

HOUSE PRICE CONVERGENCE ACROSS RESIDENTIAL SUBURBS IN MELBOURNE, AUSTRALIA

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Introduction

- This paper examines the conditional convergence of house prices across metropolitan suburbs in Melbourne, Australia, while taking into account the effects of spatial dependencies.
- Regional house price convergence has important implications for the housing affordability issue and for formulating appropriate housing policies for Melbourne.
- As houses become less affordable in the proximity of the Melbourne city centre, moving to the periphery may be an option for potential buyers. However, purchasing decisions depend not only on the current house price and available amenities in the locality, but also the future expected appreciation of house prices.

Introduction

- Potential buyers can purchase houses in less attractive areas if house prices in those areas are expected to catch up with those in high-price areas in the future.
- The main issue here remains whether there is any such catch-up effect, so that areas with low prices will experience relatively high price growth.
- House prices may diverge across cities and suburbs if potential buyers mostly focus on a few areas in the proximity of the city centre, irrespective of current house price.
- The divergence of house prices would aggravate the housing affordability crisis and congestion problem, especially in the proximity of the city centre.

Theoretical Background

- The Alonso-Mills-Muth model (Alonso, 1964; Mills, 1967; Muth, 1969):
 - explains how house prices change with distance from the central business districts.
 - households are left with the choice of whether to live in well-located, yet smaller and more expensive, housing, or in more distant, yet larger and less expensive, housing towards the city fringe.
 - There is no prediction for house price convergence in this line of models.

Theoretical Background

- Rosen (1979) and Roback (1982):
 - population, wages and house prices adjust in such a way that the marginal residents in each location receive identical utility from dwellings and associated amenities.
 - it is possible to obtain house price convergence in these models because, as long as utilities across locations differ, migration towards locations providing higher utility will cause housing prices, amenities and wages to adjust until migration will no longer pay off.

Theoretical Background

- Glaeser et al. (2001) and Guerrieri et al. (2013):
 - the mechanism of house price convergence across different neighbourhoods occurs through gentrification.
 - A demand shock for housing induces wealthier households to move outwards to the fringe of the high-priced locations, thereby expanding the high-priced neighbourhoods into the areas where house prices were initially low.
 - As people move into the formerly low-priced neighbourhoods, the positive externality from living in that neighbourhood increases, thereby driving up the equilibrium price of dwelling in that neighbourhood.

Objectives of the study

- To test the convergence hypothesis, this study mainly utilizes the regression-based convergence test premiered by Barro (1991); Barro et al. (1991); and Barro and Sala-i-Martin (1990, 1992).
- It also considers spatial dependencies while testing for convergence. The spatial analysis will not only help test for convergence while controlling for spatial effects, but also give an indication of whether there are any house price spillover effects from the neighbouring suburbs.

Past studies on house price convergence

- Previous studies on house price convergence mainly test for stochastic convergence and focus on the long-term equilibrium relationship between house prices across regions. These are mostly based on time series estimation techniques.
- A few rare attempts have been made to analyse the house price convergence and ripple effects in Australian context and these mainly use cointegration-based techniques [e.g., Luo et al. (2007) and Blake and Gharleghi (2018)].
- Studies on other countries using time series techniques:
 - Cook (2003), Drake (1995) and Holmes and Grimes (2008) for the UK.
 - Canarella et al. (2012), Clark and Coggin (2009) and Holmes et al. (2011) for the US.
 - Gong et al. (2016) for China.
 - Holmes et al. (2017) for the Paris , France.

Past studies on house price convergence

- Cook and Vougas (2009) argue that time series data for house prices could be subject to structural changes, which may cast doubt over previous findings on stochastic convergence.
- In addition, the role of spatial effects are largely ignored in these studies.
- My study mainly uses cross-sectional regression without addressing the stochastic convergence issue.
- To the best of my knowledge, this is the first attempt to test the convergence of house prices within a metropolitan area using the regression-based -convergence test that controls for spatial effects.

Basic empirical model

$$\frac{1}{T} \left[\frac{P_{Ti} - P_{1i}}{P_{1i}} \right] = \alpha + \beta \log(P_{1i}) + \sum_k \theta_k X_{ik} + u_i \quad i = 1, 2, 3, \dots, N$$

- P denotes house price in a specific Melbourne suburb, i .
- The dependent variable is the average annual growth rate of house price in that area over the year T .
- Our main focus is on the convergence coefficient, β , which reflects the effect of initial house prices (P_1) on the annual average growth of house prices over the period T .
- X_{ik} includes several control variables—such as population size, economic profile, residents' education levels and occupations, crime rate and average rent in the area

