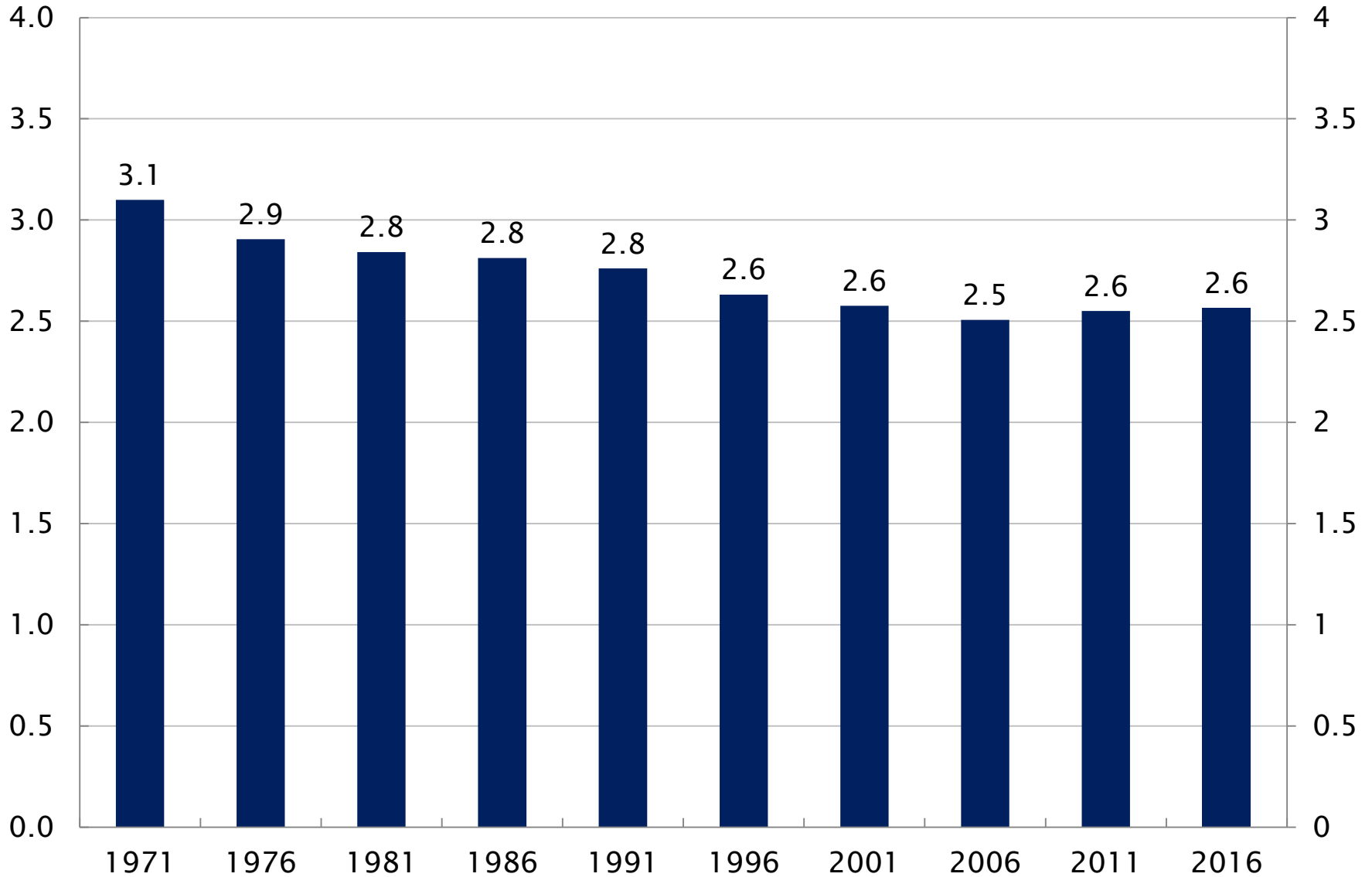
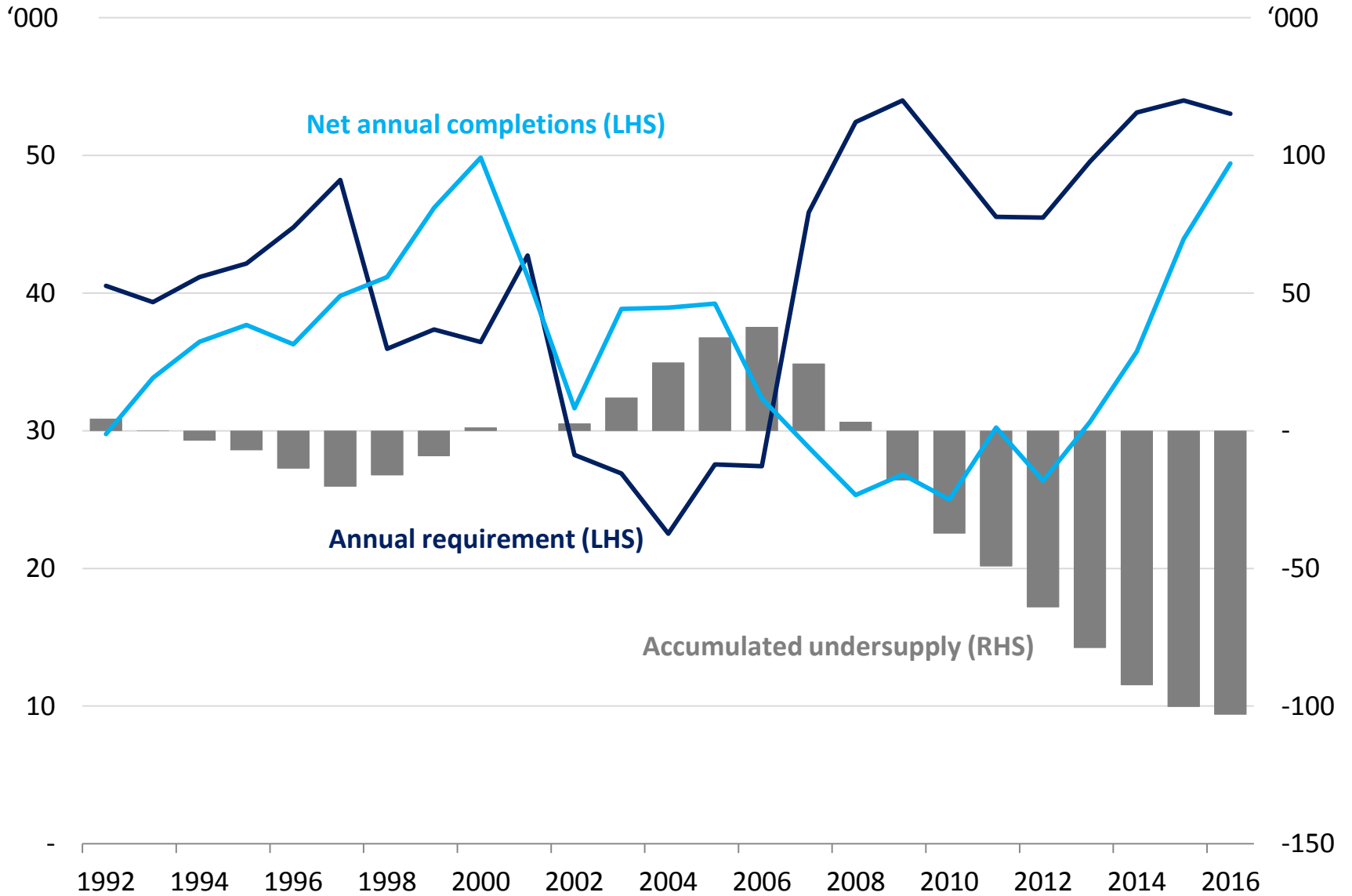


