House Prices and Macroprudential Policy in an Estimated DSGE Model of New Zealand

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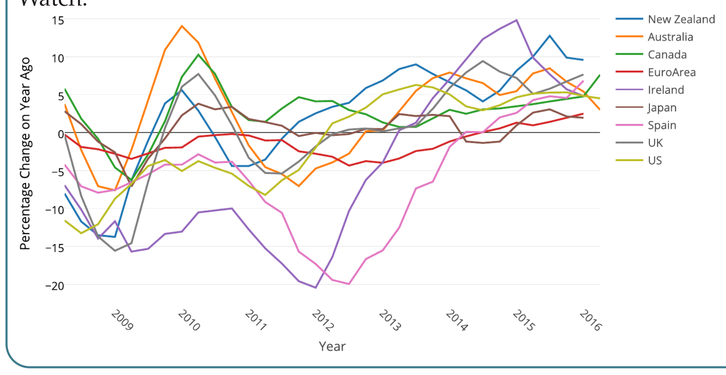
Abstract

We analyse the effects of macroprudential and monetary policies and their interactions using an estimated dynamic stochastic general equilibrium (DSGE) model tailored to New Zealand. We find that the main historical drivers of house prices are shocks specific to the housing sector. While our estimates show that monetary policy has large spillover effects on house prices, it does not appear to have been a major driver of house prices in New Zealand. We consider macroprudential policies, including the loan-to-value restrictions that have been implemented in New Zealand. We find that loan-to-value restrictions reduce house prices with negligible effects on consumer prices, suggesting that they can be used without derailing monetary policy. We estimate that the loan-to-value restrictions imposed in New Zealand in 2013 reduced house prices by 3.8 per cent and that greater forward guidance on their duration would have made them more effective.

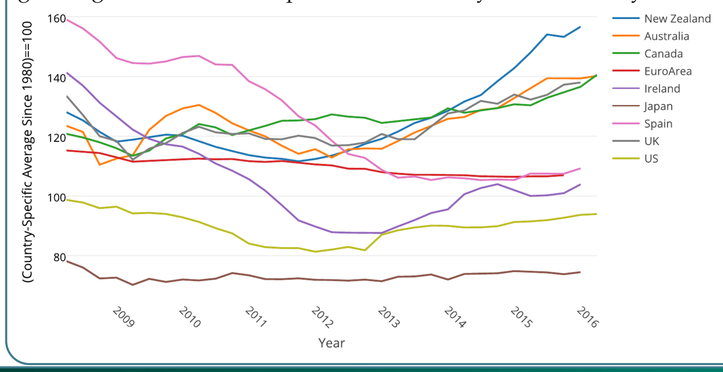
Annual Growth Rate of Real House Prices

House prices in New Zealand grew at an annual rate in 2016 Q1 of over 10 per cent, the second highest rate globally according to the IMF Global Housing Watch.



Price-to-Income Ratio

The ratio of house prices to income in New Zealand grew by 30 per cent between 2010 and 2016. Judged on the ratio of house prices to income, New Zealand's house price increases have been truly exceptional, growing faster over this period than in any other country in the OECD.



Macroprudential Policy in New Zealand

- In late 2013 house prices were rising at 10.2 per cent and loans with a loan-to-value ratio over 80 per cent were making up an increasing share of the total new loans, approaching 25 per cent.
- RBNZ limited High-LTV-ratio (> 80 per cent) home loans to at most a 10 per cent share of the total new loans originated by banks.
- October 2016 revision of LTV ratio: lending to investors with an LTV ratio over 60 per cent was limited to 5 per cent of new loans to investors, and lending to owner-occupiers with an LTV ratio over 80 per cent was limited to 10 per cent of new loans to owner-occupiers.
- As of late 2016, the house price increases continue to be over 10 per cent and the high-LTV-ratio restrictions appear to be likely to remain in place.

