that the sample period spans three distinct phases of the business cycle: the pre-GFC, GFC and post-GFC era.[8] The large disparity between mean and median returns would suggest the presence of outliers. This is confirmed by the large negative coefficients of skewness. A cursory inspection of the returns time series data depicted earlier in Figure 3 indicates a concentrated period of negative returns corresponding to the financial crisis of 2007–2009.

The historical performance of the A-REIT market by industry sectors are presented in the Figure 6.

A-REIT performance was varied in the years prior the financial crisis. The events of the GFC however resulted in significant losses to shareholder value across all A-REITs sectors. Performance has since stabilised in the years following the financial crisis. The average annual returns and standard deviation by industrial sector over these periods are presented in Table 3.

As Table 3 indicates, REIT performance was driven predominantly by the Retail sector in the years prior to the GFC. The highly heterogeneous nature of the Specialised sector resulted in a polarising effect. This sector was driven by strong performance from several funds including the ALE Property Group (specialising in food and beverage) and the Ardent Leisure Group (specialising in theme parks, health clubs and indoor entertainment). Shares in ALE Property Group were trading at approximately 80–90 cents at the time of initial offering in late 2003 and grew steadily to a peak of approximately $3.70 in mid 2007 (fourfold increase). Likewise, the Ardent Leisure Group exhibited a similar pattern of growth

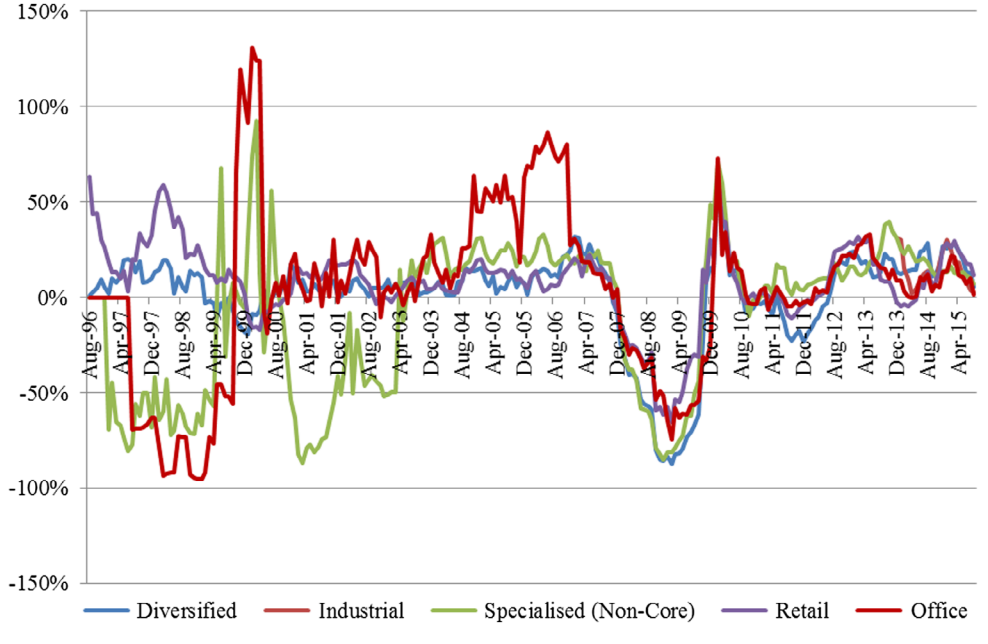

Figure 6. A-REIT historical returns (annualised): 1996–2015. Source: ASX (2017b).

Table 3. Average annual return and standard deviation by industry sector: Pre-GFC, GFC and post-GFC periods*.