Housing Prices and Migration Flows

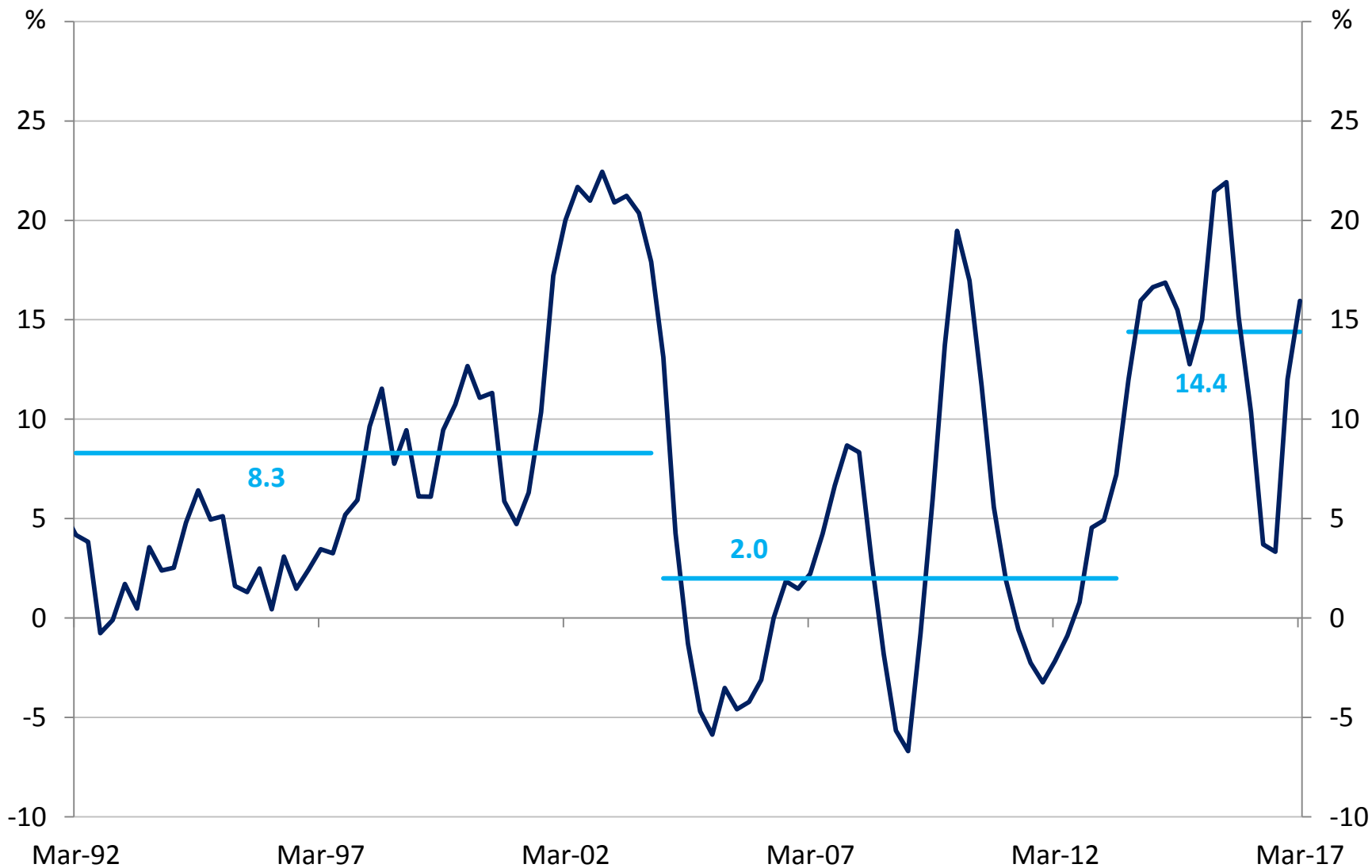
Ratio of People Per Dwelling



NSW Accumulated Undersupply



Established house price growth: Sydney



Key Policy Questions

- How much can a single jurisdiction in Australia affect its own housing prices by acting, in isolation, to improve its own housing supply?
- How do changes in the pace of national net in-migration to Australia affect housing prices, and how might this vary across States?

Presentation Structure

- Model overview
- Modelling results
 - Housing supply shock scenarios
 - Net overseas migration shock scenario
- Conclusions

The Model

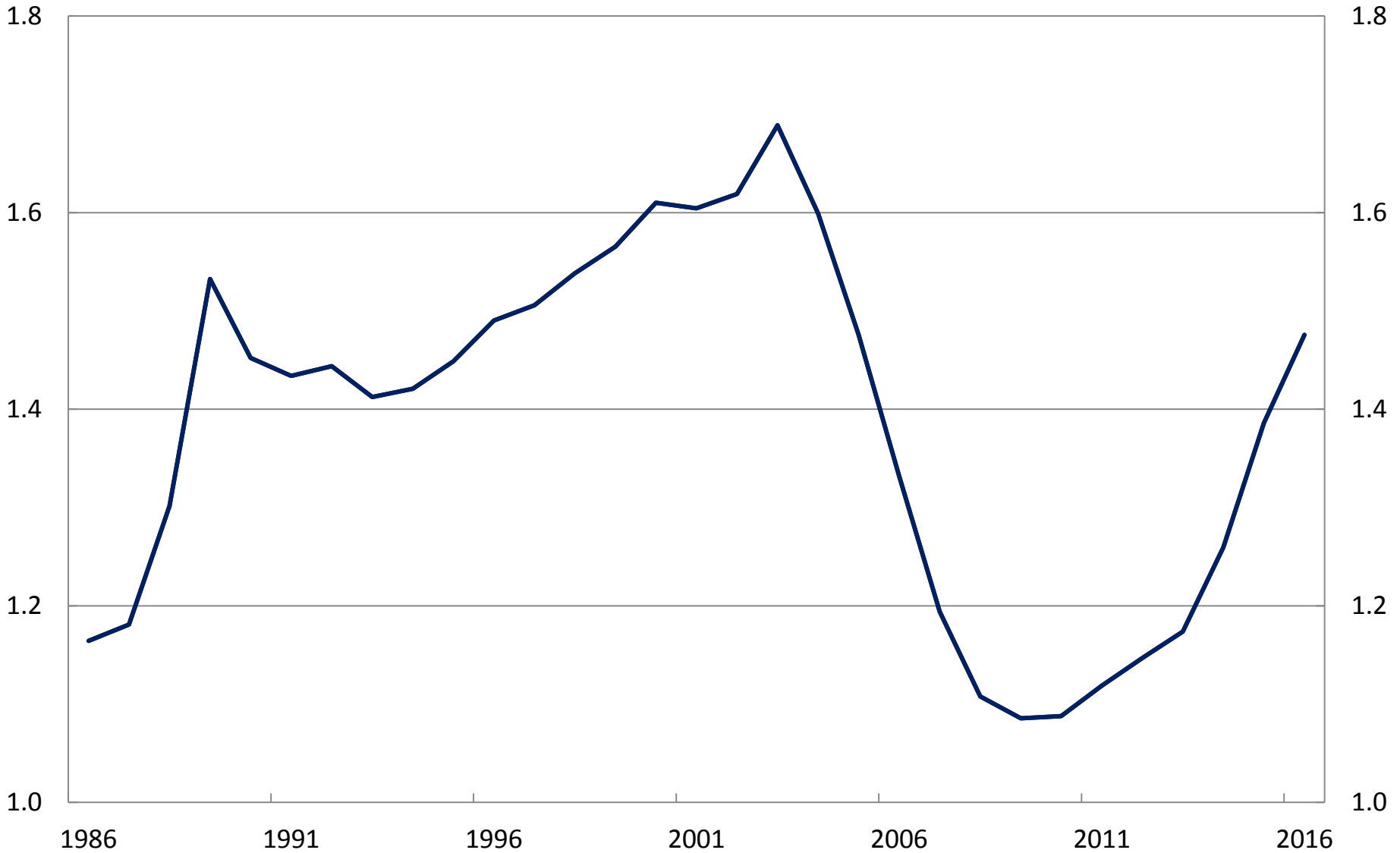
- Large two-region – NSW and Rest of Australia (RoA) – cohort component demographic model, overlaid with a housing and migration flows module
- Annual frequency, for generating projections over 40 years (to capture demographic echoes of migration or other changes)
- Lots of identities – but only four key behavioural equations

Estimated Behavioural Equations

- Relative housing price equation
- Net Overseas Migration (NOM) share equation
(NOM to NSW as share of total NOM)
- Net Interstate Migration (NIM) share equation
(NIM to NSW as share of total NSW population)
- Australian housing price growth equation

Relative Housing Prices

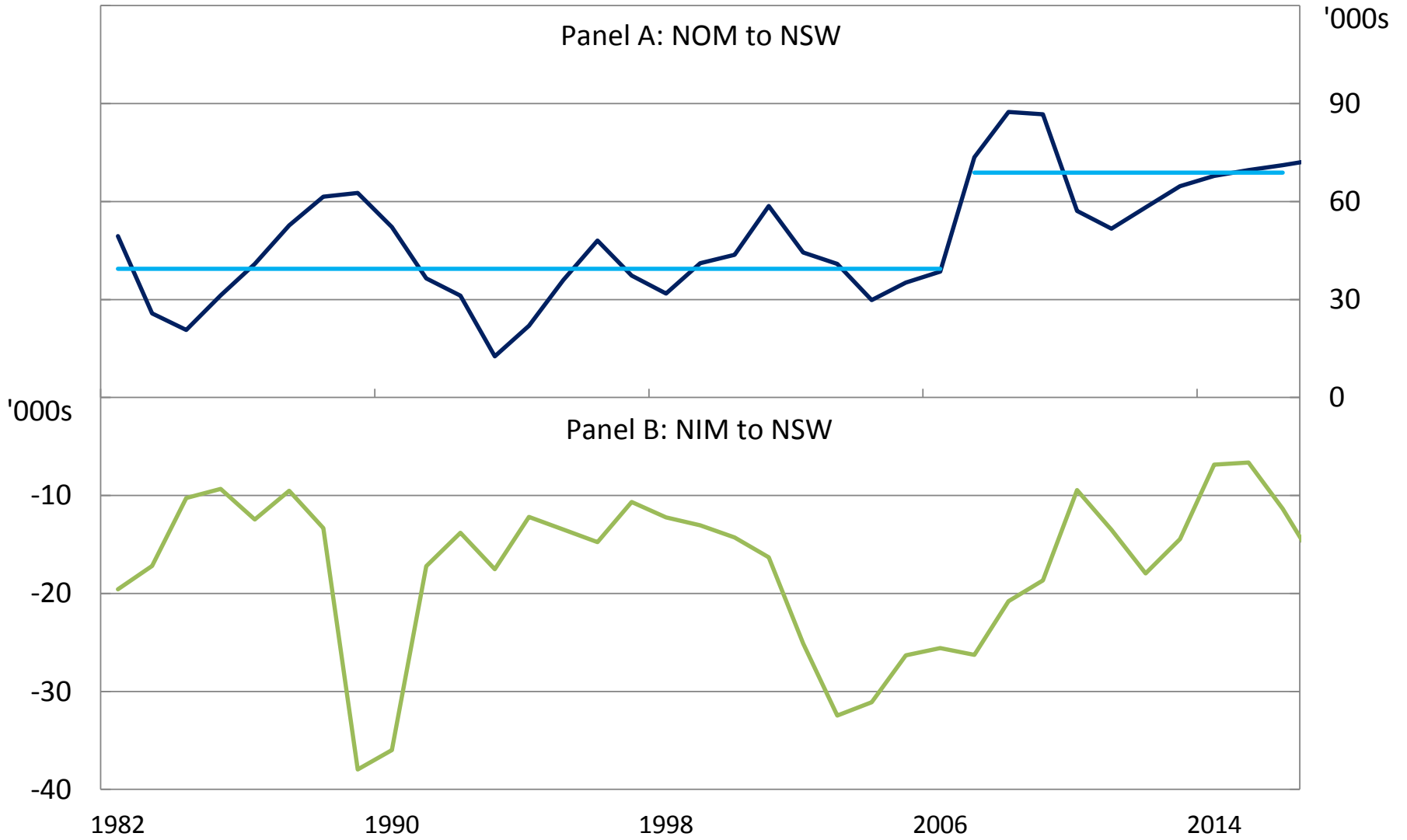
New South Wales Vs. Rest of Australia



Relative Housing Price Equation

- Key explanators
 - Relative under-/over-supply of housing in NSW vs the RoA
 - Annual changes in the NSW to RoA population ratio
 - Relative earnings in NSW vs the RoA

