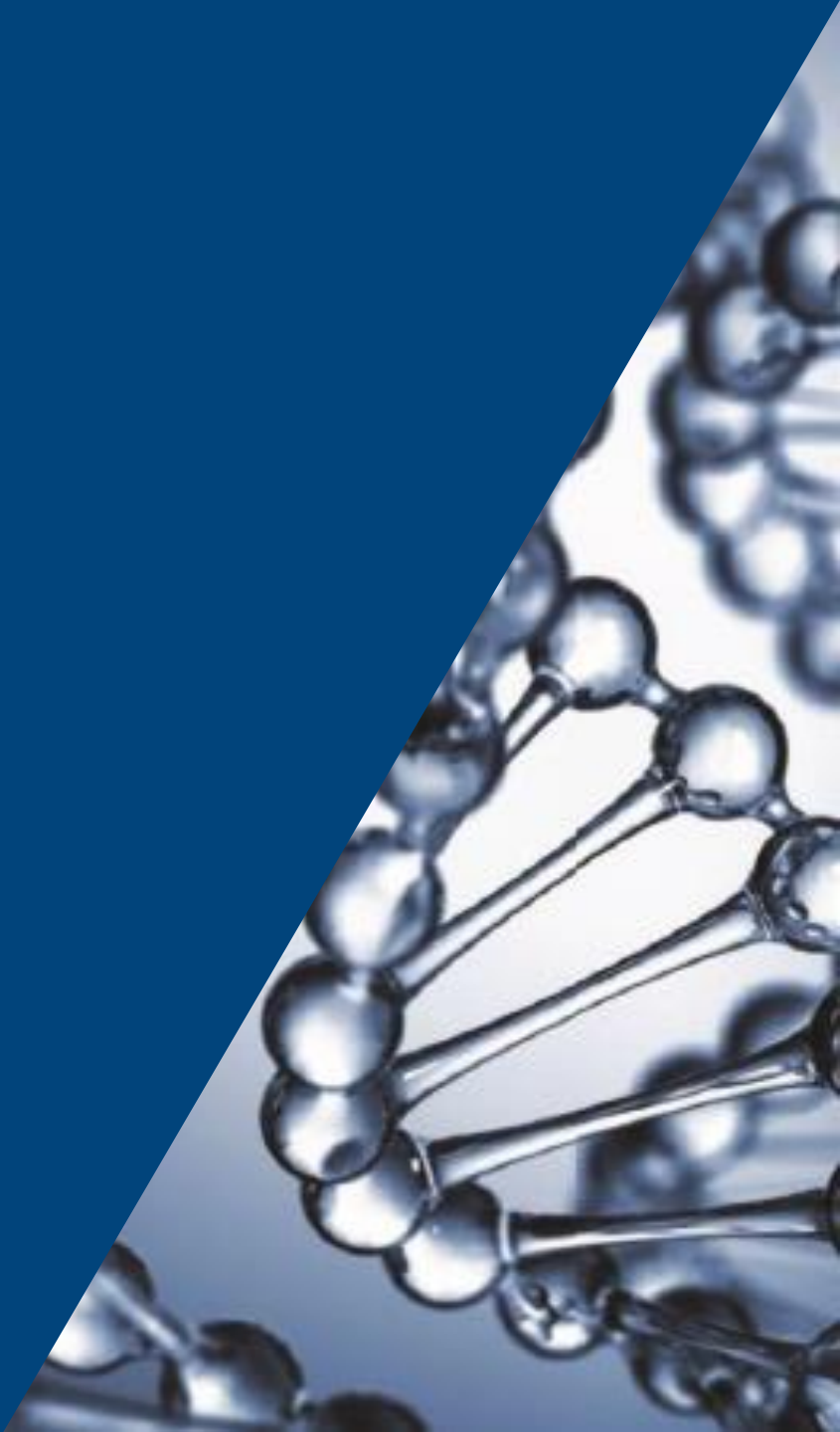


Interest Rates, Local Housing Markets and House Price Over- reactions

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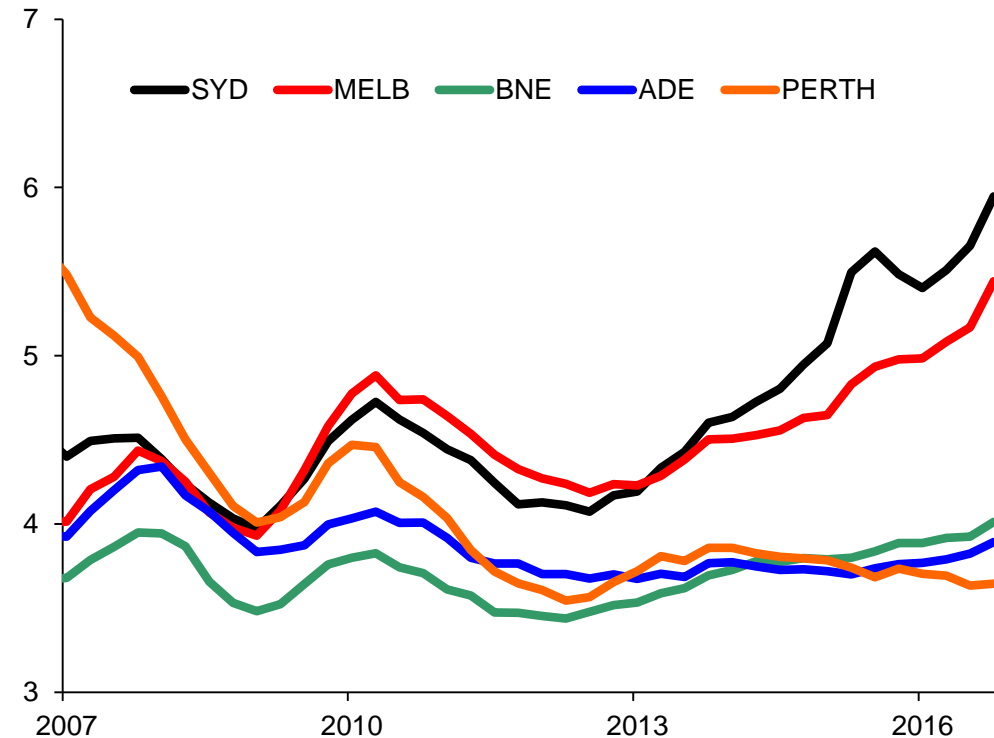
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Motivation

- Link between monetary conditions, mortgage borrowing, and house price appreciation has attracted extensive attention in recent years (Taylor 2007; Bernanke 2010).
- Usually the impact of monetary policy shocks on house prices is relatively small (Del Negro and Otrok, 2007; Glaeser, Gottlieb and Gyourko, 2010).
- However, others observe a relationship between house price booms/busts and interest rates (Taylor, 2007 and 2009; Jordà, Schularick and Taylor, 2015).

- Issue is further complicated by significant housing market differences across cities and regions (Saiz, 2010)



- Broadly, this paper considers how city-specific house price to income ratios respond to changes in the national lending rate.
- We focus, however, on two key questions:
 1. *Is it possible to identify an interest rate threshold below which there is a fundamental shift in the relationship between house price to income ratios and economic fundamentals*
 - Our empirical approach is underpinned by Himmelberg, Mayer and Sinai (2005) who suggest that house prices are theoretically more sensitive to fundamentals when rates are already low.