	Diversified	Industrial**	Specialised	Retail	Office	STOCK
Pre-GFC	7.46% (8.83%)	NA	−14.47% (42.02%)	14.17% (14.12%)	7.78% (51.65%)	9.11% (10.15%)
GFC	−52.82% (31.31%)	NA	−48.66% (33.16%)	−54.20% (27.38%)	−37.13% (24.25%)	−18.23% (22.67%)
Post-GFC	7.69% (17.26%)	3.65% (45.22%)	17.17% (15.09%)	5.59% (14.28%)	10.72% (15.69%)	6.13% (12.85%)
All	1.88% (23.54%)	NA	−6.83% (38.96%)	7.69% (19.94%)	3.26% (42.56%)	4.78% (12.85%)
All – Sharpe	−1.3202	−.4524	−.8033	−1.3458	−.6466	−1.3202

Source: Author.
*Parenthesis indicate standard deviation; **Reliable statistics for the Industrial sector during the pre-GFC and GFC periods were unavailable due to inadequate sample sizes.

trading at approximately 80 cents at the time of initial offering in 1998 before reaching a peak of approximately $3.70 in late 2007 (fourfold increase). However, performance in the sector was marred by the Aspen Group (specialising in holiday accommodation), which experienced a sharp decline in shareholder value between January 1996 and July 1999. Overall, A-REITs performance was dramatically affected by the effects of the financial crisis. All sectors recorded heavy losses relative to stocks in general. However, these patterns have reversed during the post-GFC recovery with most sectors outperforming the wider stock market.

Methodology

Previous studies evaluating the impact of movements in interest rates on the REIT sector's performance has found negative relationship with long-term interest rates but an insignificant positive relationship with short-term movements in interest rates. However, these studies such as Ratcliffe and Dimovski (2007) and Yong and Singh (2015) in Australia have used panel and panel quantile regressions methods. Similar studies overseas on Asian and UK REIT markets have used generalised autoregressive (GARCH-M) analysis (Hiang Liow & Huang, 2006). This study proposes to examine the A-REIT market performance relative to the movements in interest rates using the CAPM methodology. It follows the Chen and Tzang (1988) and (Merton, 1987) approach to show the sensitivity of REITs to short-term and long-term interest rates using the capital asset pricing model.

Merton's (1973) intertermporal capital asset pricing model (ICAPM) proposed 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 to have a covariance with each asset's return that is identical to the covariance between the changes in the state variable of interest and the asset's return, α = the risk free rate.

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

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

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

The choice of an appropriate state variable therefore is an important empirical issue. Merton (1973) suggested 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.

Based on Merton's suggestion, we propose the following:

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

The variable *STOCK* is computed as the monthly logarithmic returns for the ASX200 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. Note that leverage was not included in the model as a more direct measure of gearing risk. Such an approach may be valid for individual analysis at the funds level (characteristics-based analysis). However, this study is based on aggregates at the industry level and there is too much between fund heterogeneity in gearing to derive a meaningful average. Hence, this study uses interest rates as a sector wide source of risk. Lastly, X_t is a vector of macroeconomic indicators including inflation and GDP growth rates. To accommodate the possibility of leading and lagging effects, leads and lags of up to 2 periods in the explanatory variables were tested in the preceding equation.

To examine the effect of leverage, funds were allocated into five sectors: diversified, industrial, retail, office and specialised (non-core) REITs. Average portfolio returns were used in cross sectional asset pricing tests via Equation (3). The results are presented in the next section.

Results and discussion

To estimate the impact of industry effects, the selected 30 funds were separated into five categories based on the industrial sector of closest affiliation based on ASX descriptions (see p. 2). Further, the portioning is also based on the fund's income-producing property business rather than activities such as fund management, property services and development management. Table 4 outlines the number of funds and relative size by industrial sector.

There were 6 funds in the sample operating in the retail sector accounting for approximately 49% of the market. The second largest sector by size was the diversified sector with 11 funds accounting for approximately 34% of the market. Industrial sector REITs accounted for 10% of market size, followed by specialised (non-core) 4% and office 3%. The sample included 2 office, 2 industrial and 9 specialised REITs. The results show varying debt-to-capital ratios across the five sectors. Over 21-year sample period, industrial REIT

Table 4. A-REITs Size, Significance and Performance by Sector: 1995–2016.

