Accepted Manuscript

Size effects and economies of scale in European real estate companies

Brent W. Ambrose, Franz Fuerst, Nick Mansley, Zilong Wang

PII: S1044-0283(17)30434-9
DOI: https://doi.org/10.1016/j.gfj.2019.04.004
Reference: GLOFIN 470

To appear in: *Global Finance Journal*

Received date: 1 November 2017
Accepted date: 15 April 2019

Please cite this article as: B.W. Ambrose, F. Fuerst, N. Mansley, et al., Size effects and economies of scale in European real estate companies, Global Finance Journal, https://doi.org/10.1016/j.gfj.2019.04.004

Size effects and economies of scale in European real estate companies ☆

Brent W.Ambrose[a], Franz Fuerst[b], Nick Mansley[b] and Zilong Wang[b*]

Abstract

This study investigates scale economies in European real estate companies. We examine the effects of size on revenue, expense, profitability ratios and capital costs using panel data regression. We find that larger real estate companies in Europe are able to generate higher revenue per unit of company size, incur lower costs and produce higher returns. Net Operating Income ratios and return ratios increase while Selling, General and Administrative expense ratios decrease with the size of a company. However, we do not find evidence that larger companies have lower cost of debt or lower weighted average cost of capital. From our analysis, it is evident that particularly small firms can reap substantial economies of scale as they grow. However, the benefits of further growth tend to be much more modest for larger companies. Given REITs are on average larger than comparable non-REITs this may explain why REITs have lower economies of scale in expenses and revenues than Non-REIT real estate companies.

Keywords: Scale Economies, Size, REITs, Real Estate,
JEL Classification: D24, L25, L85

☆ This work was funded by EPRA (European Public Real Estate Association)
[a] Institute of Real Estate Studies, Penn State University, University Park, PA 16802, USA
[b] Department of Land Economy, University of Cambridge, Cambridge, CB3 9EP, UK
*Corresponding author.
E-mail addresses: bwa10@psu.edu (B.W. Ambrose), ff274@cam.ac.uk (F. Fuerst), nm558@cam.ac.uk (N. Mansley), zw325@cam.ac.uk (Z. Wang).

1. Introduction

The classic economies of scale argument with respect to real estate suggests that as real estate portfolios increase in size, the incremental cost of managing additional properties should fall (Ambrose, Highfield, & Linneman, 2005; Kim, 1986). This argument arises from two sources. First, fixed cost elements can be shared across properties, and second, that larger firms in fragmented markets have greater bargaining power. In addition, larger property companies should also have access to better debt terms and a lower cost of capital, as they have access to more finance sources (Barclay & Smith, 1995; Titman & Wessels, 1988).

Real estate companies with larger property portfolios should be more efficient than those with smaller portfolios. As firms grow and add properties, costs should rise less than the increase in asset value under management. If this is the case, larger real estate companies should be more profitable, thus providing a rationale for mergers and acquisitions. However, isolating the effects of scale is challenging, as it is necessary to control for a large number of characteristics. To give just a few examples, a portfolio of older properties may incur higher expenditure, distance between management and their property portfolios may lead to inefficiencies or lower returns, companies differ in the extent to which development activities are part of their business model and in the extent that operational management is resourced internally, externally or in joint ventures etc. However, this study takes a systematic approach to the estimation of the effect of scale by taking into account country, sector and other potential drivers of differences across firms (to the extent that data is available).

Whilst there are strong arguments that scale should offer benefits, counter arguments suggest that larger firms are subject to considerable diseconomies of scale. For example, they may find specialist resources are spread too thinly, which may lead to poorer decision-making. Larger companies also require additional resources to co-ordinate and manage activities that smaller companies can manage on an ad hoc basis. Larger companies may also get “conflicted out” of operating in certain markets. Finally, larger companies may find it hard to maintain the same passion, drive and incentivisation that smaller organisations can achieve. Consequently, it is far from clear that there will be a strong relationship between size and performance.

While most previous studies have focused on the economies of scale for US Real Estate Investment Trusts (REITs), this study investigates economies of scale for European REITs/real estate companies. Unlike the US market, where the listed real estate market is more mature and consolidated, the European market is relatively new and has grown dramatically over the last two decades with its growth facilitated by the introduction of REIT regimes across European developed markets over the past 15 years. Europe is a more fragmented market than the US with cultural differences and differences in leasing conventions and market norms across countries (and within countries) and this may make economies of scale harder to achieve than for US companies. Previously, due to the limitations of data and the size of European real estate company universe, it was difficult to econometrically measure economies of scale. In this study, we obtain 2134 firm year observations using a sample of 232 listed European real estate companies across the period 2001 to 2015. The richness of the dataset ensures a sufficient range of company size both cross-sectionally, and over time. Furthermore, we also have a sufficient number of mergers and acquisitions to test the effect of these on economies of scale.

This study briefly summarises the related literature and the issues arising from it. We then consider economies of scales of European real estate companies using panel data regression. The results show that larger real estate companies tend to generate more revenue, incur lower costs and produce higher returns but there is no evidence that larger companies have lower cost of capital. Furthermore, REITs have lower economies of scale in expenses and revenue than non-REIT real estate companies after controlling for firm characteristics.

2. Related Literature

The limited size of the REIT/real estate company universe mean that the early studies of the 1970s and 1980s struggled to find economies of scale. However, this is not uncommon across industries. As Ambrose, Highfield, and Linneman (2005) point out, the ability to econometrically measure economies of scale often eludes the technology and data at hand. Indeed early studies suggested a "small firm effect" in US REITs, with smaller firms earning higher average returns than large firms (McIntosh, Liang and Tompkins, 1991). Ambrose, Highfield, and Linneman (2005) give examples of economies of scale arising through industry consolidation and firm size in industries such as railroads, airlines, cement, steel, brewing, and oil and gas exploration.

Economies of scale can arise from a variety of factors. Firstly, scale economies may exist in a firm's cost of capital. For example, larger firms often issue equity and debt in greater amounts leading to lower underwriting spreads (Hansen and Torregrosa, 1992). Studies dating back to the 1960s document that larger firms have lower costs of raising new capital (Archer and Faerber, 1966). Secondly, scale economies are associated with greater operating efficiency and profitability. In support of the role of operating efficiencies, studies have shown that economies of scale in operations often result from horizontal consolidation within industries (Eckbo, 1992) implying that size leads to lower operating costs. In the real estate industry, Ambrose et al (2000) report that large REITs have higher net operating income (NOI) growth. In addition, Bers and Springer (1998) and Capozza and Seguin (1998) report evidence consistent with scale economies existing in REIT general and administrative (G&A) costs. For example, Capozza and Seguin (1998) note that REITs with higher property-level G&A expenses have lower shareholder's return, suggesting the market penalises firms without sufficient scale economies.

One of the problems with identifying economies of scale in empirical studies is that the econometric techniques and data are often not sufficient to uncover the effect (Ambrose, Highfield, and Linneman, 2005). For example, Ambrose et al (2000) report that their observed link between NOI growth and firm size is weak. Furthermore, Capozza and Seguin (2000) find results that are inconsistent with scale economies in G&A expenses, in contradiction to their earlier study (Capozza and Seguin, 1998). Although previous research seems to imply that economies of scale exist with respect to capital costs, Bers and Springer (1998) find small diseconomies of scale with respect to interest expense. Capozza and Seguin (2000) report a weak negative relationship between interest expense and firm size. Thus, the question of the existence of economies of scale in real estate companies remains an important question, particularly in the context of pressures for consolidation in the industry.

Research from later in the 1990s and early 2000s using data from the 1990s such as Bers and Springer (1997), Capozza and Seguin (1998) and Ambrose and Linneman (2001) find evidence of scale economies. These studies distinguish between economies of scale in expenses and the impact of size on capital costs and scale effects on earnings growth potential. In terms of the various expense items (general and administrative (G&A), interest costs, management fees, other operating expenses), economies of scale are more evident in smaller expense items. Thus, these studies conclude that the gains from economies of scale are modest. Indeed Yang (2001), suggests that the non-linear nature of economies of scale entails diseconomies of scale for larger real estate companies. However, Ambrose, Highfield and Linneman (2005) find evidence to support a link between firm profitability and firm size. Additionally, they identifiy that large REITs have better prospects for further growth while succeeding at lowering their costs. Their evidence from the stochastic frontier analysis points to further efficiency gains from continued growth and consolidation in REITs. However, Miller et al. (2006), looking at similar time periods, find little evidence of scale economies in REITs. Feng, Mckay and Sirmans (2011) report that regulation changes in the 1980s and 1990s, which facilitated vertical integration and internal management led to consolidation and growth in the REIT industry in US. However, Topuz and Isik (2009) show that although efficiency increased during the 1990s, productivity declined and technology regressed. They further show that typical REITs gained efficiency and caught up with the ones applying industry-leading practices. Isik and Topuz (2017) found that new REITs outclassed the incumbents in

terms of operating efficiency during the 1990s. These new REITs are relatively innovative, large, focused on both product and location, self-managed, publicly traded, growth oriented, non-financial constrained, use less leverage and are rich with pre-entry learning experience. Xu and Ooi (2018) extend previous studies and looked at the growth of REITs between 1992 and 2012. They observe that large REITs with more free cash flows may engage in growth activities, causing decreasing returns to scale. All of these studies focus on US REITs.