 - Kuttner (2012) also describes a theoretical ‘over-reaction’ point where house prices tend to over-react to interest rates below this point.
 2. *Does the disaggregation of house price data to the city level assist in the identification of such a threshold?*

Framework and Data



Our formal model specification, which accommodates (but does not enforce) an over-reaction point, is:

$$h_t = \beta_0 r_{t-1} + \lambda t + G(r_t; \gamma, c) [\Pi_1(L) h_t + X_t \beta_1] + \\ (1 - G(r_t; \gamma, c)) [\Pi_2(L) h_t + X_t \beta_2] + e_t \\ e_t \sim MVN(0, \Sigma)$$

where:

- (i) h_t is a vector of house price to income ratios for each of the n major cities in Australia
- (ii) r_t is the lending rate for housing loans.
- (iii) X_t is a matrix of demographic and economic regressors for each city
- (iv) $G(r_t; \gamma, c)$ is a state transition function

- The framework assumes that there are two regimes that depend on the level of interest rates, with the probability of regime 1 given by

$$G(r_t; \gamma, c) = 1 - (1 + \exp\{-\gamma(r_t - c)\})^{-1}, \quad \gamma > 0, c \geq 0$$

- The potentially non-linear effects of interest rates on housing dynamics are determined by the threshold c and the smoothness parameter γ .
- As r_t falls below c the transition function G rises above 0.5 (such that the first regime is more probable than the second regime), with γ determining the speed at which G approaches unity.
- In other words, we potentially have low(er) and high(er) interest rate regimes.

