INVESTMENT PROPERTY DIVERSIFICATION OVER DIFFERENT ECONOMIC PHASES IN NEW ZEALAND

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ABSTRACT

This study empirically investigates the enhancement of cross-sector diversification for investment properties in a small economy, where there are only a few regional choices. It also examines the distinct effects of optional diversification strategies over different economic phases. The study constructs investment property return indices using a unique listed investment property database in New Zealand, which compares the Sharpe ratio of optional investment portfolios under different diversification strategies.

It is found that a portfolio of industrial properties in Auckland is preferable to any other property portfolios over the entire sample period in New Zealand. The findings support a prior strategy to prudently select properties in a major city in this small economy. The findings recommend direct or indirect property investors prioritize the locational choice in a small economy. The findings imply that the best diversification strategy may not be consistent over different economic phases.
This study is one of the few to explicitly compare diversification strategies over different economic phases. It also provides additional new insights towards the importance of cross-sector diversification in a small economy.

Keywords: portfolio diversification, investment properties, economic phases, small economy

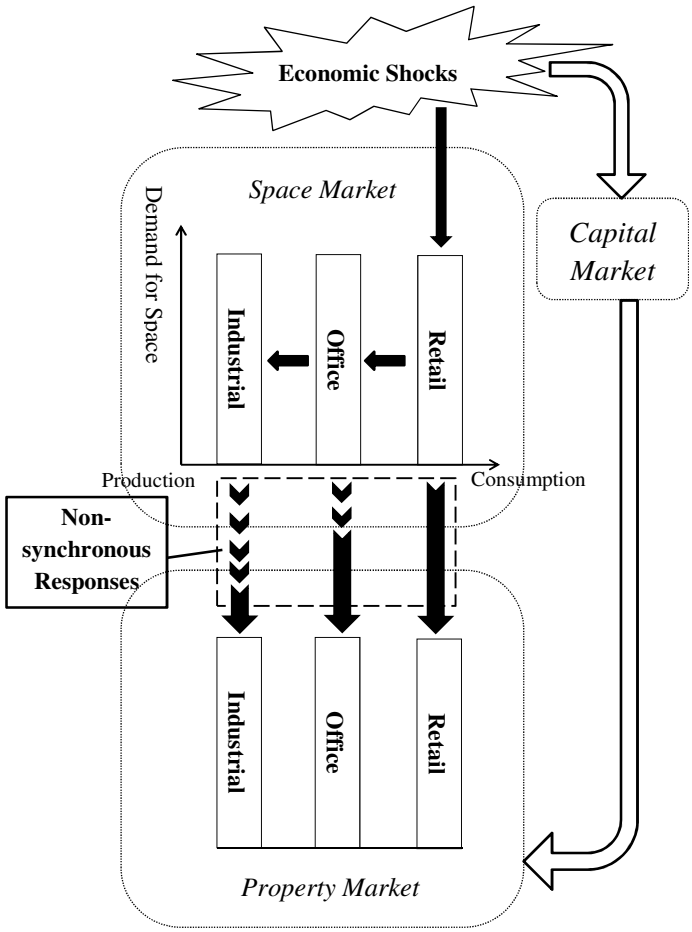
INTRODUCTION

Early studies emphasize the benefits of including properties in a mixed asset portfolio when diversification for property investments is analysed (Friedman 1971, Giliberto 1992, Kuhle 1996, Ziobrowski and Ziobrowski 1997, Chua 1999, Seiler et al 1999). Risk reduction by diversification is further examined in the context of within property portfolios (Hartzell et al 1986, Mueller and Ziering 1992, Mueller 1993, Eichholtz et al 1995, Eichholtz 1996). Empirical evidence generally shows that sector diversification has a superior performance over geographic and economic diversification in the US and UK property markets (Eichholtz et al 1995, Lee and Byrne 1998, Fisher and Liang 2000, Viezer 2000). This suggests that the correlation of business forces driving the profits of cross-sector properties is lower than the correlation of economic forces driving the profits of cross-region properties. In other words, cross-sector properties share fewer common factors influencing rental income streams, management fees, marketing costs, transaction costs, etc. than cross-region properties.

The fundamental reasons for the above phenomenon are illustrated in Figure 1. Archer and Ling (1997) explain how capital and space markets impact property markets. Based on their work, we propose this figure emphasizing how different property sectors may respond to economic shocks with time lag. The ultimate users of property space across-sectors vary widely along the production to consumption line. They consist of commodity and service end consumers, office users and producers. A bulk retail building serves end consumers. An office tower provides intermediate commercial service for producers and service providers. An industrial building is used to produce intermediate industrial products or consumer products; or it can be used for logistics purposes. Therefore different end users' consumption patterns may be affected by economic shocks with

different time lags. In other words, different end users' consumption may be impacted by economic shocks non-synchronously. Consumers' sentiment may be the first sign of the market's health status followed by the production of intermediate products. Manufacturing may be slower to pick up in the market than other intermediate and commercial service providers.

However, the end users of properties across regions may cluster together along the production to consumption line. For example, the end users of retail space across a country consume different commodities or services. If the general economy is slow and the credit line is tight, their consumption sentiment will then be simultaneously negatively impacted. On the contrary, consumer sentiment will tend to be positive in a booming economy when the credit line is loose.



Non-Synchronous Responses to Economic Shocks
Source: Authors Based on Archer and Ling (1997)
Figure 1

It seems that the non-synchronous demand and supply responses of different property sectors on economic impacts need to be taken into account when diversification benefits are examined. Such non-synchronous responses may vary over different economic phases of the business cycle: early expansion, full expansion, early contraction, and full contraction. Thus a cross-sector diversified property portfolio may provide different levels of risk-reduction benefits over expansion and contraction periods. Its risk-return performance may also vary over different economic phases. Hedander (2005) finds inconsistent significance of a focus index on all Australian Listed Property Trusts' price premium over time, in which a focus index is an opposite indicator of cross-sector diversification. His findings imply that different levels of cross-sector diversification benefits may

exist over different economic phases. However, his study does not explicitly investigate the different diversification benefits over economic phases using individual property information.

Fugazza et al (2009) examine time diversification benefits by including REITs into a mixed-asset portfolio. However, time diversification has yet to be addressed for a within-property portfolio. This study examines how cross-sector diversification benefits could be strengthened by the non-synchronous responses of different property sectors in respect to economic impacts. It compares two diversification strategies: geographic and sector diversification strategies over different economic phases. It is expected that the diversification benefits of a cross-sector property portfolio may extend to the highest level at the end of a full expansion period and at the start of a contraction period. Such benefits for a cross-sector property portfolio may decrease in the middle of a full contraction period. This is because the high volatility before and in an early contraction induces more non-synchronous demand and supply responses across sectors than in a stable expansion period. Therefore, the diversification benefits across sectors are expected to increase in a period of high volatility.