Industrial sector	No. funds	Market cap. (A$m)	Relative Size (%)	Average gearing, 21 years (%)	Average gearing, August 2007 (%)	Average gearing, August 2016 (%)
Retail	6	66,897.98	49	30	32	31
Diversified	11	46,438.71	34	37	44	36
Industrial	2	14,103.64	10	42	45	36
Specialised	9	5875.17	4	36	40	37
Office	2	4589.30	3	39	43	37

Source: Author.

exhibits high average gearing ratio (42%), while retail REITs recorded the lowest average gearing level (30%). Except for retail REITs, all other sectors recorded gearing levels above the 21-year A-REIT average (40%) during August 2007 (start of the GFC period). More recent data show all sectors with reduced debt exposure to within a 31–37 gearing range, evident of post-GFC balance sheet restructuring. Table 5 detailed the individual A-REIT debt-to-capital ratios across the five sectors over 21-year sample period.

Table 5 highlights that 12 out of the 30 REITs, approximately 40%, having gearing levels above the 21-year historical average (40%). Looking across the different sectors, nearly seven funds recorded gearing levels above 50%, including 4 in diversified sector, 1 in the respective specialised and industrial sectors. Gearing ratios for diversified sector ranged from 10 to 67%, specialised sector 29–57%, retail sector 24–43%, industrial sector 31–53% and office sector 30–43%. The Galileo Japan Trust (GJT) from the diversified sector, recorded the highest debt-to-capital ratios (67%). It appears that diversified A-REITs rely more on debt funding than single-sector funds. The results also show greater debt reliance by non-core property funds that specialise in healthcare, child care and retirement facilities.

Figure 6 and Table 3 illustrates the historical monthly total return performance data for different A-REIT sectors. The key parameters from past market data, risk, return and correlation measures, provide the platform to quantify the relationship over time between interest rates and different A-REITs sectors using the CAPM methodology. The correlation matrix between the dependent variables and explanatory variables is reproduced in Table 6.

Diversified funds exhibited a strongly significant correlation to market returns (STOCK), inflation and short-term interest rates (BILL). Industrial funds had a significant correlation

Table 5. Individual A-REITs Average Gearing Ratio (%): 1995–2016.

Diversified	Gearing	Specialised	Gearing	Retail	Gearing
GALILEO JAPAN*	67%	ALE PROP. GROUP	57%	WESTFIELD**	43%
BROOKFIELD PRIME	56%	INGENIA COMMUNT.	49%	CHARTER HALL RETAIL	33%
ASTRO JAPAN	59%	GENERATION HLTHC.	43%	SHOP. CENTS.AUS. GP	32%
GROWTHPOINT	53%	VILLA WORLD	41%	FEDERATION**.	26%
360 CAPITAL GROUP	43%	FOLKESTONE ED.	36%	BWP TRUST	24%
ABACUS PROP. GROUP	33%	ASPEN GROUP	35%	CARINDALE PROP. TRUST.	24%
DEXUS PROP. GROUP	33%	ARDENT LEISURE	32%	Industrial	Gearing
MIRVAC GROUP	28%	US MASTERS	30%	360 CAPITAL INDL.FUND	53%
GPT GROUP	25%	ARENA REIT.	29%	GOODMAN GROUP	31%
STOCKLAND	25%			Office	Gearing
CHARTER HALL GR.	10%			CROMWELL PROP. GROUP	43%
				INVESTA OFFICE FUND	30%

Source: Author.
*Galileo Japan Trust (GJT) ceased operations on 31 October 2016; **The Scentre fund was recombined with Westfield; Centro fund was recombined with Federation (now known as Vicinity Centres).

Table 6. Correlation matrix between monthly returns and explanatory variables by industry sector.