DSGE Model: Description

- Small open economy New Keynesian model with rich macro-housing linkages estimated using Bayesian techniques.
- Goal: Shed light on which shocks were responsible for the performance of the New Zealand economy both before and after the global financial crisis.
- Goal: Perform various counterfactual exercises in relation to macroprudential policy questions.
- Households: borrowers and savers with different discount factors. Derive utility from consuming non-durable goods, housing and leisure.
- Patient households (savers) purchase a positive amount of saving assets and do not borrow.
- Impatient households are the only borrowers in the economy subject to a collateral constraint.
- Two types of monopolistically-competitive intermediate goods firms: produce tradable non-durable consumption goods and non-tradable housing (durable) goods.
  - Both intermediate producers set prices in a staggered fashion allowing for price indexation to the previous period (Calvo pricing with both forward and backward-looking components).
- Two types of perfectly competitive retailers produce final goods using intermediate goods an input.
- Central Bank steering the nominal interest rate based on a rule responding to movements in CPI inflation and output growth:

$$\frac{R_t}{R} = \left(\frac{R_{t-1}}{R}\right)^{\rho_r} \left[\left(\frac{\Pi_{C,t}}{\Pi_C}\right)^{\phi_\pi} \left(\frac{Y_t}{Y_{t-1}}\right)^{\phi_y}\right]^{1-\rho_r}$$

Tables

Table 1: Variance Decomposition

variable	horizon	σ_{a_C}	σ_{a_D}	σ_m	σ^*	σ_{μ_C}	σ_{μ_D}	σ_γ
y	1	0.41	0.00	0.03	0.00	0.06	0.46	0.03
	2	0.34	0.18	0.02	0.01	0.03	0.39	0.02
	4	0.39	0.26	0.01	0.01	0.02	0.29	0.02
	8	0.45	0.30	0.01	0.01	0.02	0.21	0.01
	∞	0.55	0.29	0.01	0.00	0.01	0.14	0.01
R	1	0.14	0.13	0.00	0.34	0.08	0.17	0.15
	2	0.07	0.07	0.00	0.24	0.22	0.27	0.12
	4	0.05	0.07	0.00	0.18	0.28	0.32	0.10
	8	0.06	0.13	0.00	0.16	0.26	0.31	0.09
	∞	0.10	0.18	0.00	0.14	0.23	0.27	0.08
π_C	1	0.02	0.10	0.21	0.33	0.13	0.02	0.19
	2	0.02	0.09	0.17	0.28	0.17	0.11	0.16
	4	0.03	0.11	0.16	0.26	0.16	0.12	0.15
	8	0.04	0.12	0.16	0.26	0.17	0.12	0.14
	∞	0.04	0.13	0.15	0.25	0.17	0.12	0.14
π_D	1	0.04	0.69	0.05	0.02	0.06	0.09	0.05
	2	0.04	0.67	0.05	0.02	0.06	0.09	0.06
	4	0.04	0.64	0.05	0.03	0.07	0.10	0.06
	8	0.04	0.63	0.05	0.03	0.08	0.11	0.07
	∞	0.04	0.64	0.05	0.03	0.08	0.11	0.06
C	1	0.11	0.06	0.02	0.31	0.29	0.07	0.14
	2	0.16	0.09	0.01	0.20	0.33	0.10	0.12
	4	0.26	0.14	0.01	0.12	0.29	0.09	0.09
	8	0.40	0.18	0.01	0.08	0.20	0.06	0.07
	∞	0.58	0.15	0.00	0.05	0.13	0.04	0.04
i_D	1	0.12	0.00	0.01	0.01	0.01	0.62	0.23
	2	0.06	0.20	0.01	0.01	0.06	0.54	0.12
	4	0.04	0.34	0.00	0.01	0.08	0.44	0.09
	8	0.03	0.47	0.00	0.00	0.06	0.35	0.07
	∞	0.03	0.53	0.00	0.00	0.06	0.31	0.06

Table 2: Calibrated parameters

Parameter	Value	Definition
β_s	0.99	Discount factor of savers
β_b	0.98	Discount factor of borrowers
ϵ_C	6	Elasticity of substitution (non-durable varieties)
ϵ_D	6	Elasticity of substitution (durable varieties)
δ	0.01	Depreciation rate of residential stock
$1-\chi$	0.57	LTV ratio
γ	0.2	Share of housing in utility
τ	0.05	Property tax rate
α	0.5	Degree of openness
ζ	1	Elasticity of substitution (foreign countries goods)
η	1	Elasticity of substitution (domestic and foreign goods)