Whilst differences in costs can be observed across companies, what is not known is whether each firm is maximising its efficiency potential. Hence, any cost function derived for the entire industry could potentially be biased by these inefficiencies – as described by Anderson, Lewis, and Springer (2000). Any estimate of inefficiency needs to take into account the heterogeneity of both the businesses and the underlying real estate. REITs operating in markets where more inputs are required for the same level of revenue may erroneously be deemed inefficient and vice versa. If some companies (REITs) are sufficiently large to influence (output) prices, economic theory predicts that they will set prices above marginal cost to maximise profits. However, empirical tests of this hypothesis are inconclusive. For example, Ambrose et al (2000) find that REITs have a limited ability to influence rents.

As REITs and companies merge, the costs of subsequent integration normally occur in the first year or so, while efficiencies are realized largely subsequently. Campbell, Ghosh and Sirmans (2001) examined REIT mergers in the mid-1990s and found this pattern with returns of target firms positive whilst acquirer firm returns are slightly negative. They highlighted that, whilst there may be scale economies, geographical diversification arising from mergers can dissipate some of these benefits. This impact of distance from assets has recently been researched by Eichholtz, Holdermans and Yonder (2015) again in a US context. They find that, particularly for lower quality office property, proximity matters with higher effective rents/occupancy rates being achieved by investors located close to their occupiers. Furthermore, real estate is a capital intensive business and previous research in the US has highlighted that larger firms are able to benefit from capital cost savings as highlighted by Linneman (1997) as a motivation for consolidation in the industry.

The issues of how to estimate and distinguish economies of scale have been a subject of debate both with respect to real estate and in other industries. The banking industry for example has seen numerous studies of costs and profitability functions and their functional form. Berger and Mester (1997) note that a translog form is popular but other more flexible forms may provide a better fit for the data. The implication is that a linear form is likely to be overly restrictive.

As previous studies have noted, there is no consensus on the best metric for scale – enterprise value, output, revenue, floor space and total assets are all possibilities. The measurement of real estate services output by statistical authorities is derived as revenue less inputs from other industries and services (Allcoat, 2014). This captures the revenue impact of higher value property (requiring more capital) and a broader service offer (requiring more labour and possibly more capital). Total assets or the value of real estate is another potential measure of scale. Valuation based measures across Europe make this method possible in a way it is less so in the US where assets are more commonly just recorded at book value. The amount of space available for lease can also be seen as having relevance to scale economies but has the drawback of not adjusting for quality (location, building quality, height etc.) even if adjusting for sector. Our analysis follows previous work - Altinkhe and Hansen (2000) and Ambrose, Highfield and Linneman (2005) - by estimating the effect of firm size on multiple dimensions of revenue, cost and profitability factors.

In a study of private real estate funds, Krautz and Fuerst (2015) examine the relationship between size and success, noting market concentration in real estate funds is “above average relative to the finance industry and comparable to industries that require extensive capital investments in large-scale machinery, equipment, and technology”. Previous research indicates that performance is typically not sustained and in many cases the performance of previous funds is not clearly established. In line with signalling theory, the authors take size as a proxy for reputation and ability to manage large pools of capital. Combined with

the more developed networks that larger managers have, this enables large companies to raise capital more successfully. This study did not find evidence that larger managers were able to turn this capital raising advantage into out-performance.

Whilst there is some disagreement, studies of US REITs have generally indicated the following:

- G&A expenses / revenue is lower for larger firms – consistent with operational efficiencies from scale.
- Rental revenue as % of sales is not affected by size – there is little evidence of fundamentally different business models by size.
- Net Operating Income (NOI)/revenue increases as firms grow (Funds From Operations (FFO) growth, total debt and property focus also important) but at slowing rate – reflecting that operational efficiency feeds through to net income.
- Lower cap rates on larger firms – increased valuation of larger firms.
- Larger firms have higher payout ratios (lower leverage firms also)
- Return on Equity (ROE) is higher for larger firms – profitability increases with size
- Larger firms have lower WACC and lower systematic risk

The benefits of scale are likely to be reflected in greater operational efficiency (lower expense ratios), lower financing costs or an ability to drive higher revenue growth. There has not been a recent study of European real estate companies to establish the extent to which these findings apply in a European context, this study addresses this gap and analyses the effect of size on revenue, expense, cost of capital and return of European REIT/real estate companies. This study also extends previous studies by comparing size effects between REITs and non-REIT real estate companies.

3. Data and Methodology

We restrict our sample to European real estate companies with financial data available from the SNL REIT database and employ several selection criteria to capture companies with similar business models. First, we exclude homebuilders, hotel groups and debt investment companies since their business model is different from equity investors. Secondly, we exclude companies based in Europe that invest primarily in markets outside the European Economic Area (e.g. investing in Russia, Turkey and India etc.). Lastly, we exclude new start-up companies or companies that had their IPO during 2015, thus creating a sample of 232 real estate companies/ REITs across Europe over the period 2001 to 2015.

Previous studies on economies of scale assume firms produce homogenous products and the output is identifiable and quantifiable. In the case of REITs or real estate companies, firms invest in real estate and generate income and profits through the leasing of space. However, real estate is not homogenous and the diversity of activity across sectors and markets combined with a lack of comprehensive data on underlying portfolios makes comparison by volume of space owned or leased problematic. Thus, we employ two proxies for output: total enterprise value and total assets. The summary statistics for all the variables are shown in Table 1. Panel A shows the summary statistics for the full sample. Panel B and C show the summary statistics for non-REIT real estate companies and REITs, respectively. REITs on average are larger, have higher returns, higher revenues, higher costs, lower leverage ratios, lower short term debt ratios, lower asset growth, lower interest expense to total debt ratios, and higher Weighted Average Cost of Capital (WACC) than non-REIT real estate companies.

Table 1

Variable	Mean	Median	Min	Max	SD	N
Panel A: Full sample						
Log(EV)	6.67	6.80	0.59	10.63	1.51	2134
Log(Asset)	6.84	6.97	1.36	10.55	1.45	2134
ROE (%)	6.10	6.98	-49.79	49.81	13.97	1827
ROA (%)	3.02	2.99	-27.93	28.87	6.41	1827
NOI/Market Cap (%)	9.38	8.72	-490.74	436.70	28.93	1830
NOI/Total Asset (%)	3.45	3.88	-59.75	30.00	3.43	1830
SG&A Expenses/Total Asset (%)	1.70	1.02	0.00	39.62	2.27	2126
Total Cost / Asset (%)	5.09	4.37	0.03	34.36	3.16	1747
Total Debt/ Total Cap (%)	50.39	50.71	0.00	101.02	21.21	1826
ST Debt/ Debt (%)	18.16	9.31	0.00	100.00	23.96	1777
Asset Growth (%)	16.19	5.74	-75.04	957.93	57.94	1667
Interest Expense/Debt (%)	4.49	4.30	0.00	36.50	2.32	1814
WACC (%)	4.22	4.07	0.80	17.95	1.81	1706
REIT (Binary)	0.33	0.00	0.00	1.00	0.47	2134
MABidder (Binary)	0.08	0.00	0.00	1.00	0.26	2134
Panel B: Non-REIT real estate companies						
Log(EV)	6.45	6.63	0.59	10.19	1.53	1434
Log(Asset)	6.64	6.85	1.36	10.34	1.47	1434
ROE (%)	5.47	6.34	-49.79	49.81	14.61	1193
ROA (%)	2.51	2.62	-27.93	21.51	6.22	1193
NOI/Market Cap (%)	8.78	8.77	-490.74	436.70	34.76	1212
NOI/Total Asset (%)	3.14	3.59	-59.75	30.00	4.01	1212
SG&A Expenses/Total Asset (%)	1.97	1.22	0.00	39.62	2.58	1432
Total Cost / Asset (%)	5.64	4.91	0.03	34.36	3.48	1144
Total Debt/ Total Cap (%)	52.91	53.99	0.00	101.02	22.01	1212
ST Debt/ Debt (%)	20.03	9.67	0.00	100.00	26.02	1173
Asset Growth (%)	18.45	5.68	-75.04	957.93	68.01	1091
Interest Expense/Debt (%)	4.77	4.51	0.00	36.50	2.58	1216
WACC (%)	3.99	3.73	0.80	17.00	1.83	1129
MABidder (Binary)	0.07	0.00	0.00	1.00	0.26	1434
Panel C: REITs						
Log(EV)	7.13	7.17	2.63	10.63	1.35	700
Log(Asset)	7.25	7.23	3.51	10.55	1.30	700
ROE (%)	7.31	7.72	-42.91	44.24	12.60	634
ROA (%)	3.97	3.72	-25.28	28.87	6.66	634
NOI/Market Cap (%)	10.56	8.52	-29.63	129.67	10.35	618
NOI/Total Asset (%)	4.07	4.22	-5.75	7.28	1.69	618
SG&A Expenses/Total Asset (%)	1.15	0.68	0.00	11.12	1.29	694
Total Cost / Asset (%)	4.06	3.71	0.68	17.52	2.07	603
Total Debt/ Total Cap (%)	45.42	45.86	0.00	98.00	18.57	614
ST Debt/ Debt (%)	14.52	8.22	0.00	100.00	18.83	604
Asset Growth (%)	11.93	5.93	-45.69	289.37	30.50	576
Interest Expense/Debt (%)	3.93	4.01	0.00	13.43	1.55	598
WACC (%)	4.69	4.55	0.82	17.95	1.68	577
MABidder (Binary)	0.08	0.00	0.00	1.00	0.27	700

Note: The sample contains 232 firms and 2134 firm-year observations between 2001 and 2015. *Log(EV)* is the natural logarithm of the total enterprise value in million Euros. *Log(Asset)* is the natural logarithm of the total asset value in million Euros. *ROE* is the return on equity. *ROA* is the return on asset. *NOI/Market Cap* is the net operating income as a percentage of the market capitalisation. *NOI/Asset* is the net operating income as a percentage of the total asset. *SG&A Expenses/Total Asset* is Selling, General and Administrative expenses as a percentage of total assets. *Total Cost / Asset* is the sum of selling, general and administrative (SG&A) expense, rental operating expenses and interest expense as percentage of total assets. *Total Debt/ Total Cap* is the book value of total debt as a percentage of the total capitalisation. *ST Debt/ Debt* is the ratio of the book value of short-term debt to the book value of total debt. *Asset Growth* is the growth in the book value of total assets over the previous year. *Interest Expense/Debt* is the interest expense as a percentage of the book value of the total debt. *WACC* is the weighted average cost of capital. *REIT* is the dummy variable equal to 1 if the company is a REIT in the current year. *MABidder* is the dummy variable equal to 1 if the company is an acquirer in the current year.