	Diversified	Industrial	Specialised	Retail	Office
STOCK					
Pearson correlation	.622**	.332**	.235**	.489**	.082
Sig. (2 tailed)	.000	.000	.000	.000	.190
N	259	259	254	259	259
GDP					
Pearson correlation	−.018	.040	.062	−.087	.023
Sig. (2 tailed)	.772	.526	.329	.164	.711
N	255	255	250	255	255
Inflation					
Pearson correlation	−.196**	−.100	−.160*	−.167**	.028
Sig. (2 tailed)	.002	.110	.011	.007	.659
N	255	255	251	255	255
BILL					
Pearson correlation	.020	.086	.144*	.003	.164**
Sig. (2 tailed)	.745	.168	.022	.956	.008
N	259	259	254	259	259
BOND					
Pearson correlation	.306**	.135*	.169**	.155*	.168**
Sig. (2 tailed)	.000	.030	.007	.012	.007
N	259	259	254	259	259

Source: Author.
**Correlation is significant at the .01 level (2-tailed); *Correlation is significant at the .05 level (2-tailed).

to market returns and short-term interest rates. Specialised funds correlated strongly to market returns and short-term interest rates and less strongly (but significantly) to inflation and long-term interest rates. Funds in the retail sector had a significant correlation to market returns, inflation and short-term interest rates while the office sector correlated strongly to short-term and long-term interest rates.

The returns data however did not exhibit a significant correlation to GDP growth. 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. The results from the regression analysis are summarised in Table 7.

Fund performance in the diversified and retail sectors was well explained by the asset pricing model, whereas fund performance in the remaining industrial, specialised (non-core) and office sectors was not explained. This may in part be due to a general lack of

Table 7. Relationship between Interest Rates and A-REITs Performance: By Industry Sector.

	Diversified	Industrial	Specialised	Retail	Office
Constant	.0087	.0305	.0263	.0128	−.0084
STOCK	.8562***	1.5426***	.6577***	.7988***	.1655
Inflation	−.4785**	−.7745	−1.3632**	−.524*	.53
BILL	7.0465***	6.024	6.1227	3.1831*	7.9483*
BOND	−4.0214***	.625	3.9936	−2.906*	5.7542
Adjusted R^2	.455	.104	.073	.253	.027

Source: Author.
Notes: Results are based on estimations of Equation (3). *, ** and *** denotes statistical significance at the 10, 5 and 1% levels of significance, respectively.

observations and relatively small sample size of funds in the remaining sectors. Both the diversified and retail sector exhibited strong exposure to market risk, short-term and long-term interest rates. The findings are significant as previous studies, such as Chikolwa (2011), identifying the impact of leverage more pronounced on the retail sector principally. Overall, rising short-term interest rates contributed to positive returns while rising long-term interest rates resulted in lower returns. The results are consistent with earlier studies (Ratcliffe & Dimovski, 2007) which found that A-REITs have a significant negative relationship with long-term interest rates but a positive relationship with short-term movements in interest rates.

Analysis of fund performance during pre-GFC, GFC and post-GFC periods are shown in Table 8.

Fund performance prior to the GFC in the diversified, retail and office sectors were predominantly driven by market risk and exposure to movements in long-term interest rates. Market exposure (as indicated by so called market beta's) were less than unitary suggesting A-REITs were less sensitive to market conditions than general equities, which is consistent with findings from other research (Chan, Hendershott, & Sanders, 1990; Yong & Singh, 2015).

During the financial crisis, market risk exposure across all sectors increased in magnitude and significance. This is consistent with the behaviour of securities in general as systematic financial risk from various sources during crisis episodes are compounded and translated into market risk (Dimovski, 2009; Grout & Zalewska, 2016). Note that the GFC phase identified in the current study corresponds to a 24 month period and there are 5 regressors (including the constant) in Equation (3). Such small observation period can reduce the degrees of freedom introducing potential issues regarding the power of associated

Table 8. Sectorial analysis during pre-GFC, GFC and post-GFC periods.