Data

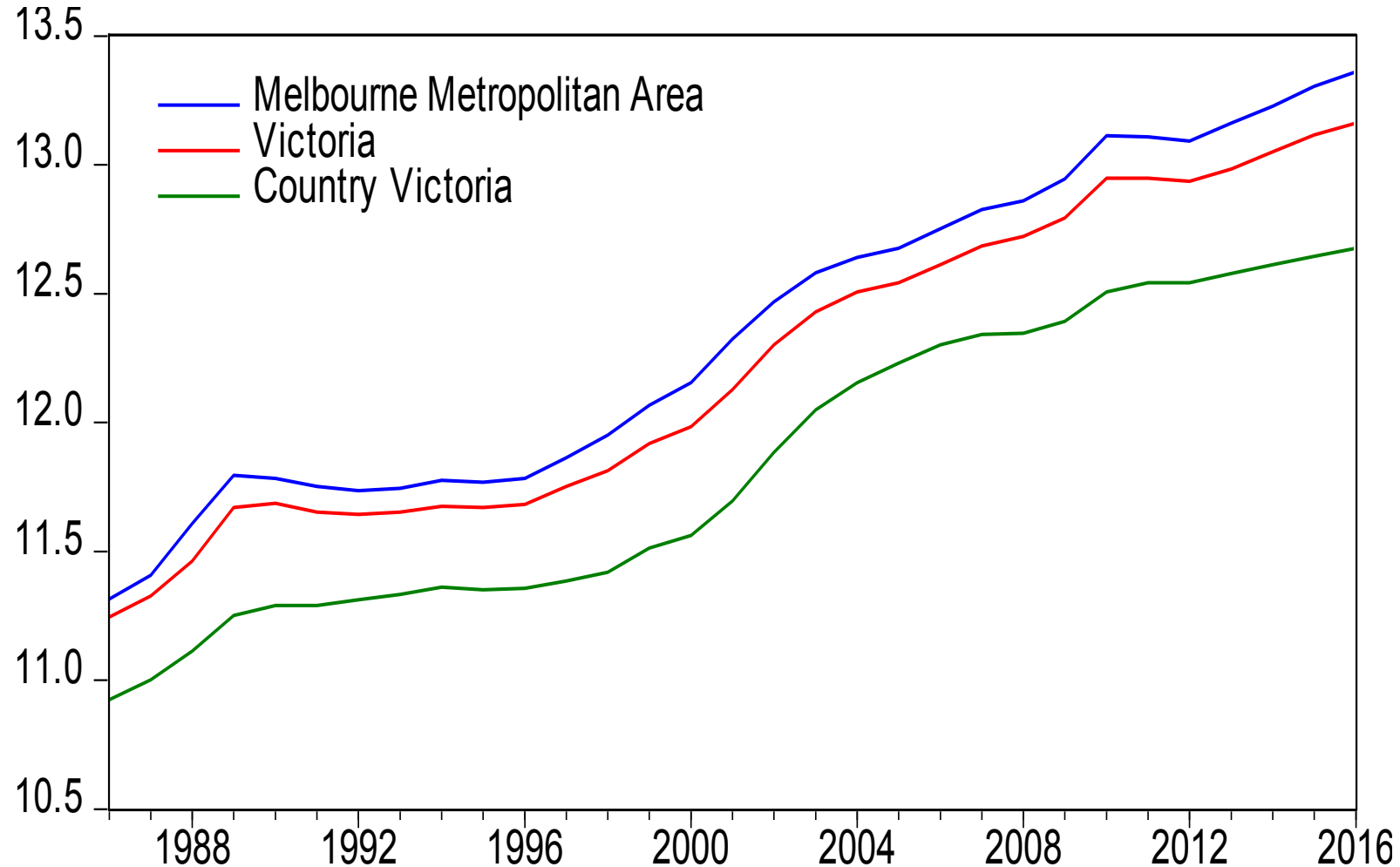
- **House price:** The median house and unit price data for Melbourne metropolitan suburbs were taken from the State Government of Victoria Department of Environment, Land, Water and Planning.
- **Population size:** Data for the number of population in 2006 and 2011 for each suburb were taken from the SEIFA census database of the Australian Bureau of Statistics.
- **Education and employment index:** This index reflects the educational and occupational structure of communities. Source: the SEIFA census database of the Australian Bureau of Statistics .
- **Economic resource index:** This index includes the level of income and wealth for the families living in each suburb. Source: the SEIFA census database of the Australian Bureau of Statistics .

Data

- **Rent:** The average weekly rent data for metropolitan Melbourne suburbs were taken from the Department of Health and Human Services of the State Government of Victoria.
- **Crime rate:** The number of non-aggravated burglary incidences per 1,000 population was used as a proxy for the crime rate. The data were taken from the Crime Statistics Agency Victoria (2016). As data were unavailable for the years prior to 2012, this study used 2012 crime data in each regression model.