To examine the size effect on the outcome variable Y (expenses and revenues respectively in the two estimations) of real estate companies, we specify the following model:

$$Y_{it} = \alpha_i + \beta_1 Size_{it} + \beta_2 Size_{it}^2 + \beta_3 (REIT * Size)_{it} + \beta_4 (REIT * Size^2)_{it} + \beta_5 REIT_{it} + \beta_6 X_{it} + \varepsilon_{it} \quad (1)$$

We use selling, general and administration (SG&A) expenses as a percentage of total asset and total cost[1] as a percentage of asset as the measures of expenses of real estate companies. We use net operating income (NOI) as a percentage of market capitalisation and NOI as a percentage of total asset as the measures of revenues of real estate companies. If economies of scale exist, we should find that revenue measures increase and expense measures decline as size increases. We also include the square of the size to capture any non-linear size effects. Since REIT status has tax benefits and requires companies to distribute most of their earnings as dividends, the behaviour of a REIT might be different from a Non-REIT real estate company. Thus, we include a dummy variable REIT[2] and its interactions with size to examine whether size effects are different between REITs and non-REIT real estate companies. X_{it} includes a set of control variables which are described in Table 1.

To examine the size effect on return of real estate companies and cost of capital respectively, we estimate the following equation:

$$RC_{it} = \alpha_i + \beta_1 Size_{it} + \beta_2 Size_{it}^2 + \beta_3 (REIT * Size)_{it} + \beta_4 (REIT * Size^2)_{it} + \beta_5 REIT_{it} + \beta_6 X_{it} + \varepsilon_{it} \quad (3)$$

We use return on equity (ROE) and return on assets (ROA) as the measures of profitability of real estate companies. As in the previous estimations, we would interpret higher returns as an indication of economies of scale.

Since real estate is a capital-intensive industry, the cost of capital could be an important factor that determines the performance of real estate companies. We employ two measures for the cost of capital: interest expenses as a percentage of total debt and WACC which is estimated as follows:[3]

$$WACC = k_d \left(\frac{D}{D+E}\right) + k_s \left(\frac{E}{D+E}\right) \quad (5)$$

k_d and k_s represent the cost of debt (D) and the cost of equity (E), respectively. We estimate the cost of debt as the ratio of interest expenses to book value of debt (D). The market value of equity (E) is the company's market capitalisation. Given the relatively short period many real estate companies or REITs have traded publicly, obtaining sufficient returns data to calculate a stable beta is problematic. Furthermore, we found a significant number of negative betas by using available historical returns. Thus, we estimate the cost of equity using a version of the dividend growth model:

$$k_s = \frac{DIV}{E} + g \quad (6)$$

DIV represents the total dividends declared, E is the equity market capitalisation, and g is the projected growth rate. In order to proxy for the projected growth rate, we average the previous two years dividend growth rate, and the previous year's dividend growth rate is estimated by the weighted average dividend growth rate over all companies which pay dividend in our sample.[4].

[1] Total cost is the sum of SG&A expenses, operating rental expenses and interest expenses

[2] In order to get the accurate date of conversion, all the conversion dates are collected from the company's financial report or website. REIT is a dummy variable takes value of 1 if the he company is REIT current year.

[3] Due to the poor coverage of preferred stock dividend for the European real estate companies, we assume here company only issue common stock and debt.

[4] For example, the projected dividend growth rate for year 2006 is estimated by averaging of the weighted average dividend growth rate for 2004 and 2005 for all real estate companies.

We employ panel regression to estimate equations (1)-(4), the choice of fixed or random effect[5] is guided by the Hausman test. Property investments across time, sectors and countries differ in terms of their historic development, lease structures, services offer and regulations. We include year, sector and country dummies as control variables. The distribution of our sample across time is shown in Figure 1, most of our sample is between 2006 and 2015. Our sample consists of companies based in 19 European countries with the UK comprising around 37% of observations. Figures 2 and 3 show the distribution of our sample across countries and property type, respectively. We note that most of the European REITs or real estate companies are diversified across property type, unlike in United States where there are a substantial number of companies who are focused on one property type. Figure 4 shows the sample distribution of REITs and non-REIT real estate companies across time. The proportion of REITs has increased since 2007, the year the UK introduced REITs which make up a sizable proportion of our European sample. Figure 5 shows the distribution of the log of the total enterprise value in our sample. The distribution is slightly left skewed and the sample of real estate companies has a wide range of total enterprise values.

We further control for leverage and growth. Growth is captured by asset growth rate, whereas leverage is captured by total debt as a percentage of total firm capitalisation and short-term debt as a percentage of total debt. The real estate industry is not static as merger and acquisition (M&A) activities occur over time. Firms could acquire assets or other real estate companies to achieve economies of scale. We control for corporate acquisition activity with a dummy variable which equals 1 if the company is a bidder for and purchaser of shares of other real estate companies (including private companies) at any point in the sample period.

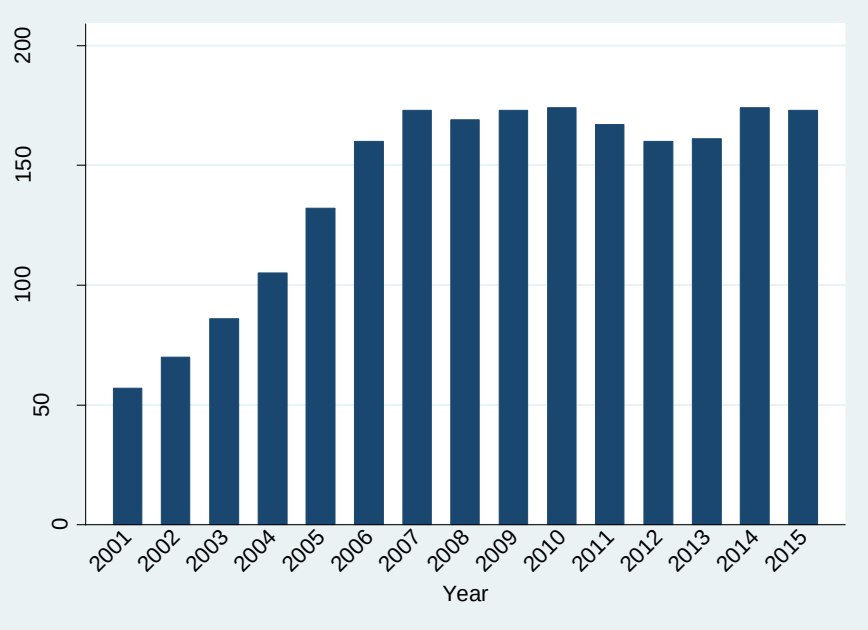

Figure 1: Sample distribution of companies across time

[5] Ordinary Least Square (OLS) is ruled out since it cannot deal with unobserved heterogeneity.

