Downside Systematic Risk in Australian Listed Property Trusts

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Abstract

Previous studies on systematic risk have demonstrated the link between financial and management structure determinants and systematic risk. However, systematic risk is estimated by assuming return is normally distributed. This assumption is generally rejected for real estate returns. Therefore, downside systematic risk appears as a more sensible risk measure in estimating market-related risk. This study contributes to this body of knowledge by examining the determinants of downside systematic risk in Australian Listed Property Trusts (LPTs) over 1993-2005. The results reveal that systematic risk and downside systematic risk are empirically distinguishable. More specifically, there is limited evidence on the connection between these financial and management structure determinants and systematic risk. However, downside systematic risk is sensitive to leverage and management structure.

Keywords: downside systematic risk, financial determinants, management structure, listed property trusts

1. INTRODUCTION

Investment in Listed Property Trusts (LPTs) or Real Estate Investment Trusts (REITs) has traditionally considered risk as an important factor particularly systematic risk. Numerous studies on systematic risk in the literature have also demonstrated that LPT's financial condition and management structure have implications for its systematic risk. Most of these studies have utilised the cross-sectional difference of LPT financial conditions and LPT management structure in estimating the relationship between these variables and systematic risk. A LPT's systematic risk is measured by the beta coefficient in the Capital Asset Pricing Model (CAPM) in which it is measured in a variance framework.

However, the appropriateness of using CAPM in particular the use of beta as systematic risk measure has been debated in recent years (see Section 2.2). In fact, several studies suggest using downside systematic risk (downside beta) rather than systematic risk for measuring market-related risk for an asset in line with the theoretical superiorities of downside risk. Downside risk was first introduced by Roy (1952) based on the safety first rule. It appears as a more intuitively appealing risk measure compared to variance for several reasons such as downside risk does not require an assumption about the return distribution of an asset; it is more consistent with the investor's expected utility function and combining information provided by variance and skewness into one measure (Nawrocki, 1999, Estrada, 2002).

Hogan and Warren (1974) and Bawa and Linderberg (1977) also demonstrated that downside risk (lower partial moment) can be generalised into CAPM and they developed a Mean-lower Partial Moment Capital Asset Pricing Model (MLPM-CAPM). More importantly, the results from Price et al. (1982) and Nantell et al. (1982) depicted that if the return distributions are not normally distributed, downside systematic risk is different from traditional systematic risk.

In real estate field, downside risk has also received some attention and it was only introduced to real estate in late 1990s by Sivitanides (1998) and Sing and Ong (2000). Both of studies revealed that downside risk produces divergence portfolio allocations in comparison with the mean-variance portfolio. This was confirmed by the findings from Byrne and Lee (2004) for U.K. real estate portfolios, and Peng (2005) for Australian real estate portfolio allocations. More importantly, Cheng (2001) argued that bootstrapped simulated downside risk model provided a more realistic allocation for real estate.

However, the question of downside systematic risk in LPTs has been the subject of relatively little research. As a consequence, the aim of this paper is to address this gap in the literature by examining the downside systematic risk in Australian LPTs. The investigation is furthered by examining the differences in the sensitivities of systematic risk and downside systematic risk to the LPT's financial conditions and its management structure.

The reminder of the paper is structured as follows. Section 2 reviews the connection between financial determinants and management structure and systematic risk. The importance of downside systematic risk is also reviewed in Section 2. The data and methodology are discussed in Section 3. Section 4 reports on and discusses the empirical results. Section 5 concludes the paper.

2 LITERATURE REVIEW

This section contains 2 parts. The first part focuses on a review on the determinants of systematic risk in real estate. The second part reviews the importance and advantages of MLPM-CAPM in estimating systematic risk.

2.1 Systematic Risk and its Determinants

In recent years, several studies on systematic risk have demonstrated the association between systematic risk of a LPT with the market-related risk and its financial conditions. Patel and Olsen (1984) is probably the first study in the real estate context, utilised a small sample size of U.S. REITs from 1976 to 1978 and provided evidence that short-term financial leverage, business risk and the advisor fee of a LPT are directly related to its systematic risk.

More recently, Delcoure and Dickens (2004) extended their study by employing a larger sample size of U.S. REITs. The results indicated that business risk is significantly and negatively related to the REIT systematic risk in all models while there are no similar significant results for marketability and agency variables. Additionally, they found an inverse relationship between REIT systematic risk and short term and variable-rate financing; while a positive and statistically significant relationship between long-term debt and REIT systematic risk. Consistently, Allen et al. (2000) also found a positive and significant relationship between total financial leverage and systematic risk. Besides, Allen et al. (2000) also confirmed the findings of Patel and Olsen (1984) in which the asset variable (the proportion of the REIT invested in equity real estate) is insignificant in explaining beta. They also showed that specialisation (the total of the squared proportions of the REIT's portfolio invested in each property type) is an insignificant factor in explaining systematic risk.

Apart from the above variables, Conover et al. (1998) provided indirect evidence for the role of size in systematic risk in which they found that the return and risk differences between large and small foreign real estate firms were statistically significant. Similarly, Gyuorko and Nelling (1996) examined the systematic risk of REITs from 1988 to 1992 and found a positive and statistically significant relationship between size and systematic risk. In Australia, Tan (2004) provided indirect evidence and showed that large size LPTs have a higher beta. Conversely, a more recent study from Litt et al. (1999) employed a different study period (1993-1997) for the U.S. REIT market and showed contrary results where they presented a low negative correlation between size and systematic risk. Ambrose and Linneman, 2001 and Byrne and Lee (2003) revealed similar results in which no significant size effect is found for U.S. REITs' and U.K. property funds' betas. More recently, Ambrose et al. (2005) re-examined and documented a significant inverse relationship between beta and size and they attributed this to the economies of scale in REITs.

Furthermore, several studies examined the influence of the management structure of the LPT on its systematic risk. Capozza and Seguin (2000) demonstrated that externally managed REITs have higher systematic risk than self-managed REITs. Consistently, Allen et al. (2000) studied the impacts of management strategy on risk and offered evidence that self-management REITs exhibit less systematic risk. However, Ambrose and Linneman (2001) revealed that internally managed REITs have had a higher beta in recent years.

In Australia, Tan (2004) examined the effect of management structure on the performance of Australian LPTs. The results indicated that LPTs employing an internal management structure outperform externally managed LPTs. Additionally, the results also offered some indirect evidence about the management structure effect on systematic risk in which externally managed LPTs show higher systematic risk. This is consistent with the findings from Newell and Tan (2005) for the earlier study period, however, they also found an increase in systematic risk for internally managed LPTs in recent years.

2.2 Systematic Risk and Downside Systematic Risk

Sharpe (1964) developed CAPM based on the Mean-Variance model which was developed by Markowitz (1952). It asserts that beta can be used to measure the systematic risk of an asset. CAPM suggests that an asset is riskier if the asset exhibits a higher beta. However, a higher beta can also be contributed by the upside swings of an asset in which it increases considerably more than the market upswing. This is not intuitively appealing and most investors, particularly risk relative investors, would probably not accept this method in measuring the systematic risk for an asset (Estrada, 2006).

Additionally, Bawa (1975) and Fishburn (1977) also highlighted the flaws in CAPM by assuming irrelevance of investors utility functions in asset pricing and all assets are normally distributed. In real estate context, the normal distribution assumption in real estate returns is rejected in many studies (Graff et al., 1997, Maitland-Smith and

Brooks, 1999, Myer and Webb, 1993, 1994, Peng, 2005). As a consequence, CAPM which is analysed under a non-normality distribution might provide misleading results. Therefore, not surprisingly, a review by Fama and French (2004) revealed that there is little empirical evidence in finance literature supporting CAPM.