	Diversified	Industrial	Specialised	Retail	Office
Pre-GFC					
Constant	−.0001		.0129	.0065	−.01
STOCK	.4053***		.6514	.4285***	−.7317*
Inflation	.0733	NA	−1.0734	.1015	.942
BILL	−.0429		5.2875	−.3419	5.6935
BOND	−4.0929***		8.1395	−2.2262*	11.0738*
Adjusted R^2	.293	NA	.015	.152	.042
GFC					
Constant	−.0254		.0571	.0544	−.1046
STOCK	1.5609***		1.1823***	1.1831**	1.8201***
Inflation	−.2858	NA	−2.8743	−2.8408	2.8457
BILL	6.1719		3.8717	1.3382	−1.109
BOND	.4225		−5.23	−5.4505	−1.1919
Adjusted R^2	.774	NA	.597	.363	.309
Post-GFC					
Constant	.0218**	−.016	.0202*	.0336*	.0112
STOCK	.5275***	1.1296***	.3079***	.6447***	.5919***
Inflation	−.8246*	.8067	−.4189	−1.6067*	−.3132
BILL	−4.4635*	1.9366	−.3437	−1.1072	.9428
BOND	−1.6073	−.746	2.6324	−2.7427	−3.8161**
Adjusted R^2	.348	.276	.131	.156	.339

Source: Author.

Results are based on estimations of Equation (3). *, ** and *** denotes statistical significance at the 10, 5 and 1% levels of significance, respectively.

statistical tests. However, extending the observation period would be counterintuitive if the interest is studying the financial crisis and its impact on the identified risk factors. The use of a dummy variable (while ensuring continuity in the modelling period and preserving degrees of freedom) would do little more than act a "shift" parameter and the effect of the financial crisis on individual parameter estimates would not be assessable.

During the post-GFC recovery phase, market risk diminished in magnitude but remained a significant risk factor across all sectors. Inflation risk became significant in the diversified and retail sectors. Interest rate risk was less prominent across various sectors. This was expected as the economy transitioned into a low interest environment following quantitative easing measures adopted by central banks across developed economies. In principle, inflation and interest rates are related as central banks adjust cash rates as part of the inflation targeting regime. However, the two are not always related. For example, recent years have seen historically low interest rates coupled with low inflation.

Conclusion

This research examined the relationship over time between interest rates and different A-REITs sectors, namely: diversified, industrial, retail, office and specialised (non-core) REITs. The analysis was conducted using A-REITs and macroeconomic data over 21 years (1995–2016), with the capital asset pricing model used to test the significance of interest rate on A-REITs performance. The 90-day bank bill and 10-year government bond yield rates were used as short-term and long-term interest rate proxies, respectively.

In total, 30 A-REITs were used for the study. To be included in the sample, REITs had to 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$100 million in market capitalisation were not considered. Retail funds accounted for approximately 50% of the market. The second largest sector by size was the diversified sector with (34%), followed by industrial funds (10%). Specialised (non-core) and office market were minimal in size. The results show varying debt-to-capital ratios across the five sectors. Gearing ratios for the diversified sector ranged from 10 to 67%, specialised sector 29–57%, retail sector 24–43%, industrial sector 31–53% and office sector 30–43%. It appears that diversified A-REITs rely more on debt funding than single-sector funds.

The CAPM modelling results show that both the diversified and retail sectors exhibited strong exposure to market risk and short- and long-term interest rates. Rising short-term interest rates contributed to positive returns while rising long-term interest rates resulted in lower returns. While this result appears contradictory, one possible explanation is that rising short-term interest rates may be indicative of a strengthening economy as central banks commonly raise interest rates during such periods to curb inflationary pressure. However, the impacts of movements in interest rates on industrial, specialised (non-core) and office sectors were not well explained by the asset pricing model. This could be due to the relatively small sample size of these funds. Overall, the results suggests that gearing levels and by extension costs of debt, do play a significant role in the returns generating process. Highly leveraged funds performed better under rising short-term interest rates compared to those with lower leverage, which may be a result of improved rental yields associated with periods of economic growth.