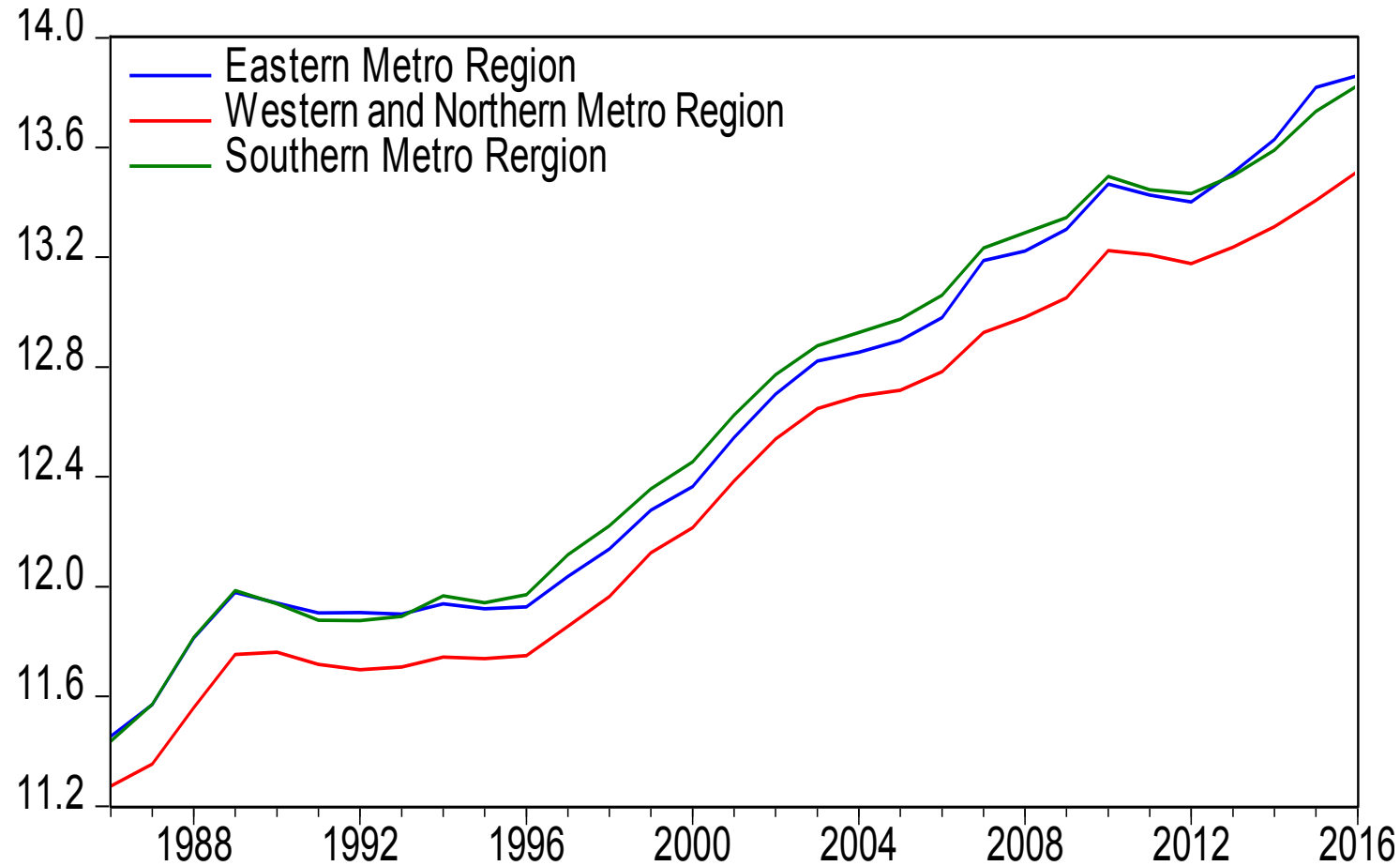
Some preliminary observations

- Log of median house prices in LGAs (within Victoria).



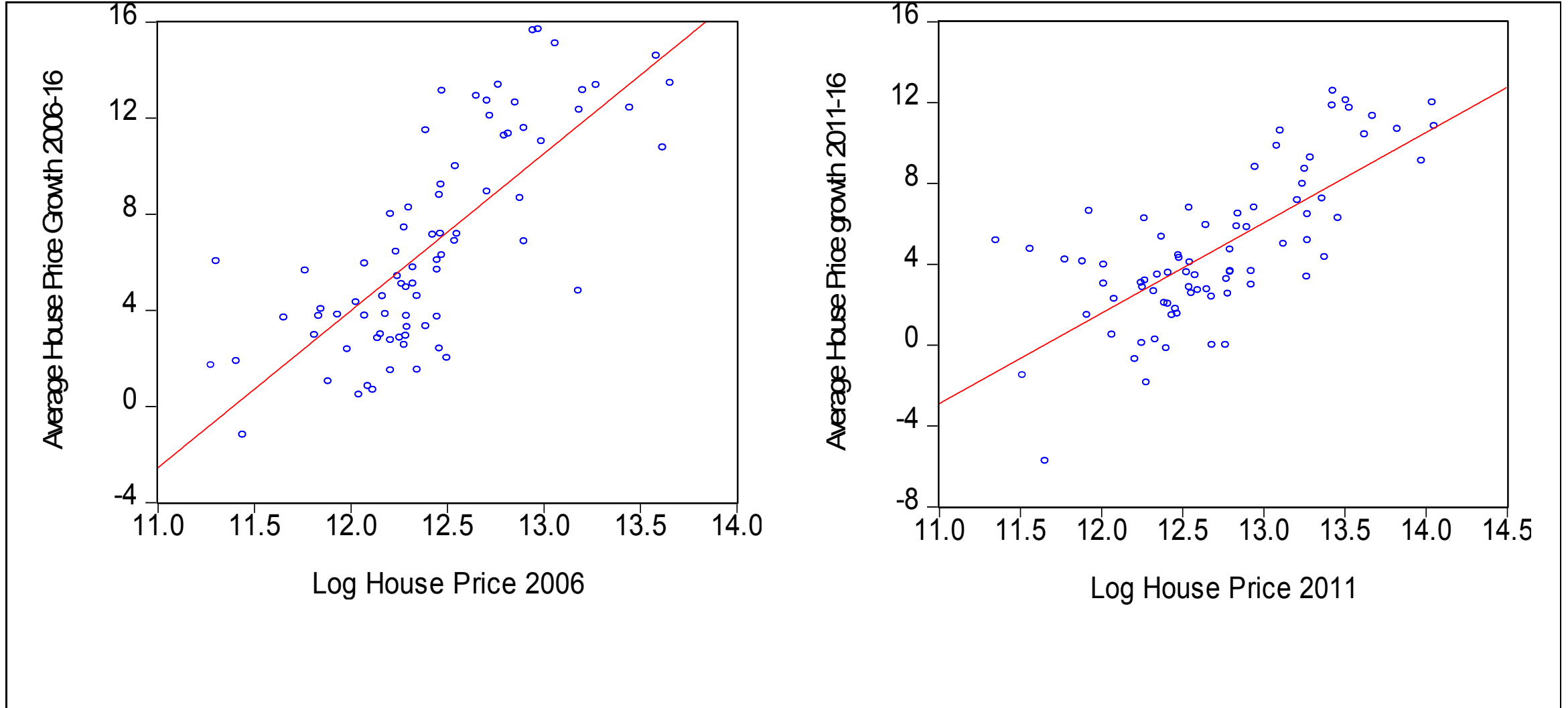
Some preliminary observations

- Log of median house prices in LGAs (within Metropolitan Melbourne).