In order to obviate these limitations, Hogan and Warren (1974) and Bawa and Linderberg (1977) suggested using downside risk rather than variance as a risk measure and developed a MLPM-CAPM, which is a model that does not rely on these assumptions. Both studies concluded that the MLPM-CAPM model is preferred to CAPM at least on theoretical grounds. Harlow and Rao (1989) improved the MLPM-CAPM model and developed a more general model, which is known as the Generalised Mean-Lower Partial Moment CAPM. This is a MLPM-CAPM model for any arbitrary benchmark return. More importantly, their empirical results support the use of the Generalised MLPM-CAPM model, while no similar evidence is found for traditional CAPM. Another important caveat from the study is that target return should equal to the mean of the assets' returns rather than the risk-free rate.

However, empirical tests by Jahankhani (1976) reveal little improvement for MLPM-CAPM model over the traditional CAPM model. Besides, Nantell and Price (1979) revealed analytical results that variance and semi-variance produce similar equilibrium rates of return under the assumption of a bi-variate normal distribution of returns for an asset and the market. In contrast, Nantell et al. (1982) demonstrated that skewness in the distribution of market returns has a profound impact on CAPM in which a divergence of results is obtained from both MLPM-CAPM and CAPM models if skewness exists in the asset return distribution. Consistently, Price et al. (1982) showed that systematic risk in a downside risk framework is different from systematic risk in a mean-variance framework if the return distributions are in lognormal form and this supported the use of the MLPM-CAPM model.

Moreover, Estrada (2000, 2002, 2004) reported significantly different results generated by these models and argued the superiority of using MLPM-CAPM model in emerging markets by providing evidence for supporting the use of downside beta over traditional beta. Post and Vilet (2004) also provided evidence that MLPM-CAPM outperforms the traditional CAPM in explaining the cross-section of U.S. stock returns. This was confirmed by Ang et al. (2006) for U.S. stock. Fraser et al. (2004) also provided indirect empirical evidence from the U.K. stock market to support MLPM-CAPM. The results offered evidence in favourite of the CAPM in a bear market when there is a higher likelihood of negative returns and downside risk, whereas no similar result is found in a bull market. However, little, if any, the superiority of MLPM-CAPM in real estate evidence has been demonstrated. One exception is Cheng (2005) who has demonstrated the superiority of downside systematic risk over traditional systematic risk in explaining U.S. real estate return variation.

The primary conclusion that can be drawn from the literature is that downside systematic risk appears to be a more intuitively appealing than systematic risk and it is distinguishable from the traditional systematic risk. Many endeavours have also demonstrated the link between systematic risk and financial determinants and management structures. However, relatively little focus has been placed on the relationship between downside systematic risk and these variables.

3. DATA AND METHODOLOGY

3.1 Data

The data comprise all LPTs listed on the Australian Stock Exchange (ASX) from 1993 to 2005. This study is sub-divided into six different periods in line with the arguments of time-variation in systematic risk. For the purpose of reliably assessing a LPT's economic and financial situation, 3-year intervals are employed in which it is argued that annual accounting information cannot show the real situation of a company (Alexander et al., 2003). The methodology is also adopted by Patel and Olsen (1984) and Chaudhry et al. (2004). Another reason for using 3-year interval is to incorporate as many LPTs as possible in the study. 106 LPTs were identified by using the Global Industry Classification Standard (GICS) and ASX Sub-Code over the study period.[1] However, there were only 73 LPTs have adequate information over these 6 different study periods in line with short-lived of LPTs. Period 1 includes the average annual accounting information from 1993 to 1995. There were 25 LPTs that had sufficient accounting data for all the variables. A LPT was removed from the sample if it did not have complete accounting information for the period. Period 2 spans from 1995 to 1997, Period 3 is 1997 to 1999, Period 4 is 1999 to 2001, Period 5 is 2001-2003 and Period 6 is 2003 to 2005.

Monthly returns for LPTs were obtained from *Bloomberg* for the corresponding period. Annual data for total asset (TA), long term debt (LTD), short-term debt (STD), Earning before Interest and Tax (EBIT), the number of common shares outstanding, market capitalisation and total number of traded shares were collected from *Bloomberg* and *DatAnalysis*. The missing data were found manually by using the Shares Magazine. It is a monthly magazine by ASX, which is bound with ASX journal. The ASX All Ordinaries Price Index is used as a benchmark and the one month interbank rate is employed as the risk-free rate. Both of these data sets were extracted from *Datastream*. Management structures, type of property and geographic characteristics for all LPTs were collected from Property Investment Research reports and LPT company annual reports.

3.2 Methodology

In the mean-variance framework, CAPM employs variance as a risk measure and it can be computed by:

$$Var(R_i) = E\left[(R_i - \mu_i)^2\right] \tag{1}$$

where R_i represents return of asset i and μ_i is the mean of the returns.

The expected required return in the mean-variance framework can be displayed as follows:

[1] The GICS for delisted LPTs are not necessary available via Bloomberg and DatAnalysis. Hence, ASX sub-code was used to identify the classification of the delisted LPTs.

$$E(R_i) = R_f + \left[E(R_m) - R_f\right] * \beta_i \tag{2}$$

where R_f is the risk-free rate of return, β_i represents beta of asset i in which it also can be expressed as:

$$\beta_i = \frac{Cov(R_i, R_m)}{Var(R_m)} \tag{3}$$

where $COV(R_i, R_m)$ is the covariance between asset i and market, $Var(R_m)$ is the variance of the market returns.

In the downside risk framework, Hogan and Warren (1974), Bawa and Linderberg (1977) and Harlow and Rao (1989) proposed using downside risk as the risk measure. Downside risk/Lower Partial Moment (LPM) is given as follows:

$$LPM_i = E\left\{Min\left[(R_i - \mu_i), 0\right]^{\alpha}\right\} \tag{4}$$

The Co-Lower Partial Moment (CLPM) is defined as:

$$CLPM_i = E\left\{(R_i - R_f) Min\left[(R_m - \mu_m), 0\right]\right\} \tag{5}$$

where μ_m is the benchmark for market, α is the degree of the Lower Partial Moment (LPM) and R_m is the market return. For consistency, the α is equal to 2 in this study. It should be noted it is also known as semi-variance.

The expected required return on asset i based on MLPM-CAPM is:

$$E(R_i) = R_f + \left[E(R_m) - R_f\right] \frac{CLPM(R_m, R_i)}{LPM(R_m)} \tag{6}$$

where R_f is the risk-free rate of return, $\frac{CLPM(R_m, R_i)}{LPM(R_m)}$ can be simplified to the downside beta of asset i (β_i^D).

Recently, Estrada (2002) formally defines downside beta as following:

$$\beta_i^D = \frac{E\left\{Min\left[(R_i - \mu_i), 0\right] Min\left[(R_m - \mu_m), 0\right]\right\}}{E\left\{Min\left[(R_m - \mu_m), 0\right]^2\right\}} \tag{7}$$

where μ_i is the benchmark for asset i.

In this study, the beta and downside beta for asset i were computed in the first stage of the analysis by using Equations (3) and (7) respectively in which the target rate for Equation (7) is set equal to mean of the benchmark. Thereafter, the computed beta and downside beta were regressed respectively with the average accounting-based variables over the three-year interval and management structure by using Equation (8) and Equation (9).

$$\beta_i = \alpha + \beta_s STLeverage + \beta_l LTLeverage + \beta_b BusRisk + \beta_p PAsset + \beta_t Ln(Turnover)$$

$$+ \beta_m Ln(MarketCap) + \beta_{mgmt}(Management) + \varepsilon \quad (8)$$

$$\beta_i^D = \alpha + \beta_s^D STLeverage + \beta_l^D LTLeverage + \beta_b^D BusRisk + \beta_p^D PAsset + \beta_t^D Ln(Turnover)$$

$$+ \beta_m^D Ln(MarketCap) + \beta_{mgmt}^D(Management) + \varepsilon \quad (9)$$

where *STLeverage* presents the short-term leverage of asset i, *LTLeverage* is the long-term leverage of asset i, *BusRisk* is business risk of asset i, *PAsset* is property asset investment of asset i, *Turnover* is turnover of asset i, *MarketCap* is market capitalisation of asset i, *Management* is a dummy variable with a value of 0 a externally managed LPT and 1 for an internally managed LPT.