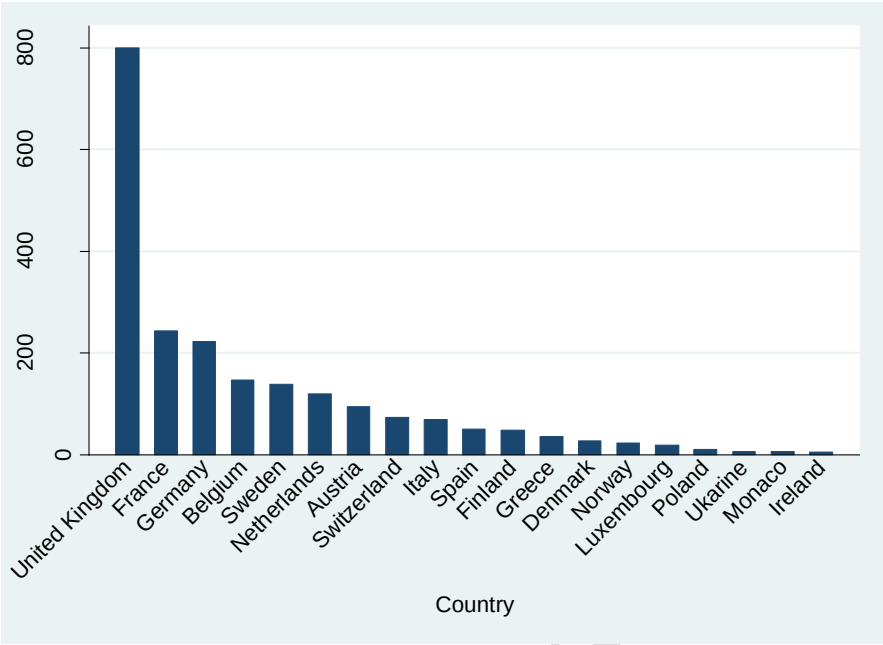

Figure 2: Sample distribution of company years by country

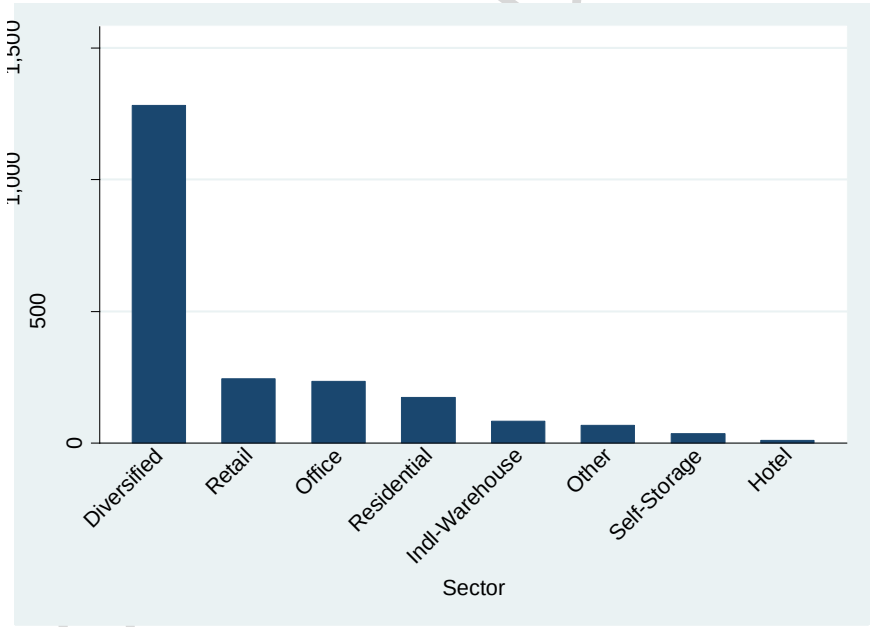

Figure 3: Sample distribution across sectors

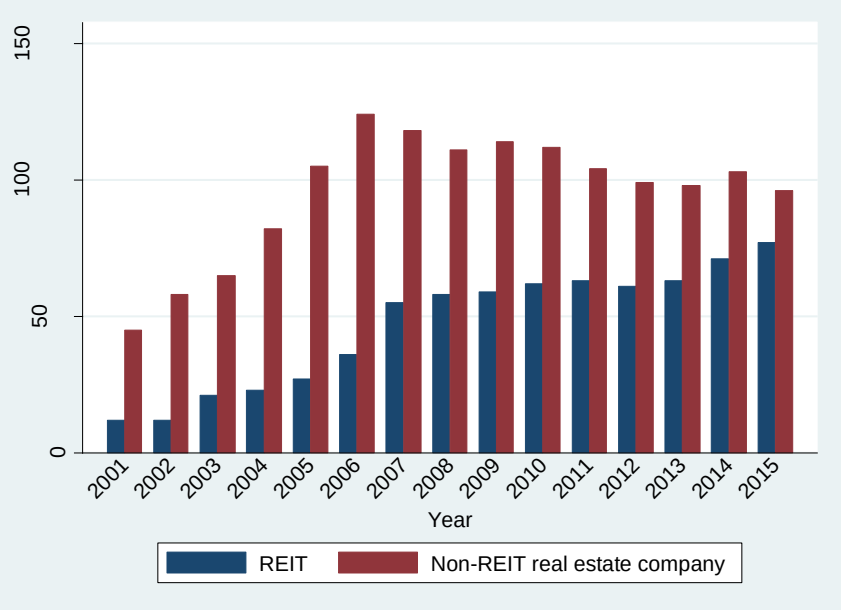

Figure 4: Sample distribution of REIT and Non-REIT real estate companies across time

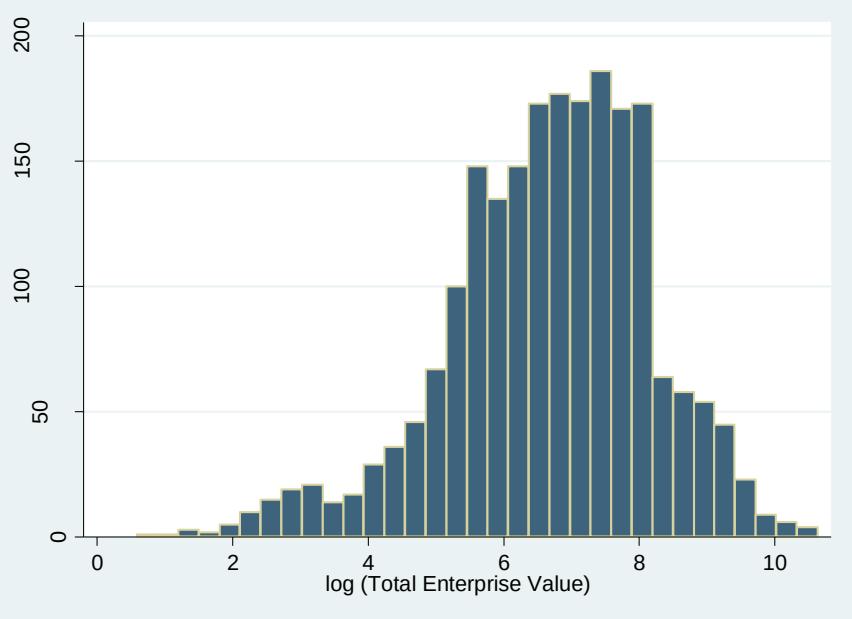

Figure 5: Sample distribution of log (Total Enterprise Value)

4. Empirical Results

Table 2 provides the panel regression results for the impact of size on the expense ratios of real estate companies. Since total asset is used as a denominator for the expense measures, only total enterprise value is used as a size measure. The results show evidence of economies of scale in SG&A expenses. The negative and significant coefficient for firm size and the significantly positive coefficient for the quadratic total enterprise value indicates a significant effect of firm size. SG&A expenses decrease with firm size but at a decreasing rate. The rate of decrease depends on the size of the firm e.g. at 100 million, 500 million, 1 billion and 5 billion Euros total enterprise value. A 1% increase in total enterprise value is associated with a decrease in SG&A/Asset of 0.98, 0.58, 0.41 and 0.01 basis points, respectively, reflecting a decreasing impact of economies of scale. The optimum total enterprise value to achieve the lowest

SG&A/Asset ratio is estimated at just under €6bn over the 2001-15 period. The existence of economies of scale in the expense measures is in line with evidence from US REITs presented by Ambrose, Highfield and Linneman (2005). The predicted SG&A Expenses/Assets ratio from the regression is illustrated in Figure 6 below.[6] We observe that firms can achieve substantial economies of scale when firms are small, but when the firm's total enterprise value grows beyond 6 billion euros, firms are experiencing slight diseconomies of scale, Yang (2001) also finds these diseconomies of scale. No size effects were detected for total cost which consists of SG&A expense, interest expense and rental operating expense. The insignificant coefficient for size indicates that there is no size effect on the sum of interest expense and rental operating expense.[7]

The results show that the size effect on SG&A/Asset is different between REITs and non-REIT real estate companies. REITs on average have a lower SG&A expenses ratio than non-REIT real estate companies. The coefficient for log(EV) and Log(EV) x REIT are -2.125 and 1.794 respectively. This implies the coefficient of log(EV) for REIT is -0.331. As firm size gets larger, SG&A expenses decrease less for REIT than for Non-REIT real estate companies. The coefficient for $Log(EV)^2$ and $Log(EV)^2$ x REIT are 0.124 and -0.12, respectively. This implies that the coefficient of $Log(EV)^2$ for REIT is only 0.004 and indicates that SG&A expenses decline at a lower rate for REITs than they decline for Non-REIT real estate companies.