New Zealand listed investment properties have been used for this study for three reasons. Firstly, New Zealand is a small economy with a population of only 4.4 million. Table 1 compares the key statistics between New Zealand, Australia, the United Kingdom and the United States. The Gross Domestic Product (GDP) of New Zealand is less than one-tenth of the GDP of Australia and only about 0.8 per cent of the GDP of the US. The capitalisation of the New Zealand stock market is significantly smaller than that of UK and US, with industry sectors less diversified. The industry sectors of New Zealand are clustered in food, farming, natural resources (food, energy and forestry), property, building, investment, goods and service and thus the diversification benefits from a wide range of industry sectors can be excluded in the New Zealand property context. The cross-sector property diversification is more likely to be based on the non-synchronous responses to economic impacts across different property sectors.

	New Zealand	Australia	UK	US
Population (‘000)	4,419.2	22,381.0	62,260.4	311,907.3
GDP (US$ billions)#	115.2	1,356.1	2,190.2	15,087.7
Capitalization of Stock Market (US$ billions)#	47.5	1,198.0	3,266.0	18,929.0
Land Area per Capita (sq. m.)	59,582.8	343,250.5	3,885.8	29,327.4
Housing Stock (‘000)	1,583.2	8,789.9	27,416.0	131,285.5
Number of Homeownership (‘000)	759.2	5,727.9	19,074.6	77,959.9

#The data source of GDP is DataStream. The data source of stock market capitalization is New Zealand Stock Exchange (NZX) or Wikipedia.

Comparison of Key Statistics between New Zealand and Other Economies
Source: Euromonitor International (Year of 2011)
Table 1

Secondly, a single sector may perform better than other cross-region or cross-sector property portfolios in a larger economy. Evidence shows that a single retail sector outperforms other cross-

sector or cross-region portfolios in the US (Eichholtz et al 1995). The superior performance of the retail sector may result from the variety of industry sectors and the loose credit line in a large expansion economy. This study examines whether a single sector may outperform other diversified portfolios in a small economy, such as New Zealand.

Thirdly, there are few major cities in New Zealand with Wellington and Auckland being the two largest. Most of the investment properties in the country are located in the above two cities. About 75 per cent of listed investment properties are in the two cities. This is based on the data we collected from annual reports of listed property portfolios. The two cities have different major functions. Wellington is the political centre of New Zealand and the Wellington property market is largely driven by government tenants. Auckland conversely is the commercial hub. Given these differences, geographic diversification in this study can also be considered as economic diversification. Furthermore, Auckland and Wellington utilise different lease structures (Halvitigala et al 2011). Landlords in Auckland tend to apply net leases under which the tenants pay operational expenses including city council rates, insurance, utilities, repair and maintenance on top of their rental obligation. In Wellington, however gross leases apply and the tenant's rental obligation includes operational expenses. Therefore, geographic or economic diversification benefits reach a high level in New Zealand. Under the context of high-level geographic or economic diversification, this study could further strengthen the evidence in the literature that cross-sector diversification works better than either geographic or economic diversification if the evidence is consistently found over different economic phases in New Zealand.

More specifically, this study contributes to the literature from the following three perspectives. Firstly, the literature has yet to explicitly document the non-synchronous responses from different property sectors and thus the findings provide additional insights into the understanding of cross-sector diversification benefits regarding property sectors' non-synchronous responses to economic impacts. Secondly, the research on a small economy like New Zealand will provide further evidence to the literature about whether diversification benefits are different within a small economy from a large economy. Lastly, this study identifies an area of future research on a new dimension for diversification - non-synchronous timing effects.

The paper now follows with a literature review and a description of the research methodology. It is then followed by a discussion of the results and their implications and concludes with a discussion highlighting further research opportunities.

LITERATURE REVIEW

The diversification benefits for property portfolios have been widely confirmed in past studies (Lai et al 1992, Wolverton et al 1998, Cheng and Liang 2000, Byrne and Lee 2000). Cheng and Liang (2000), Geurts and Jaffe (1996) and Lee and Stevenson (2005b) use the Sharpe ratio to examine the diversification benefits and confirm the risk reduction benefits regardless of the choice of diversification strategies. The literature documents property diversification benefits in respect to three main strategies: geographic, cross-sector and economic diversification. Geographic diversification is constructed based on the implication that the risk profiles of properties in different geographical locations are distinct to each other.

Recently, the traditional classification of geographical location has been replaced with economic regions focusing mainly on the demand for accommodation driven by economic forces, thus introducing the concept of economic diversification. Studies of the US property market confirm that diversification by economic regions provides risk reduction benefits (Malizia and Simons 1991, Mueller 1993, Lee and Byrne 1998, Nelson and Nelson 2003).

Empirical results suggest that the cross-sector diversification strategy provides better diversification benefits in terms of achieving lower volatility than the geographic diversification strategy in the US market (Miles and McCue 1982, Miles and McCue 1984, Hartzell et al 1986). Fisher and Liang (2000) confirm a similar result at the index level by constructing cross-sector and cross-region portfolios using the NCREIF Index. Byrne and Lee (2000) and Lee and Stevenson (2005b) find that portfolios diversified by sectors have more risk reduction benefits than geographically diversified portfolios in their evaluation of two diversification strategies within the UK market.
Gyourko and Nelling (1996) in their study of the US market discover that retail properties have significantly higher systematic risk than other types of properties. Byrne and Lee (2000) in their examination of the sector diversified portfolio in UK market argue that the performance of retail property has a lower return than industrial property but offers the most consistent return profile during the period.

