



Financial Services Forum Crown Promenade Hotel Melbourne • 30 April – 1 May 2012



House Price Risk Models for Banking and Insurance Applications

Katja Hanewald and Michael Sherris

© Australian School of Business, AIPAR and CEPAR
University of New South Wales, Sydney, Australia



UNSW
THE UNIVERSITY OF NEW SOUTH WALES

cepar
ARC CENTRE OF EXCELLENCE IN
POPULATION AGEING RESEARCH



Introduction

- Research program at CEPAR
 - Risk modelling
 - Products
 - Policy and regulation
- House price risk (equity release products)

House Price Risk



- **Banks, Insurers and Regulators**
 - Private/institutional real estate investors
 - Providers of housing-related financial products
 - Regulator and risk based capital for lenders/insurers

House Price Risk

- **Products and Product Risks**
 - Mortgage loans and mortgage insurance
 - Equity release products/reverse mortgages
 - ABS and MBS
 - Property insurance
- **Risk management solutions are limited**



Reasons for our Study

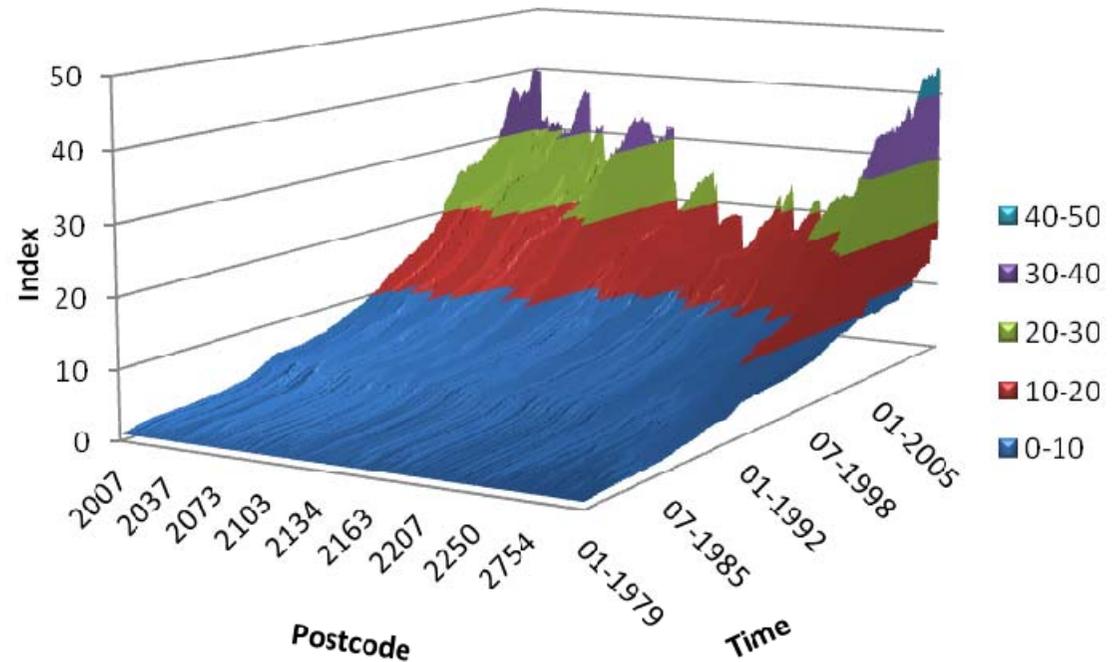
- Need for better house price risk models
 - Limited detailed analysis of models for quantifying house price risk (publicly available)
 - Limited analysis of housing related financial products based on house price data other than at a market-wide level
- Industry collaboration with Residex

What do we do?

- House price risk and returns are studied based on a **large micro-level data set (postcode level)**
- Models of house price risk are compared that allow for **temporal and cross-sectional risks**, and **risk factors**
- **Identify applications** for pricing, risk management, and portfolio management of house price products and portfolios

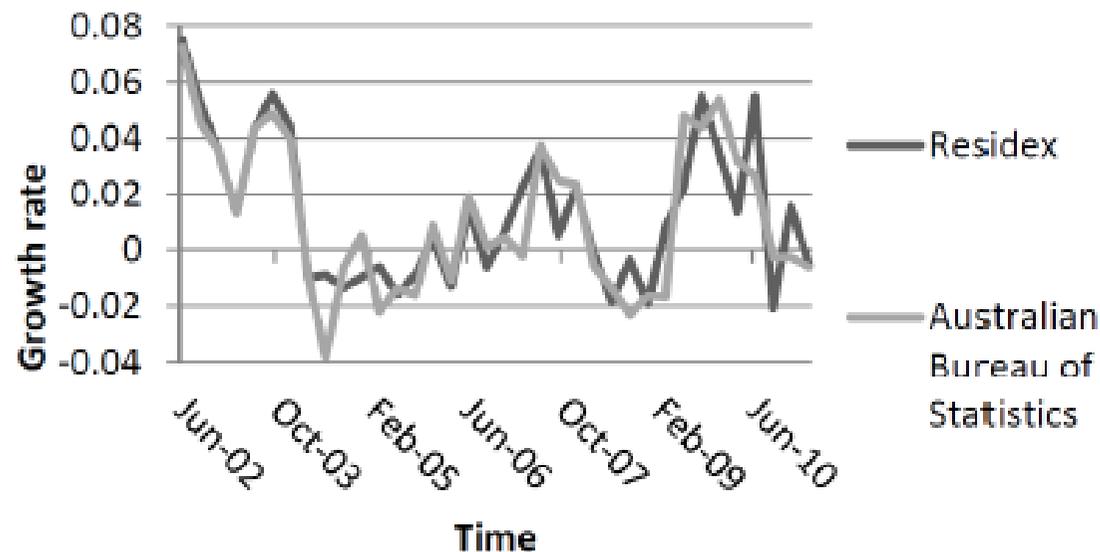
Data

- House price indices for all Sydney postcode areas
- Risk factors
- Sydney market index