Going forward, this research has wider industry significance. Although, Australia's interest rates are currently at record low levels, the rates are expected to move back up as the economy recovers. This is similar to the current economic cycle faced by the US REITs market. The current signs in USA are of strong macroeconomic recovery – increased employment, consumer spending, which has also increased the demand for commercial properties. Therefore, quantifying the different A-REIT sector's performance patterns would broaden investors' understanding in financial asset pricing and implications of any future interest rates movements respective to different listed property markets in Australia.

Notes

1. Calculated as the percentage of total debt to market capitalisation.
2. The cash rate was 1.50% at the time of this writing.
3. Adjusted for dividend payments, stock splits and so forth.
4. 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).
5. This is implemented in Matlab software via the 'spline' function. The method involves fitting a third order polynomial around existing data points to interpolate unobserved values between these data points.
6. The Scentre group was created in June 2014 when the Westfield Group separated its United States and European businesses from its operations in Australia and New Zealand.
7. Annual Ret $= \prod_{i=1}^{12} \left(1 + R_i\right) - 1.$
8. The pre-GFC period consists of observations between August 1996 and August 2007. The GFC period consists of observations between September 2007 and August 2009 and the post-GFC period consists of observations from September 2009 onwards.

Acknowledgement

The authors would like to acknowledge the contribution of Mr. Mario Saccoccio, Melbourne-based property professional, for his ongoing industry involvement with the research. We acknowledge research funding contributions from School Property, Construction and Project Management at RMIT University. In addition, we acknowledge contributions made by research supervisor, Professor Dr. David Higgins (Birmingham City University).

Disclosure statement

No potential conflict of interest was reported by the authors.

References

ABS. (2017). *Key economic indicators* (Catalogue No. 1345.0). Sydney: Australian Bureau of Statistics. Retrieved June 12, 2017, from http://www.abs.gov.au

Akimov, A., Stevenson, S., & Zagonov, M. (2015). Public real estate and the term structure of interest rates: a cross-country study. *The Journal of Real Estate Finance and Economics, 51*(4), 503–540.

Allen, M.T., Madura, J., & Springer, T. M. (2000). REIT characteristics and the sensitivity of REIT returns. *The Journal of Real Estate Finance and Economics, 21*(2), 141–152.

Ambrose, B., & Linneman, P. (2001). REIT organizational structure and operating characteristics. *Journal of Real Estate Research, 21*(3), 141–162.

ASX. (2017a). *SandP/ASX all ordinaries accumulation index*. Sydney: Australian Securities Exchange. Retrieved July 22, 2017, from http://au.spindices.com/indices/equity/all-ordinaries