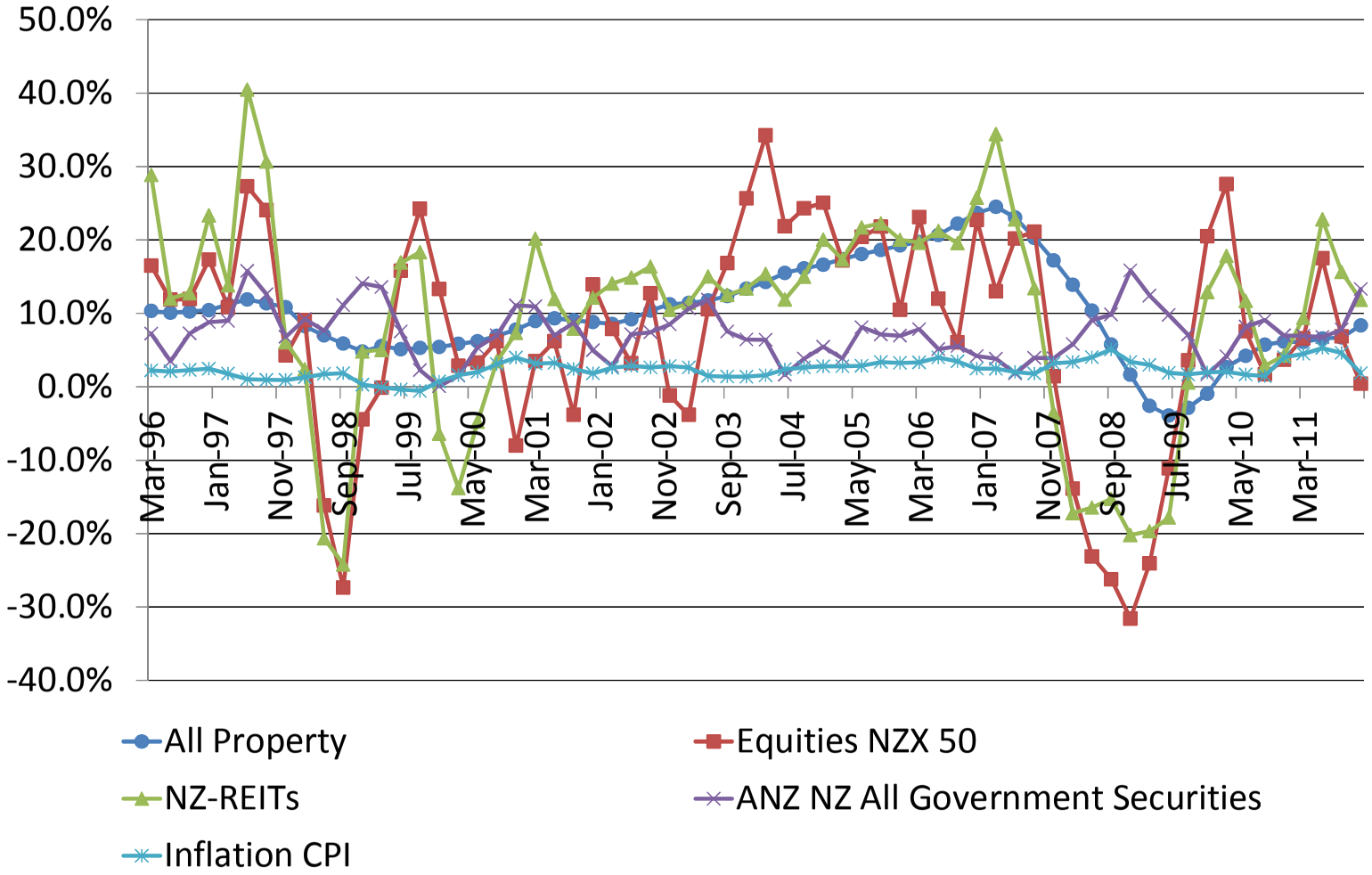
The above studies use data from the UK and US property markets indicating that sector diversification or a single sector performs better than geographic diversification. However, Newell and Tan (2003) find when researching three property sectors located in key CBDs of Australia that geographic diversification performs slightly better than sector diversification. In the New Zealand context, several studies find that property provides diversification benefits to a portfolio holding multiple asset-classes when the benefits of including property in investment portfolios are investigated (Newell and Boyd 1995, Newell and De Witt 1997 and Newell et al 1996). These studies also find that it is possible to hedge inflation by investing in New Zealand investment property. In addition, Nartea and Eves (2008) suggest that risk-return performance may improve when farmland is included in an investment or property portfolio within New Zealand.

A comparison of alternative diversification strategies has not to date been conducted in the context of the New Zealand property market. This research seeks to redress this by evaluating alternative diversification strategies within the New Zealand property market. Geographically, New Zealand is situated far away from most of the major economies around the world. Suitable locations for investment properties tend to be limited in New Zealand. Auckland is New Zealand's largest metropolitan region, followed by Wellington, Christchurch, and Hamilton. Auckland has an estimated population of 1.44 million, which is over 30 per cent of New Zealand's total population. Auckland is the financial and employment centre and also the largest economic hub in the country. The above facts reduce the choice for property investors to diversify their investment portfolios into other regions.

There are no clear economic boundaries within New Zealand due to the market being highly integrated and concentrated in Auckland; this tends to result in low informational search costs for investors. Different regions share the same statutory legal system and the country promotes the free market ideology. This may inevitably result in a high correlation in performance of investment properties across different regions. Thus, within this context we expect that sector diversified portfolios will outperform geographically diversified portfolios.

This study also compares the two diversification strategies over different economic phases. The literature documents the inconsistent performance of property portfolios over time and, as Eicholtz et al (1995) suggest, ex-post research results cannot be formed as the basis of constructing property portfolios in the ex-ante basis. Myer and Webb (1991) find that no single portfolio diversification strategy constantly provides superior performance over different time periods and Chandrashekaran (1999) in his study relating to REIT returns confirms that different investment vehicles exhibit time varying mean-variance and covariance performance over different periods. Cheng and Liang (2000) find no consistency for the performances of an efficient portfolio over time and Lee and Stevenson (2005a) find none of the optional diversification strategies consistently outperform the

naive method or market benchmark in UK market during 1982 to 1998. Based on the same data, Lee and Stevenson (2005b) suggest that the optimal property selection strategy should be amended over time. The previous studies support our argument that it is important to examine portfolio risk-return performance when the different economic phases are taken into account.

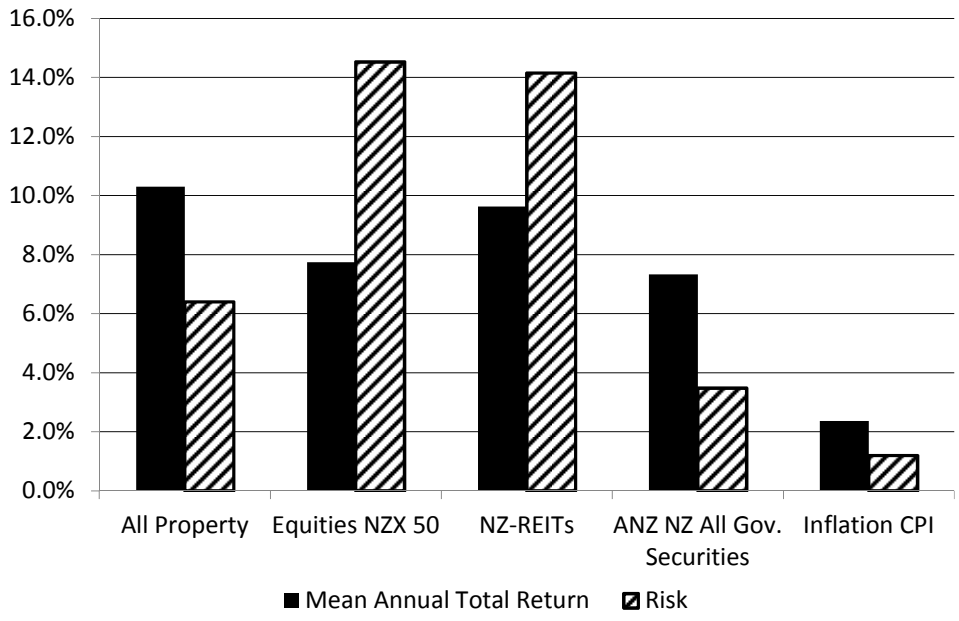


Annual Total Return of New Zealand Asset Classes (March 1996 to December 2011)
Source: IPD New Zealand Property Investors Digest
Figure 2