The definitions of the above variables are suggested by the literature as follows:

a) Leverage. In this study, the ratio of total short-term debt to total assets and the ratio of total long-term debt to total assets are used to measure the leverage level of a LPT. In general, it is hypothesised that systematic risk and downside systematic risk are positively related to leverage ratio.
b) Business Risk. It is measured by the ratio of total annual earnings (before interest and taxes) to average total assets. A negative association is expected between business risk and systematic risk and downside systematic risk respectively.
c) Property asset. Property asset is measured by the ratio of total property investment to total assets. It is hypothesised that property asset is expected to be negatively related to systematic risk and downside systematic risk.
d) Turnover. The turnover is measured by the natural logarithm of the ratio of average trading volume to common shares outstanding. An inverse relationship between turnover and systematic risk is hypothesised.
e) Market capitalisation (size). The market capitalisation is determined by multiplying the total shares outstanding by the current LPT's price. A negative relationship is expected between market capitalisation and systematic risk and downside systematic risk respectively.
f) Management Structure. In Australia, an internal management structure permits LPT to engage in property development and/or fund management activities. Hence, it is expected that internally managed LPTs are exposured to higher systematic risk in both frameworks.

(Insert Table 1)

Table 1 reports descriptive statistics of the LPT market from the sample. Obviously, since the 1990s, the market has experienced a dramatic growth in which the number of LPTs has increased dramatically from 38 in Period 1 to 60 in Period 3. Thereafter the market has undergone a consolidation phase via merger and acquisition activities. It is evident that the number of LPTs has decreased to 37 in Period 6, whilst the average market capitalisation of LPTs has increased dramatically from $334 million in Period 1 to $1,340 million in Period 6. The growth also renewed the attention of the investors as there was a gradual increase in turnover until Period 6. The increased turnover is expected to reduce the market risk in which LPTs become more liquid.

Another interesting point that can be seen in Table 1 is that the LPT market has also undergone some structural changes in which the debt level has increased in last decade in particular long-term debt. The long-term debt has increased substantially from an average of 7% in Period 1 to 28% in Period 6. Additionally, there is a trend showing a steady increase in the number of LPTs employ an internal management structure via the stapled security structure. Consequently, the property asset proportion of LPTs has decreased in recent years which it is evident in Period 5 and 6. These changes have further increased the sensitivity of LPTs to the market's risk. The structural change in recent years is also being evident in business risk. The business risk of LPTs was stable in first three periods and peaked in Period 4, thereafter it decreased in Periods 5 and 6.

4. RESULTS AND DISCUSSION

4.1 Comparison between Beta and Downside Beta

The average standard deviation, downside deviation, beta and downside beta are presented in Table 2. Panel A in Table 2 reveals that standard deviation exhibits higher risk than downside deviation. The results are also consistent with the previous studies on downside risk framework such as Sing and Ong (2000) and Peng (2005).

(Insert Table 2)

Notably, the results from Panel B in Table 2 indicate the dynamics of beta in Australian LPTs in which it varies from 0.292 in Period 1 to 0.432 in Period 6. The results confirm the findings from previous studies on time variation in beta. Khoo et al. (1993) and Liang et al. (1995) demonstrated a decline in market beta in U.S. REITs from the 1970s to the end of the 1980s. Matysiak and Brown (1997) also found that the equity betas of eighteen U.K. property companies vary over time. Consistently, Newell and Tan (2005) also revealed similar results from Australian LPTs. Similar results are also found in Panel B Table 2 for downside beta. These results indicate that downside beta as well as beta varies from time to time.

Interestingly, downside beta reveals that Period 4 has the highest systematic risk, while beta shows it has the lowest beta. This provides some indirect evidence to support the dissimilarity between beta and downside beta. Another interesting observation from Table 2 is that downside betas are substantially higher than betas. Over the sample, on average, downside betas are at least 25% higher than betas. In other words, beta underestimates downside systematic risk.[2] This confirms the argument of Price et al. (1982) in which beta for the low risk sample actually underestimates downside systematic risk. The results are also consistent with the results that were found by Estrada (2002) for emerging stock markets.

To reinforce the findings on the significant differences between beta and downside beta, t-statistics and sign-tests are conducted. For the t-statistic, it is hypothesised that the mean difference between beta and downside beta is equal to zero $\left(\overline{X} = 0\right)$, while the alternate hypothesis is $\overline{X} \neq 0$. T-statistics can be displayed as follows:

$$X_i = Beta_i - DownsideBeta_i \tag{10}$$

$$t = \frac{\overline{X} - 0}{S / \sqrt{n}} \tag{11}$$

where $\overline{X}$ is the mean of X_i, and S is the standard deviation of X_i over the sample.

A non-parametric test (sign test) is also conducted. The null hypothesis is the number of positive differences and negative differences are equal; whereas its alternate hypothesis is the numbers of positive (negative) differences are more likely. The sign test can be computed as following:

$$z = \frac{(K \pm 0.5) - 0.5n}{0.5\sqrt{n}} \tag{12}$$

where K is number of negative/positive differences, and n is number of observations.

(Insert Table 3)

Table 3 shows the results from t-statistics and sign-tests for the differences between beta and downside beta. Table 3 provides strong evidence to reject the null hypothesis of similarity of both beta and downside beta. T-statistics reveal that downside beta has a statistically significant difference from beta at least at the 5% level in all periods except Periods 1 and 6. In other words, the null hypothesis in which zero difference between beta and downside beta is rejected for Periods 2, 3, 4 and 5.

Z-statistics also confirm previous findings and offer evidence that downside beta is consistently higher than beta in all periods and the null hypothesis for all periods can be rejected at the 1% significant level with the Z-test. All of these are consistent with the findings from Price et al. (1982) for U.S. stocks.

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[2] Most of LPTs in the sample exhibit beta and downside beta that are lower than 1. Hence, Australian LPTs are considered as low risk.

Another interesting observation from Periods 1 and 6 is the null hypothesis cannot be rejected by t-statistic, while these are rejected by Z-statistic with 1% significant level. Obviously, smaller sample size could be one of the plausible explanations, while it cannot be the only reason account for this scenario. Another possible explanation is the non-normality in return distributions. 88%, 36% and 24% of the number of LPTs from the sample in Period 1 can be rejected by Jarque-Bera, Lillifors and Shapiro-Wilk normality tests respectively. Similar strong normality rejection evidence is found for Period 6. T-statistic is a parametric test that requires normality assumption. On the other hand, sign-test is a non-parametric test which is liberated from this assumption. Hence, it is not surprisingly that Z-statistics in Table 3 reject the null hypothesis with statistically significant at 1%; while, no similar evidence for t-statistics.

In sum, beta and downside beta are varying from time to time and both are distinguishable. The important caveat from these findings is that the financial determinants for beta might not be suitable to explain downside beta. Therefore, it is crucial to examine the determinants of downside beta.

4.2 Determinants of Systematic Risk

Table 4A presents the regression results between beta and the financial determinants and LPT structures over the six different periods from Equation (8). Surprisingly, in Periods 1, 4 and 6, none of the variables are significant in explaining beta. Notably, the coefficient on turnover is significant and positive in Periods 2 and 3, suggesting that the higher turnover of a LPT, the riskier is the LPT in terms of systematic risk. This is conspicuous and inconsistent with the previous findings in U.S. REITs.