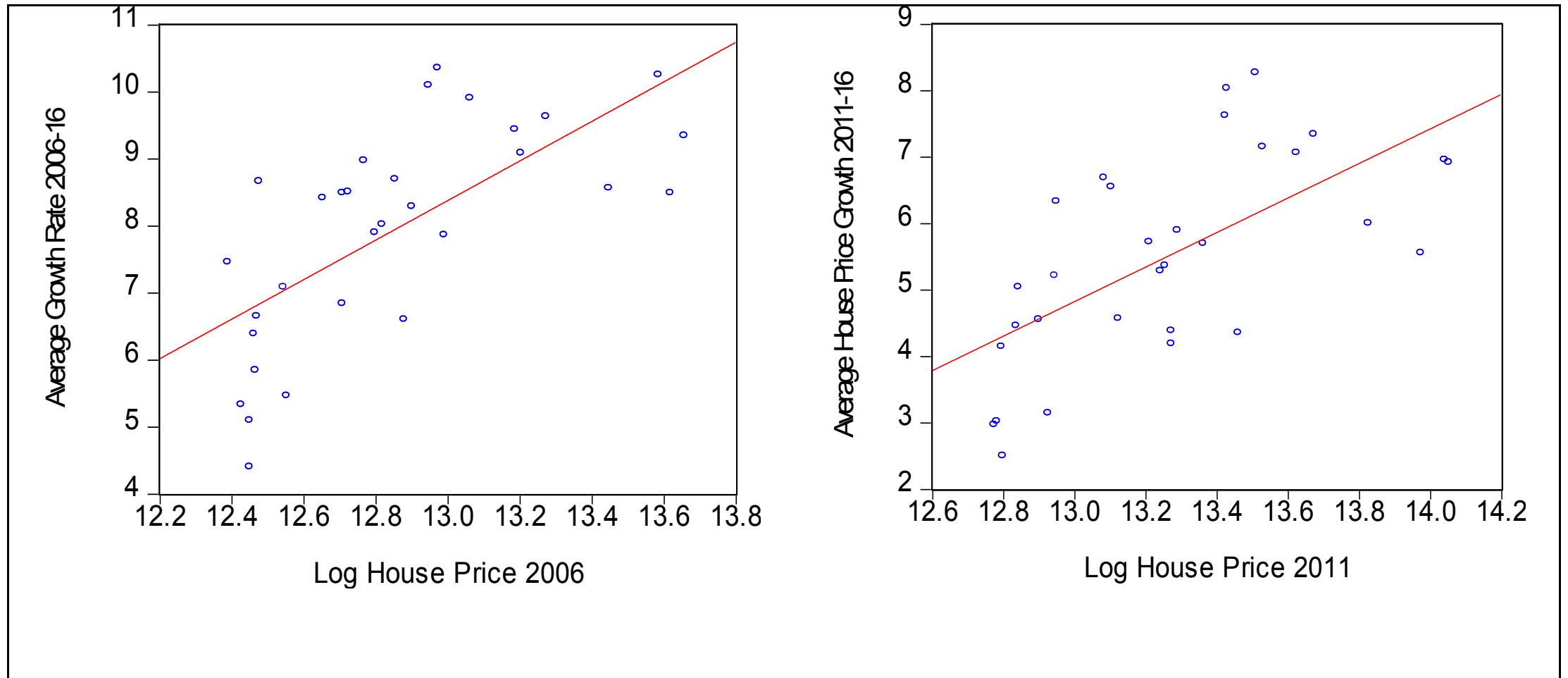
Some preliminary observations

- Initial house price level vs house price growth (All LGAs in Victoria)



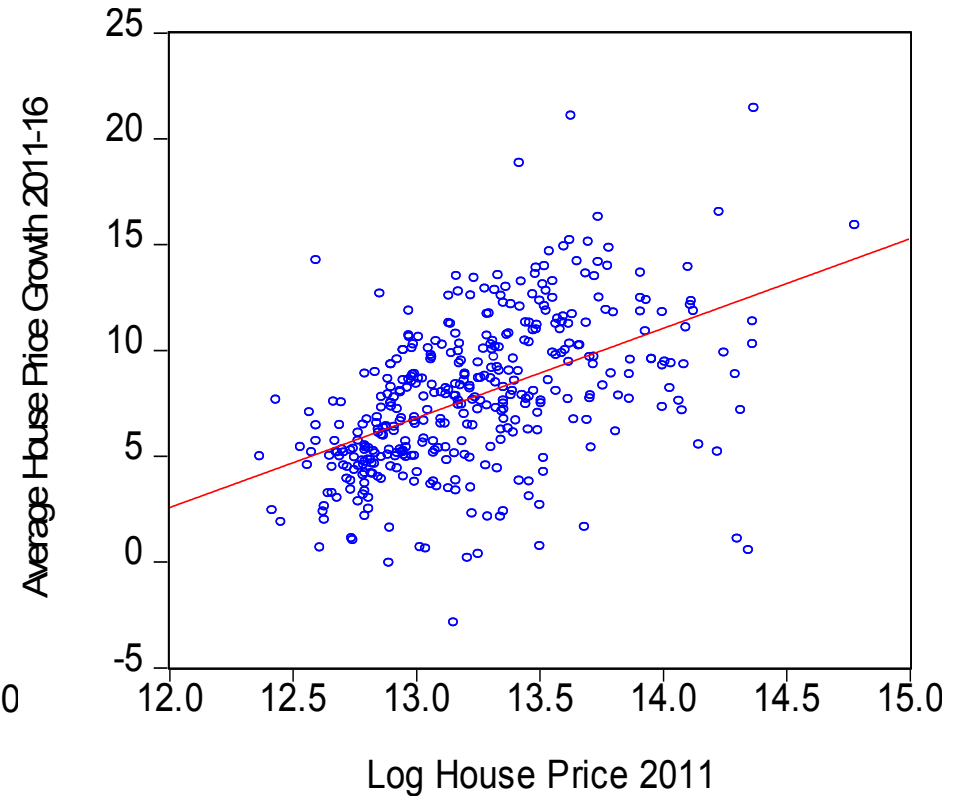
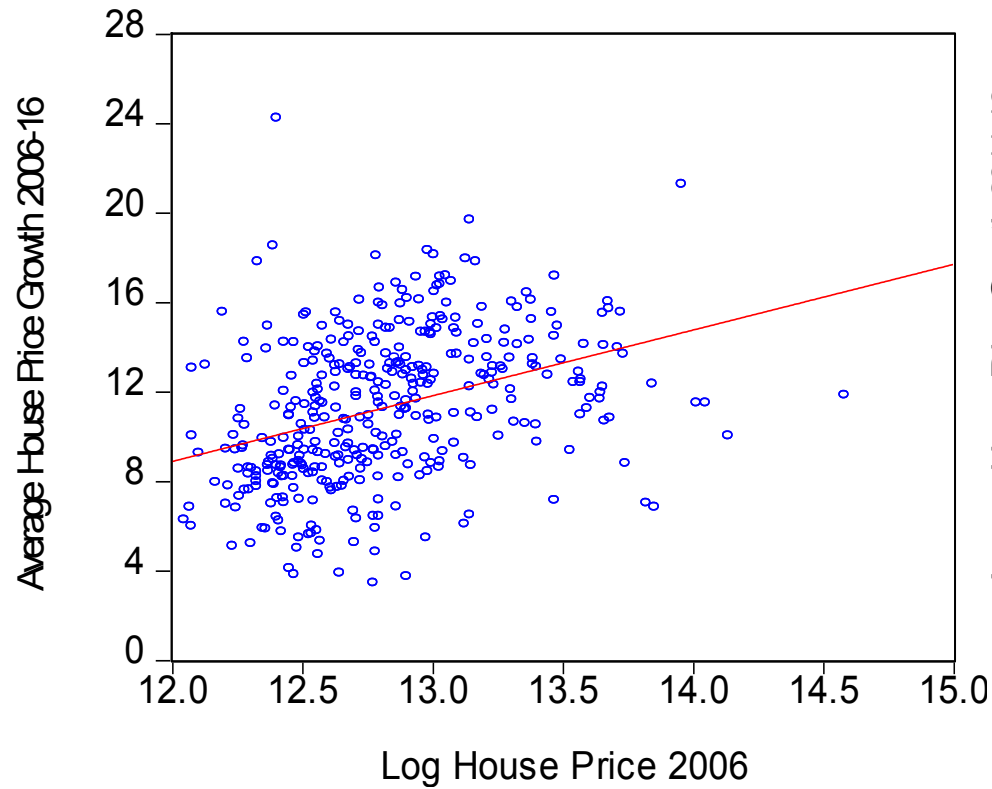
Some preliminary observations