Table 3: Structural Parameter Estimates

Parameter	Distribution	Baseline		$\omega \sim U(0,1)$	
		Posterior Mean	90 % Interval	Posterior Mean	90 % Interval
σ	$\Gamma(1,0.1)$	1.13	(0.99 ; 1.27)	1.99	(1.75 2.24)
ϕ	$\Gamma(1,0.1)$	2.16	(2.00 ; 2.33)	2.15	(1.98 2.31)
h	$\beta(0.4,0.05)$	0.19	(0.15 ; 0.23)	0.47	(0.39 0.54)
ω	$\beta(0.35,0.05)$	0.19	(0.15 ; 0.23)	0.64	(0.62 0.66)
ρ_r	$\beta(0.5,0.1)$	0.78	(0.74 ; 0.82)	0.63	(0.57 0.69)
ϕ_π	$\Gamma(2,0.1)$	2.03	(1.88 ; 2.19)	1.99	(1.83 2.15)
ϕ_y	$\Gamma(0.2,0.1)$	0.27	(0.11 ; 0.42)	0.64	(0.52 0.76)
θ_C	$\beta(0.75,0.05)$	0.65	(0.59 ; 0.71)	0.93	(0.91 0.94)
θ_D	$\beta(0.65,0.05)$	0.43	(0.37 ; 0.48)	0.86	(0.83 0.89)
ι_C	$\beta(0.5,0.1)$	0.35	(0.21 ; 0.48)	0.12	(0.07 0.17)
ι_D	$\beta(0.5,0.1)$	0.27	(0.14 ; 0.39)	0.04	(0.02 0.05)
ρ_{a_C}	$\beta(0.5,0.1)$	0.96	(0.94 ; 0.97)	0.69	(0.65 0.73)
ρ_{a_D}	$\beta(0.5,0.1)$	0.50	(0.42 ; 0.58)	0.50	(0.42 0.58)
ρ^*	$\beta(0.5,0.1)$	0.66	(0.60 ; 0.73)	0.65	(0.55 0.75)
ρ_{μ_C}	$\beta(0.5,0.1)$	0.43	(0.36 ; 0.50)	0.31	(0.25 0.37)
ρ_{μ_D}	$\beta(0.5,0.1)$	0.57	(0.50 ; 0.64)	0.14	(0.10 0.18)
ρ_γ	$\beta(0.5,0.1)$	0.75	(0.69 ; 0.81)	0.93	(0.91 0.95)
Log data density:			-1336		-1543

Table 4: Shock Standard Deviation Estimates

Parameter	Distribution	Baseline		$\omega \sim U(0,1)$	
		Posterior Mean	90 % Interval	Posterior Mean	90 % Interval
σ_{a_C}	$\Gamma^{-1}(1,2)$	2.22	(1.96,2.49)	2.18	(2.18, 2.85)
σ_{a_D}	$\Gamma^{-1}(1,2)$	3.58	(3.02,4.14)	11.89	(11.89, 19.57)
σ_m	$\Gamma^{-1}(1,2)$	0.24	(0.20,0.27)	0.31	(0.31, 0.44)
σ_{μ_C}	$\Gamma^{-1}(1,2)$	1.34	(1.13,1.54)	0.70	(0.70, 1.21)
σ_{μ_D}	$\Gamma^{-1}(1,2)$	1.52	(1.17,1.86)	0.44	(0.44, 0.64)
σ^*	$\Gamma^{-1}(1,2)$	4.27	(3.15,5.36)	2.52	(2.52, 3.40)
σ_γ	$\Gamma^{-1}(1,2)$	5.42	(4.67,6.15)	5.62	(5.62, 7.75)

Table 5: Relative Standard Deviations

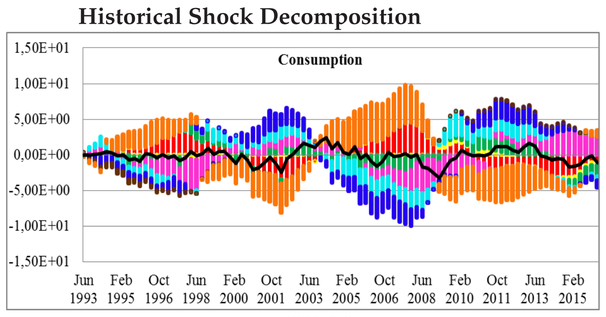
Variable	Relative St. Deviations: Data	Model
Output	1.00	1.00
Interest rate	0.41	0.13
CPI inflation	0.47	0.17
Property price inflation	1.94	0.48
Consumption	1.02	0.69
Housing investment	8.33	18.72
Employment	1.49	0.54

