



## Copyright Statement

The digital copy of this thesis is protected by the Copyright Act 1994 (New Zealand). This thesis may be consulted by you, provided you comply with the provisions of the Act and the following conditions of use:

- Any use you make of these documents or images must be for research or private study purposes only, and you may not make them available to any other person.
- Authors control the copyright of their thesis. You will recognise the author's right to be identified as the author of this thesis, and due acknowledgement will be made to the author where appropriate.
- You will obtain the author's permission before publishing any material from their thesis.

To request permissions please use the Feedback form on our webpage.  
<http://researchspace.auckland.ac.nz/feedback>

## General copyright and disclaimer

In addition to the above conditions, authors give their consent for the digital copy of their work to be used subject to the conditions specified on the Library [Thesis Consent Form](#)

The Investment Risk of  
Institutional-grade Commercial Real Estate in Australia

Edward John Schuck

A thesis submitted in partial fulfilment of the  
requirements for the degree of Doctor of Philosophy in Property,  
The University of Auckland, 2003.

## **The University of Auckland**

### **Thesis Consent Form**

This thesis may be consulted for the purpose of research or private study provided that due acknowledgement is made where appropriate and that the author's permission is obtained before any material from the thesis is published.

I agree that the University of Auckland Library may make a copy of this thesis for supply to the collection of another prescribed library on request from that Library; and

I agree that this thesis may be photocopied for supply to any person in accordance with the provisions of Section 56 of the Copyright Act 1994.

Signed:.....

Date:.....

## **ABSTRACT**

Knowledge of the investment risk of investment-grade commercial real estate ('ICRE') is important because it determines the approaches which should be taken to portfolio management. However, relatively little is known about this risk.

This research expands the body of knowledge of ICRE investment risk by producing conclusions about the information content of prices and the distribution of returns in the ICRE context. It is broken into three main parts.

First, the ICRE returns-generating process is characterised to form a basis for deducing theoretical conclusions about the information content of prices and the stochastic attributes of returns. The rationale for this approach lies in capital markets literature, which demonstrates that the characteristics of the information structure of markets, the decision-making processes of investors and the market trading mechanism determine the main attributes of the process of price evolution (which is assumed to be the main driver of returns). The analysis concludes that ICRE prices are partially informed, and changes in prices are described by a 'jump' process.

Second, analysis of a database of 'large' price changes supplied by the Property Council of Australia is undertaken to empirically test the jump process hypothesis. This analysis provides evidence that natural events associated with changes in the leasing structure of properties are a primary driver of relatively large, infrequent dislocations in valuation-based prices.

With parts one and two as a backdrop, the third part of this research empirically tests a discrete mixture of normals ('DMON') model of investment risk. Capital markets research shows that a DMON model flows naturally from jump price processes. DMON models fitted to cross-sectional returns on individual properties supplied by the

PCA are found to be superior to the normal and stable Paretian models previously proposed by other researchers.

In aggregate these conclusions have serious implications for the management of ICRE portfolios, and suggest a need for additional research. Some implications include:

- Mean-lower partial variance is superior to mean-variance optimisation.
- Forecasting the distribution of ICRE returns forms a new tool for active management.
- Passive portfolio management is inappropriate.
- Comparables-based valuations may be unreliable for investment decisions.

This work is dedicated to my supervisor, Professor Gerald R. Brown.  
Without his support and patience, it may never have been completed.

# TABLE OF CONTENTS

<b>I.</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	The definition of investment risk .....	2
1.2	The information content of prices .....	4
1.3	The risk functions of investments .....	8
1.4	ICRE assets in the universe of risk assets .....	11
1.5	The information content of individual ICRE prices .....	13
1.6	The distribution of individual ICRE investment risk .....	15
1.7	Research methodology, data and summary of results .....	19
<b>II.</b>	<b>LITERATURE REVIEW .....</b>	<b>26</b>
2.1	The information content of ICRE prices .....	26
2.2	The investment risk of individual ICRE assets .....	28
2.2.1	Studies of individual investment risk .....	30
2.3	Summary and conclusions .....	39
<b>III.</b>	<b>THEORETICAL RESEARCH METHODOLOGY .....</b>	<b>41</b>
3.1	Capital markets research .....	41
3.1.1	ICRE assets: Common or private value goods? .....	42
3.2	The information content of prices .....	43
3.3	The distribution of ICRE investment risk .....	49
3.3.1	Uncertainty: Innovations in market prices .....	49
3.3.2	Distributional models and the price process .....	52
3.3.3	The ICRE price process: Continuous or jump? .....	56
<b>IV.</b>	<b>THE ANATOMY OF THE ICRE MARKET .....</b>	<b>58</b>
4.1	Introduction .....	58
4.2	The ICRE asset class .....	60
4.3	Natural events relevant to the pricing of ICRE assets .....	62
4.4	Elements of the price-generating system .....	66
4.4.1	The information structure of ICRE markets .....	66
4.4.2	The decision-making of institutional investors .....	75
4.4.3	The ICRE market trading mechanism .....	77
4.5	Conclusion .....	88
<b>V.</b>	<b>THE INVESTMENT RISK OF ICRE ASSETS .....</b>	<b>89</b>
5.1	Introduction .....	89
5.2	The information content of prices .....	89
5.2.1	The observability of natural events .....	90
5.2.2	The information structure of ICRE markets .....	91
5.2.3	Translating information into transaction prices .....	93
5.2.4	Information revelation of prices .....	97
5.2.5	Theoretical conclusions about the information content of prices .....	104
5.3	The theoretical basis for a stable Paretian model of ICRE investment risk .....	105
5.3.1	The generation of ICRE prices: Continuous or jump process? .....	106
5.3.2	Theoretical conclusion about a stable Paretian model of risk .....	110
<b>VI.</b>	<b>EMPIRICAL TEST OF THE JUMP PROCESS HYPOTHESIS .....</b>	<b>112</b>
6.1	Introduction .....	112
6.2	The PCA explanations database .....	113
6.3	Empirical testing .....	115
6.4	Results .....	117
6.5	Price changes around lease events .....	120
6.6	Conclusion .....	124