(Insert Table 4A)

The coefficient for market capitalisation is only negative and statistically significant in Period 5, suggesting that the larger size of a LPT greatly reduces the chance of higher market risk. In contrast, no similar significant result is found for market capitalisation in other periods. This is also evident in equivalent studies such as Litt et al. (1999) and Ambrose and Linneman (2001) for U.S. REITs and Byrne and Lee (2003) for U.K. property funds which show little impact from size on systematic risk. However, it is inconsistent with the findings from Gyuorko and Nelling (1996) and the indirect evidence from Tan (2004) for Australian LPTs.

The results also reveal that property asset is only negatively and statistically significantly related to beta at 5% level in Periods 2 and 3. However, no similar significant evidence is found for other periods. The insignificance of the property asset result is consistent with the previous studies in U.S. REITs. This can be attributed to the little variation in property asset proportions for LPTs. In Australia, most of the LPTs maintain a high proportion of property asset. Hence, it is not surprising that this variable does not provide a good explanation for beta.

Surprisingly, the results reveal that short-term debt to be positively correlated to beta in all periods except Period 6; while it is only significant in Period 3. Similarly, long-term debt has a statistically insignificant relationship with beta. These are counter to the results found in U.S. REITs in which there is little evidence to support the explanation power of leverage in Australian LPTs' betas. The plausible explanation could be the relative low leverage level for Australian LPTs. As observed by Newell and Tan (2005), in comparison to U.S. REITs, the leverage levels for Australian's LPTs generally are considered low even though there has been an increase in leverage levels for Australian LPTs in recent years.

The results also reveal that business risk is positively linked to beta, suggesting that the LPTs with high business risk would have higher market risk. However, this variable is insignificant over all time periods. The insignificance of this variable contradicts to the previous studies of U.S. REITs. The lack of significance for this variable probably can be attributed to the little variation in the sample for this variable in which the median for business risk over all periods remains constant at around 7%.

The management coefficient also reveals that internally managed LPTs have a higher beta. This is consistent with the findings from recent studies such as Ambrose and Linneman (2001). However, the evidence to support this factor is generally insignificant as it is only significant in Period 5. This provides indirect evidence to support the findings of Capozza and Seguin (2000) who demonstrated that the differences in management structure can be solely attributed to the financial risk (leverage). Since, no significant influence of financial risk on Australian LPTs' betas is found; it is not surprising that this factor is insignificant in explaining betas.

Overall, turnover and property asset have significant explanatory power in regards to beta. However, these explanatory powers have diminished in recent years. More importantly, the financial variables and management structure variables are found for explaining beta in U.S. REITs are not suitable for Australian LPTs.

4.3 Determinants of Downside Systematic Risk

Table 4B displays the regression results between downside beta and financial and LPT management structure variables from Equation (9). Conversely with the results for beta in general, short-term leverage reveals a strong relationship with downside beta. These indicate that in comparison with beta, downside beta which only focuses on the downside risk is more sensitive to leverage. More importantly, these significant results are consistent with the hypothesis, suggesting that higher leverage leads the greater market risk. Another interesting point is downside beta is more sensitive to short-term leverage than long-term leverage.

(Insert Table 4B)

In general, market capitalisation shows a negative relationship with downside beta. However, it is a significant variable in explaining downside beta in early study period in which market capitalisation is negatively and statistically significant being at least at 5% level with downside beta for Periods 1 and 4. This suggests that large LPTs can lower downside systematic risk and this can be attributed to the economies of scale.

However, the coefficient in Periods 2 and 3 are positive and it is statistically significant at 5% in Period 3. This is consistent with the indirect evidence from Newell and Tan (2005) for Australian LPTs in which their sub-period analysis shows that larger LPTs has higher market risk in this period.

Clearly, internally managed LPTs exhibit higher downside beta than externally managed LPTs except for Periods 1 and 6. However, unlike beta, management structure is significant in explaining downside beta in Periods 2, 3 and 5. Coincidently, the results show that downside beta is more sensitive to leverage in comparison with beta. As a consequence, it is reasonable to expect that management structure has stronger influence on downside beta, if the findings from Capozza and Seguin (2000) can be generalised into a downside risk framework.

An inverse relationship is evident between property asset and downside beta over all time periods, suggesting a higher property asset level in a LPT has a lower downside beta. However, property asset variable is only significant in explaining downside beta in Period 6. This can be largely attributed to the relatively small differences in property asset holdings between LPTs.

Interestingly, no evidence is available to show business risk and turnover variables are significant over any of the periods. These results contradict the findings for beta in which turnover has significance explanation power to beta. On the other hand, this supports the alternative hypothesis of this study in which beta and downside beta sensitivities to financial conditions and management structure are different.

In summary, leverage has significant explanation power for downside beta. Besides, the importance of the market capitalisation and management structure variables in explaining downside beta are also found. However, the size effect has diminished in recent years. More importantly, the explanation variables which are significant in explaining beta do not have similar explanatory power in downside beta. These results also render further support to downside systematic risk being distinguishable from systematic risk.

4.4 Property Type and Geographic Specialisation

Nevertheless, there are a few concerns that still need to be addressed. LPTs have different investment characteristics where they invest in different property types and different locations. The evidence from Ambrose and Linneman (2001), Byrne and Lee (2003) and Delcoure and Dickens (2004) suggests that beta does vary to a noticeable extent by controlling of these characteristics. However, Gyourko and Nelling (1996) and Allen et al. (2000) showed that diversification across property types and geographic location does not have a significant impact on diversification of systematic risk.

To reinforce the previous findings, the investment characteristics of LPTs should be controlled. In this study, controlling the type of property and location by employing dummy variables could be a vain exercise in line with the issue of undue multicollinearity and small sample size especially in Period 1. Pearson correlation displays that office and retial sectors are strongly correlated with statistically significant at least at 5% from Period 1 to Period 5. Similar mutlicolinearity issues are also found by Variance-inflation Factor (VIF). Moreover, strong correlation between New South Wales and Victoria are also evident.[3]

Therefore, the Herfindahl-property type (or geographic) index is employed in this study in order to capture the differences in LPTs' holdings and overcome the issues. The Herfindahl-property type (or geographic) index is given as follow:

$$D_i^{prop} = \sum_{i=1}^{N} w_i^2 \qquad (13)$$

$$D_i^{geo} = \sum_{i=1}^{N} w_i^2 \qquad (14)$$

where N is the number of property type (or geographic) segments and w_i is the weight of the LPT's investment in segment i. [4]

The Herfindahl-property type index is based on the 5 segments, namely, office, industrial, retail, leisure and others. If a LPT only specialises in the office market, the weight for office would be equal to one and zero for other segments; the Herfindahl-property type index is also equal to one. A naïve property type diversification strategy will result in a Herfindahl-property type index of $0.2\,(1/n)$. Hence, D_i^{prop} value for a LPT will vary from 0.2 to 1 and it is subject to the level of differences in property types.

Herfindahl-geographic index is also constructed for geographic specialisation based on 4 segments (New South Wales, Victoria, Queensland and others). Similar to the Herfindahl-property type index, a greater geographic diversification for a LPT is reflected in a smaller Herfindahl-geographic index. On the other hand, if the LPT is heavily concentrated in one particular segment; the Herfindahl-property type index is equal to one.