New Zealand Investment Property Market

Figure 2 illustrates the annual total returns of five different asset classes in New Zealand. The portfolio of all investment properties shows a smooth and sustained positive return with low volatility from March 1996 to December 2011. On the contrary, *NZX 50* (the main equity index provided by New Zealand Stock Exchange (NZX)) and *NZ REITs* (New Zealand Real Estate Investment Trusts, also called New Zealand Listed Property Trusts) experienced volatile returns over this period. Both indices slumped significantly after the Asian Financial Crisis (AFC) beginning in 1997 and the recent Global Financial Crisis (GFC) beginning in 2007. However, the 1997 AFC had a slight impact on the All Property Portfolio, whereas the return of the All Property Portfolio dropped moderately after the GFC and reached the negative trough in June 2009 followed by a recovery trend. Overall, the All Property Portfolio had a return premium above the New Zealand government securities and proved to be a good investment to hedge inflation (with the exception of approximately one year after the commencement of the GFC).

Figure 3 shows the mean annual total return and the risk for the five asset classes in New Zealand. The property market provides the highest mean return over the period and a moderate risk level. *NZ REITs* experienced the second highest mean return and risk, whereas the equity index has a slightly higher mean return than New Zealand all government securities. But the equity index experienced the highest risk. Figures 2 and 3 suggest that investments in relation to property are attractive to risk-averse investors among the optional asset classes. This confirms the importance of investigating the optional diversification strategies for the investment property market in New Zealand.



Return and Risk of Asset Classes in New Zealand (March 1996 to December 2011)
Source: IPD New Zealand Property Investors Digest
Figure 3

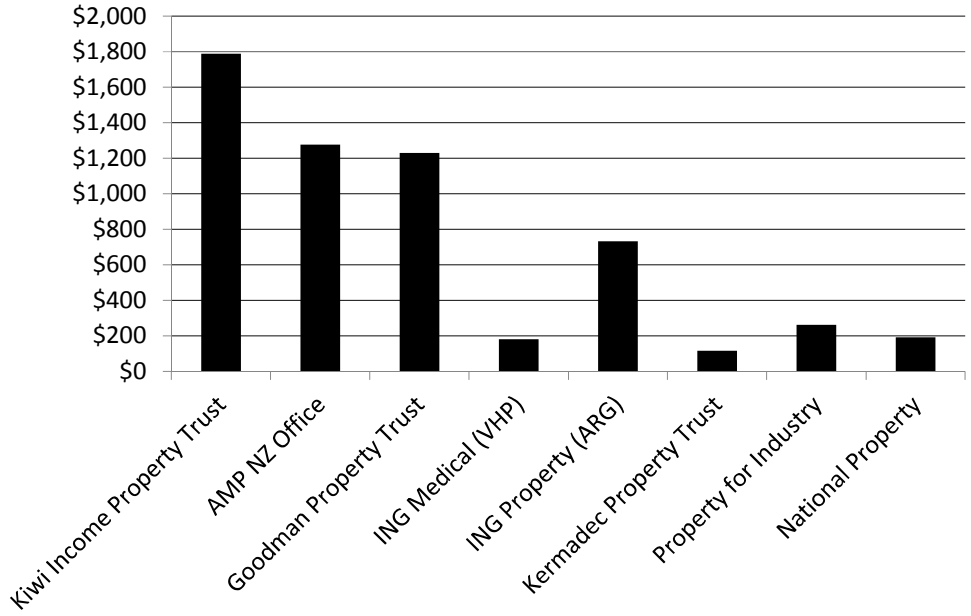
METHODOLOGY

Data Sources

This study uses rental income and property values to calculate the total returns for investment properties within unit trusts and property companies listed on New Zealand Stock Exchange. The

data are collected from annual reports which include the rental revenue and the annual revaluation of each individual property by independent investment property valuers. Figure 4 provides the value of properties held by these listed property portfolios in 2010. *Kiwi Income Property Trust* held the largest property portfolio in dollar value followed by *AMP NZ Office* and *Goodman Property Trust*. The sample consists of eight listed property portfolios which have 297 properties in total. These portfolios are the major property portfolios listed on the New Zealand Stock Exchange in the sample period.

Properties which have undergone significant refurbishment, extensions or alternations are excluded from the sample in order to avoid bias. The number of properties in the sample is more than half of the properties used in the IPD index in the New Zealand market. IPD index was not a practical option for the present study because of the following two reasons. One reason is that the data at the individual property level is needed because we construct the hypothetical portfolios in accordance to pure-geographic or pure-sector diversification strategies with respect to four optional major locations and four property sectors. This can only be analysed after individual property level data are collected. The other reason is because we need a consistent sample with return information which adopted external valuation only. Although minor capital expenditure is excluded, it is expected that this wouldn't have significant effect on the findings.



Property Value of Listed Property Portfolios in 2010 (NZ$ Millions)
Source: Annual Reports of Listed Property Portfolios (2010)
Figure 4

The sample used in this study spans from 2002 to 2010. Most property portfolios were listed on NZX in late 1990s and early 2000s. The nine-year study period is separated into three sub-periods:

1. 2002-2004–the full expansion period;
2. 2005-2007–the late expansion period; and
3. 2008-2010–the early contraction period.

The sample is divided by the years of 2005 and 2008 because a significant inverted yield curve was observed from 2005 to 2007 and the recent global financial crisis started in late 2007. The global credit line became restrictive after the recent global financial crisis began in late 2007. There are

three years in each sub-period when the economy went through the peak expansion and early contraction periods over these nine years. Due to the property value information for medical properties not being available from 2002 to 2004, the analysis provides for two sub-periods from 2005 to 2010 in regard to medical properties.

Assessing Geographic and Cross-Sector Diversification

The two dimensions of diversification strategy investigated in this study are geographic and sector diversification. There are four portfolios under each diversification strategy for the whole sample period. Table 2 provides the name and a brief explanation for the eight hypothetical portfolios. The top four portfolios are geographically diversified, whereas the bottom four portfolios are diversified across property sectors.

Brief	Description
Cross-region Portfolio	
INDUSTRIAL	This portfolio consists of *industrial* properties *across regions*.
OFFICE	This portfolio consists of *office* properties *across regions*.
RETAIL	This portfolio consists of *retail* properties *across regions*.
MEDICAL	This portfolio consists of *medical service* properties *across regions*.
Cross-sector Portfolio	
AUCKLAND	This portfolio consists of *cross-sector* properties in *Auckland*.
WELLINGTON	This portfolio consists of *cross-sector* properties in *Wellington*.
CHRISTCHURCH	This portfolio consists of *cross-sector* properties in *Christchurch.*
OTHER REGIONS	This portfolio consists of *cross-sector* properties in *other small regions*.