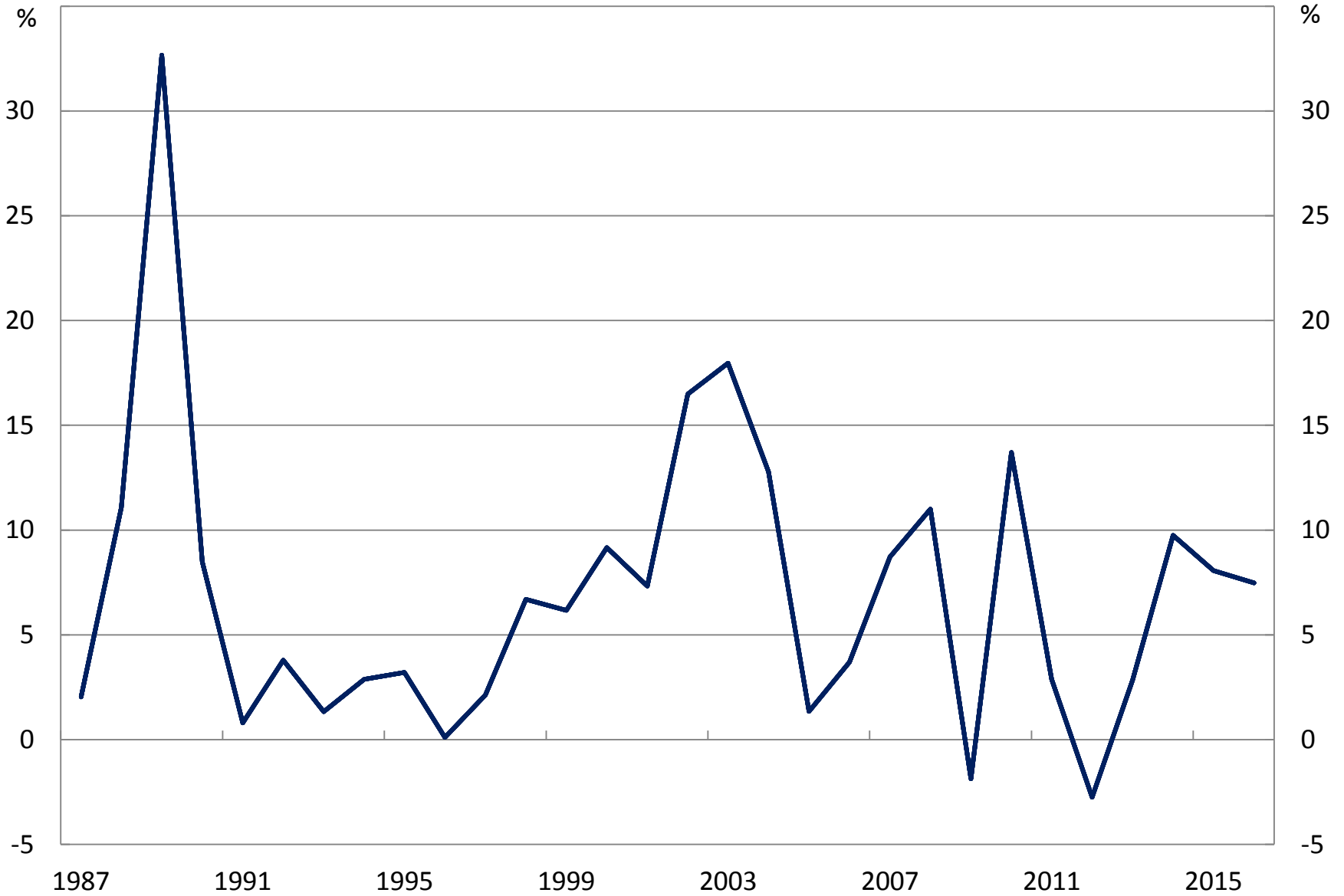
NOM and NIM to NSW in Thousands of Persons



NSW NOM and NIM Share Equations

- Key explanators
 - The unemployment rate differential between NSW and the RoA
 - Annual changes in mining investment as a share of GDP
 - Relative housing prices in NSW vs the RoA
 - Relative earnings in NSW vs the RoA (NOM share equation only)

Australian Housing Price Growth

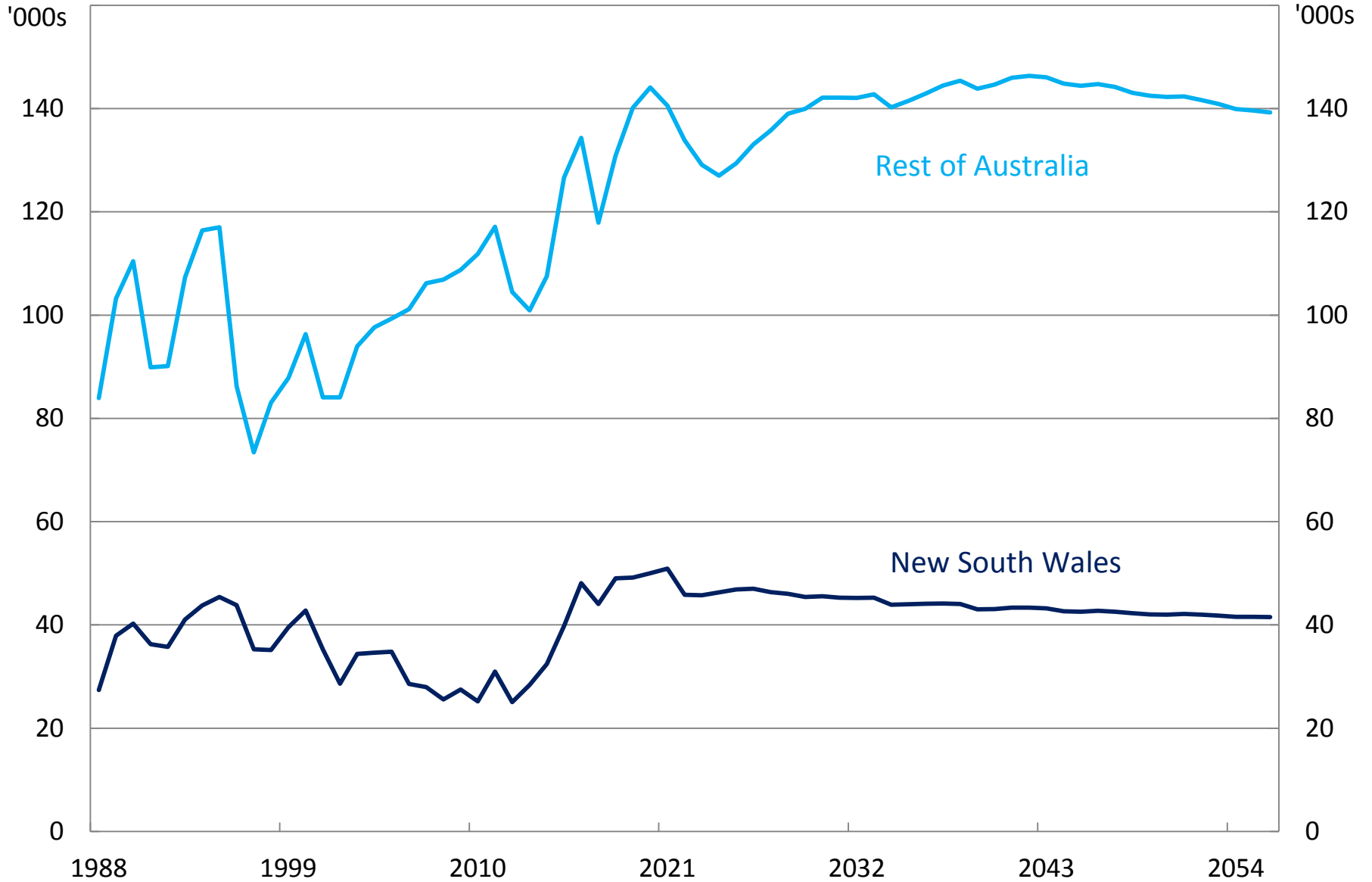


Australian Housing Price Growth Equation

- Key explanators
 - Required ratio of mortgage payments to household disposable income for a new mortgage (error-correction-type term)
 - Level and changes in national housing under-/over-supply per capita
 - Real variable mortgage interest rates
 - Simple GFC dummy

Model Results

Chart 3.1: Annual NSW and RoA Housing Supply Profiles



Scenario A

Increase of 5,000 p.a. to NSW
Housing Supply

Chart 3.5: Impact of an Increase in Annual NSW Housing Supply
 Response to a permanent 5,000 p.a. increase