The Herfindahl-property type and Herfindahl-geographic indices for each LPT is regressed with beta in equations (15) and (16) respectively:

$$\beta_i = \alpha + \beta_s STLeverage + \beta_l LTLeverage + \beta_b BusRisk + \beta_p PAsset + \beta_t Ln(Turnover) + \beta_m Ln(MarketCap) + \beta_{mgmt}(Management) + \beta_d D_i^{prop} + \varepsilon \qquad (15)$$

$$\beta_i = \alpha + \beta_s STLeverage + \beta_l LTLeverage + \beta_b BusRisk + \beta_p PAsset + \beta_t Ln(Turnover) + \beta_m Ln(MarketCap) + \beta_{mgmt}(Management) + \beta_d D_i^{geo} + \varepsilon \qquad (16)$$

[3] The results are available from authors upon on request
[4] See Gyourko and Nelling (1996) for details.

Next, the Herfindahl-property type and Herfindahl-geographic indices for each LPT is also further regressed with downside beta in equations (17) and (18) respectively:

$$\beta_i^D = \alpha + \beta_s^D STLeverage + \beta_l^D LTLeverage + \beta_b^D BusRisk + \beta_p^D PAsset + \beta_t^D Ln(Turnover)$$

$$+ \beta_m^D Ln(MarketCap) + \beta_{mgmt}^D (Management) + \beta_d^D D_i^{prop} + \varepsilon \qquad (17)$$

$$\beta_i^D = \alpha + \beta_s^D STLeverage + \beta_l^D LTLeverage + \beta_b^D BusRisk + \beta_p^D PAsset + \beta_t^D Ln(Turnover)$$

$$+ \beta_m^D Ln(MarketCap) + \beta_{mgmt}^D (Management) + \beta_d^D D_i^{geo} + \varepsilon \qquad (18)$$

where $STLeverage$ presents the short-term leverage of asset i, $LTLeverage$ is the long-term leverage of asset i, $BusRisk$ is business risk of asset i, $PAsset$ is property asset investment of asset i, $Turnover$ is turnover of asset i, $MarketCap$ is market capitalisation of asset i, $Management$ is a dummy variable with a value of 0 for an externally managed LPT and 1 for an internally managed LPT, D_i^{prop} is Herfindahl-property type index and D_i^{geo} is Herfindahl-geographic index.

(Insert Table 5A)

In general, the regression results from Equation (15) are reported in Table 5A and the results are similar to the baseline results that are found in Table 4A. Clearly, there is no considerable variation observed in comparing it to Table 4A in which the evidence to support property asset and turnover are only significant in the early study period. Little evidence is available to support other variables having a strong explanatory power for systematic risk. Importantly, these findings corroborate the findings from Table 4A. The lack of variation between the results and the previous results is not surprising given the relatively low impact of the degree of specification in property type on systematic risk.

The results are further examined using Herfindahl-geographic index. Table 5B reports the regression results with beta and the determinants and Herfindahl-geographic index from Equation (16).

(Insert Table 5B)

Generally, the results reveal that LPTs specialising in a particular location exhibit a lower systematic risk. However, a marginal effect of the degree of geographic specialisation on systematic risk is found in which is only significant at 5% in Period 2. Therefore, little alteration is evident on the baseline results and the previous results are considered to be quite consistent even after considering the degree of geographic concentration.

Similarly, the previous results for downside systematic risk are reinforced by further regressing with the degree of property-type specialisation with Equation (17). The results are reported in Table 6A.

(Insert Table 6A)

Consistently, no substantial difference is found from Table 6A for downside systematic risk in comparison to Table 4B. The significance of leverage is consistent with the results from Table 4B even after controlling for the degree of concentration in property type. Additionally, the significant explanatory power of market capitalisation and management structure are also evident. The insignificance of other variables is also found.

(Insert Table 6B)

Table 6B exhibits the regression results between downside systematic risk and its determinants and degree of geographic specialisation from Equation (18). An insignificant coefficient on the Herfindahl-geographic index suggests no indispensable effect from the degree of concentration in location on downside systematic risk. The result indicates that neither LPTs heavily concentrated in a particular location nor LPTs diversified by location are unable to considerably lower the downside systematic risk. Most of variables reveal results that corroborate the results from Table 4B once the geographic specialisation of LPTs is controlled.

The baselines are also further examined the impact of different target rate on downside beta. Risk-free rate and zero rate of return are other common used cut-off points in downside risk analysis. Hence, the downside beta is first further measured with risk-free rate (β_{rf}^{-}) and second measured by zero rate of return (β_{0}^{-}). The correlations results among different downside beta measures are showed in Table 7.

(Insert Table7)

Table 7 exhibits that the previous results do not change with the way of estimating asymmetries in betas. More specifically, the results are robust to using different target rate of returns. Obviously, β^{-}, β_{rf}^{-} and β_{0}^{-} are all strongly correlated with each other over all time periods with correlation greater than 0.75. These downside beta measures even exhibit stronger correlation results in Periods 1, 4, 5 and 6. Given these strong correlations, it is not surprisingly that no evidence to support these different target rate returns change the baselines results in Table 4B considerably.[5]

5. CONCLUSIONS

In recent years, the use of CAPM and beta have been widely criticised in the literature. In this study, MLPM-CAPM and downside systematic risk have been employed in analysing Australian LPTs and three noteworthy results are found. First, consistent with the previous empirical evidence; downside systematic risk and traditional systematic risk in Australian LPTs are distinguishable. Second, although, turnover and property asset reveal some explanatory power for Australian LPT's beta, these explanatory powers have diminished in recent years. Thus, little evidence is found for the link between systematic risk and financial variables and management structure. More importantly, there is little evidence to suggest that these variables in the same manner that U.S. REITs could explain Australian LPTs' betas. Third, a strong relationship between downside systematic risk and leverage, management structure and market capitalisation were found. However, a decline trend for the explanatory power of size in recent years is also evident. These results also provided further evidence of the dissimilarity between systematic risk and downside systematic risk in which systematic risk and downside systematic risk sensitivities to financial determinants and management structure are dissimilar.

The important practical implication from this study is that more rigid interpretation from investors and real estate analysts is required with reference to the higher returns from high leverage and internal managed LPTs. There is little evidence that these high returns appear to be compensation for the greater systematic risk; these returns could for rewarding downside systematic risk in line with different traits for both downside and traditional systematic risks. Considering the limitations surrounding the relatively small number of LPTs in Australian LPTs, future research should extend this study by employing a market with larger number of LPTs in order to more accurately measure the implications of the financial variables to downside systematic risk. The additional variables should also be considered for the purpose of increasing the explanation power of the models.

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[5] These results are available upon on request

References:

Alexander, D., Britton, A. & Jorissen, A. (2003) *International Financial Reporting and Analysis*, London, Thomson Learning.

Allen, M.T., Madura, J. & Springer, T.M. (2000) REIT Characteristics and the Sensitivity of REIT Returns, *Journal of Real Estate Finance and Economics*, 21(2), pp. 141-152.

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), pp. 323-350.

Ambrose, B.W. & Linneman, P.D. (2001) REIT Organizational Structure and Operating Characteristics, *Journal of Real Estate Research*, 21(3), pp. 141-161.

Ang, A., Chen, J. & Xing, Y. (2006) Downside Risk, *Review of Financial Studies*, 19(4), pp. 1191-1239.

Bawa, V.S. (1975) Optimal Rules For Ordering Uncertain Prospects, *Journal of Financial Economics*, 2(1), pp. 95-121.

Bawa, V.S. & Linderberg, E.B. (1977) Capital Market Equilibrium in a Mean-Lower Partial Moment Framework, *Journal of Financial Economics*, 5(2), pp. 189-200.

Byrne, P. & Lee, S. (2003) An Exploration of the Relationship between Size, Diversification and Risk in UK Real Estate Portfolios: 1989-1999, *Journal of Property Research*, 20(2), pp. 191-206.