- Initial house price level vs house price growth (All LGAs in Melbourne)



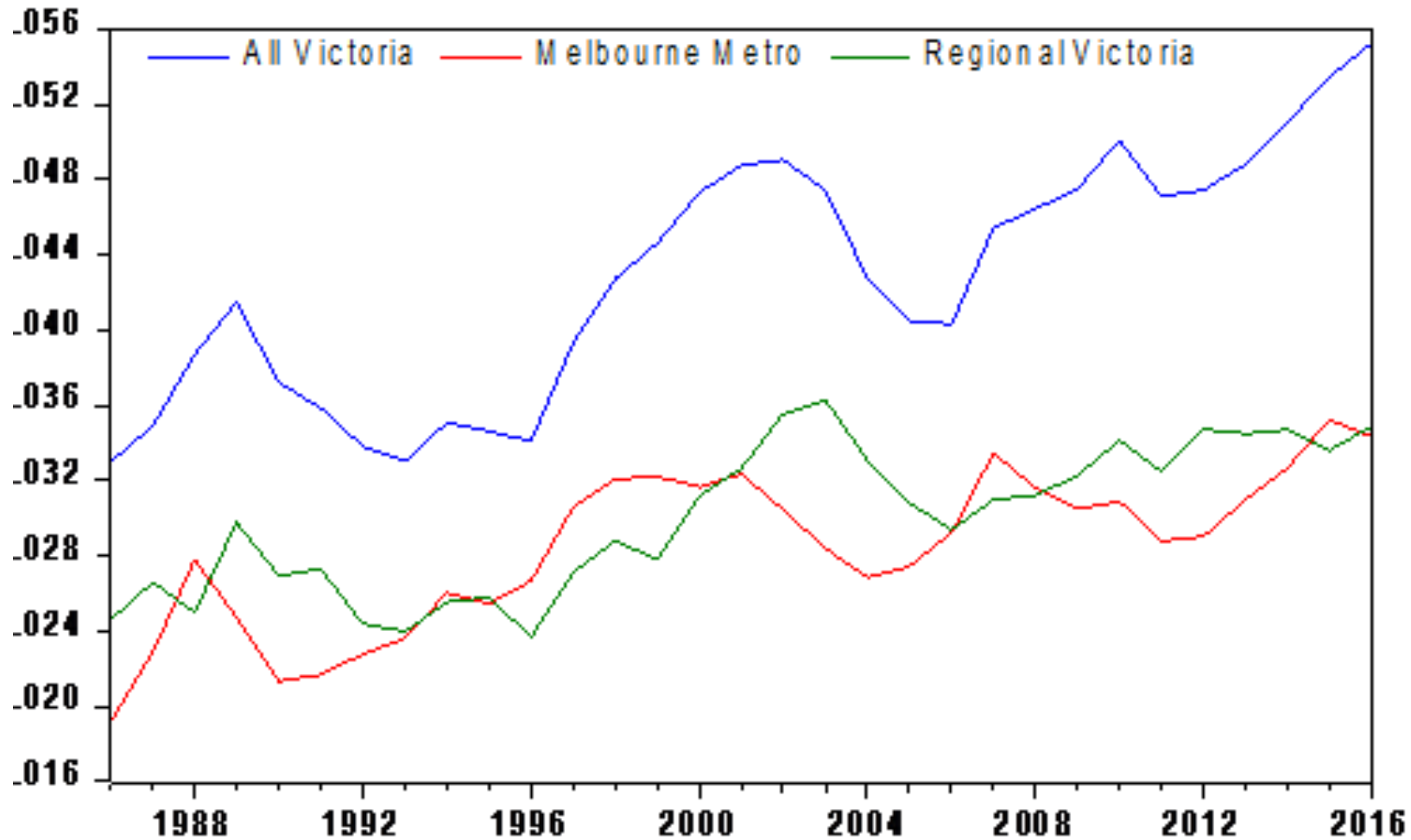
Some preliminary observations

- Initial house price level vs house price growth (Suburbs in Melbourne)