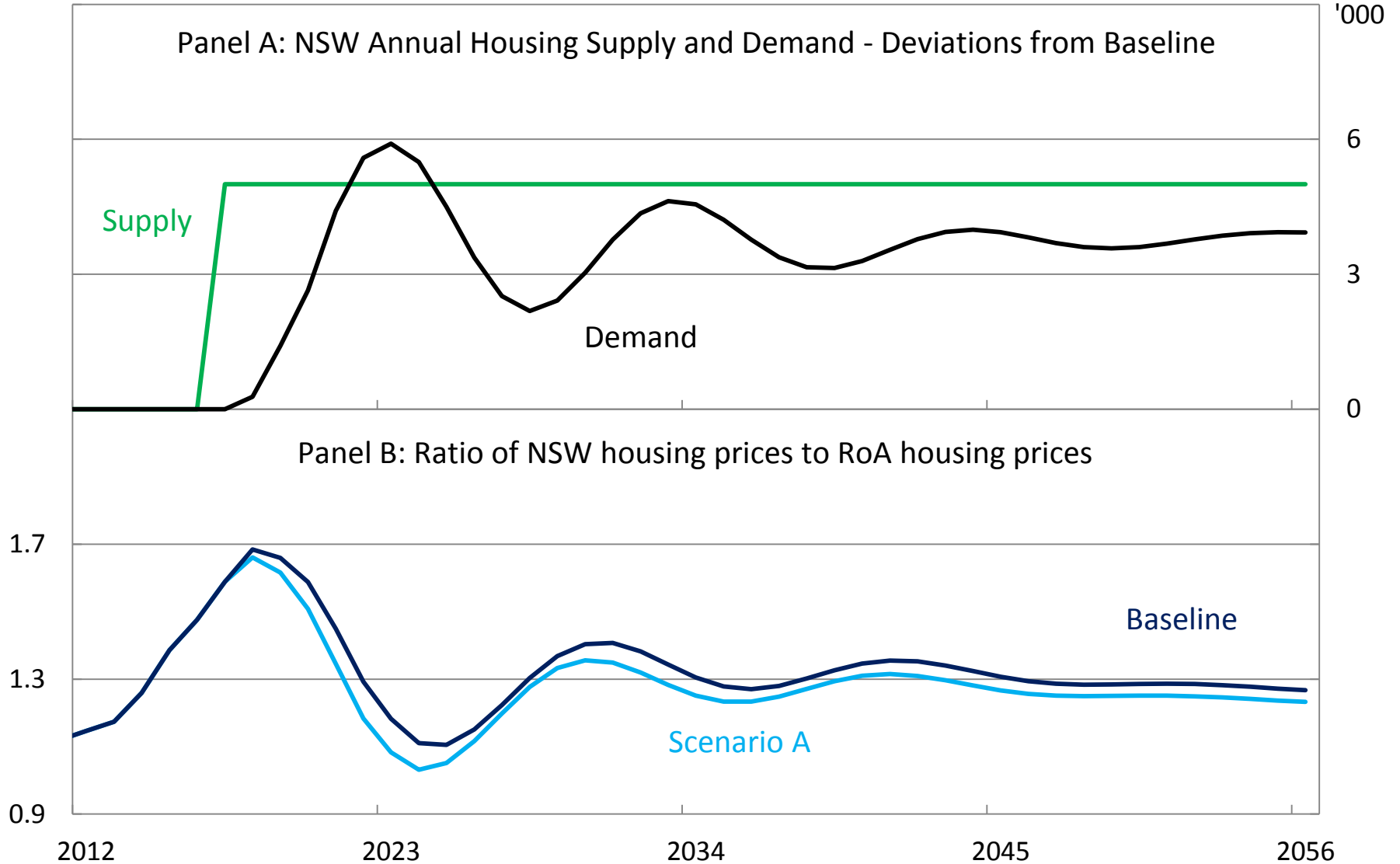


Chart 3.6: Impact of Increase in Annual NSW Housing Supply
Response to a permanent 5,000 p.a. increase

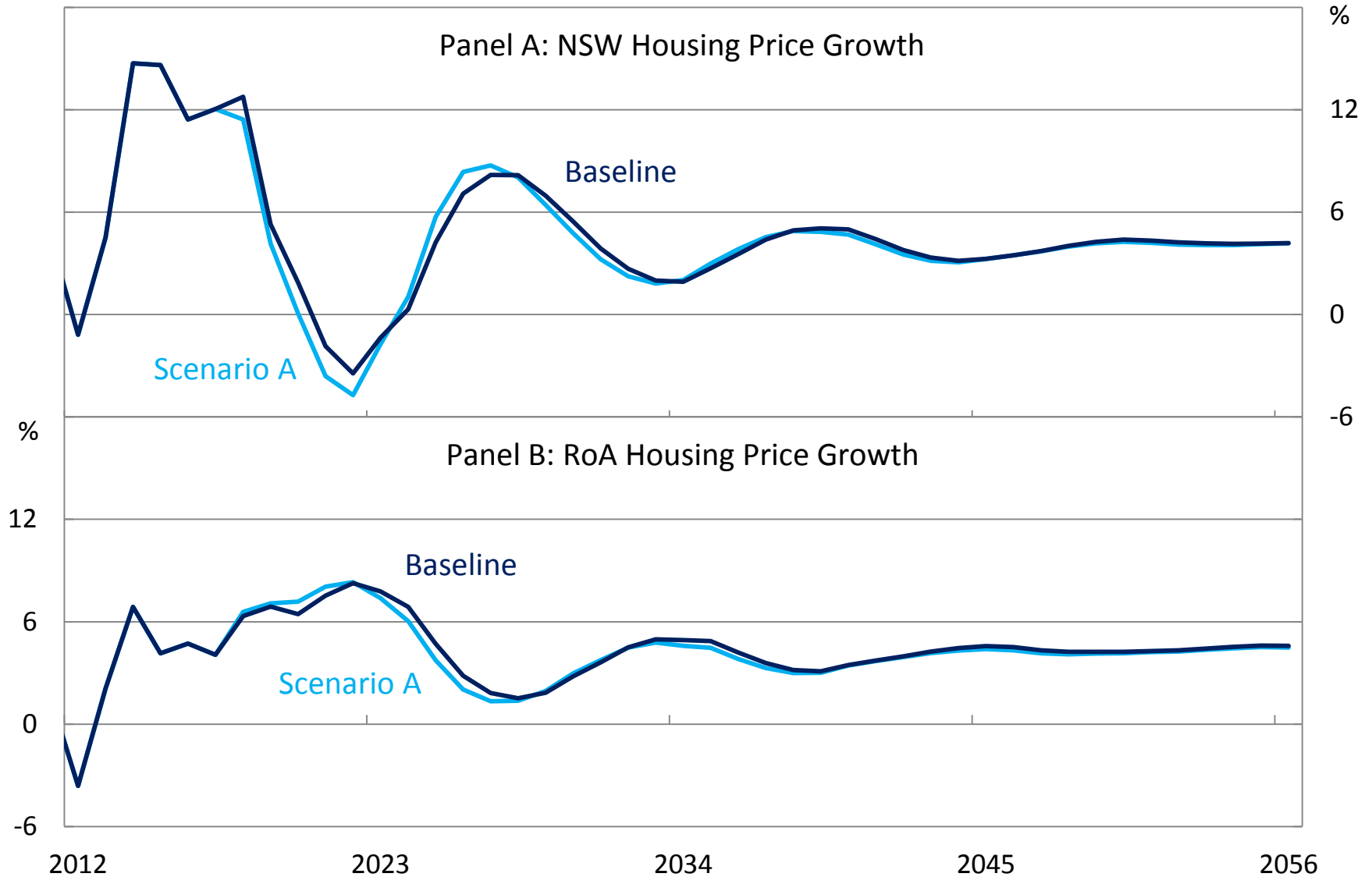


Chart 3.7: NSW Housing Supply and Demand under Scenario A
Deviations from baseline, with demand changes disaggregated by source