Byrne, P. & Lee, S. (2004) Different Risk Measures: Different Portfolio Compositions? *Journal of Property Investment and Finance*, 22(6), pp. 501-511.

Capozza, D.R. & Seguin, P.J. (2000) Debt, Agency, and Management Contracts in REITs: The External Advisor Puzzle, *Journal of Real Estate Finance and Economics*, 20(2), pp. 91 - 116.

Chaudhry, M.K., Maheshwari, S. & Webb, J.R. (2004) REITs and Idiosyncratic Risk, *Journal of Real Estate Research*, 26(2), pp. 207-222.

Cheng, P. (2001) Comparing Downside-Risk and Mean-Variance Analysis Using Bootstrap Simulation, *Journal of Real Estate Portfolio Management*, 7(3), pp. 225-238.

Cheng, P. (2005) Asymmetric Risk Measures and Real Estate Returns, *Journal of Real Estate Finance and Economics*, 30(1), pp. 89-102.

Conover, C.M., Friday, H.S. & Howton, S. (1998) The Relationship between Size and Return for Foreign Real Estate Investments, *Journal of Real Estate Portfolio Management*, 4(2), pp. 107-112.

Delcoure, N. & Dickens, R. (2004) REIT and REOC Systematic Risk Sensitivity, *Journal of Real Estate Research*, 26(3), pp. 237-254.

Estrada, J. (2000) The Cost of Equity in Emerging Markets: A Downside Risk Approach, *Emerging Markets Quarterly*, 4(1), pp. 19-30.

Estrada, J. (2002) Systematic Risk in Emerging Markets: The D-CAPM, *Emerging Markets Review*, 3(4), pp. 365-379.

Estrada, J. (2004) The Cost of Equity of Internet Stocks: A Downside Risk Approach, *The European Journal of Finance*, 10(4), pp. 239-254.

Estrada, J. (2006) Downside Risk in Practice, *Journal of Applied Corporate Finance*, 18(1), pp. 117-125.

Fama, E.F. & French, K.R. (2004) The Capital Asset Pricing Model: Theory and Evidence, *Journal of Economic Perspectives*, 18(3), pp. 25-46.

Fishburn, P.C. (1977) Mean-Risk Analysis with Risk Associated with Below-Target Returns, *American Economic Review*, 67(2), pp. 116-126.

Fraser, P., Hamelink, F., Hoesli, M. & Macgregor, B. (2004) Time-varying Betas and the Cross-sectional Return-risk Relation: Evidence from the UK, *The European Journal of Finance*, 10(4), pp. 255-276.

Graff, R.A., Harrington, A. & Young, M.S. (1997) The Shape of Australian Real Estate Return Distributions and Comparisons to the United States, *Journal of Real Estate Research*, 14(3), pp. 291-308.

Gyuorko, J. & Nelling, E. (1996) Systematic Risk and Diversification in the Equity REIT Market, *Real Estate Economics*, 24(4), pp. 493-515.

Harlow, W.V. & Rao, R.K.S. (1989) Asset Pricing in a Generalized Mean-Lower Partial Moment Framework: Theory and Evidence, *Journal of Financial and Quantitative Analysis*, 24(3), pp. 285-311.

Hogan, W.W. & Warren, J.M. (1974) Toward The Development of an Equilibrium Capital-Market Model Based On Semivariance, *Journal of Financial and Quantitative Analysis*, 9(1), pp. 1-11.

Jahankhani, A. (1976) E-V and E-S Capital Asset Pricing Models: Some Empirical Tests, *Journal of Financial and Quantitative Analysis*, 11(4), pp. 513-528.

Khoo, T., Hatrzell, D. & Hoesli, M. (1993) An Investigation of the Changes in Real Estate Investment Trust Betas, *Journal of the American Real Estate & Urban Economics Association*, 21(2), pp. 107-130.

Liang, Y., Mclntosh, W. & Webb, J.R. (1995) Intertemporal Changes in the Riskiness of REITS, *Journal of Real Estate Research*, 10(4), pp. 427-433.

Litt, J., Mei, J. & Webber, P. (1999) A Risk Adjustment Model for REIT Evaluation, *Real Estate Finance*, 16(1), pp. 9-19.

Maitland-Smith, J.K. & Brooks, C. (1999) Threshold Autoregressive and Markov Switching Models: An Application to Commercial Real Estate, *Journal of Property Research*, 16(1), pp. 1-19.

Markowitz, H. (1952) Portfolio Selection, *Journal of Finance*, 7(1), pp. 77-91.

Matysiak, G.A. & Brown, G.R. (1997) A Time-varying Analysis of Abnormal Performance of UK Property Companies, *Applied Financial Economics*, 7(4), pp. 367-377.

Myer, F.C.N. & Webb, J.R. (1993) Return Properties of Equity REITs, Common Stocks, and Commercial Real Estate: A Comparison, *Journal of Real Estate Research*, 8(1), pp. 87-106.

Myer, F.C.N. & Webb, J.R. (1994b) Retail Stocks, Retail REITs, and Retail Real Estate, *Journal of Real Estate Research*, 9(1), pp. 65-78.

Nantell, T.J. & Price, B. (1979) An Analytical Comparison of Variance and Semivariance Capital Market Theories, *Journal of Financial and Quantitative Analysis*, 14(2), pp. 221-242.

Nantell, T.J., Price, K. & Price, B. (1982) Mean-Lower Partial Moment Asset Pricing Model: Empirical Evidence, *Journal of Financial and Quantitative Analysis*, 17(5), pp. 763-782.

Nawrocki, D.N. (1999) A Brief History of Downside Risk Measures, *Journal of Investing*, 8(3), pp. 9-24.

Newell, G. & Tan, Y.K. (2005) The Changing Risk Profile of Listed Property Trusts. *Paper Presented at the Pacific Rim Real Estate Society Conference 2005*, Melbourne, Australia.

Patel, R.C. & Olsen, R.A. (1984) Financial Determinants of Systematic Risk in Real Estate Investment Trusts, *Journal of Business Research*, 12(4), pp. 481-491.

Peng, V. (2005b) Risk Measurements and Listed Property Trusts Investment Strategies: Focusing on the Downside, *Pacific Rim Property Research Journal*, 11(2), pp. 178-199.

Post, T. & Vilet, P.V. (2004) Conditional Downside Risk and the CAPM, *Working Report, Erasmus Research Institute of Management (ERIM), Rotterdam School of Management/ Rotterdam School of Economics, Erasmus Universiteit Rotterdam*, Rotterdam, Netherlands.

Price, K., Price, B. & Nantell, T.J. (1982) Variance and Lower Partial Moment Measures of Systematic Risk: Some Analytical and Empirical Results, *Journal of Finance*, 37(3), pp. 843-855.

Roy, A.D. (1952) Safety First and the Holding of Assets, *Econometrica*, 20(3), pp. 431-449.

Sharpe, W. (1964) Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk, *Journal of Finance*, 19(3), pp. 425-442.

Sing, T.F. & Ong, S.E. (2000) Asset Allocation in a Downside Risk Framework, *Journal of Real Estate Portfolio Management*, 6(3), pp. 213-223.

Sivitanides, P.S. (1998) A Downside-Risk Approach to Real Estate Portfolio Structuring, *Journal of Real Estate Portfolio Management*, 4(2), pp. 159-168.

Tan, Y.K. (2004) The Effect on Management Structure on the Performance of Listed Property Trusts, *Paper Presented at the European Real Estate Society Conference 2004*, Milan, Italy.