ASX. (2017b). *SandP/ASX 200 A-REIT index*. Sydney: Australian Stock Exchange. Retrieved July 17, 2017, from http://au.spindices.com/indices/equity/sp-asx-200-a-reit-sector
ASX. (2017c). *Managed funds*. Sydney: Australian Securities Exchange. Retrieved July 22, 2017, from http://www.asx.com.au/products/managed-funds.htm
Chan, K., Hendershott, P., & Sanders, A. (1990). Risk and return on real estate: Evidence from equity REITs. *Real Estate Economics, 18*(4), 431–452.
Chen, K., & Tzang, D. (1988). Interest-rate sensitivity of real estate investment trusts. *Journal of Real Estate Research, 3*(3), 13–22.
Chikolwa, B. (2011). Investigating the capital structure of A-REITs. *Journal of Real Estate Literature, 19*(2), 391–412.
De Francesco, A., & Hartigan, L. (2009). The impact of changing risk characteristics in the A-REIT sector. *Journal of Property Investment and Finance, 27*(6), 543–562.
De Francesco, A. (2007). Gearing and the Australian real estate investment market. *Journal of Property Investment and Finance, 25*(6), 579–602.
Dimovski, W. (2009). The global financial crisis and the centro properties group earnings revision and refinancing announcements: An event study. *Pacific Rim Property Research Journal, 15*(4), 417–429.
Encyclopaedia of Mathematics. (2015). *Spline interpolation*. Finland: European Mathematical Society. Retrieved March 23, 2017, from https://www.encyclopediaofmath.org/index.php/Spline_interpolation
Gibbons, M. R. (1982). Multivariate tests of financial models: A new approach. *Journal of Financial Economics, 10*(1), 3–27.
Gibbons, M. R. (1980). *Econometric methods for testing a class of financial models: An application of the Nonlinear Multivariate Regression Model.* University of Chicago, ProQuest Dissertations Publishing.
Grout, P. A., & Zalewska, A. (2016). Stock market risk in the financial crisis. *International Review of Financial Analysis, 46*, 326–345.
Hedander, J. (2005). Focus, liquidity and firm value: An empirical study of listed property trusts in Australia. *Pacific Rim Property Research Journal, 11*(1), 84–111.
Hiang Liow, K., & Huang, Q. (2006). Interest rate risk and time-varying excess returns for Asian property stocks. *Journal of Property Investment & Finance, 24*(3), 188–210.
Higgins, D. (2007). Placing commercial property in the Australian capital markets. *RICS Research Paper Series, 7* (12), London.
Laopodis, N. (2009). REITs, the stock market and economic activity. *Journal of Property Investment & Finance, 27*(6), 563–578.
Li, L. (2012). *The determinants of reit volatility* (Working paper, Citeseer). Retrieved February 22, 2016, from http://citeseerx.ist.psu.edu/viewdoc/download?doi10.1.1.299.4863&rep=rep1&type=pdf
Liang, Y., & Webb, J. (1995). Pricing interest-rate risk for Mortgage REITs. *Journal of Real Estate Research, 10*(4), 461–469.
Merton, R. C. (1987). A simple model of capital market equilibrium with incomplete information. *The Journal of Finance, 42*(3), 483–510.
Merton, R. C. (1973). An intertemporal capital asset pricing model. *Econometrica, 41*(5), 867–887.
McCue, T., & Kling, J. (1994). Real estate returns and the macroeconomy: Some empirical evidence from real estate investment trust data, 1972-1991. *Journal of Real Estate Research, 9*(3), 277–287.
Newell, G., & Najib Razali, M. (2009). The impact of the global financial crisis on commercial property investment in Asia. *Pacific Rim Property Research Journal, 15*(4), 430–452.
Newell, G. (2006). The changing risk profile of listed property trusts. *Australian Property Journal, 39*(3), 172–180.
Newell, G. (2005). Factors influencing the performance of listed property trusts. *Pacific Rim Property Research Journal, 11*(2), 211–227.
Newell, G., & Wen Peng, H. (2008). Assessing the significance of motivating factors and risk factors in infrastructure funds management. *Pacific Rim Property Research Journal, 14*(4), 399–411.
Ratcliffe, C., & Dimovski, B. (2007). The responsiveness of LPT returns and their attributes. *Pacific Rim Property Research Journal, 13*(3), 280–297.
RBA. (2017). *Chart pack – Interest rates*. Sydney: Reserve Bank of Australia. Retrieved May 01, 2017, from http://www.rba.gov.au/chart-pack/interest-rates.html

Rowland, P. J. (2010). *Australian property investments and financing*. Sydney: Thomson Reuters (Professional Australia) Limited.

Su, H., Huang, C., & Pai, T. (2010). The hybrid characteristic of REIT returns: Evidence from Japanese and U.S. markets. *Journal of Real Estate Literature, 18*(1), 77–98.

West, T., & Worthington, A. C. (2006). Macroeconomic risk factors in Australian commercial real estate, listed property trust and property sector stock returns. *Journal of Financial Management of Property and Construction, 11*(2), 105–116.

Yong, J., & Singh, A. (2015). Interest rate risk of Australian REITS: A panel analysis. *Pacific Rim Property Research Journal, 21*(1), 77–88.

Zarebski, P., & Dimovski, B. (2012). Determinants of capital structure of A-REITS and the global financial crisis. *Pacific Rim Property Research Journal, 18*(1), 3–19.