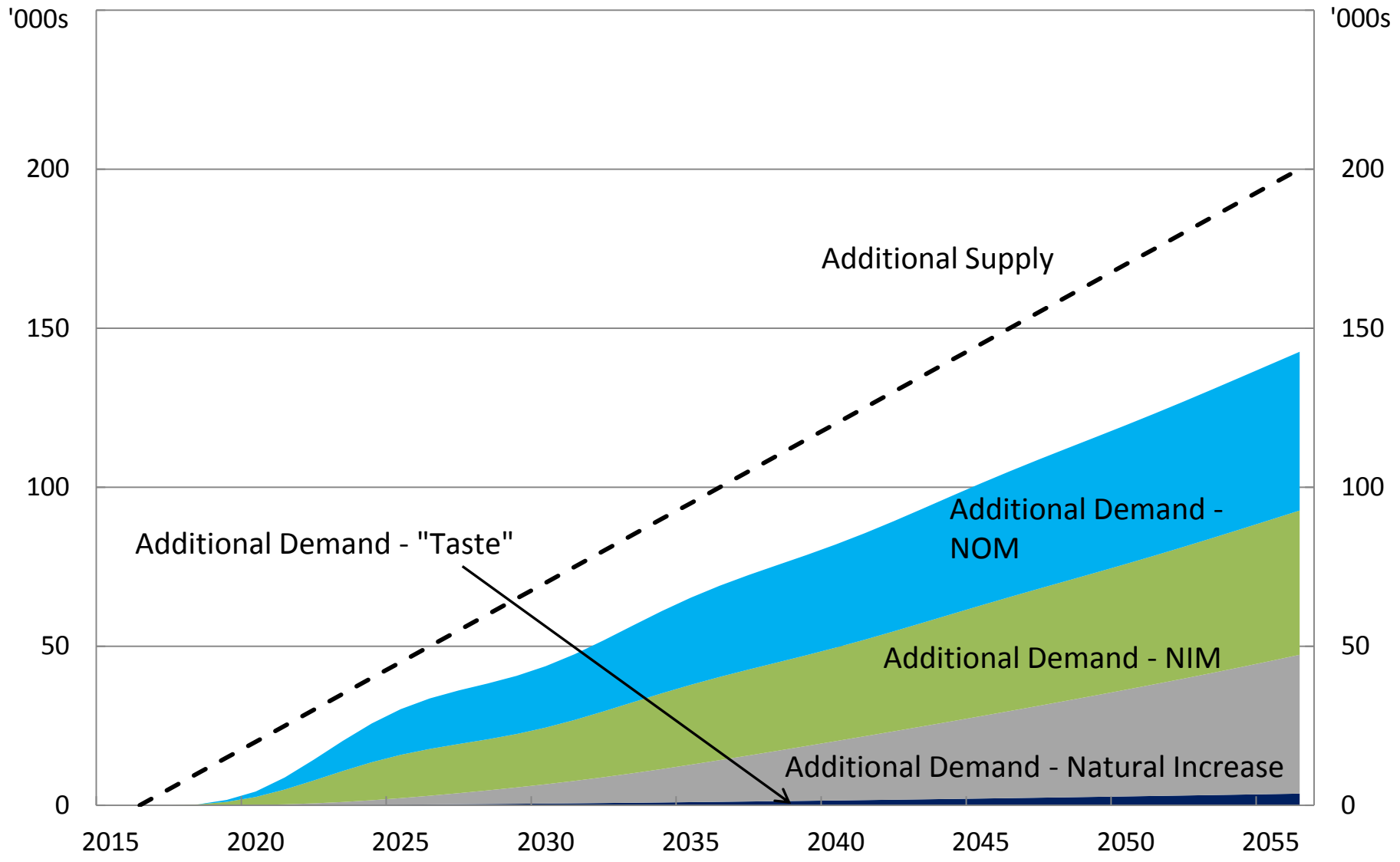


Table 3.1 – Impact of a Sustained Boost to Annual NSW Housing Supply
Deviations of Key Indicators from Baseline for a 5,000 p.a. Supply Increase

Indicator	Impact at Given Forecast Horizon			
	Percentage change relative to baseline, unless otherwise stated			
	2-year	5-year	10-year	40-year
<i>Relative Housing Prices</i> (NSW versus the RoA)	-1.4	-7.1	-2.5	-2.6
<i>Housing Price Growth (a)</i>				
Australia	-0.4	-0.3	-0.2	-0.1
NSW	-1.3	-1.7	1.2	0.0
RoA	0.2	0.5	-0.8	-0.1
<i>Housing Price Level</i>				
Australia	-0.4	-1.3	-2.2	-5.4
NSW	-1.2	-5.7	-3.9	-7.2
RoA	0.2	1.6	-1.4	-4.7
<i>Annual Net In-Migration (b)</i>				
Australia	0.0	0.0	0.0	0.0
NSW	0.7	10.6	5.9	4.6
RoA	-0.7	-10.6	-5.9	-4.6
<i>Housing Under-/Over-Supply (c)</i>				
Australia (d)	10.0	25.3	51.1	203.3
NSW	9.7	16.0	16.2	57.2
RoA	0.3	9.3	34.9	146.0
<i>Population</i>				
Australia	0.0	0.0	0.0	0.0
NSW	0.0	0.3	0.9	2.9
RoA	0.0	-0.1	-0.4	-1.1

(a) Change relative to baseline measured in percentage points.

(b) Change relative to baseline measured in thousands of persons.

(c) Change relative to baseline measured in thousands of houses, rather than in percentage terms. A positive number indicates a reduction in under-supply (or increase in over-supply).

(d) Note that although the total supply increase nationwide in Scenario A, relative to baseline, is exactly 200,000 over the 40-year forecast horizon, the Australia-wide change in housing under-/over-supply can differ from this figure (albeit only in a very minor way), even though total net overseas migration to Australia is the same in both cases. Primarily, this reflects that the model's projected equilibrium levels of housing stock per capita are slightly different for NSW versus the RoA (always very modestly higher in the latter). As a result, differing population flows between the two regions, in Scenario A versus the baseline, will alter the model's assessed level of equilibrium housing demand Australia-wide.

Scenario B

15,000 p.a. Increase to National Housing Supply
(5,000 p.a. in NSW, 10,000 p.a. in the RoA)

Chart 3.8: NOM and NIM to NSW under Scenarios A and B
Deviations from baseline

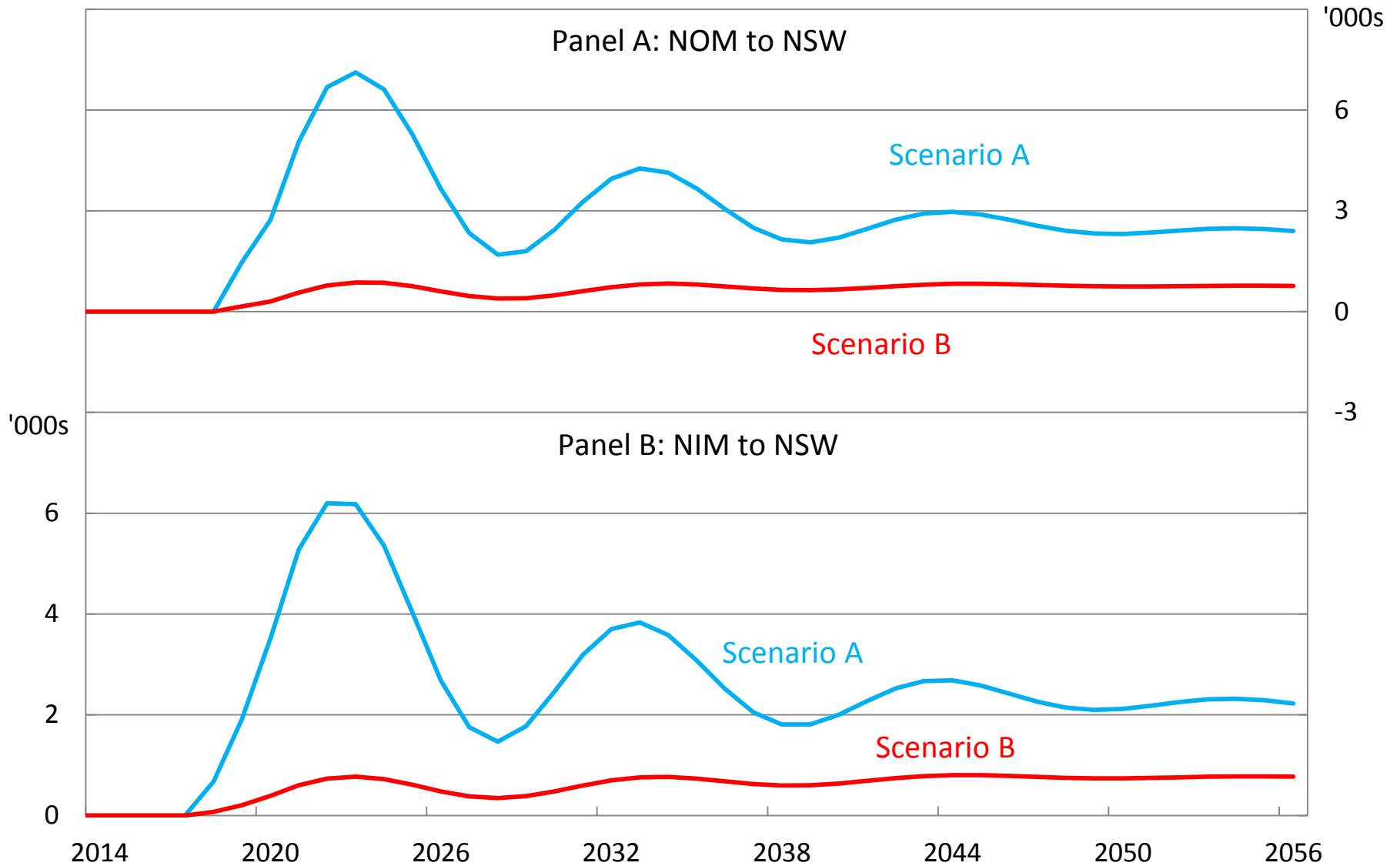
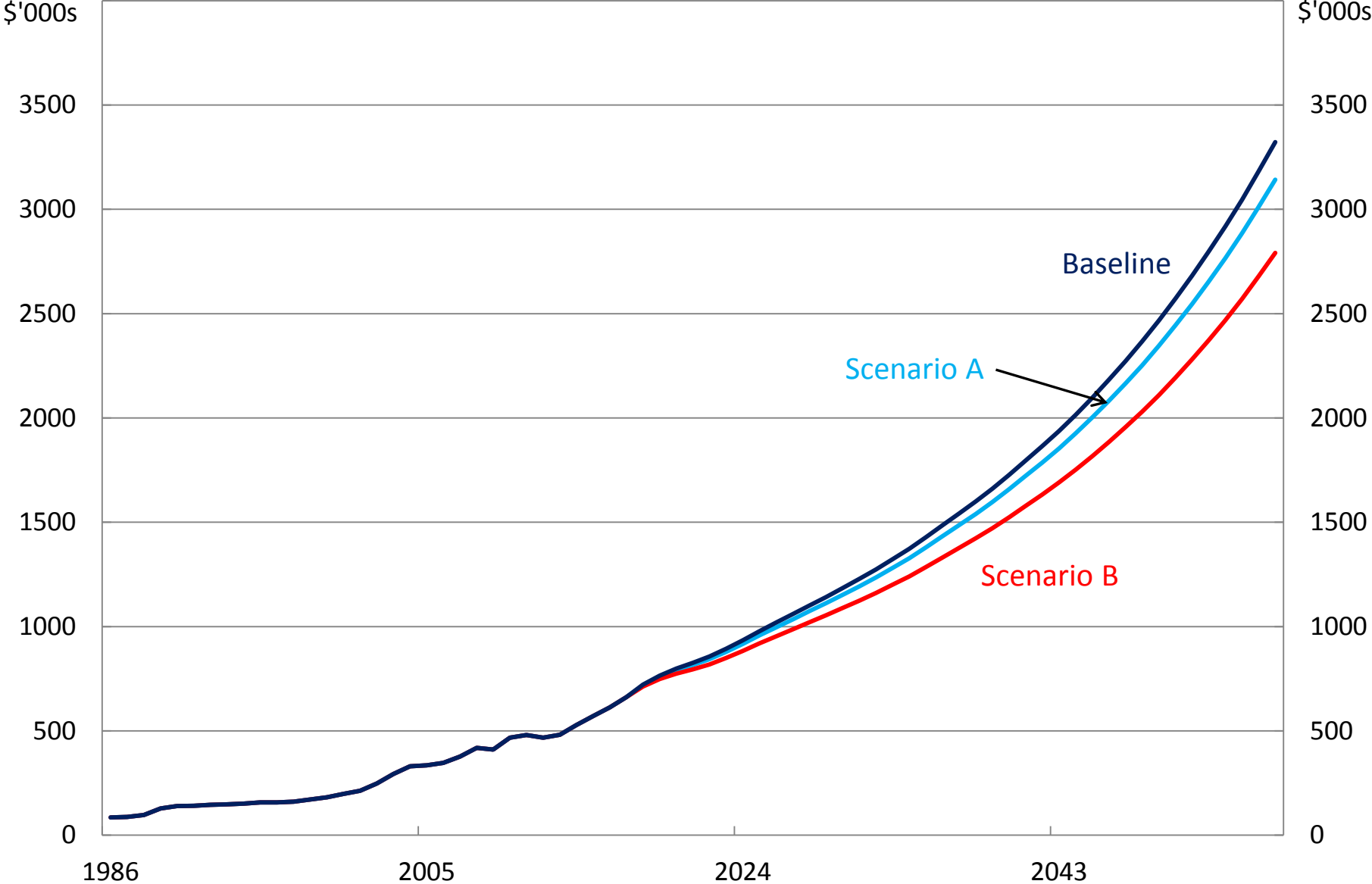