- Conditional on the transition function parameters γ, c we can obtain the remaining parameters ψ as the solution to an OLS problem.
- Consequently, we can estimate the entire set of model parameters by solving the following non-linear least squares problem for γ, c

$$\min_{\gamma, c} \sum_{i=1}^n \sum_{t=p+1}^T (h_{it} - z'_{it}\psi)^2$$

where p is the number of lags in the model.

- With normal errors, this yields the maximum likelihood parameter estimates. But even in the absence of normality we still obtain quasi maximum likelihood estimates (Potscher and Prucha, 1997; Leybourne, Newbold and Vougas, 1998).

Data

- (1) The house price measure h_t is constructed on a quarterly basis for Sydney, Melbourne, Brisbane, Adelaide and Perth (December 1995 to June 2015)

$$h_{it} = \frac{\text{dwelling price}_{it}}{\text{hhold disposable income}_{it}}$$

where dwelling prices are from CoreLogic-RP Data.

- (2) r_t is the housing lending rate based on the RBA's standard variable mortgage rate measure

- (3) x_{it} contains:

- the current growth rate of the resident population in the state, g_{it}
- the state-specific unemployment rate, u_{it-1}
- household sentiment data regarding whether it is a good time to buy a dwelling, s_{it-1}
- Local housing supply, q_{it-2}
- the city's inflation based on CPI, π_{it-1}