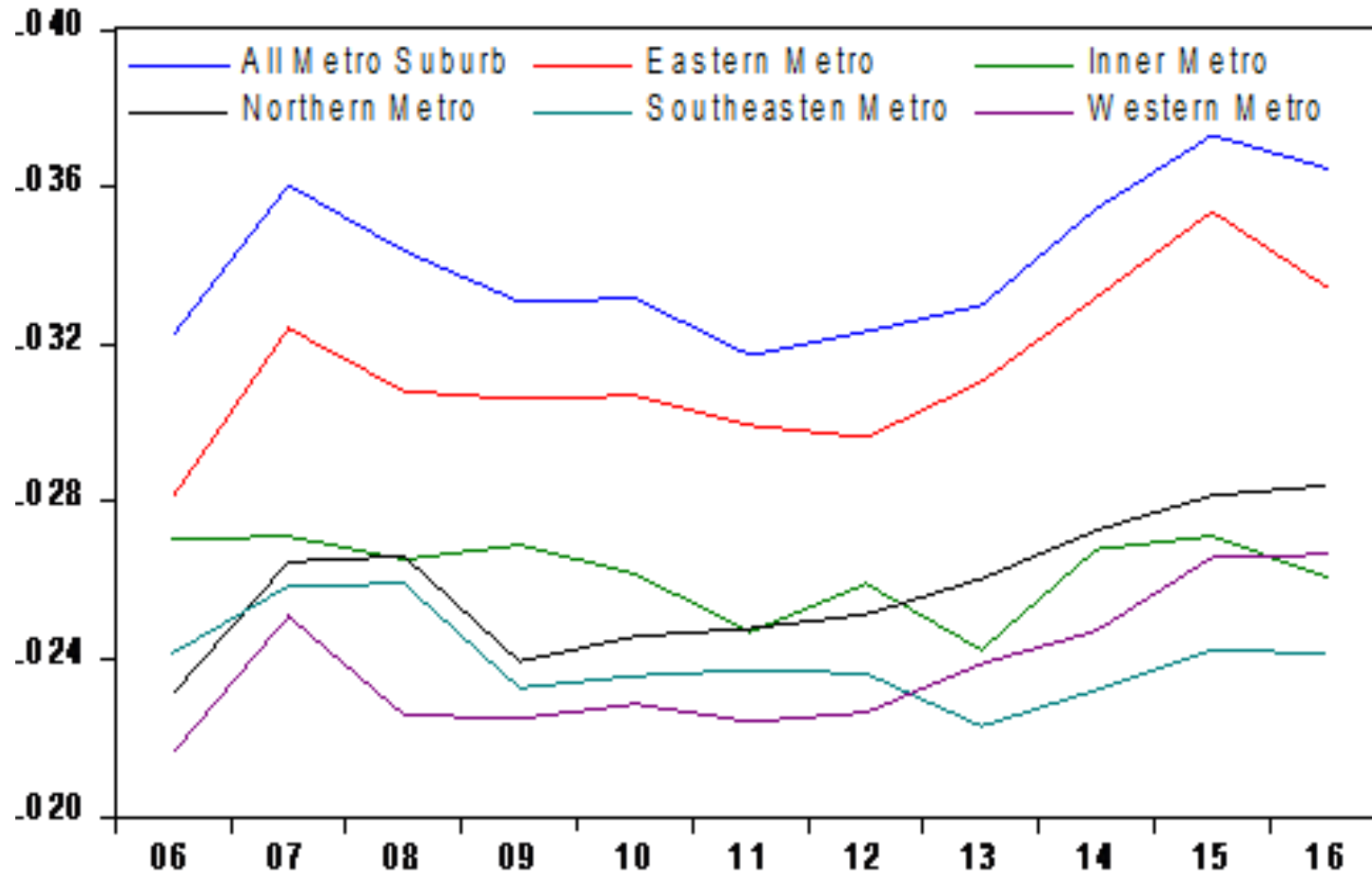
Some preliminary observations

- Log house price—coefficient of variations (Within LGAs in Victoria)



Some preliminary observations

- Log house price—coefficient of variations (Within metropolitan suburbs)