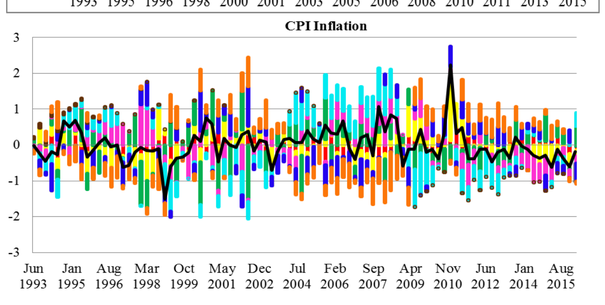
Table 6: Correlations

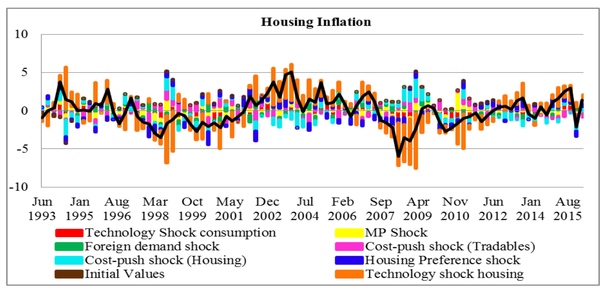
Correlations	Data	Model
y, π_D	0.03	0.11
y, i_D	0.61	0.61
R, π_C	0.31	0.57
R, C	-0.22	-0.59
y, C	0.50	0.31
π_C, C	-0.14	-0.31
π_D, R	-0.11	0.26
π_C, i_D	0.33	0.10
i_D, n	0.53	0.88

Graphs

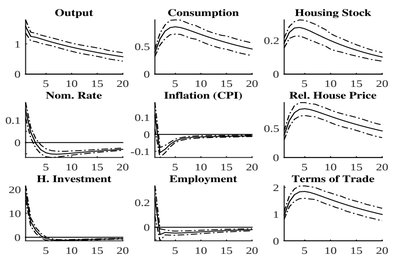
Historical Shock Decomposition



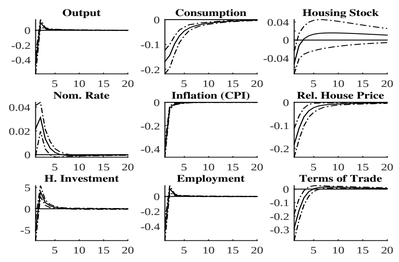




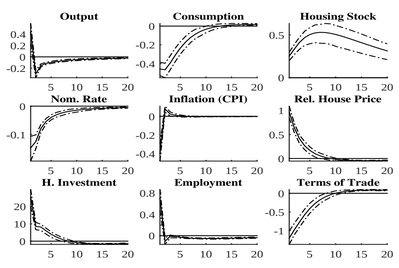
IRFs to a Technology Shock in the Housing Industry



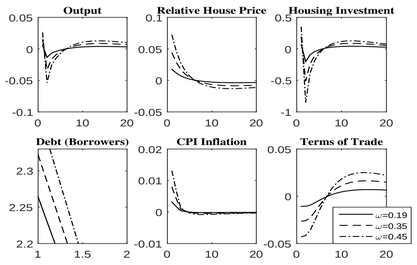
IRFs to a Contractionary Monetary Policy Shock



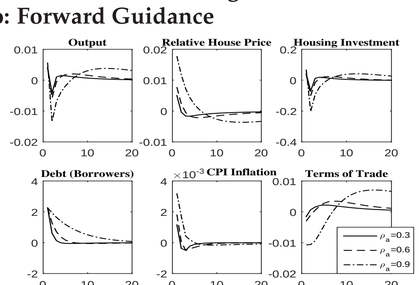
IRFs to a Housing Preference Shock



IRFs of a Percentage Point Increase in the LTV Ratio



IRFs of a One-Percentage-Point Increase in the LTV Ratio: Forward Guidance



Results

- Historical drivers of house prices in New Zealand - mostly shocks specific to the housing sector.
- Monetary policy has large spillover effects on house prices - notwithstanding, it does not appear to have been a major driver of house prices in New Zealand.
- Macroprudential policies have large impacts on house prices but only a small effect on consumer prices - their use does not derail the use of monetary policy.
- We estimate that the impact of the LTV ratio restrictions imposed in New Zealand reduced house prices by 3.8 per cent.
- Clearer guidance from the Reserve Bank of New Zealand on the duration of the LTV ratio restrictions – forward guidance on macroprudential policy – would have led them to have a greater effect on house prices.
- LTV ratio restrictions provide a useful macroprudential tool in situations when controlling house prices is a goal of economic policy.