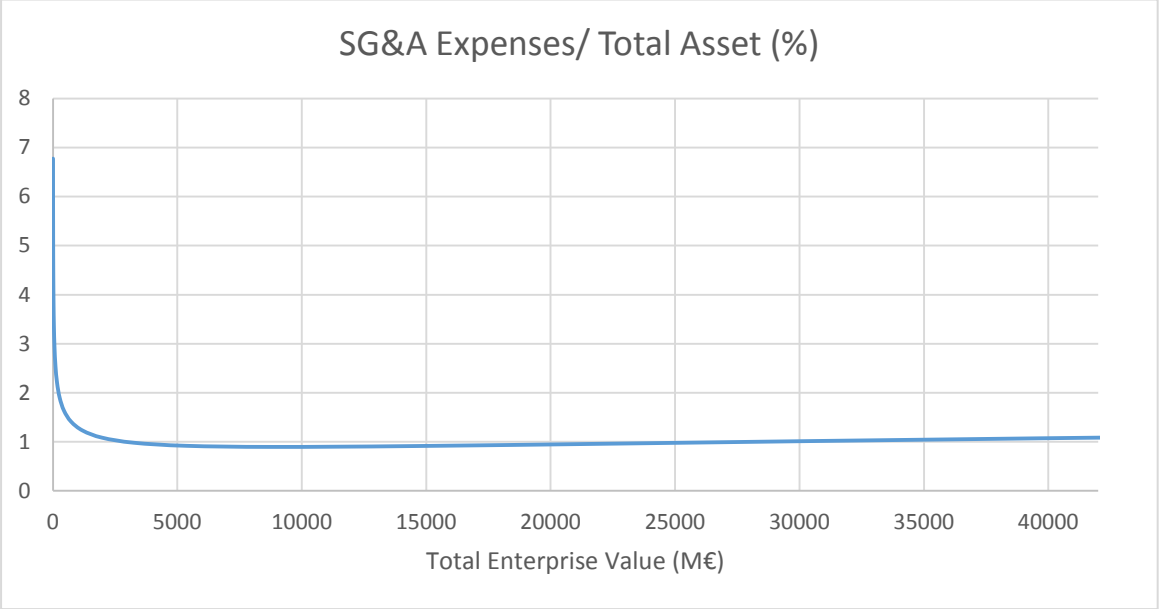

Figure 6: Predicted SG&A Expenses/Total Assets by Size of Firm

Turning to the impact of acquisitions, we find evidence that acquisitions in the previous year increase SG&A expense and total cost ratios. SG&A expense ratios decrease with the total debt to total capitalisation ratio. This indicates that more highly leveraged firms operate more efficiently. A possible explanation is that given the pressure from debt servicing, they have more focus on SG&A expense. The total cost to total asset ratio increases with leverage, measured by the total debt to total capitalisation ratio. Combining the results, we conclude that although high leverage firms operate more efficiently by reducing SG&A expenses, the increase in interest expenses is more than offset by efficiency gains and leads to an increase in total cost ratios. Finally, asset growth is associated with a decrease in SG&A expense and total cost. Faster growing companies appear to be able to spread costs and lower the cost per asset.

Table 3 provides the panel regression results for the impact of size on two revenue related metrics of real estate companies: NOI as a percentage of market capitalisation and NOI as a percentage of total assets.

[6] The prediction assumes all other variables at mean value.

[7] We also undertook regression analysis on other cost (interest expense+ rental operating expense) / asset and rental operating expense/ asset. There is no evidence of economies of scale. Results are available upon request.

When total assets is used as the denominator for the revenue measurements, only total enterprise value is used for size measure. Overall, the results show evidence of economies of scale in revenue. For the NOI/Market Cap estimations, we find significant positive coefficients for both firm size measures and significant negative coefficient for the quadratic size effect. NOI ratios increase with firm size but at a decreasing rate. The rate of increase depends on the size of the firm. A 1% increase in total enterprise value is associated with an increase in NOI/Market Cap of 11.4, 4.9, 2 and -4.5 basis points, respectively. From the regression results, the optimum total enterprise value is around 1.7 billion Euros. Looking at the estimations using total assets, the rate of increase in NOI/Market Cap depends on the size of the firm e.g. at 100 million, 500 million, 1 billion and 5 billion Euros total asset, 1% increase in total asset is associated with an increase NOI/Market Cap by 10.3, 6.3, 4.6 and 0.6 basis points, respectively. The optimum total asset to achieve the highest NOI/Market Cap is around 6.5 billion Euros. This result can either be mean that larger firms have a lower valuation (higher cap rate) reflecting market views of growth prospects or that larger firms are better able to deliver NOI and/or are less dependent on trading and development to deliver income to shareholders. Similar results are found for NOI/Asset, NOI/Asset increase with firm size but at a decreasing rate as firm size increases. The rate of increase depends on the size of the firm. A 1% increase in total assets is generally associated with an increase in NOI/Market Cap of 2.66, 1.59, 1.12 and 0.05 basis points, respectively. The optimum total enterprise value to achieve the highest NOI/Asset is 5410 million Euros. REITs on average can generate higher NOI than non-REIT real estate companies. The results also indicate that NOI increases less for REITs than for non-REIT real estate companies. Thus, REITs seem to have lower economies of scale in NOI than non-REIT real estate companies.

There is evidence that acquiring assets in the previous year has a positive effect on NOI/Market Cap, but no effect on NOI/Asset. These results indicate that acquiring assets in previous year is associated with a decrease in the market capitalisation. Total debt to total capitalisation ratio and asset growth have a negative effect on NOI/Asset, but no effect on NOI/Market Cap. High leverage and faster growth generate lower NOI and reduce the market capitalisation at the same time.

As larger real estate companies tend to generate higher revenue and incur lower costs, they should outperform smaller companies, all else equal. Table 5 provides the panel regression results for the impact of size on the return of the real estate companies. The results show evidence of economies of scale in return. We find significant positive coefficients for firm size and insignificant coefficients for the quadratic terms. The results suggest that a 1% increase in total enterprise value is associated with an increase in ROE and ROA of 9.7 and 5 basis points respectively and that a 1% increase in total asset is associated with an increase of ROE by 11.1 basis points. Interestingly, although the size effect between REIT and non-REIT real estate companies are different in expense and revenue, there is no difference in return. Acquiring assets in both the current and previous year has no significant impact on returns either. Returns decrease with leverage as measured by the total debt to total capitalisation ratio, thus more highly leveraged firms deliver lower returns. This result is consistent with other studies, notably Ambrose, Highfield, & Linneman (2005). Return also decreases with the short-term debt to total debt ratio as long-term financing is associated with higher returns. Furthermore, stronger asset growth is also associated with higher returns.

Table 6 provides the panel regression results for the impact of size on the cost of capital. These results coincide with Bers and Springer (1998) who find small diseconomies of scale with interest expense. Similarly, we expect larger firms to have lower weighted average cost of capital since larger firms are typically seen as less risky. But none of our estimations show this correlation. Although the size effect on cost of debt does not differ between REITs and non-REIT real estate companies, REITs on average have a higher WACC than non-REIT real estate companies and the WACC of REITs decreases with firm size but at a decreasing rate. The cost of debt increases if the company acquired assets in the previous year, but the acquisition has no effect on WACC. There is no evidence in our results that leverage increases the cost of debt, but WACC increases with leverage, indicating the cost of equity increases with leverage as the firm becomes riskier. Furthermore, the cost of debt and WACC decrease with higher asset growth.

In conclusion, our analysis presents evidence of economies of scale for real estate companies. Whilst we did not find evidence that larger firms have lower debt servicing costs or WACC, larger firms appear to

generate higher NOI and incur lower SG&A expenses, thus generating higher returns. REITs tend to exhibit lower economies of scale in NOI and SG&A expenses than their non-REIT real estate counterparts. While the size effect on return and cost of debt does not differ between REITs and non-REIT real estate companies, there appear to be economies of scale in WACC for REITs.

Table 2: Expense Measures

	(1) SG&A/Asset	(2) Total Cost/Asset
Log(EV)	-2.125***	-1.879
	(-3.25)	(-1.63)
$Log(EV)^2$	0.124***	0.076
	(2.61)	(0.95)
Log(EV)*REIT	1.794**	1.927
	(2.54)	(1.46)
$Log(EV)^2$*REIT	-0.120**	-0.121
	(-2.43)	(-1.34)
REIT	-6.408***	-7.093
	(-2.59)	(-1.51)
MABidder	0.075	0.008
	(0.88)	(0.05)
$MABidder_{t-1}$	0.151*	0.353**
	(1.89)	(2.47)
Total Debt/ Total Cap	-0.014***	0.014**
	(-3.71)	(2.07)
ST Debt/ Debt	0.003	0.009
	(1.31)	(1.34)
Asset Growth	-0.003***	-0.010***
	(-3.60)	(-6.11)
Intercept	13.290***	16.392***
	(5.91)	(4.00)
Year Control	Yes	Yes
Sector Control	Yes	Yes
Country Control	Yes	Yes
N	1346	1346
Adj. R2	0.769	0.690

Note: The sample contains 232 firms and 2134 firm-year observations between 2001 and 2015. *Log(EV)* is the natural logarithm of the total enterprise value in million Euros. *SG&A Expenses/Total Asset* is Selling, General and Administrative expenses as a percentage of total assets. *Total Cost / Asset* is the sum of selling, general and administrative (SG&A) expense, rental operating expenses and interest expense as percentage of total assets. *Total Debt/ Total Cap* is the book value of total debt as a percentage of the total capitalisation. *ST Debt/ Debt* is the ratio of the book value of short-term debt to the book value of total debt. *Asset Growth* is the growth in the book value of total assets over the previous year. *REIT* is the dummy variable equal to 1 if the company is a REIT in the current year. *MABidder* is the dummy variable equal to 1 if the company is an acquirer in the current year. t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Revenue Measures