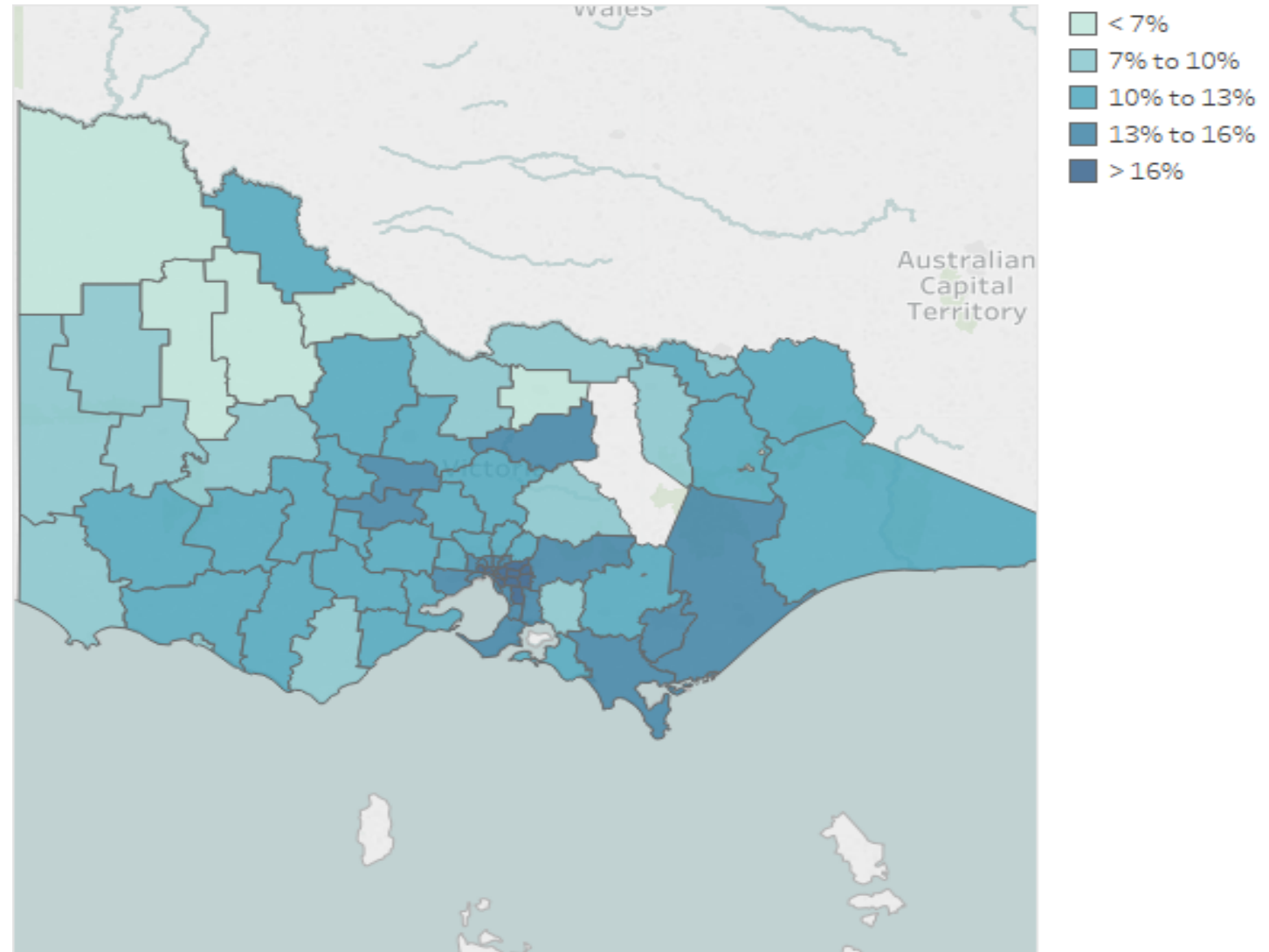


Estimation results of the basic model

	Dependent variable: Average annual house price growth			
	Freestanding houses, 2006–2016	Freestanding houses, 2011–2016	Units/apartments, 2006–2016	Units/apartments, 2011–2016
<i>Log initial house price</i>	-1.457 (0.928)	-1.352 (1.02)	-5.514*** (1.185)	-4.456*** (1.539)
<i>Log initial number of population</i>	0.511*** (0.155)	0.342** (0.165)	0.293 (0.276)	0.345 (0.336)
<i>Initial education and employment index</i>	0.028*** (0.004)	0.025*** (0.004)	0.014*** (0.003)	0.007** (0.003)
<i>Initial economic resource index</i>	-0.025*** (0.003)	-0.016*** (0.003)	-0.003 (0.004)	0.011 (0.004)
<i>Initial rent</i>	0.007 (0.005)	0.014*** (0.004)	0.004 (0.008)	0.016*** (0.006)
<i>Crime rate</i>	-0.066** (0.034)	-0.053** (0.023)	-0.137*** (0.042)	-0.073* (0.043)
<i>Constant</i>	21.764*** (8.231)	8.143 (9.889)	63.168*** (0.042)	34.634** (16.629)
<i>Sample size</i>	387	393	306	311
<i>Adj R²</i>	0.40	0.44	0.13	0.14