Chart 3.9: Australian Housing Price Levels under Different Scenarios



Scenario C

Temporary Reduction in Annual Net
Overseas Migration to Australia
(Average Cut of 64,000 p.a. for Five Years)

NOM to Australia

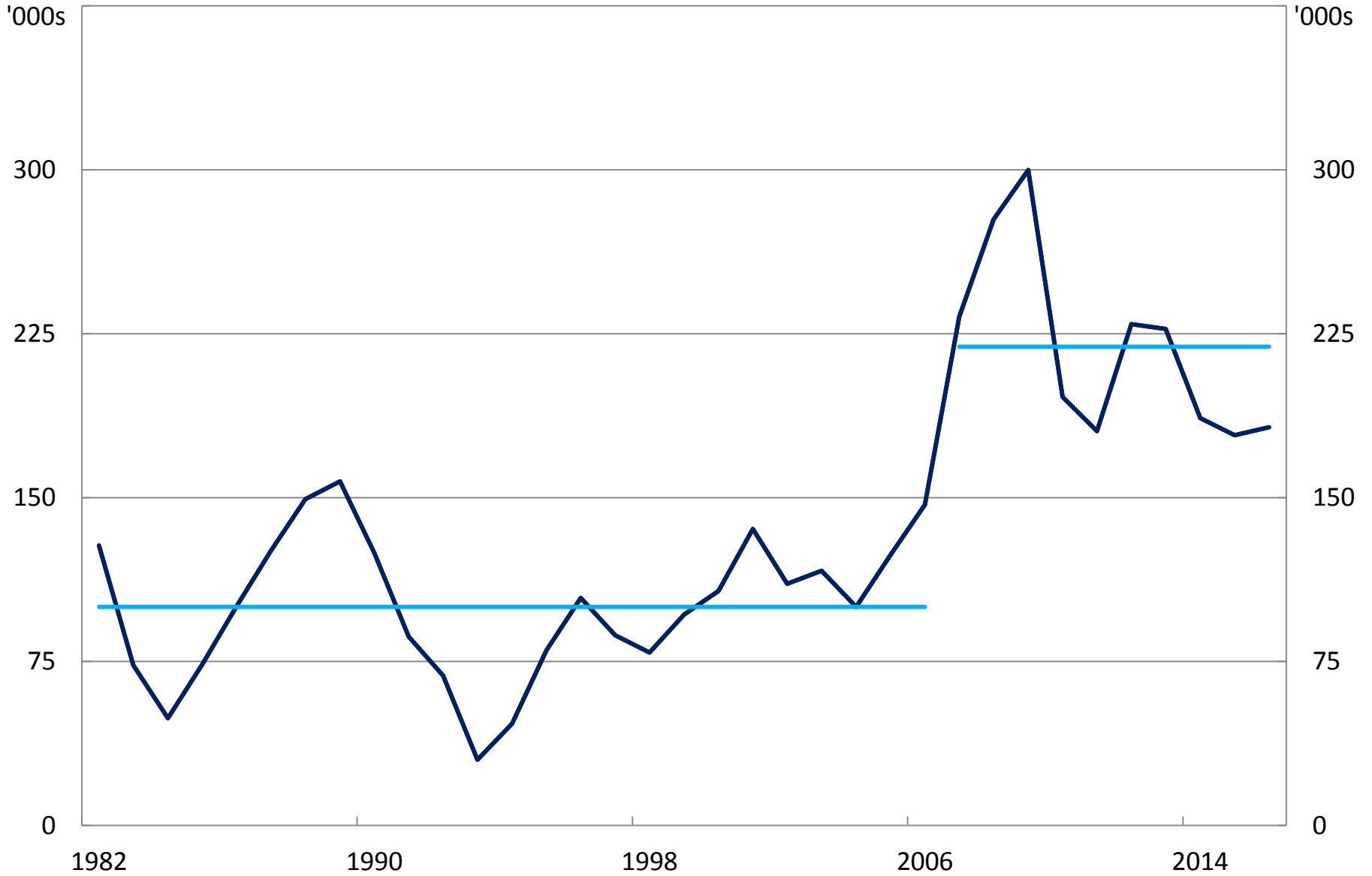


Chart 3.13: Impact of a Temporary Decrease in NOM to Australia
 Response to an average NOM decrease of 64,000 p.a. for five years