Table 1: Summary Statistics

Period	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Total Number of LPTs	38	54	60	41	46	37
Number of LPTs in the Sample	25	34	42	31	32	27
Short-term debt/ Total Asset (%)	0.382	1.320	2.103	2.766	4.691	4.140
Long-term debt/ Total Asset (%)	7.185	13.326	19.918	24.951	26.251	28.038
Business Risk (%)	6.639	6.847	6.281	9.827	7.168	7.526
Property Asset (%)	77.700	85.940	87.670	88.259	85.383	80.268
Turnover (%)	20.822	28.227	34.432	36.641	48.897	49.530
Market Capitalisation (in million)	334.424	430.610	536.847	827.639	1,225.999	1,399.938
Management Structure (%)	16.000	14.706	16.667	19.355	25.000	37.037

Note: Period 1 (1993-1995); Period 2 (1995-1997), Period 3 (1997-1999), Period 4 (1999-2001), Period 5 (2001-2003) and Period 6 (2003-2005). All figures are the average of all LPTs over the sample. Management structure shows the percentage of LPTs employing as internal management structure.

Table 2: Riskiness and Beta and Downside Beta in Australian LPTs

Period	**Standard Deviation**	**Downside Deviation**
Panel A		
Period 1	0.144	0.038
Period 2	0.054	0.029
Period 3	0.076	0.037
Period 4	0.086	0.041
Period 5	0.061	0.033
Period 6	0.090	0.033
Panel B		
Period	**Beta**	**Downside Beta**
Period 1	0.292	0.544
Period 2	0.399	0.585
Period 3	0.498	0.620
Period 4	0.283	0.674
Period 5	0.356	0.511
Period 6	0.432	0.562

Note: The figures are the average of standard deviation, downside deviation, beta and downside beta over the sample.

Table 3: Comparison between Beta and Downside Beta

Period	T-statistics	Z-statistics
Period 1	-0.741	4.000**
Period 2	-17.174**	5.659**
Period 3	-2.584*	3.549**
Period 4	-4.994**	4.670**
Period 5	-3.695**	3.712**
Period 6	-0.650	4.234**

Note: * indicates significant at 5% and ** indicates significant at 1%.

Table 4A: Regressions between Beta and Financial Variables and Management Structure

Period	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Constant	9.130 (1.159)	1.671 (1.608)	1.001 (1.116)	4.583 (1.788)	3.429 (2.615)	0.958 (0.248)
Short-term Debt/Total Debt	36.499 (0.700)	1.065 (0.540)	5.726 (4.479)**	0.497 (0.160)	1.111 (1.377)	-3.736 (-0.937)
Long-term Debt/Total Debt	-2.614 (-0.585)	0.173 (0.525)	-0.243 (-0.715)	-0.868 (-0.676)	0.097 (0.150)	2.479 (1.582)
Business Risk	22.966 (1.075)	1.725 (0.561)	1.731 (0.522)	0.119 (0.214)	0.162 (0.124)	0.678 (0.151)
Property Asset	-0.003 (-0.001)	-0.650 (-2.259)*	-0.854 (-2.496)*	-1.311 (-0.986)	-0.021 (-0.046)	-0.055 (-0.035)
Ln(Turnover)	0.763 (1.052)	0.219 (3.337)**	0.204 (3.493)**	0.097 (0.451)	0.112 (1.532)	0.120 (0.404)
Ln(Market Cap)	-0.485 (-1.206)	-0.028 (-0.574)	0.016 (0.363)	-0.146 (-1.320)	-0.148 (-2.843)**	-0.063 (-0.407)
Management Structure	0.971 (0.900)	0.108 (0.917)	0.129 (1.170)	0.063 (0.199)	0.369 (2.841)**	0.832 (1.670)
R2 (%)	0.178	0.468	0.656	0.128	0.641	0.333
F-statistics	0.527	3.270*	9.249**	0.480	6.124**	1.357

Note: * indicates significant at 5% and ** indicates significant at 1%. The correlation matrix (bivariate multicollinearity assessment) and variance-inflation factor (multivariate multicollinearity assessment) do not reveal the issue of undue multicollinearity.

Table 4B: Regressions between Downside Beta and Financial Variables and Management Structure

Period	**Period 1**	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
Constant	3.116 (3.357)	0.810 (1.020)	-0.151 (-0.231)	6.093 (3.312)	2.611 (1.658)	1.668 (2.202)
Short-term Debt/Total Debt	5.662 (0.921)	3.748 (2.488)*	2.667 (2.865)**	0.198 (0.089)	2.542 (2.487)*	1.912 (2.447)*
Long-term Debt/Total Debt	0.493 (0.937)	0.300 (1.193)	-0.282 (-1.140)	0.107 (0.116)	1.213 (1.475)	1.126 (3.670)**
Business Risk	3.496 (1.389)	-4.206 (-1.792)	-1.530 (-0.633)	0.183 (0.457)	-0.843 (-0.510)	-0.181 (-0.206)
Property Asset	-0.013 (0.043)	-0.093 (-0.422)	-0.431 (-1.731)	-1.912 (-2.003)	-0.172 (-0.304)	-0.885 (-2.912)**
Ln(Turnover)	0.156 (1.829)	0.056 (1.118)	-0.431 (-1.731)	0.038 (0.244)	0.084 (0.908)	0.114 (1.958)
Ln(Market Cap)	-0.136 (-2.867)*	0.006 (0.150)	0.062 (2.776)*	-0.192 (-2.424)*	-0.118 (-1.788)	-0.031 (-1.043)
Management Structure	-0.140 (-1.098)	0.234 (2.590)*	0.223 (2.776)**	0.098 (0.430)	0.401 (2.439)*	-0.055 (-0.562)
R2 (%)	0.409	0.422	0.484	0.412	0.675	0.546
F-statistics	1.678	2.711*	4.563**	2.299*	7.116**	3.261*

Note: * indicates significant at 5% and ** indicates significant at 1%. The correlation matrix (bivariate multicollinearity assessment) and variance-inflation factor (multivariate multicollinearity assessment) do not reveal the issue of undue multicollinearity.

Table 5A: Regressions between Beta and Financial Variables and Management Structure by Controlling Property Type Specialisation

Period	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Constant	9.001 (1.064)	1.958 (1.767)	0.138 (0.141)	4.368 (1.551)	3.185 (2.310)	3.864 (0.935)
Short-term Debt/Total Debt	37.972 (0.631)	0.794 (0.394)	5.486 (4.421)**	0.604 (0.188)	1.103 (1.335)	-4.075 (-1.062)
Long-term Debt/Total Debt	-2.683 (-0.561)	0.253 (0.730)	-0.371 (-1.107)	-0.896 (-0.680)	0.093 (0.141)	2.371 (1.574)
Business Risk	22.778 (1.022)	1.850 (0.597)	0.382 (0.116)	0.113 (0.199)	0.160 (0.120)	0.752 (0.175)
Property Asset	0.051 (0.019)	-0.625 (-2.144)*	-0.887 (-2.681)*	-1.380 (-0.987)	-0.033 (-0.071)	0.410 (0.270)
Ln(Turnover)	0.761 (1.016)	0.227 (3.399)**	0.166 (2.757)*	0.085 (0.369)	0.109 (1.339)	0.193 (0.665)
Ln(Market Cap)	-0.484 (-1.166)	-0.038 (-0.745)	0.050 (1.099)	-0.138 (-1.166)	-0.146 (-2.571)*	-0.155 (-0.982)
Management Structure	0.973 (0.874)	0.084 (0.682)	0.144 (1.347)	0.077 (0.232)	0.370 (2.784)*	0.501 (0.962)
Herfindahl – Property Type Index	0.099 (0.054)	-0.148 (-0.791)	0.353 (1.865)	0.130 (0.207)	0.030 (0.119)	-1.438 (-1.606)
R2 (%)	0.178	0.481	0.689	0.129	0.641	0.417
F-statistics	0.434	2.898**	9.118**	0.408	5.140**	1.609

Note: * indicates significant at 5% and ** indicates significant at 1%. The correlation matrix (bivariate multicollinerity assessment) and variance-inflation factor (multivariate multicollinearity assessment) do not reveal the issue of undue multicollinearity.