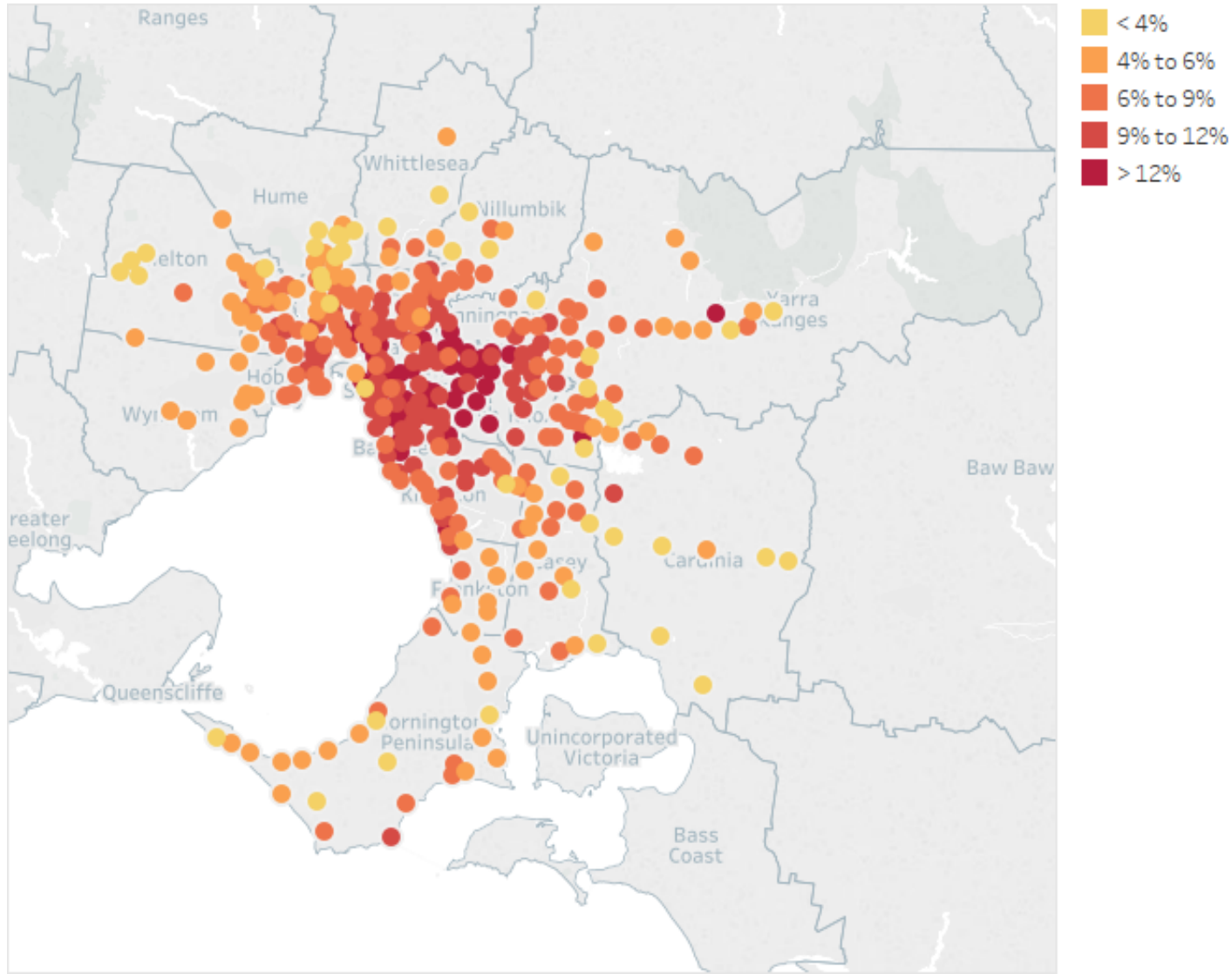
Spatial analysis

- Annual growth (2001–2016 average house price) in Victorian LGAs.



Spatial analysis

- Average annual house price growth (2011–2016) in Melbourne suburbs



Spatial analysis

$$\frac{1}{T} \left[\frac{P_{Ti} - P_{1i}}{P_{1i}} \right] = \alpha + \beta \log(P_{1i}) + \sum_k \theta_k X_{ik} + u_i \quad i = 1, 2, 3, \dots, N$$

- This can be expressed in a simplified way as:

$$y_i = \alpha + \beta p_i + \sum_k \theta_k X_{ik} + u_i$$

or in matrix form, as: $\mathbf{y} = \alpha + \mathbf{p}\beta + \mathbf{X}\boldsymbol{\theta} + \mathbf{u}$

A Spatial Lag model can be specified as:

$$\mathbf{y} = \alpha + \rho \mathbf{W}\mathbf{y} + \mathbf{p}\beta + \mathbf{X}\boldsymbol{\theta} + \mathbf{u}$$

Spatial analysis

$$\mathbf{y} = \alpha + \rho \mathbf{W}\mathbf{y} + \mathbf{p}\beta + \mathbf{X}\boldsymbol{\theta} + \mathbf{u}$$

- where \mathbf{W} is the spatial weight matrix representing the spatial relationship among observations.
- this is an $N \times N$ matrix with elements w_{ij} indicating whether the two suburbs i and j are spatially related.
- The \mathbf{W} matrix is based on the distance between suburbs, where coordinates (longitudes and latitudes) are used to determine the locations and distances between locations.
- each element (w_{ij}) is defined as the inverse of the distance, d_{ij} , if the distance between i and j is less than certain distance band, D , and the value of w_{ij} is set to zero otherwise.
- The diagonal elements of \mathbf{W} are set equal to zero and this matrix is made row-standardised

Spatial analysis

- Spatial Error regression model:

$$\mathbf{y} = \alpha + \mathbf{p}\beta + \mathbf{X}\theta + \mathbf{u}$$

$$\mathbf{u} = \lambda\mathbf{W}\mathbf{u} + \mathbf{e}$$

Or equivalently:

$$\mathbf{y} = \alpha + \mathbf{p}\beta + \mathbf{X}\theta + (\mathbf{I} - \lambda\mathbf{W})^{-1}\mathbf{e}$$

a random shock introduced in a particular suburb will not only affect the house price growth in that suburb, but through the spatial transformation $(\mathbf{I} - \lambda\mathbf{W})^{-1}$, will also impact the growth rates of house prices in other suburbs.

		Dependent variable: Average annual house price growth				
		Growth: 2006–2016		Growth: 2011–2016		
		Spatial lag model	Spatial error model	Spatial lag model	Spatial error model	
Spatial model —estimation results for houses in metropolitan suburbs	<i>Log initial house price</i>	-1.959*** (0.701)	-1.734** (0.764)	-1.543** (0.673)	-1.246* (0.731)	
	ρ	0.965*** (0.034)		0.953*** (0.046)		
	λ		0.958*** (0.042)		0.940*** (0.059)	
	<i>Sample size</i>	387	387	393	393	
	<u>Diagnostic tests for spatial dependence in OLS regression:</u>					
	<i>Lagrange multiplier statistics [p-values]</i>	137.537 [0.000]	112.624 [0.000]	103.946 [0.000]	76.899 [0.000]	
<i>Moran's I statistics [p-values]</i>		15.657 [0.000]		13.115 [0.000]		

Dependent variable: Average annual unit price growth

Growth: 2006–2016

Growth: 2011–2016

Spatial lag
model

Spatial error
model

Spatial lag
model

Spatial error
model

*Log initial house
price*

-5.715***
(0.955)

-6.00***
(0.963)

-4.532***
(1.074)

-4.568***
(1.079)

ρ

0.928***
(0.071)

0.723***
(0.220)

λ

0.933***
(0.066)

0.686***
(0.255)

Sample size

306

306

311

311

Diagnostic tests for spatial dependence in OLS regression:

*Lagrange multiplier
statistics [p-values]*

64.583***
[0.000]

60.683***
[0.000]

10.402***
[0.001]

5.496**
[0.019]

*Moran's I statistics
[p-values]*

11.942***
[0.000]

3.829***
[0.000]

- Spatial model —estimation results for units in metropolitan suburbs

Main Findings and Conclusion

- This study finds evidence of conditional house price convergence in Melbourne, Australia.
- The estimation results suggest about 1.3 to 2% convergence rates for houses, and about 4.5 to 6% convergence rates for units.
- This paper finds a strong neighbourhood effect, implying that house and unit price growth in a suburb affects price growth in neighbouring suburbs positively and significantly.
- It also finds that relatively higher levels of education and more skilled/professional workers are placing upwards pressures on the growth rates of house and unit prices.
- The role of a suburb's economic profile on future house price growth appears to be negative.
- The rental return is found to be important for growth in unit prices, but may not be important for house price growth.
- Population size and the crime rate appears to affect growth in house prices but does not significantly affect unit prices.

•Thank You !