Hypothetical Portfolios
Source: Authors
Table 2

This study applies a value-weighted average method to obtain return indices. Byrne and Lee (2000) argue that equal-weighted diversification works better than value-weighted diversification because value-weighted diversification puts more weight on high-value properties than low-value properties. High-value properties usually present higher risk than low-value properties when liquidity is taken into account. However, such bias on high-value properties can be mitigated when the performance is measured by the Sharpe ratio. Furthermore, as shown in Table 3, the number of low-value properties is much larger than the number of high-value properties in the sample. Collectively, small properties could have significant impact on the portfolio performance when a value-weighted method is applied. As shown in Table 3, there is great divergence of individual property value in the sample. This study used all properties in the sample because dividing or cutting the sample will further reduce the small sample size.

	Period	Number of Properties	Average	Standard Deviation	Min	Max	Median
INDUSTRIAL	2002-2004	54	$5,250	$3,312	$1,460	$14,200	$4,500
	2005-2007	62	$8,120	$6,038	$1,837	$38,767	$6,333
	2008-2010	77	$14,335	$20,302	$1,500	$122,667	$8,640
OFFICE	2002-2004	30	$42,644	$48,909	$5,950	$207,000	$26,067
	2005-2007	47	$44,820	$53,554	$1,260	$260,607	$27,050
	2008-2010	57	$55,984	$61,675	$1,333	$299,967	$32,317
RETAIL	2002-2004	12	$31,085	$36,322	$453	$86,597	$5,808
	2005-2007	19	$40,699	$59,069	$803	$230,833	$12,927
	2008-2010	24	$54,060	$102,787	$753	$459,033	$9,243
MEDICAL	2005-2007	11	$20,199	$27,020	$2,380	$75,275	$10,705
	2008-2010	10	$24,281	$30,874	$4,225	$84,477	$12,375
AUCKLAND	2002-2004	66	$18,167	$37,588	$1,460	$207,000	$5,950
	2005-2007	92	$21,843	$41,067	$1,837	$260,607	$8,737
	2008-2010	110	$33,663	$63,984	$1,500	$459,033	$10,773
WELLINGTON	2002-2004	12	$25,721	$20,703	$2,600	$70,930	$20,501
	2005-2007	22	$33,251	$32,015	$4,383	$103,333	$19,736
	2008-2010	24	$45,272	$38,435	$4,815	$132,250	$32,758
CHRISTCHURCH	2002-2004	11	$17,727	$24,858	$2,000	$84,835	$6,715
	2005-2007	8	$50,649	$77,363	$3,125	$230,833	$13,780
	2008-2010	11	$50,478	$70,821	$3,113	$245,333	$20,750
OTHER REGIONS	2002-2004	7	$34,765	$39,608	$453	$86,597	$5,440
	2005-2007	17	$28,176	$39,166	$803	$119,433	$12,401
	2008-2010	23	$21,324	$32,840	$753	$112,667	$10,175

Descriptive Statistics of Individual Property Values for Each Portfolio (NZ$ '000)
Source: Authors

Table 3

Risk-return performance is compared in each sub-period. The Sharpe ratio is obtained for each portfolio in each sub-period:

$$Sharpe \quad Ratio = \frac{\mu_i - R_f}{\sigma_i} \tag{1}$$

where:

μ_i represents the mean return of a portfolio *i*;

σ_i represents the estimated standard deviation of the excess return of the portfolio *i*; and

R_f represents the risk-free rate.

The Sharpe ratio measures the excess return against the risk of excess return.

Lee and Higgins (2009) propose the calculation of adjusted and modified Sharpe ratios based on the return information generated from property value index. The reason is that valuation usually smooths return, and valuation data present strong auto-correlation over the long run. They argue that the traditional Sharpe ratio could bring bias when return on valuation has auto-correlation problems. This study uses the traditional Sharpe ratio as shown in Equation 1. It is argued however for this study that the Sharpe ratio is appropriate due to the following three reasons.

Firstly, significant auto-correlation presents in long time series data. This research investigates a nine-year sample. In each sub-period, there is three years. Auto-correlation is not expected to be significant in the sample of the present study. Secondly, the present study focuses on risk-return performance over different economic phases. Auto-correlation is not expected to be strong across different economic phases. Thirdly, if there is any auto-correlation in property return series, it is anticipated that the level or significance of auto-correlation could be similar across different property sectors and regions, because the sample is in a small economy where there are limited location and industry sector choices. Therefore, in this study the traditional Sharpe ratio is not likely to bring bias into the ranking and statistical comparison of risk-return performance with regard to hypothetical portfolios.

A rigorous comparison of Sharpe ratio is conducted using Z-statistic proposed by Jobson and Korkie (1981) and applied in Lee and Stevenson's (2005a) study. The Z-statistic on Sharpe performance is shown as follows:

$$Z = \frac{\sigma_j\left(\mu_i - R_f\right) - \sigma_i\left(\mu_j - R_f\right)}{\sqrt{\Theta}} \tag{2}$$

where:

Θ is calculated as below:

$$\Theta = \frac{1}{T}\left[2\sigma_i^2\sigma_j^2 - 2\sigma_i\,\sigma_j\,\sigma_{ij} + \frac{1}{2}\mu_i^2\sigma_j^2 + \frac{1}{2}\mu_j^2\sigma_i^2 - \frac{\mu_i\,\mu_j}{2\sigma_i\,\sigma_j}\left(\sigma_{ij}^2 + \sigma_i^2\sigma_j^2\right)\right] \tag{3}$$

where:

T is the number of observations of portfolio *i*'s return; and

σ_{ij} is the covariance of the excess returns of portfolios *i* and *j*.

The above test has low statistical power. The rejection power of a false null is low (Jorion, 1985). The rejection power may be further reduced by a small number of observations for a portfolio in each sub-period. The number of observations in each sub-period is three. It is expected that there is significantly strong difference between two portfolios' risk-return performance if the Z-statistic is significant.

RESULTS

Table 4 shows the distribution of properties by location and sector. Auckland is the largest property investment market followed by Wellington. Industrial properties represent 44.78% of the total number of properties, followed by office comprising the second largest number, which takes 30.97% of the overall sample. Medical properties are the smallest sector. Office properties have the largest dollar value in the sample of approximately NZ$2.17 billion in the study period, followed by retail properties with a value of NZ$807 million.