House Price Data

- “Non-Revisionary Repeat Sales Indices” provided by Residex



House Price Data

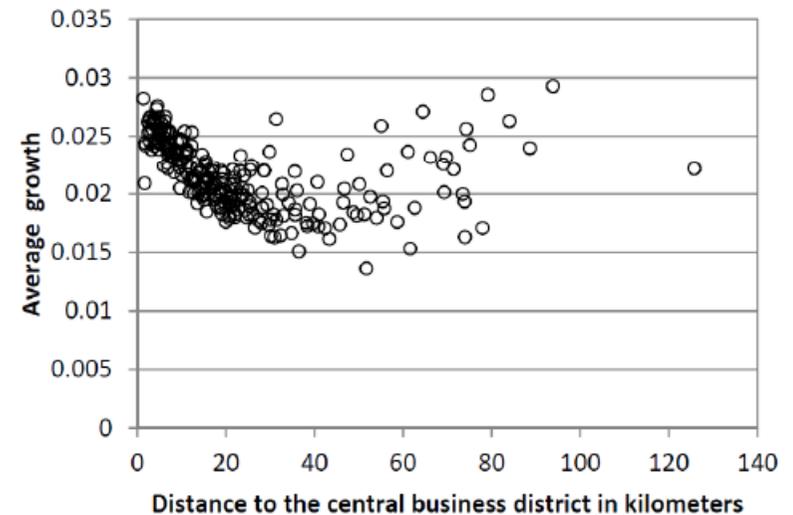
Frequency	Mean	Std. Dev.	CV
Monthly	0.73%	1.10%	151.04%
Quarterly	2.16%	2.42%	111.93%
Yearly	8.26%	7.21%	87.24%

- Model the growth rates of postcode-level house price indices
 - over time and over the cross-section:

$$growth_{it} = f(X_{it}, Y_t) + \varepsilon_{it}$$

Data on Risk Factors

- Macro / financial time series
- Postcode area characteristics
 - Geographic
 - Socio-demographic



Risk Models

- Multivariate time series models
- Panel data (cross sectional time series) models based on
 - House price market index
 - Macro / financial, seasonal, geog. variables
 - Socio-demog. and geog. postcode area characteristics

Multivariate Time Series Models

- Effectively capture observed autoregressive and moving average patterns
 - ARIMA(3,1,1) explains 73.4% of the variability in postcode-level house price growth rates
- **Applications:** Modelling the risk exposure of a house portfolio that is representative of the postcode, simulation using historical data

Panel Data Models: Market Index

$$growth_{it} = \alpha + \beta_i market_growth_t + \varepsilon_{it}$$

- Postcode level “house price beta”

- Heterogeneity:

42-45% of house price

risk explained

- Summary statistics for β_i

Region	Mean*	Std. Dev.*
Total	0.459	0.105
CBD	0.518	0.075
Harbor	0.532	0.060
Airport	0.511	0.070
Coast	0.491	0.084

Panel Data Models: Market Index

$$growth_{it} = \alpha + \beta_i market_growth_t + \varepsilon_{it}$$

- Applications:
 - Risk management: Indexed-based hedging
 - Portfolio management: β_i as market betas

Panel Data Models: Macro / Financial, Seasonal, and Geog. Variables

- Impact of exogenous variables on house prices
 - Significant factors: **GDP**, **unemployment rates**, **real interest rates** and the **ASX All Ordinaries Index** (current and lagged)
 - Significant seasonal effects
 - Significant non-linear effect of distance to CBD
 - Models explain 20.8% - 48.8% of house price risk

Panel Data Models: Macro / Financial, Seasonal, and Geog. Variables

- Applications:
 - RM: Improve hedging
 - Pricing: Risk factor models for pricing
 - PM: Construct portfolios with diversification across asset classes



Panel Data Models: Socio-Demog. and Geog. Postcode Area Characteristics

- Impact of **postcode-level income, unemployment rates, median age, and household size** on house prices
 - Significant effects found for all four variables
 - Lagged variables control for endogeneity
 - Model explains 61.5% of house price risk
- **Applications:** Factor models for risk pricing

Summary and Conclusions

- This paper is one of the first to
 - assess a range of models (time series/panel data),
 - quantify risk both temporal and cross sectional, and
 - to do this at a postcode level for a major city
- Key result: Large proportion of house price risk is due to heterogeneity (not captured in market index models)



Summary and Conclusions

- Research has important **applications in banking and insurance**
 - Risk assessment and pricing of equity release products, mortgage loans, and mortgage insurance policies
 - Assessment of the basis risk of indexed-linked housing derivatives / home equity insurance
- Topics for current and future projects



Thank you very much!

Contact:

m.sherris@unsw.edu.au

k.hanewald@unsw.edu.au

Full paper:

Australian School of Business Research Paper No. 2011ACTL11

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1961402

Discussion Points

- Indexed-based hedging:
 - Product design
 - What type of index should be used?
- Reverse mortgages:
 - How do providers currently manage risks?
 - Which other risk management strategies should be considered?