Table 5B: Regressions between Beta and Financial Variables and Management Structure by Controlling Geographic Specialisation

Period	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Constant	10.370 (1.089)	2.364 (2.368)	0.386 (0.336)	5.257 (1.838)	4.760 (3.027)	1.775 (0.320)
Short-term Debt/Total Debt	36.784 (0.685)	1.475 (0.810)	5.663 (4.406)**	1.345 (0.386)	0.731 (0.885)	-4.099 (-0.924)
Long-term Debt/Total Debt	-2.367 (-0.503)	-0.175 (-0.522)	-0.282 (-0.819)	-0.827 (-0.634)	-0.256 (-0.380)	2.217 (1.093)
Business Risk	22.637 (1.028)	1.158 (0.408)	2.505 (0.726)	0.072 (0.126)	0.130 (0.102)	0.834 (0.179)
Property Asset	-0.319 (-0.112)	-0.468 (-1.702)	-0.792 (-2.256)*	-1.209 (-0.888)	0.241 (0.551)	-0.090 (-0.056)
Ln(Turnover)	0.700 (0.886)	0.132 (1.874)	0.199 (3.367)**	0.089 (0.405)	0.185 (2.146)*	0.123 (0.402)
Ln(Market Cap)	-0.526 (-1.180)	-0.056 (-1.204)	0.036 (0.734)	-0.176 (-1.419)	-0.215 (-3.187)**	-0.089 (-0.441)
Management Structure	0.922 (0.817)	0.072 (0.658)	0.150 (1.323)	0.038 (0.118)	0.385 (3.032)**	0.812 (1.563)
Herfindahl-Geographical Index	-0.504 (-0.249)	-0.619 (-2.397)*	0.220 (0.862)	-0.373 (-0.568)	-0.419 (-1.507)	-0.301 (-0.211)
R2 (%)	0.181	0.568	0.663	0.140	0.673	0.335
F-statistics	0.443	4.102**	8.125**	0.448	5.926**	1.133

Note: * indicates significant at 5% and ** indicates significant at 1%. The correlation matrix (bivariate multicollinerity assessment) and variance-inflation factor (multivariate multicollinearity assessment) do not reveal the issue of undue multicollinearity.

Table 6A: Regressions between Downside Beta and Financial Variables and Management Structure by Controlling Property Type Specialisation

Period	**Period 1**	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
Constant	3.014 (3.037)	1.136 (1.362)	-0.156 (-0.207)	6.287 (3.112)	2.925 (1.681)	1.029 (1.295)
Short-term Debt/Total Debt	6.831 (0.967)	3.441 (2.268)*	2.666 (2.806)**	0.102 (0.044)	2.579 (2.474)*	1.986 (2.694)*
Long-term Debt/Total Debt	0.438 (0.782)	0.391 (1.498)	-0.283 (-1.102)	0.133 (0.140)	1.233 (1.472)	1.150 (3.972)**
Business Risk	3.346 (0.782)	-4.064 (-1.743)	-1.538 (-0.612)	0.188 (0.460)	-0.831 (-0.495)	-0.197 (0.238)
Property Asset	0.030 (0.094)	-0.064 (-0.293)	-0.431 (-1.703)	-1.850 (-1.843)	-0.111 (-0.189)	-0.988 (-3.383)**
Ln(Turnover)	0.155 (1.760)	0.066 (1.312)	-0.004 (-0.086)	0.049 (0.300)	0.102 (1.002)	0.098 (1.765)
Ln(Market Cap)	-0.135 (-2.769)*	-0.005 (-0.142)	0.062 (1.799)	-0.199 (-2.339)*	-0.130 (-1.809)	-0.011 (-0.357)
Management Structure	-0.138 (-1.060)	0.206 (2.228)*	0.223 (2.728)**	0.086 (0.360)	0.398 (2.374)*	0.018 (0.180)
Herfindahl Index for Property Type	0.079 (0.368)	-0.167 (-1.189)	0.002 (0.014)	-0.117 (-0.261)	-0.144 (-0.462)	0.317 (1.840)
R2 (%)	0.417	0.453	0.484	0.413	0.678	0.618
F-statistics	1.410	2.587*	3.875**	1.939	6.049**	3.634*

Note: * indicates significant at 5% and ** indicates significant at 1%. The correlation matrix (bivariate multicollinerity assessment) and variance-inflation factor (multivariate multicollinearity assessment) do not reveal the issue of undue multicollinearity.

Table 6B: Regressions between Downside Beta and Financial Variables and Management Structure by Controlling Geographic Specialisation

Period	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Constant	3.323 (2.969)	0.800 (0.945)	0.157 (0.187)	6.011 (2.907)	3.871 (1.890)	1.866 (01.720)
Short-term Debt/Total Debt	5.709 (0.905)	3.742 (2.425)*	2.699 (2.866)*	0.095 (0.038)	2.225 (2.070)*	1.824 (2.100)*
Long-term Debt/Total Debt	0.534 (0.966)	0.305 (1.073)	-0.263 (-1.043)	0.102 (0.108)	0.919 (1.046)	1.063 (2.675)*
Business Risk	3.441 (1.329)	-4.198 (-1.747)	-1.917 (-0.759)	0.188 (0.456)	-0.870 (-0.525)	-0.143 (-0.157)
Property Asset	-0.065 (-0.195)	-0.095 (-0.409)	-0.462 (-1.799)	-1.925 (-1.954)	0.046 (0.075)	-0.894 (-2.851)*
Ln(Turnover)	0.146 (1.571)	0.057 (0.961)	-0.001 (-0.023)	0.039 (0.244)	0.145 (1.291)	0.115 (1.918)
Ln(Market Cap)	-0.143 (-2.721)*	0.006 (0.153)	0.052 (1.439)	-0.189 (-2.100)*	-0.174 (-1.978)	-0.038 (-0.955)
Management Structure	-0.148 (-1.115)	0.235 (2.521)*	0.213 (2.558)*	0.101 (0.429)	0.415 (2.508)*	-0.060 (-0.586)
Herfindahl Index for Geographical	-0.084 (-0.352)	0.009 (0.042)	-0.110 (-0.589)	0.045 (0.095)	-0.350 (-0.965)	-0.073 (-0.261)
R2 (%)	0.413	0.422	0.490	0.414	0.687	0.547
F-statistics	1.408	2.281	3.959**	1.926	6.325**	2.722*

Note: * indicates significant at 5% and ** indicates significant at 1%. The correlation matrix (bivariate multicollinerity assessment) and variance-inflation factor (multivariate multicollinearity assessment) do not reveal the issue of undue multicollinearity.

Table 7: Correlations between Different Downside Beta Measures

Period	β^-	β_{rf}^-	β_0^-
Period 1			
β^-	1.000		
β_{rf}^-	0.998	1.000	
β_0^-	0.991	0.998	1.000
Period 2			
β^-	1.000		
β_{rf}^-	0.756	1.000	
β_0^-	0.984	0.753	1.000
Period 3			
β^-	1.000		
β_{rf}^-	0.801	1.000	
β_0^-	0.993	0.784	1.000
Period 4			
β^-	1.000		
β_{rf}^-	0.980	1.000	
β_0^-	0.996	0.979	1.000
Period 5			
β^-	1.000		
β_{rf}^-	0.967	1.000	
β_0^-	1.000	0.967	1.000
Period 6			
β^-	1.000		
β_{rf}^-	0.938	1.000	
β_0^-	0.937	0.934	1.000