	(1) NOI/Market Cap	(2) NOI/Market Cap	(3) NOI/Asset
Log(EV)	30.135***		5.725***
	(3.15)		(2.62)
$Log(EV)^2$	-2.033***		-0.333**
	(-2.96)		(-2.43)
Log(EV)*REIT	-20.165***		-3.727**
	(-2.88)		(-2.24)
$Log(EV)^2$*REIT	1.356***		0.241**
	(2.78)		(2.07)
Log(Asset)		21.708*	
		(1.91)	
$Log(Asset)^2$		-1.237*	
		(-1.65)	
Log(Asset)*REIT		-15.375**	
		(-2.06)	
$Log(Asset)^2$*REIT		0.998**	
		(1.97)	
REIT	70.188***	55.588**	14.390**
	(2.86)	(2.09)	(2.45)
MABidder	-4.420	-5.059*	-0.309
	(-1.57)	(-1.77)	(-1.38)
$MABidder_{t-1}$	4.462***	3.929**	0.284
	(2.84)	(2.53)	(1.63)
Total Debt/ Total Cap	0.068	0.047	-0.026*
	(0.59)	(0.39)	(-1.69)
ST Debt/ Debt	0.073	0.069	0.004
	(0.70)	(0.66)	(0.58)
Asset Growth	-0.007	-0.002	-0.003*
	(-0.80)	(-0.30)	(-1.71)
Intercept	-102.963***	-83.123**	-17.768**
	(-3.15)	(-2.02)	(-1.98)
Year Control	Yes	Yes	Yes
Sector Control	Yes	Yes	Yes
Country Control	Yes	Yes	Yes
N	1623	1623	1623
Adj. R2	0.344	0.341	0.404

Note: The sample contains 232 firms and 2134 firm-year observations between 2001 and 2015. *Log(EV)* is the natural logarithm of the total enterprise value in million Euros. *Log(Asset)* is the natural logarithm of the total asset value in million Euros. *NOI/Market Cap* is the net operating income as a percentage of the market capitalisation. *NOI/Asset* is the net operating income as a percentage of the total asset. *Total Debt/ Total Cap* is the book value of total debt as a percentage of the total capitalisation. *ST Debt/ Debt* is the ratio of the book value of short-term debt to the book value of total debt. *Asset Growth* is the growth in the book value of total assets over the previous year. *REIT* is the dummy variable equal to 1 if the company is a REIT in the current year. *MABidder* is the dummy variable equal to 1 if the company is an acquirer in the current year. t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Return Measures

	(1) ROE	(2) ROE	(3) ROA
Log(EV)	9.680**		5.045**
	(2.36)		(2.33)
$Log(EV)^2$	-0.354		-0.208
	(-1.17)		(-1.36)
Log(EV)*REIT	3.447		3.497
	(0.65)		(0.82)
$Log(EV)^2$*REIT	-0.315		-0.248
	(-0.83)		(-0.87)
Log(Asset)		10.114**	
		(2.25)	
$Log(Asset)^2$		-0.378	
		(-1.22)	
Log(Asset)*REIT		7.874	
		(1.25)	
$Log(Asset)^2$*REIT		-0.595	
		(-1.37)	
REIT	-5.702	-22.245	-10.660
	(-0.32)	(-0.99)	(-0.68)
MABidder	1.389	1.401	0.382
	(1.33)	(1.34)	(0.90)
$MABidder_{t-1}$	0.180	0.221	0.005
	(0.18)	(0.22)	(0.01)
Total Debt/ Total Cap	-0.276***	-0.313***	-0.130***
	(-8.52)	(-9.27)	(-8.98)
ST Debt/ Debt	-0.044**	-0.045**	-0.011
	(-2.37)	(-2.38)	(-1.41)
Asset Growth	0.041***	0.042***	0.018***
	(3.36)	(3.36)	(3.30)
Intercept	-37.232**	-37.598**	-20.254***
	(-2.55)	(-2.25)	(-2.59)
Year Control	Yes	Yes	Yes
Sector Control	Yes	Yes	Yes
Country Control	Yes	Yes	Yes
N	1550	1550	1550
Adj. R2	0.466	0.465	0.487

Note: The sample contains 232 firms and 2134 firm-year observations between 2001 and 2015. *Log(EV)* is the natural logarithm of the total enterprise value in million Euros. *Log(Asset)* is the natural logarithm of the total asset value in million Euros. *ROE* is the return on equity. *ROA* is the return on asset. *Total Debt/ Total Cap* is the book value of total debt as a percentage of the total capitalisation. *ST Debt/ Debt* is the ratio of the book value of short-term debt to the book value of total debt. *Asset Growth* is the growth in the book value of total assets over the previous year. *REIT* is the dummy variable equal to 1 if the company is a REIT in the current year. *MABidder* is the dummy variable equal to 1 if the company is an acquirer in the current year. t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Capital Cost Measures

	(1) Cost of debt	(2) Cost of debt	(3) WACC	(4) WACC
Log(EV)	-0.069		0.451	
	(-0.08)		(0.83)	
$Log(EV)^2$	-0.020		-0.039	
	(-0.33)		(-0.99)	
Log(EV)*REIT	0.817		-2.508***	
	(0.60)		(-2.79)	
$Log(EV)^2$*REIT	-0.047		0.156***	
	-0.069		0.451	
Log(Asset)		-0.012		0.793
		(-0.01)		(1.08)
$Log(Asset)^2$		-0.017		-0.061
		(-0.23)		(-1.22)
Log(Asset)*REIT		1.201		-1.597
		(0.69)		(-1.64)
$Log(Asset)^2$*REIT		-0.068		0.100
		(-0.65)		(1.52)
REIT	-3.753	-5.437	10.388***	6.813*
	(-0.67)	(-0.75)	(3.11)	(1.92)
MABidder	-0.176	-0.186	0.016	0.021
	(-1.37)	(-1.45)	(0.13)	(0.18)
$MABidder_{t-1}$	0.251*	0.242*	0.150	0.154
	(1.87)	(1.79)	(1.34)	(1.42)
Total Debt/ Total Cap	-0.011	-0.009	0.027***	0.028***
	(-1.33)	(-1.14)	(5.64)	(5.72)
ST Debt/ Debt	-0.001	-0.000	0.002	0.002
	(-0.10)	(-0.09)	(0.71)	(0.80)
Asset Growth	-0.009***	-0.009***	-0.006***	-0.006***
	(-4.35)	(-4.45)	(-4.31)	(-4.30)
Intercept	6.669**	6.087	2.108	0.802
	(2.22)	(1.45)	(1.08)	(0.30)
Year Control	Yes	Yes	Yes	Yes
Sector Control	Yes	Yes	Yes	Yes
Country Control	Yes	Yes	Yes	Yes
N	1385	1385	1385	1385
Adj. R2	0.359	0.358	0.507	0.504

Note: The sample contains 232 firms and 2134 firm-year observations between 2001 and 2015. *Log(EV)* is the natural logarithm of the total enterprise value in million Euros. *Log(Asset)* is the natural logarithm of the total asset value in million Euros. *ROE* is the return on equity. *Total Debt/ Total Cap* is the book value of total debt as a percentage of the total capitalisation. *ST Debt/ Debt* is the ratio of the book value of short-term debt to the book value of total debt. *Asset Growth* is the growth in the book value of total assets over the previous year. *Cost of debt* is the interest expense as a percentage of the book value of the total debt. *WACC* is the weighted average cost of capital. *REIT* is the dummy variable equal to 1 if the company is a REIT in the current year. *MABidder* is the dummy variable equal to 1 if the company is an acquirer in the current year. t statistics in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01

5. Robustness Check

Our sample includes real estate companies with assets between €3.9 million and €38.1 billion. Within the sample, there are 153 firm-year observations with assets under €100 million. Among those 153 firm-year observations, 139 observations are non-REIT real estate companies with average assets of €44.9 million and 14 observations are REITs with average assets of €57.0 million. The evidence of economies of scale might be caused by those small companies. In this section, we drop all the firm-year observations associated with companies with assets of under €100 million and re-run all the models as a robustness check. Table 6 shows the robustness check of expense measures. The results are broadly consistent with the full sample regressions. One notable difference is the coefficient of size on SG&A which is much

smaller compared to the full sample regression. Furthermore, the quadratic terms become insignificant. In the full sample, because of the large coefficient of the size effect on SG&A expenses, SG&A expenses fall rapidly with size initially and the impact on predicted SG&A expenses as illustrated in Figure 6. Next, Figure 7 displays the prediction based on firms with assets greater than €100m. This shows a shallower curve initially compared to Figure 6 and there are no diseconomies of scale across the range of total enterprise values in our sample. REITs on average still have lower SG&A expenses than non-REIT real estate companies, but there is no evidence of economies of scale for REITs. Since the coefficient for log(EV) and Log(EV) x REIT are -0.952 and 0.967, respectively, this implies the coefficient of log(EV) for REIT is 0.011.