Findings

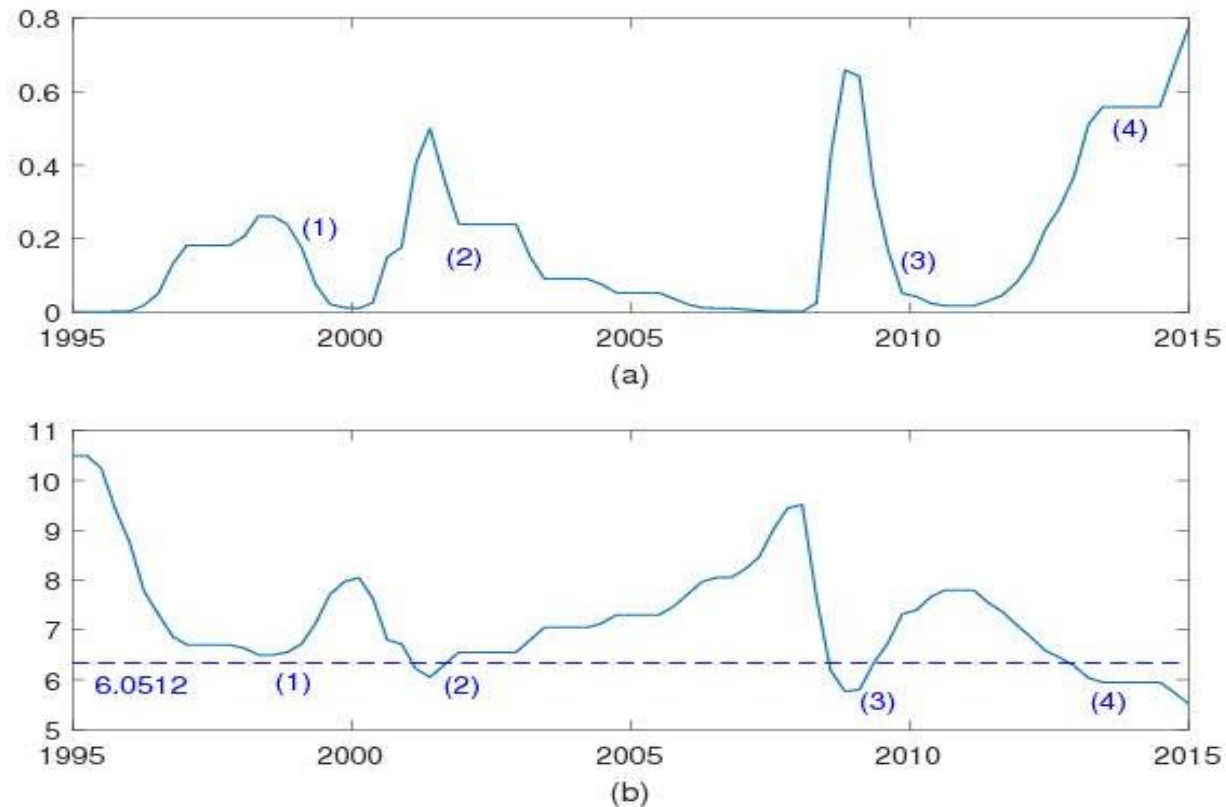
Parameter estimates across regimes

	High-rate regime	Low-rate regime
Pop. growth rate	0.0109	0.0278
Unemployment rate	-0.0390	0.0953
Housing sentiment	0.0008***	-0.0024**
Supply	-0.0685**	-0.2137**
Inflation	-0.0123	0.7827**
<u>Interest rates</u>		
Sydney		-0.3288***
Melbourne		-0.2835***
Brisbane		-0.2451***
Adelaide		-0.2556***
Perth		-0.2585***

What happens to the spill-over dynamics when interest rates fall below the threshold?

- It is evident that, just as the impact of economic and demographic conditions vary, the spillover dynamics (Π_1, Π_2) change noticeably as G increases.
- Importantly, housing dynamics are stable when Π_2 prevails (viz. $r > c$).
- However, when Π_1 prevails (such that $r < c$) with the VAR system becoming *unstable*.
- This result continues to hold even if we estimate the model with detrended h_t or if we add additional variables to X_t .

What do the transition probabilities look like?



(a) time-varying transition function; (b) bank lending rates (the dashed line is estimated threshold c). The four numbered episodes are: (1) Asian Financial Crisis; (2) the 2001 US recession; (3) the GFC; and (4) the ZLB period.

What happens if aggregate data are used?

- There seems to be a threshold at 7.02 per cent which is considerably higher than the 6.05 per cent estimated with aggregate data.
- It is difficult to meaningfully associated this threshold with periods of sharp changes affordability.
- The persistence parameters are less than unity in both regimes (0.63 and 0.51 for the first and second regimes respectively) indicating that the stability/instability dichotomy no longer continues to be applicable
- Aggregation appears to overstate the level of stability in the house price to income ratio.
 - House prices can never become unstable under the aggregate model.

Implication 1 – Is regime uncertainty costly?

- In order to compute the cost of housing regime uncertainty, we compute the lending rate target r^* that is consistent with stable long-run house price to income ratios.
- Involves solving for the lowest lending rate for which the roots of

$$\det (I_n - \Pi(1)z - \Pi(2)z^2) = 0$$

$$\Pi(L) = G(r; \gamma, c) \Pi_1(L) + (1 - G(r; \gamma, c)) \Pi_2(L)$$

all lie outside the unit circle.