	Number of Properties					**Value of Properties (NZD '000)**
	Auckland (%)	*Wellington (%)*	*Christchurch (%)*	*Other Regions (%)*	*Total (%)*	
Industrial	104 (35.02%)	8 (2.69%)	8 (2.69%)	13 (4.38%)	**133 (44.78%)**	**$624,745**
Office	55 (18.52%)	26 (8.75%)	5 (1.68%)	6 (2.02%)	**92 (30.97%)**	**$2,173,186**
Retail	12 (4.04%)	8 (2.69%)	10 (3.37%)	25 (8.42%)	**55 (18.52%)**	**$807,473**
Medical	10 (3.37%)	0 (0.00%)	0 (0.00%)	7 (8.42%)	**17 (5.73%)**	**$230,471**
Total	**181 (60.95%)**	**42 (14.13%)**	**23 (7.74%)**	**51 (17.18%)**	**297 (100%)**	**$3,835,876**
Value of Properties (NZD '000)	**$2,324,264**	**$715,192**	**$388,570**	**$407,849**	**$3,835,876**	

The Distribution of Properties across Sectors and Regions from 2002 to 2010
Source: Authors
Table 4

The sample is not expected to impose a significant problem although it is unbalanced. Newell and Tan (2003) also use an unbalanced sample to generate value-weighted returns and assess the geographic and sector diversification in the Australian property market. Similarly, their sample contains a large proportion of office properties and properties in New South Wales. They find that both diversification strategies deliver risk-reduction benefits to property investors and that geographic diversification has slightly better diversification benefits than sector diversification. They compare equal-weighted and value-weighted returns as well and find insignificant difference of portfolio correlation between the above two methods.

Table 5 provides the average total return for each portfolio. The total return is the sum of the rental return and capital return (because properties having significant refurbishments, extensions or alterations are excluded from the sample). Results show that all portfolios experience an increase in return during the late expansion period and *OFFICE, WELLINGTON* and *AUCKLAND* show the

greatest growth over the period. After the 2007 GFC, the return of all portfolios dropped significantly. *OFFICE* and *RETAIL* has the largest reduction in return. In the early contraction period, four cross-sector portfolios (at the bottom of the table) show greater return reduction than the cross-region portfolios (at the top of the table). Over the entire sample period, *INDUSTRIAL* has the highest return and *OFFICE* has the lowest return.

	(Entire Period) **2002-2010**	(Full Expansion) **2002-2004**	(Late Expansion) **2005-2007**	(Early Contraction) **2008-2010**
		Cross-region Portfolio		
INDUSTRIAL	15.88%	20.25%	20.56%	8.17%
OFFICE	11.87%	9.73%	20.11%	5.30%
RETAIL	12.62%	15.24%	15.47%	5.43%
MEDICAL	--	--	16.98%	11.67%
		Cross-sector Portfolio		
AUCKLAND	12.08%	11.46%	18.50%	6.47%
WELLINGTON	14.17%	12.15%	24.40%	5.84%
CHRISTCHURCH	12.81%	12.99%	16.33%	5.47%
OTHER REGIONS	12.64%	16.49%	17.00%	5.06%

Average Total Return of Portfolios
Source: Authors
Table 5

	(Entire Period) **2002-2010**	(Full Expansion) **2002-2004**	(Late Expansion) **2005-2007**	(Early Contraction) **2008-2010**
		Cross-region Portfolio		
INDUSTRIAL	7.07%	1.78%	2.08%	1.51%
OFFICE	7.60%	1.03%	2.86%	6.33%
RETAIL	5.73%	3.13%	2.87%	4.77%
MEDICAL	--	--	2.89%	0.12%
		Cross-sector Portfolio		
AUCKLAND	6.05%	0.84%	2.34%	4.69%
WELLINGTON	9.44%	1.16%	2.82%	6.31%
CHRISTCHURCH	5.56%	2.20%	3.66%	3.14%
OTHER REGIONS	6.75%	3.75%	1.69%	6.17%

Risk of Portfolios
Source: Authors
Table 6

Table 6 provides the risk for each portfolio in respect to the overall study period and three sub-periods. The risk of *OFFICE*, *AUCKLAND* and *WELLINGTON* increases from the full expansion period (2002-2004) to the late expansion (2005-2007) and the early contraction periods (2008-

2010). This suggests that the volatility increases in regard to the return of office buildings and properties in Auckland and Wellington, when the performance of the economy peaks and starts to go downwards. *AUCKLAND* has the lowest risk level among the three portfolios.

The portfolios of *RETAIL* and *OTHER REGIONS* shows reduced level of risk from the full expansion to the late expansion period. *INDUSTRIAL*, *MEDICAL* and *CHRISTCHURCH* has lower risk in the early contraction period than the late expansion period. These findings suggest that the portfolios of retail properties and properties in other small regions have stable income and sustained prospect value in the late expansion period; however, the volatility of these portfolios' return increases when the economy shows signs of contraction. On the contrary, stable income and sustained value is observed in respect to the portfolios of industrial and health care properties and the properties in Christchurch when the economy starts to contract. Over the entire study period, the portfolio of properties in Wellington has the highest risk. The portfolio of properties in Christchurch during these periods shows the lowest risk.

	(Entire Period) **2002-2010**		(Full Expansion) **2002-2004**		(Late Expansion) **2005-2007**		(Early Contraction) **2008-2010**		
	Sharpe Ratio	*Rank*	Sharpe Ratio	*Rank*	Sharpe Ratio	*Rank*	Sharpe Ratio	*Rank*	Range of Ranking [Min, Max]
Cross-region Portfolio									
INDUSTRIAL	1.61	*1*	2.37	*2*	4.03	*3*	1.70	*1*	[1,3]
OFFICE	0.72	*6*	2.33	*3*	2.47	*6*	0.09	*7*	[3,7]
RETAIL	0.92	*3*	1.39	*6*	2.32	*7*	0.13	*6*	[3,7]
MEDICAL	--	--	--	--	4.77	*2*	0.94	*2*	[2]
Cross-sector Portfolio									
AUCKLAND	0.94	*2*	1.71	*5*	3.26	*5*	0.31	*3*	[2,5]
WELLINGTON	0.90	*4*	4.35	*1*	3.75	*4*	0.16	*5*	[1,5]
CHRISTCHURCH	0.92	*3*	0.81	*7*	2.18	*8*	0.21	*4*	[3,8]
OTHER REGIONS	0.85	*5*	2.04	*4*	8.28	*1*	0.07	*8*	[1,8]
Min	0.72		0.81		2.17		0.07		
Max	1.61		4.35		8.28		1.70		
Max/Min	2.24		5.34		3.82		25.15		

The Sharpe Ratio and Ranking for Portfolios
Source: Authors
Table 7

Table 7 shows the comparison of the Sharpe ratio and its ranking over the entire sample period and three sub-periods. *INDUSTRIAL* sustains a high rank of Sharpe ratio. *RETAIL* sustains a low rank of Sharpe ratio in sub-periods. However, its rank in the entire period is close to the top. *MEDICAL* keeps the second position of Sharpe ratio performance over the late expansion and early contraction

periods. The other five portfolios experience significant fluctuation of their Sharpe ratio rankings. *OFFICE* has good performance in the full expansion period; however, this performance is not observed in the late expansion and early contraction periods. This might result from its increasing risk level over the later two sub-periods. *OTHER REGIONS* experience the largest fluctuation in its ranking, jumping to the top in the late expansion period and slumping down to the bottom when the economy starts to contract. The reason may be that small regions may have high dependence on the growth of other big regions, for instance, Auckland and Wellington and the small regions are most severely hit when the economy is negatively impacted.