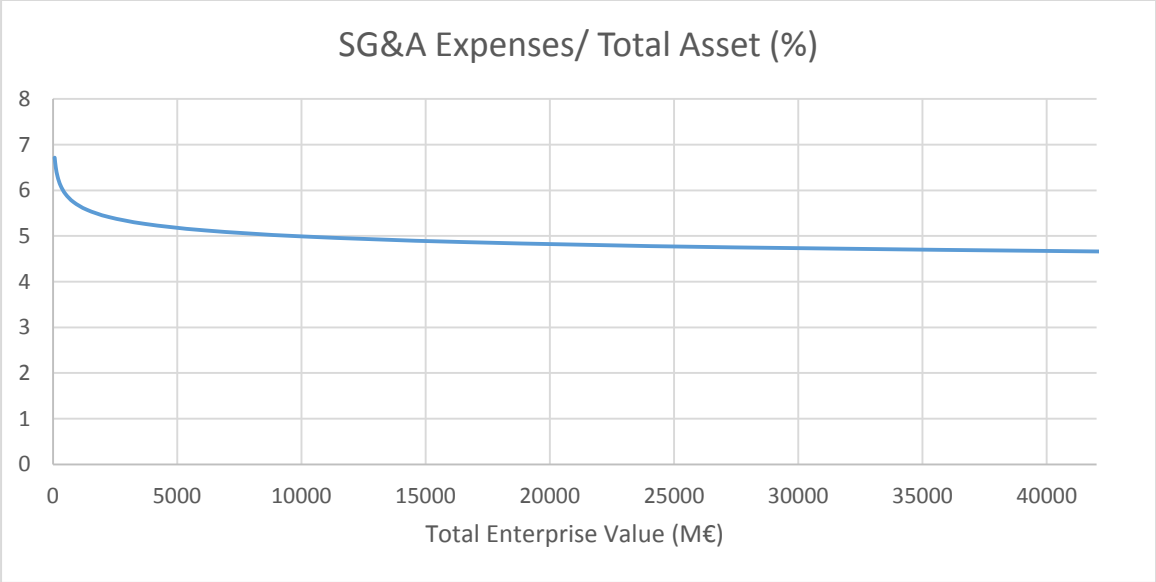

Figure 7: Predicted SG&A Expenses/Total Assets by Size of Firm

Table 7 shows the robustness check of revenue measures. The economies of scale in revenue disappears. It therefore appears that economies of scale in revenue mainly come from those companies with asset under €100 million. Table 8 shows the robustness check for return measures. There are still economies of scale in return, but the quadratic term becomes insignificant. There appears no difference in the size effect between REITs and non-REIT real estate companies. Table 9 shows the robustness check for capital cost measures. The results confirm the conclusion of the full sample analysis. No economies of scale are detected in either cost of debt or WACC. The economies of scale in WACC for REITs disappear, implying a reduction of WACC for larger firms mainly stems from smaller REITs with assets under €100 million.

In general, our robustness check results are consistent with the full sample estimations except for the revenue measures. Companies with asset under €100 million can indeed achieve substantial economies of scale in SG&A expense and NOI. Furthermore, the difference in the size effect between REITs and non-REIT real estate companies disappears once companies under €100 million are excluded. Since most of the companies we exclude are non-REIT real estate companies, the difference in the size effect between REITs and non-REIT real estate companies in the full sample analysis is mainly caused by those non-REIT real estate companies with asset under €100 million that can achieve substantial economies of scale.

Table 6: Expense measures – exclude firms with asset under 100 million Euros.

	(1) SG&A/Asset	(2) Total Cost/Asset
Log(EV)	-0.952**	-0.232
	(-2.13)	(-0.26)
$Log(EV)^2$	0.042	-0.036
	(1.30)	(-0.57)
Log(EV)*REIT	0.967*	0.720
	(1.72)	(0.66)
$Log(EV)^2$*REIT	-0.064	-0.040
	(-1.61)	(-0.53)
REIT	-3.641*	-2.984
	(-1.84)	(-0.76)
MABidder	0.033	-0.057
	(0.40)	(-0.39)
$MABidder_{t-1}$	0.118	0.313**
	(1.55)	(2.25)
Total Debt/ Total Cap	-0.012***	0.010**
	(-4.28)	(2.25)
ST Debt/ Debt	0.005**	0.008***
	(2.58)	(2.64)
Asset Growth	-0.002***	-0.009***
	(-3.97)	(-8.05)
Intercept	8.963***	10.691***
	(5.73)	(3.35)
Year Control	Yes	Yes
Sector Control	Yes	Yes
Country Control	Yes	Yes
N	1279	1279
Adj. R2	0.779	0.750

Note: The sample contains 232 firms and 2134 firm-year observations between 2001 and 2015. *Log(EV)* is the natural logarithm of the total enterprise value in million Euros. *SG&A Expenses/Total Asset* is Selling, General and Administrative expenses as a percentage of total assets. *Total Cost / Asset* is the sum of selling, general and administrative (SG&A) expense, rental operating expenses and interest expense as percentage of total assets. *Total Debt/ Total Cap* is the book value of total debt as a percentage of the total capitalisation. *ST Debt/ Debt* is the ratio of the book value of short-term debt to the book value of total debt. *Asset Growth* is the growth in the book value of total assets over the previous year. *REIT* is the dummy variable equal to 1 if the company is a REIT in the current year. *MABidder* is the dummy variable equal to 1 if the company is an acquirer in the current year. t statistics in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01

Table 7: Revenue measures – exclude firms with asset under 100 million Euros

	(1) NOI/Market Cap	(2) NOI/Market Cap	(3) NOI/Asset
Log(EV)	2.429		1.731
	(0.21)		(1.33)
$Log(EV)^2$	0.043		-0.075
	(0.06)		(-0.89)
Log(EV)*REIT	-3.136		-1.304
	(-0.32)		(-1.13)
$Log(EV)^2$*REIT	0.154		0.066
	(0.24)		(0.86)
Log(Asset)		-16.712	
		(-1.10)	
$Log(Asset)^2$		1.376	
		(1.52)	
Log(Asset)*REIT		9.476	
		(0.81)	
$Log(Asset)^2$*REIT		-0.694	
		(-0.90)	
REIT	15.441	-29.190	6.292
	(0.44)	(-0.67)	(1.50)
MABidder	-5.943*	-6.221*	-0.339**
	(-1.81)	(-1.85)	(-2.00)
$MABidder_{t-1}$	3.087*	2.881*	0.235
	(1.89)	(1.79)	(1.64)
Total Debt/ Total Cap	0.382***	0.369***	-0.012
	(3.63)	(3.13)	(-0.85)
ST Debt/ Debt	0.107	0.108	-0.006
	(0.70)	(0.71)	(-0.90)
Asset Growth	-0.009	-0.009	-0.004***
	(-1.26)	(-1.15)	(-3.11)
Intercept	-76.494	38.989	-1.668
	(-1.30)	(0.67)	(-0.31)
Year Control	Yes	Yes	Yes
Sector Control	Yes	Yes	Yes
Country Control	Yes	Yes	Yes
N	1279	1279	1279
Adj. R2	0.318	0.319	0.530

Note: The sample contains 232 firms and 2134 firm-year observations between 2001 and 2015. *Log(EV)* is the natural logarithm of the total enterprise value in million Euros. *Log(Asset)* is the natural logarithm of the total asset value in million Euros. *NOI/Market Cap* is the net operating income as a percentage of the market capitalisation. *NOI/Asset* is the net operating income as a percentage of the total asset. *Total Debt/ Total Cap* is the book value of total debt as a percentage of the total capitalisation. *ST Debt/ Debt* is the ratio of the book value of short-term debt to the book value of total debt. *Asset Growth* is the growth in the book value of total assets over the previous year. *REIT* is the dummy variable equal to 1 if the company is a REIT in the current year. *MABidder* is the dummy variable equal to 1 if the company is an acquirer in the current year. t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Return measures – excluding firms with asset under 100 million Euros

	(1) ROE	(2) ROE	(3) ROA
Log(EV)	13.748**		7.539**
	(2.05)		(2.28)
$Log(EV)^2$	-0.615		-0.352
	(-1.32)		(-1.56)
Log(EV)*REIT	1.937		-0.392
	(0.23)		(-0.09)
$Log(EV)^2$*REIT	-0.212		0.006
	(-0.37)		(0.02)
Log(Asset)		12.450*	
		(1.87)	
$Log(Asset)^2$		-0.503	
		(-1.11)	
Log(Asset)*REIT		9.120	
		(1.04)	
$Log(Asset)^2$*REIT		-0.670	
		(-1.13)	
REIT	-0.401	-27.240	3.705
	(-0.01)	(-0.85)	(0.23)
MABidder	0.493	0.468	0.328
	(0.44)	(0.42)	(0.71)
$MABidder_{t-1}$	-1.007	-1.031	-0.275
	(-0.97)	(-1.00)	(-0.58)
Total Debt/ Total Cap	-0.265***	-0.304***	-0.139***
	(-7.20)	(-7.98)	(-7.90)
ST Debt/ Debt	-0.043**	-0.042**	-0.011
	(-2.18)	(-2.10)	(-1.40)
Asset Growth	0.039***	0.040***	0.018***
	(2.84)	(2.83)	(2.88)
Intercept	-52.835**	-48.013**	-30.068**
	(-2.17)	(-1.96)	(-2.46)
Year Control	Yes	Yes	Yes
Sector Control	Yes	Yes	Yes
Country Control	Yes	Yes	Yes
N	1229	1229	1229
Adj. R2	0.491	0.492	0.505

Note: The sample contains 232 firms and 2134 firm-year observations between 2001 and 2015. *Log(EV)* is the natural logarithm of the total enterprise value in million Euros. *Log(Asset)* is the natural logarithm of the total asset value in million Euros. *ROE* is the return on equity. *ROA* is the return on asset. *Total Debt/ Total Cap* is the book value of total debt as a percentage of the total capitalisation. *ST Debt/ Debt* is the ratio of the book value of short-term debt to the book value of total debt. *Asset Growth* is the growth in the book value of total assets over the previous year. *REIT* is the dummy variable equal to 1 if the company is a REIT in the current year. *MABidder* is the dummy variable equal to 1 if the company is an acquirer in the current year. t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Capital Cost measures– exclude firms with asset under 100 million Euros.