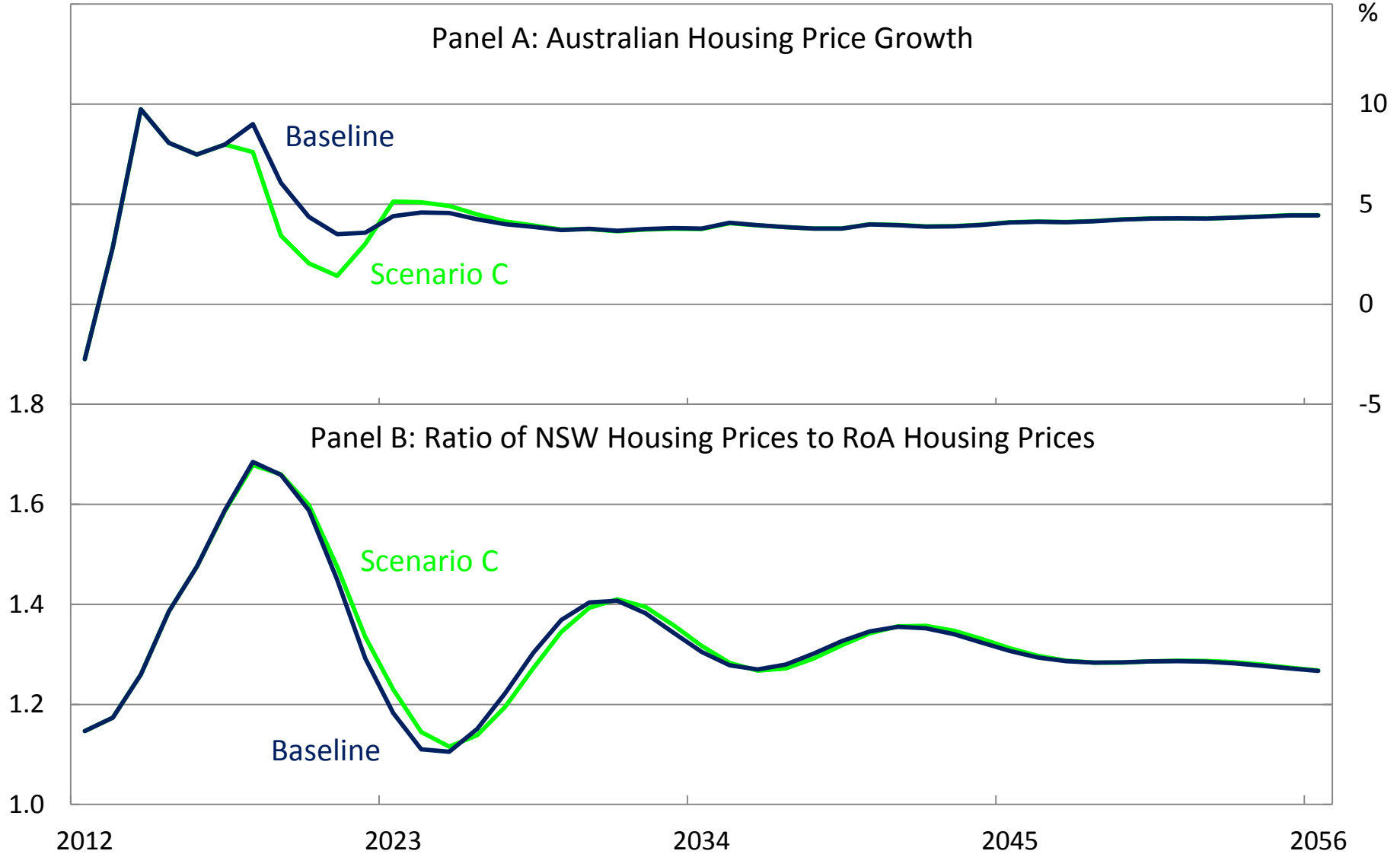


Chart 3.14: Australian Housing Prices under Different Scenarios

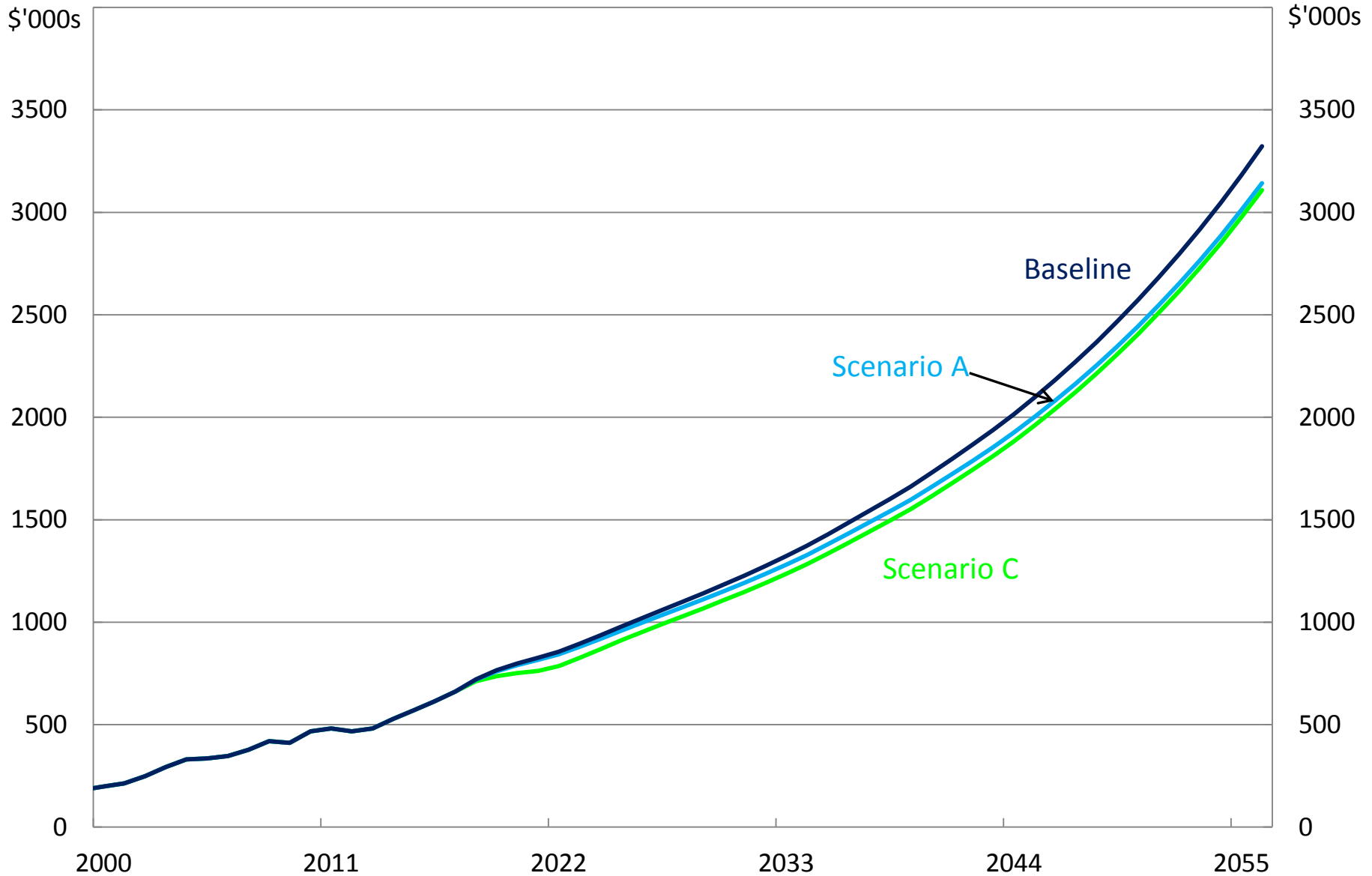


Table 3.2 – Impact of a Temporary Reduction in National NOM

Deviations of Key Indicators from Baseline (Average Reduction of 64,000 p.a. for Five Years)

Indicator	Impact at Given Forecast Horizon			
	Percentage change relative to baseline, unless otherwise stated			
	2-year	5-year	10-year	40-year
<i>Relative Housing Prices</i>				
(NSW versus the RoA)	-0.4	1.8	-1.1	0.1
<i>Housing Price Growth (a)</i>				
Australia	-1.4	-2.1	0.2	0.0
NSW	-1.6	-1.3	-1.2	0.0
RoA	-1.3	-2.6	0.9	0.0
<i>Housing Price Level</i>				
Australia	-1.3	-7.8	-6.7	-6.5
NSW	-1.5	-6.8	-7.3	-6.4
RoA	-1.1	-8.5	-6.3	-6.5
<i>Annual Net In-Migration (b)</i>				
Australia	-80.0	-40.0	0.0	0.0
NSW	-24.1	-11.2	-0.5	0.1
RoA	-55.9	-28.8	0.5	-0.1
<i>Housing Under-/Over-Supply (c)</i>				
Australia	51.6	144.7	164.8	251.7
NSW	16.6	39.3	53.3	70.9
RoA	35.0	105.4	111.5	180.8
<i>Population</i>				
Australia	-0.5	-1.3	-1.4	-1.4
NSW	-0.5	-1.2	-1.5	-1.4
RoA	-0.5	-1.4	-1.3	-1.4

(a) Change relative to baseline measured in percentage points.

(b) Change relative to baseline measured in thousands of persons.

(c) Change relative to baseline measured in thousands of houses, rather than in percentage terms. A positive number indicates a reduction in under-supply (or increase in over-supply).

Conclusions

Demand Side

- Even a temporary NOM reduction could significantly alleviate price pressures
 - Average NOM cut of 64,000 for 5 years might generate a slightly larger price impact than a permanent 5,000 p.a. supply increase
 - Easy to engineer
 - Would also generate *earlier* price relief

Conclusions

Supply Side

- Improving supply also very important
- Challenging to achieve on a sustained basis
 - Co-ordination problems (land release, planning, infrastructure, etc)
 - Managing local concerns
 - Conflicting incentives for States re housing
- Migration flows create an additional “free rider” challenge – in terms of “leakage” of price benefits to other States

Conclusions

Supply Side

- Re this “free rider” problem:
 - States may get other compensating *benefits* from increased migration flows (negating “free rider” concerns)
 - Either way, if trying to control housing price growth, actions by States to boost supply will be more successful if co-ordinated than if done in isolation