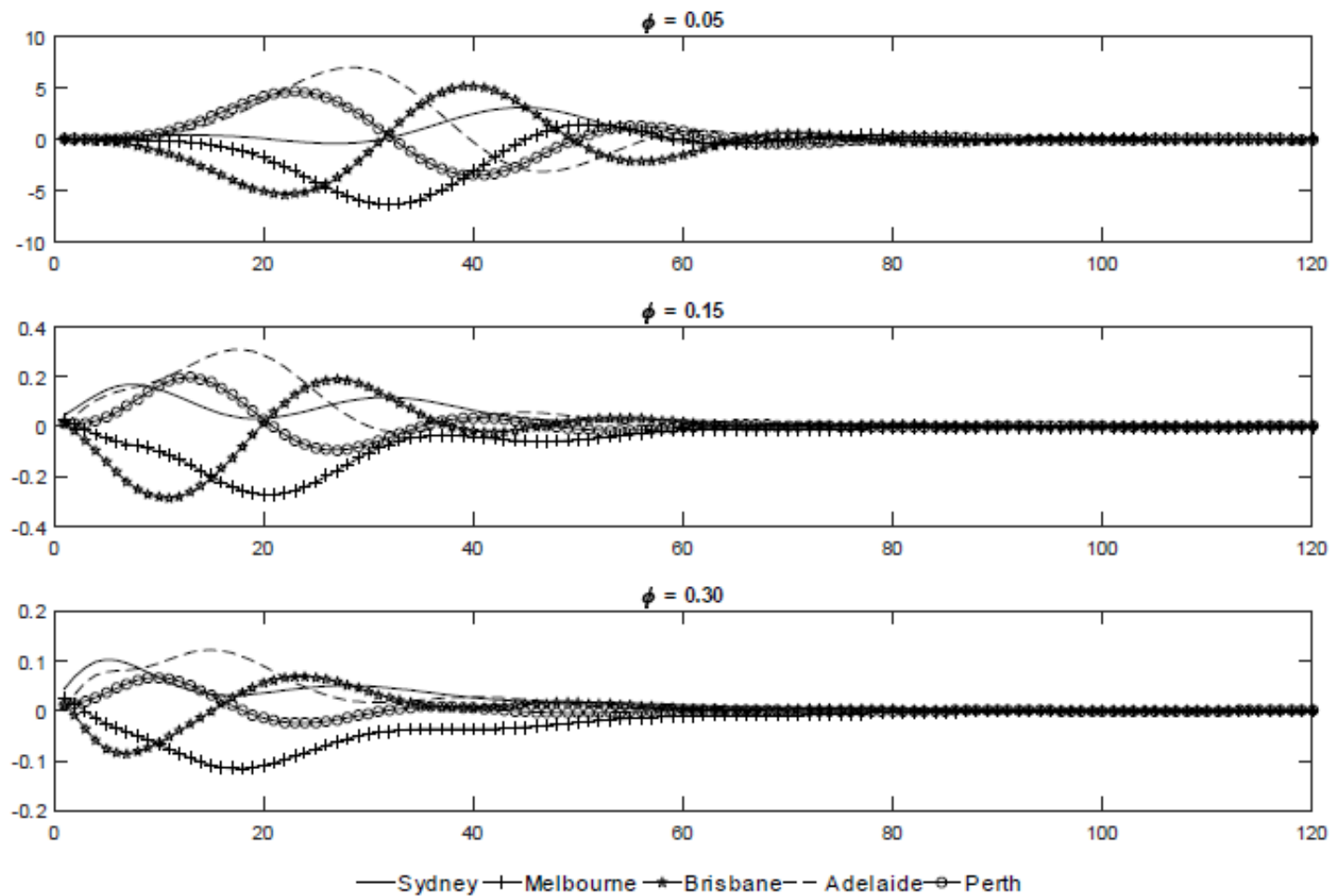
- Note, if there is no regime uncertainty ($\gamma \rightarrow \infty$) then $r^* = c$
- We find that $r^* = 6.82$ such that the cost (or risk-premium) of inter-city regime uncertainty ($r^* - c$) is at least an estimated 77 basis points.

Implication 2 – What role do banks play in ensuring stability?

- (i) Assume simply that bank lending rates converge to the target r^* at rate ϕ

$$r_t = (1 - \phi)r_{t-1} + \phi r^* + \varepsilon_t$$

- (ii) We estimate a set of city specific VARs for $(r_t; X_t)$ in order to obtain estimates of X_t conditional on the path for r_t .
- (iii) We determine impulse responses using the smooth threshold model specified in this paper conditional on a range of different interest rate starting points and lending rate rigidities ϕ
- (iv) The responses seem sensible – slow convergence to r^* increasing housing instability
- (v) Importantly, initial interest rate becomes relatively unimportant when $\phi \approx 0.4$ (historically, $\phi \approx 0.15$).



Conclusion

1. Our results suggest that house price dynamics appear to depend non-linearly on interest rates.
2. In particular, we observe an interest rate threshold that represents a tipping point for instability in local house price dynamics.
3. The use of regional data is important and has a significant impact on results.
4. The presence of unobserved stable and unstable regimes appears to be costly in terms of target lending rates.
5. Bank lending rate rigidities seem to be more important than the lending rate observed at the time of a shock.