Table 7 also provides the range of Sharpe ratio and its ranking across portfolios and over time. It is found that the results of Sharpe ratio are divergent across economic phases. The early contraction period observes the most deviated performance of the portfolios as shown by the high value of 'Max/Min', 25.15, which is based on the Sharpe ratio. The late expansion period sees the least deviated performance of the portfolios as shown by 'Max/Min', 3.82. It suggests that the risk-return performance of a portfolio has larger deviation from another portfolio in full expansion or early contraction phase than in a peak economy. This implies that the application of this diversification technique is used more cautiously in the full expansion and early contraction periods than in the late expansion period. It is also found that cross-region portfolios are likely to have more stable Sharpe ratio performance than cross-sector portfolios over different economic phases, when the range of Sharpe ratio ranking is examined over time. In respect to the entire sample period, the Sharpe ratio of cross-sector portfolios is close to each other. The Sharpe ratio of cross-region portfolios has larger spread. It suggests that investors are better off prioritising the selection of a property sector over a region when they invest in properties in New Zealand.

	INDUS TRIAL	OFFICE	RETAIL	AUCK LAND	WELLING TON	CHRIST CHURCH
OFFICE	-2.0028**					
RETAIL	-1.8021*	0.5912				
AUCKLAND	-1.6556	1.1067	0.0775			
WELLINGTON	-1.6992*	0.9356	-0.0532	-0.2101		
CHRISTCHURCH	-1.7913*	0.5989	0.0408	-0.0503	0.0759	
OTHER REGIONS	-2.0423**	0.4403	-0.3174	-0.3049	-0.1598	-0.3106

Note: Two-tail Z-statistic, **5% Significance Level, *10% Significance Level

Z-statistic of Sharpe Ratio from 2002 to 2010
Source: Authors
Table 8

There might be concern that the comparison of Sharpe ratio may not provide strong evidence because the number of years in each sub-period is small. The Z-statistic is provided to examine the significant difference in the Sharpe ratio performance. It takes into account the small number of years in each sub-period. The Z-statistic of the entire study period is shown in Table 8. A significantly negative Z-statistic means the portfolio listed in a column outperforms the portfolio listed in a row, vice versa. It is found that *INDUSTRIAL* significantly outperforms *OFFICE* and *OTHER REGIONS* from 2002 to 2010. *INDUSTRIAL* also has significantly better Sharpe ratio performance than *RETAIL*, *WELLINGTON* and *CHRISTCHURCH*.

Full Expansion Period: 2002-2004

	INDUS TRIAL	OFFICE	RETAIL	AUCK LAND	WELLING TON	CHRIST CHURCH
OFFICE	-0.0427					
RETAIL	-1.0419	-0.8939				
AUCKLAND	-0.7893	-0.7507	0.3767			
WELLINGTON	1.3228	1.4614	1.7004*	1.7639*		
CHRISTCHURCH	-1.6044	-1.4371	-0.9307	-1.0790	-1.9721**	
OTHER REGIONS	-0.3513	-0.2725	0.8661	0.3432	-1.3578	1.5449

Late Expansion Period: 2005-2007

	INDUS TRIAL	OFFICE	RETAIL	MEDICAL	AUCK LAND	WELLING TON	CHRIST CHURCH
OFFICE	-0.9936						
RETAIL	-1.0211	-0.1285					
MEDICAL	0.3797	1.5003	1.3763				
AUCKLAND	-0.4730	2.7198***	0.8083	-0.8208			
WELLINGTON	-0.1743	1.7025*	1.0129	-0.5262	0.3975		
CHRISTCHURCH	-1.1371	-0.3396	-0.1769	-1.4171	-1.0423	-1.2540	
OTHER REGIONS	1.4801	2.3712**	2.0796**	1.2648	1.8985*	1.6970*	2.1465**

Early Contraction Period: 2008-2010

	INDUS TRIAL	OFFICE	RETAIL	MEDICAL	AUCK LAND	WELLING TON	CHRIST CHURCH
OFFICE	-1.6748*						
RETAIL	-1.6965*	0.0858					
MEDICAL	-0.1039	1.2399	1.1522				
AUCKLAND	-1.5052	0.4480	0.3621	-1.0672			
WELLINGTON	-1.6725*	0.1422	0.0570	-1.1357	-0.3070		
CHRISTCHURCH	-1.6197	0.2465	0.1618	-1.1114	-0.2042	0.1051	
OTHER REGIONS	-1.7429*	-0.0504	-0.1374	-1.2013	-0.4944	-0.1941	-0.2980

Note: Two-tail Z-statistic, ***1% Significance Level, **5% Significance Level, *10% Significance Level

Z-statistic of Sharpe Ratio for Each Sub-Period
Source: Authors
Table 9

The 10% significance level is strong in this test because the Z-statistic of Sharpe ratio has low rejection power of a false null (Jorion, 1985). The findings suggest that a portfolio purely consisting of industrial properties could outperform other geographic or cross-sector diversified property portfolios. *INDUSTRIAL* only outperforms *AUCKLAND* insignificantly. This is because most of the industrial properties are in Auckland and they form a significant proportion of the *AUCKLAND* portfolio.

The Z-statistic of Sharpe ratio for each sub-period is shown in Table 9. The results show that the Sharpe ratio performance differs from one sub-period to another with *WELLINGTON* significantly outperforming *RETAIL*, *AUCKLAND* and *CHRISTCHURCH* in the full expansion period, and significantly underperforming *INDUSTRIAL* in the early contraction period.

Although *WELLINGTON* outperforms *OFFICE*, it underperforms *OTHER REGIONS* in the late expansion period. *OTHER REGIONS* also outperforms the other three cross-sector portfolios of *AUCKLAND*, *WELLINGTON* and *CHRISTCHURCH* in the late expansion period. This suggests that properties in small regions are sluggish in benefitting from the growth of the economy. Furthermore, a balanced cross-sector portfolio performs better than an unbalanced cross-sector portfolio because *OTHER REGIONS* contains properties from all four sectors and demonstrates a balanced portfolio versus a concentrated portfolio. *OTHER REGIONS* also significantly outperforms *RETAIL* and *OFFICE* in the late expansion period. *OFFICE* significantly underperforms the two cross-sector portfolios of *AUCKLAND* and *WELLINGTON*. These findings suggest that consumer sentiment and business confidence have been impaired since the observation of inverse yield curve in 2005. In this late expansion period, *OTHER REGIONS*—a balanced cross-sector portfolio—shows superior performance than the most of other portfolios when the volatility in the property market becomes higher than the previous sub-period.

MEDICAL is the only portfolio that doesn't outperform or underperform any other portfolio in the late expansion and early contraction periods. It suggests that *MEDICAL* has a stable position in the market reflecting health service having a lower elasticity of demand than the retail and office sectors.