	(1) Cost of debt	(2) Cost of debt	(3) WACC	(4) WACC
Log(EV)	-1.354		-1.088	
	(-1.15)		(-1.11)	
$Log(EV)^2$	0.065		0.068	
	(0.83)		(1.00)	
Log(EV)*REIT	1.942		-1.231	
	(1.20)		(-1.11)	
$Log(EV)^2$*REIT	-0.121		0.069	
	(-1.19)		(0.93)	
Log(Asset)		-1.463		-0.441
		(-0.77)		(-0.40)
$Log(Asset)^2$		0.078		0.023
		(0.63)		(0.31)
Log(Asset)*REIT		2.435		-0.561
		(1.07)		(-0.48)
$Log(Asset)^2$*REIT		-0.148		0.031
		(-1.05)		(0.40)
REIT	-7.817	-9.964	5.882	3.053
	(-1.20)	(-1.10)	(1.46)	(0.72)
MABidder	-0.162	-0.176	0.022	0.028
	(-1.29)	(-1.39)	(0.18)	(0.24)
$MABidder_{t-1}$	0.279**	0.268**	0.160	0.163
	(2.06)	(1.97)	(1.46)	(1.52)
Total Debt/ Total Cap	-0.010	-0.008	0.026***	0.027***
	(-1.13)	(-0.88)	(5.00)	(5.26)
ST Debt/ Debt	-0.002	-0.002	0.002	0.002
	(-0.42)	(-0.40)	(0.60)	(0.67)
Asset Growth	-0.010***	-0.010***	-0.007***	-0.007***
	(-4.67)	(-4.61)	(-4.49)	(-4.39)
Intercept	11.551**	11.584	7.694**	5.379
	(2.50)	(1.53)	(2.13)	(1.28)
Year Control	Yes	Yes	Yes	Yes
Sector Control	Yes	Yes	Yes	Yes
Country Control	Yes	Yes	Yes	Yes
N	1311	1311	1311	1311
Adj. R2	0.369	0.367	0.506	0.502

Note: The sample contains 232 firms and 2134 firm-year observations between 2001 and 2015. *Log(EV)* is the natural logarithm of the total enterprise value in million Euros. *Log(Asset)* is the natural logarithm of the total asset value in million Euros. *ROE* is the return on equity. *Total Debt/ Total Cap* is the book value of total debt as a percentage of the total capitalisation. *ST Debt/ Debt* is the ratio of the book value of short-term debt to the book value of total debt. *Asset Growth* is the growth in the book value of total assets over the previous year. *Cost of debt* is the interest expense as a percentage of the book value of the total debt. *WACC* is the weighted average cost of capital. *REIT* is the dummy variable equal to 1 if the company is a REIT in the current year. *MABidder* is the dummy variable equal to 1 if the company is an acquirer in the current year. t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6. Conclusions

This study set out to test the hypothesis that listed real estate companies enjoy positive size effects regarding their operational efficiency and profitability that outweigh the inefficiencies associated with large and complex internal structures. The European listed real estate market provides a suitable laboratory for testing this hypothesis due to its size, heterogeneity and growth over the last two decades. Unlike in the US, REITs are a relatively recent phenomenon in Europe. While the bulk of empirical evidence is on US REITs, this study investigates the effect of firm size on expense, revenue, return and capital cost for European real estate companies and compares the size effects of REITs and non-REIT real estate companies.

To test for economies of scale, we use real estate company data from SNL database and focus on companies who invest primarily in Europe with a sample of 232 real estate companies over the 2001-15 period. Employing panel data regression with fixed effects for geography, time and property type effects, we found that larger real estate companies are able to generate higher revenue per unit of company size, incur lower costs and produce higher returns. NOI ratios and return ratios increase while SG&A expense ratios decrease with the size of a company. We do not find evidence of larger companies having lower cost of debt or weighted average cost of capital.

From our analysis, it is evident that particularly small firms can reap economies of scale as they grow. However, the benefits of further growth tend to be more modest for larger companies. Perhaps not surprisingly, there is no evidence that the group of the largest firms in our sample with total enterprise value over €6bn benefit at all from further growth regarding the metrics we investigated.

Our results suggest that REITs have lower economies of scale in both expenses and revenues than Non-REIT real estate companies. While the reasons for these differences warrant further investigation, we observe that REITs are on average larger than non-REITs which may limit the comparability of these two types of companies.

References

Allcoat, J. (2014). Real Estate Activities Industry Review-2014.

Altınkılıç, O., & Hansen, R. S. (2000). Are there economies of scale in underwriting fees? Evidence of rising external financing costs. *Review of financial Studies*, *13*(1), 191-218.

Ambrose, B. W., Ehrlich, S. R., Hughes, W. T., & Wachter, S. M. (2000). REIT economies of scale: fact or fiction?. *The Journal of Real Estate Finance and Economics*, *20*(2), 211-224.

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

Ambrose, B. W., Highfield, M. J., & Linneman, P. D. (2005). Real estate and economies of scale: the case of REITs. *Real Estate Economics*, *33*(2), 323.

Anderson, R., Lewis, D., & Springer, T. (2000). Operating efficiencies in real estate: a critical review of the literature. *Journal of Real Estate Literature*,*8*(1), 1-18.

Archer, S. H., & Faerber, L. G. (1966). Firm size and the cost of externally secured equity capital. *The Journal of Finance*, *21*(1), 69-83.

Barclay, M. J., & Smith, C. W. (1995). The maturity structure of corporate debt. *The Journal of Finance*, 50(2), 609–631.

Berger, A. N., & Mester, L. J. (1997). Inside the black box: What explains differences in the efficiencies of financial institutions?. *Journal of banking & finance*, *21*(7), 895-947.

Bers, M. and Springer, T. M. (1997). Economies-of-scale for Real Estate Investment Trusts, *Journal of Real Estate Research*, Vol. 14, pp. 275–290.

Bers, M. and Springer, T. M. (1998). Sources of Scale Economies for Real Estate Investment Trusts, *Real Estate Finance*, Vol. 14, pp. 47–56.

Campbell, R. D., Ghosh, C., & Sirmans, C. F. (2001). The information content of method of payment in mergers: evidence from real estate investment trusts (REITs). *Real Estate Economics, 29(3),* 361-387.

Capozza, D. R., & Seguin, P. J. (1998). Managerial style and firm value. *Real Estate Economics, 26(1), 131-150.*

Capozza, D. R., & Seguin, P. J. (2000). Debt, agency, and management contracts in REITs: the external advisor puzzle. *The Journal of Real Estate Finance and Economics*, *20*(2), 91-116.

Eckbo, B. E. (1992). Mergers and the value of antitrust deterrence. *The Journal of Finance*, *47*(3), 1005-1029.

Eichholtz, P., Holtermans, R., & Yönder, E. (2015). The economic effects of owner distance and local property management in US office markets. *Journal of Economic Geography*, lbv018.

Feng, Z., Price, S. M., & Sirmans, C. (2011). An overview of equity real estate investment trusts (REITs): 1993–2009*. Journal of Real Estate Literature, 19(2),* 307-343.

Hansen, R. S., & Torregrosa, P. (1992). Underwriter compensation and corporate monitoring. *The Journal of Finance*, *47*(4), 1537-1555.

Isik, I., & Topuz, J. C. (2017). Meet the “born efficient” financial institutions: Evidence from the boom years of US REITs. *The Quarterly Review of Economics and Finance, 66(C),* 70-79

Kim, H. Y. (1986). Economies of scale and economies of scope in multiproduct financial institutions: Further evidence from credit unions. *Journal of Money, Credit and Banking*, 18(2), 220–226.

Krautz, S., & Fuerst, F. (2015). Size signals success: evidence from real estate private equity. Available at SSRN: https://ssrn.com/abstract=2649904 or http://dx.doi.org/10.2139/ssrn.2649904.

Linneman, P. (1997). *The forces changing the real estate industry forever*. Real Estate Center, Wharton School of the University of Pennsylvania.

McIntosh, W., Liang, Y., & Tompkins, D. L. (1991). An Examination of the Small-Firm Effect within the REIT Industry. *Journal of Real Estate Research*, *6*(1), 9-18.

Miller, S. M., Clauretie, T. M., & Springer, T. M. (2006). Economies Of Scale And Cost Efficiencies: A Panel - Data Stochastic - Frontier Analysis Of Real Estate Investment Trusts. *The Manchester School*, *74*(4), 483-499.

Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. *The Journal of Finance*, 43(1), 1–19.

Topuz, J. C., & Isik, I. (2009). Structural changes, market growth and productivity gains of the US real estate investment trusts in the 1990s. *Journal of Economics and Finance, 33(3),* 288-315.

Xu, R., & Ooi, J. T. (2018). Good Growth, Bad Growth: How Effective are REITs' Corporate Watchdogs?. *The Journal of Real Estate Finance and Economics,* 1-23.

Yang, S. (2001). Is bigger better? A re-examination of the scale economies of REITs. *Journal of Real Estate Portfolio Management*, *7*(1), 67-77.

Declarations of interest: none