<b>VII. EMPIRICAL TEST OF THE DISCRETE MIXTURE MODEL</b>	
<b>PART 1: DATA AND METHODOLOGY</b>	<b>126</b>
7.1 Introduction.....	126
7.2 Research approach.....	127
7.3 The PCA dataset .....	128
7.4 The real estate market model .....	131
7.5 DMON model pre-specification for limited cross-sectional data .....	134
7.6 Expectations of relationship between parameters.....	136
7.7 Sampling theory: The DMON model.....	138
7.8 Sampling theory: The stable Paretian model .....	143
<b>VIII. EMPIRICAL TEST OF THE DISCRETE MIXTURE MODEL</b>	
<b>PART 2: RESULTS AND EVALUATION</b>	<b>146</b>
8.1 Introduction.....	146
8.2 Consistency of the empirical data with a DMON model .....	147
8.3 Preliminary tests of the stable Paretian hypothesis .....	157
8.4 Empirical curve-fitting.....	160
8.4.1 Mixtures of normal distributions .....	160
8.4.2 Stable Paretian distributions .....	162
8.4.3 Goodness-of-fit.....	163
8.5 Evaluation of the results of model-fitting.....	168
8.6 Conclusion.....	174
<b>IX. SUMMARY, IMPLICATIONS AND FURTHER RESEARCH</b>	<b>177</b>
9.1 Introduction.....	177
9.2 The distribution of ICRE investment risk .....	177
9.3 The information content of ICRE prices.....	190
9.4 Further research .....	202
<b>APPENDIX A – DISTRIBUTIONAL MODELS OF FINANCIAL ASSETS.....</b>	<b>208</b>
A.1 The stable Paretian hypothesis.....	211
A.2 Contra-indications to the stable Paretian hypothesis .....	213
A.3 Alternative distributional models – continuous mixtures .....	219
A.5 Alternative distributional models – discrete mixtures .....	225
A.6 Summary of distributional hypotheses.....	235
<b>APPENDIX B – FACTORS AFFECTING THE MARKET PRICE OF AN ICRE ASSET .....</b>	<b>237</b>
<b>APPENDIX C – DISCUSSION OF THE OBSERVABILITY OF NATURAL EVENTS .....</b>	<b>243</b>
<b>APPENDIX D – ALTERNATIVE MODELS OF INVESTMENT SELECTION.....</b>	<b>247</b>



## LIST OF TABLES

<u>Table</u>	<u>Title</u>
1	Studies of the Informational Efficiency of Individual Real Estate Assets
2	Pricing Factors and their Associated Natural Events
3	Pricing Factors and the Characteristics of their Associated Natural Events
4	Explanations of 'Large' Valuation Changes – 1996 to 2000 Index Committee – Property Council of Australia
5	Explanations of 'Large' Valuation Changes – 1996 to 2000 Index Committee – Property Council of Australia
6	Explanations of 'Large' Valuation Changes – 1994 to 1997 Research Committee – Property Council of New Zealand
7	Proportion of Index Revalued in Each Period and Sector Property Council of Australia Sectoral Indices
8	Sample Statistics; Property Council of Australia – Office Properties
9	Sample Statistics; Property Council of Australia – Retail Properties
10	Sample Statistics; Property Council of Australia – Industrial Properties
11	Deviations from Sample Mean (% per annum) Property Council of Australia – All Properties by Type
12	Mixture of Normals ( $N = 2$ ) – Parameters and Variances Property Council of Australia – Office Properties
13	Mixture of Normals ( $N = 2$ ) – Parameters and Variances Property Council of Australia – Retail Properties
14	Mixture of Normals ( $N = 2$ ) – Parameters and Variances Property Council of Australia – Industrial Properties
15	Sample Distribution – Parameters and Variances Property Council of Australia – Office Properties
16	Sample Distribution – Parameters and Variances Property Council of Australia – Retail Properties
17	Sample Distribution – Parameters and Variances Property Council of Australia – Industrial Properties
18	Mixture of Normals ( $N = 2$ ) – Sample vs. Implied Means and Standard Deviations – Property Council of Australia – All Properties
19	Capital Weightings and Index Returns Property Council of Australia – CBD Office Properties



## LIST OF FIGURES

<u>Figure</u>	<u>Title</u>
1	Relationship between Data Emitters, Information Market, and Pricing Mechanism
2	Jones Lang LaSalle – Australian Commercial Real Estate Sales over A\$5m
3	Histogram of Individual Property Returns – Property Council of Australia
4	Sample Cross-sectional Histograms – Property Council of Australia All Sectors
5	Sample Mean and Skewness vs. Time Property Council of Australia – CBD Office Properties
6	Sample Mean and Skewness vs. Time Property Council of Australia – CBD Retail Properties
7	Standard Deviation vs. Sample Size Property Council of Australia – Office Properties
8	Standard Deviation vs. Sample Size Property Council of Australia – Retail Properties
9	Standard Deviation vs. Sample Size Property Council of Australia – Industrial Properties
10	Stable and DMON Densities and Sample Histogram Property Council of Australia – Office Properties
11	Differences Between Component Means Property Council of Australia – All Properties
A-1	Stable Distributions ( $\alpha = 2$ (normal), 1.75)