INDUSTRIAL significantly outperforms the four portfolios of *RETAIL*, *OFFICE*, *WELLINGTON* and *OTHER REGIONS* in the early contraction period. This can be explained by the fact that the core industries in New Zealand supply products that have especially low elasticity of demand. These products include dairy, fishing, farming, forestry and natural resources. The primary industry sectors listed on NZX support the above key categories of products. The inelastic demand for food and resource guarantees the good performance of industrial properties when the economy turns down.

DISCUSSION

The ranking of Sharpe ratio provides mixed findings in respect to the benefits of geographic and cross-sector diversification. The superior risk-return performance of industrial properties could also be explained by its nature of high liquidity (Giambona et al 2008). Industrial properties are used for storage space and logistic purposes as well as manufacturing. The liquidity of industrial properties is high when the storage space can be easily modified for other usage. In addition, each individual industrial property tends to be lower in value than an office or retail property thus resulting in industrial property being more liquid. This may increase the market value of industrial properties when the credit line becomes tight after the 2007 GFC.

The above finding differs from the result of Eichholtz et al's (1995) study based in the US which concludes that a portfolio of retail properties outperforms other geographically diversified

portfolios. One possible explanation is shown as follows. There is sustained demand for retail goods from consumers in the US over their study period. In New Zealand this result would be more unlikely due to its size and the strong influence of consumer sentiment being sensitive to global commodity prices and exchange rates.

Except for the superior performance of industrial properties, the results indicate that cross-sector diversification provides better risk-return performance than geographically diversified portfolios after comparing the value and ranking of Sharpe ratio. This finding is consistent with the findings of Miles and McCue (1982), Miles and McCue (1984) and Hartzell et al (1986). However, it differs from Newell and Tan's (2003) results in the Australian market. They find that geographic diversification provides marginal additional benefits than cross-sector diversification. This might result from the fact that Australia has a variety of main business sectors located in different States. A variety of business sectors provide additional diversification benefits to a cross-region property portfolio. A cross-sector portfolio in New Zealand has diversification benefits because property sectors have non-synchronous responses to economic shocks.

The results suggest that the risk-return performance can differ significantly between the short-run and long-run and the Sharpe ratio can vary substantially over different economic phases. This is demonstrated by an examination of the Z-statistic. The significantly outperforming portfolios differ over time and it would be a better choice to hold a cross-sector portfolio consisting of properties in Wellington in the full expansion period. However, an investor would benefit more from holding a portfolio consisting of properties in other small regions than Wellington in the late expansion period. In the early contraction period, the portfolio of properties in other small regions significantly loses out to the portfolio consisting of industrial properties only, as most industrial properties are located in Auckland.

The diverse fundamental drivers of a property sector or region may contribute to the significantly varying Sharpe ratio performance over different economic phases. The findings suggest that investors consider the tenants' nature of business and the elasticity of demand for the tenants' service or products when an efficient portfolio is constructed based on investors' risk preference. Investors that require a defensive property portfolio could consider properties occupied by tenants supplying service or goods with inelastic demand. On the contrary, in a period of strong economic growth, aggressive property investors may benefit from negotiating gross leases on their properties. The results also indicate that a pure retail property portfolio fails to demonstrate a significantly superior risk-return performance even in the full expansion period due to the consumption patterns of consumers being highly sensitive within a small economy. This can be observed in the New Zealand stock market where there are portfolios comprising purely of industrial and office property, but no exclusively retail property portfolios. Retail properties tend to supplement listed property portfolios in order to achieve greater diversification.

CONCLUSION

This study investigates the cross-sector versus cross-region diversification over different economic phases in New Zealand, which is a small economy. The findings suggest that cross-sector diversification benefits are highlighted in Wellington in the full expansion period. Such benefits are strengthened in the small regions in the late expansion period. This may result from the strong non-synchronous responses from different property sectors in the small regions. The findings imply that cross-sector diversification benefits may increase or reduce over different economic phases. It suggests that diversification strategies do not necessarily need to be consistent over time.

A single industrial property sector persistently outperforms other diversification portfolios over the entire sample period. Especially in a high volatile economic phase such as the early contraction

period, the industrial property sector sustained a high rank in respect to risk-return performance. Most of the industrial buildings are in Auckland, the economic centre of New Zealand. Two implications can possibly be drawn from this finding. On one hand, it is not necessary for an investor to hold a property portfolio diversified across different sectors in a small economy when diversification benefits concern him. The risk-return performance of a property sector relies on the sector's service and added-value.

On the other hand, a superior property sector is different between a large economy such as US and a small economy such as New Zealand. A possible explanation is shown below. The US has a variety of industry sectors. A single retail sector can outperform other diversified property portfolios especially when the credit line is loose and the domestic consumption power is strong. However, the domestic consumption power in New Zealand is not as strong as in the US. New Zealand's economy depends on exporting natural recourses and dairy products. The industry property sector that is empowered by the strong demand from logistics and storage space shows stronger performance than the retail sector in New Zealand. However, further research is required to analyse the reasons for different superior property sectors between the US and New Zealand, for example, the impact of retail turnover on the retail property risk-return performance over different economic phases.

The above finding suggests that it is beneficial for an investor to cautiously select a well-performed property sector, taking into account the underlying forces driving the income stream of the property sector in New Zealand.

WELLINGTON loses its top position in the late expansion and early contraction periods and is ranked in the middle range in respect to Sharpe ratio. One possible explanation is that gross lease contracts have disadvantage when the energy and utility price unexpectedly increases, with the energy and oil prices being lower and more stable in the full expansion phase than the late expansion and early contraction phases. The above finding may provide a possible implication that gross rents would not be the first choice in a market when the downside risk of energy and water resource price for property landlords is high and gross rents could possibly be a good choice in a stably expanding economic phase. Further study can be conducted in order to investigate the relationship between energy price and risk-return performance of properties with gross lease contracts.

This study has a few limitations that need to be further considered in later studies. Firstly, the study period is constrained by the available investment property information. The number of observations in each sub-period is limited. A further study with a larger number of observations in each sub-period is recommended when the number of observations in New Zealand grows over time. An additional study can also be conducted using IPD New Zealand index when more pure cross-sector portfolios are available at the index level. Secondly, the value-weighted return indices may constrain the optimal weight on a property. This may result in a sub-optimal allocation. A further study applying optimization technique can be conducted following Eun and Resnick's (1988) certainty-equivalence tangency (CET) portfolio strategy. However, there could be practical limitations on applying portfolio optimization in the property context because properties are illiquid and have high information and transaction costs. Lastly, unlisted commercial properties are not included in the study, due to the unavailability of information. Unlisted investment properties constitute a significant proportion of investment properties in the market. This problem may be mitigated when listed investment properties' risk-return performance reflects the property market's performance in equilibrium. It is recommended to conduct further research including unlisted investment property information. In addition, further investigation of the evidence of non-

synchronous responses of property sectors in respect to economic impacts in another small or large economy is recommended.

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