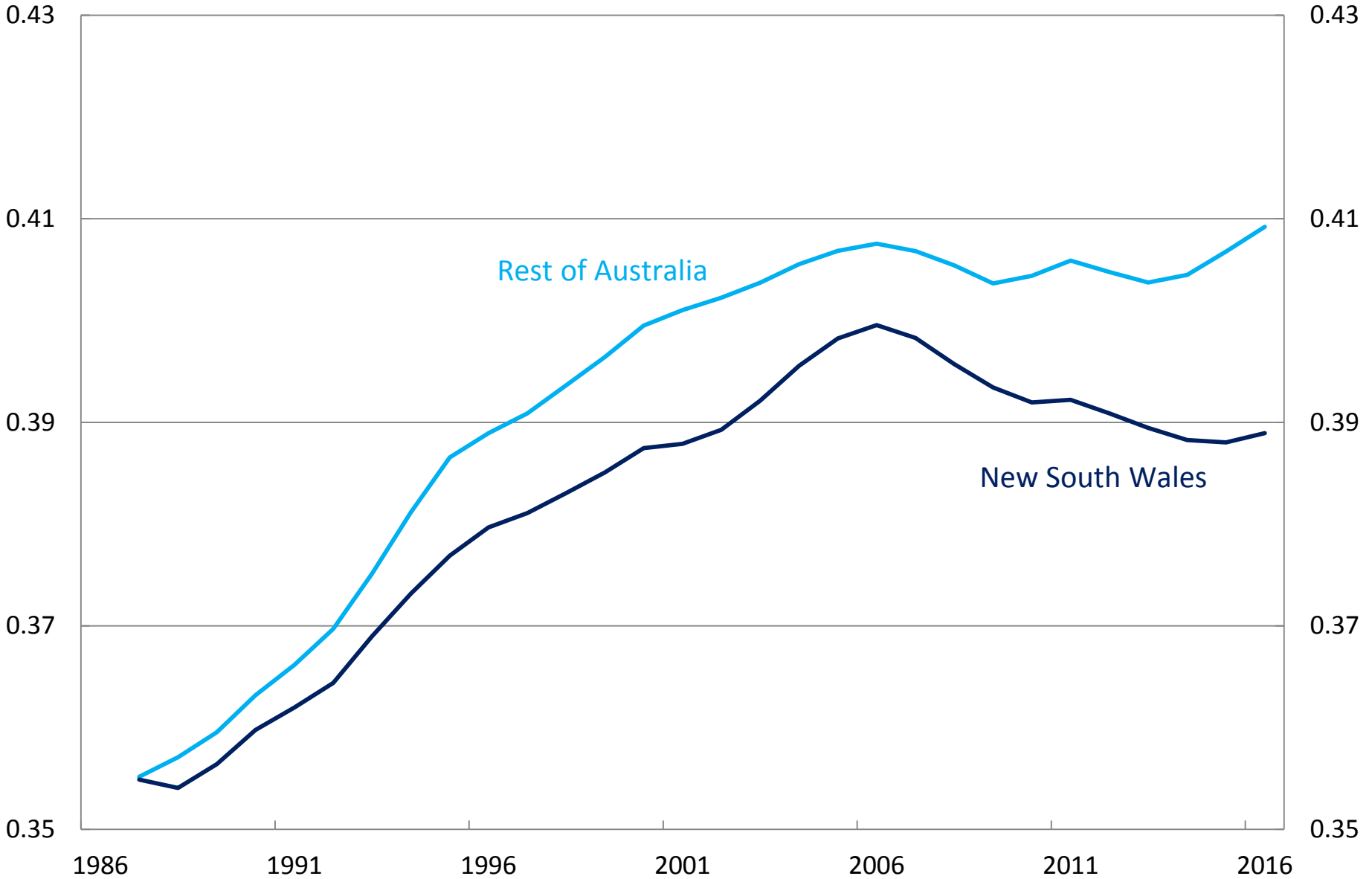
Housing Prices and Migration Flows

Spare Slides

Measuring Housing Under-/Over-Supply

- Simple approach based on examining housing stock per capita data

Chart 2.2: Housing Stock Per Capita



Measuring Housing Under-/Over-Supply

- Simple approach based on examining housing stock per capita data
- For NSW and RoA, fit simple logarithmic curves to actual housing stock per capita data – as indicators of “underlying” housing demand
- Form resulting “housing stock per capita disequilibrium” measures , for use as explanators in behavioural equations
- Measures align well with more sophisticated methods

Chart 2.1: Disequilibrium in Housing Stock Per Capita

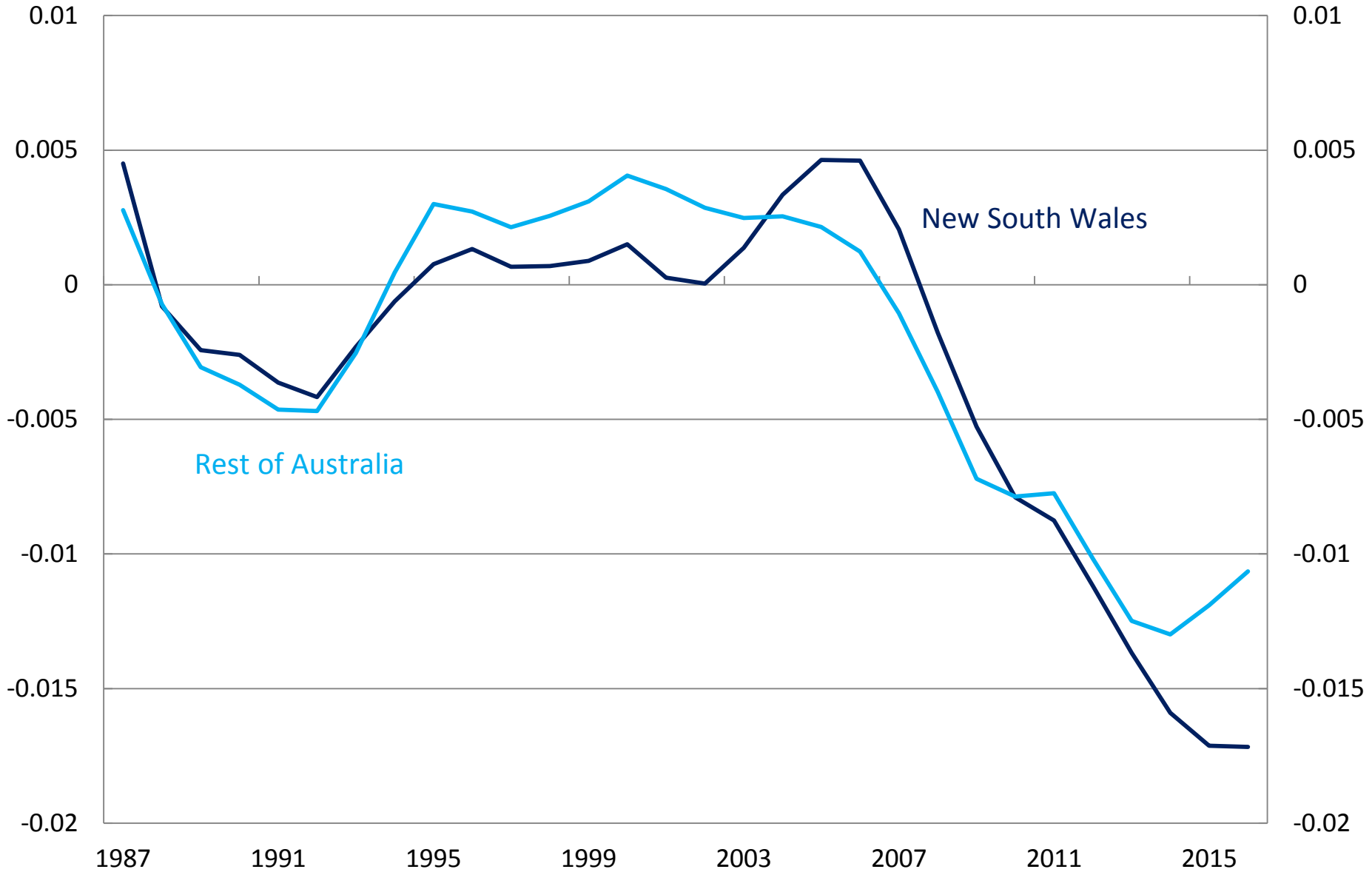
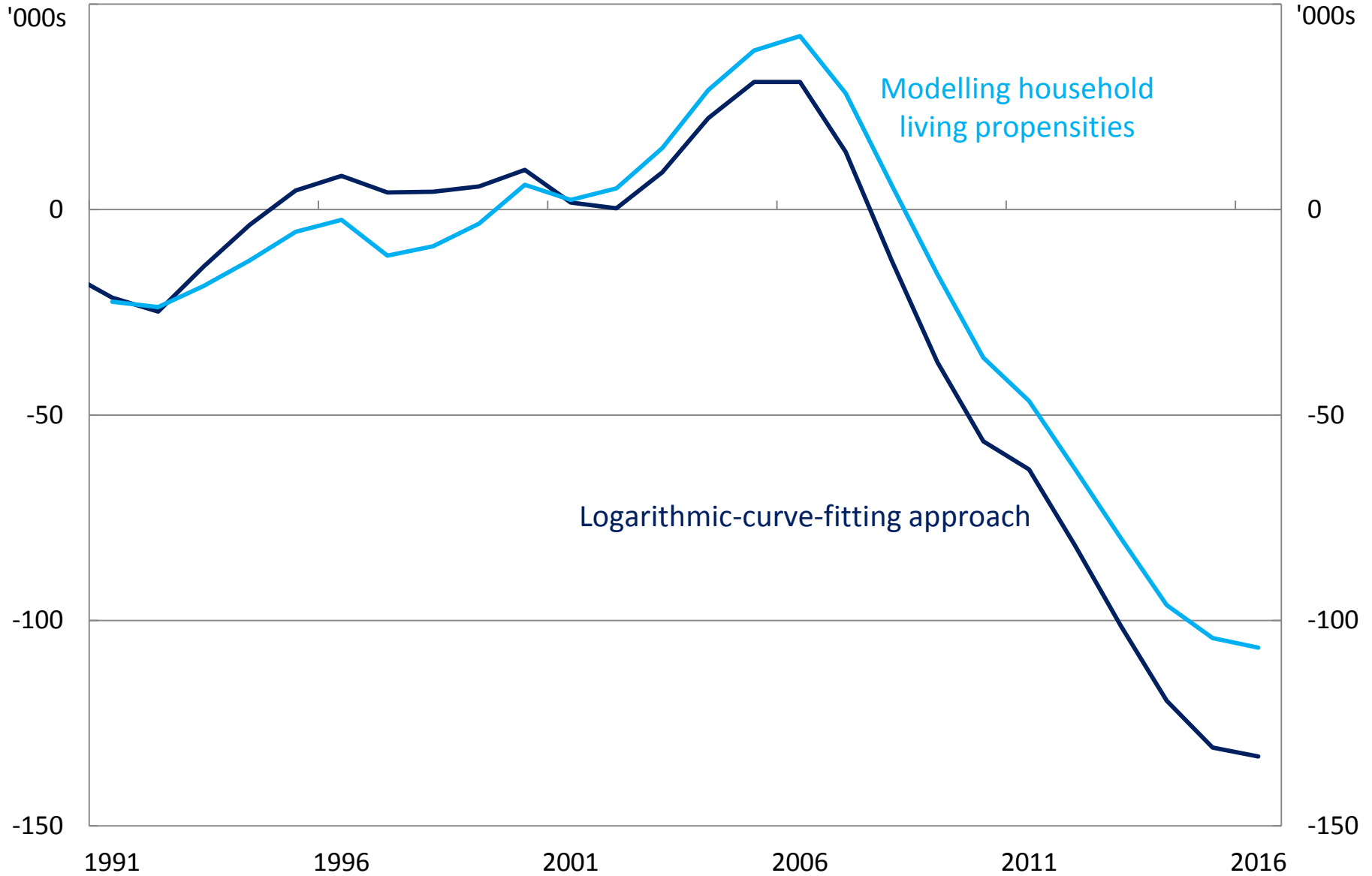
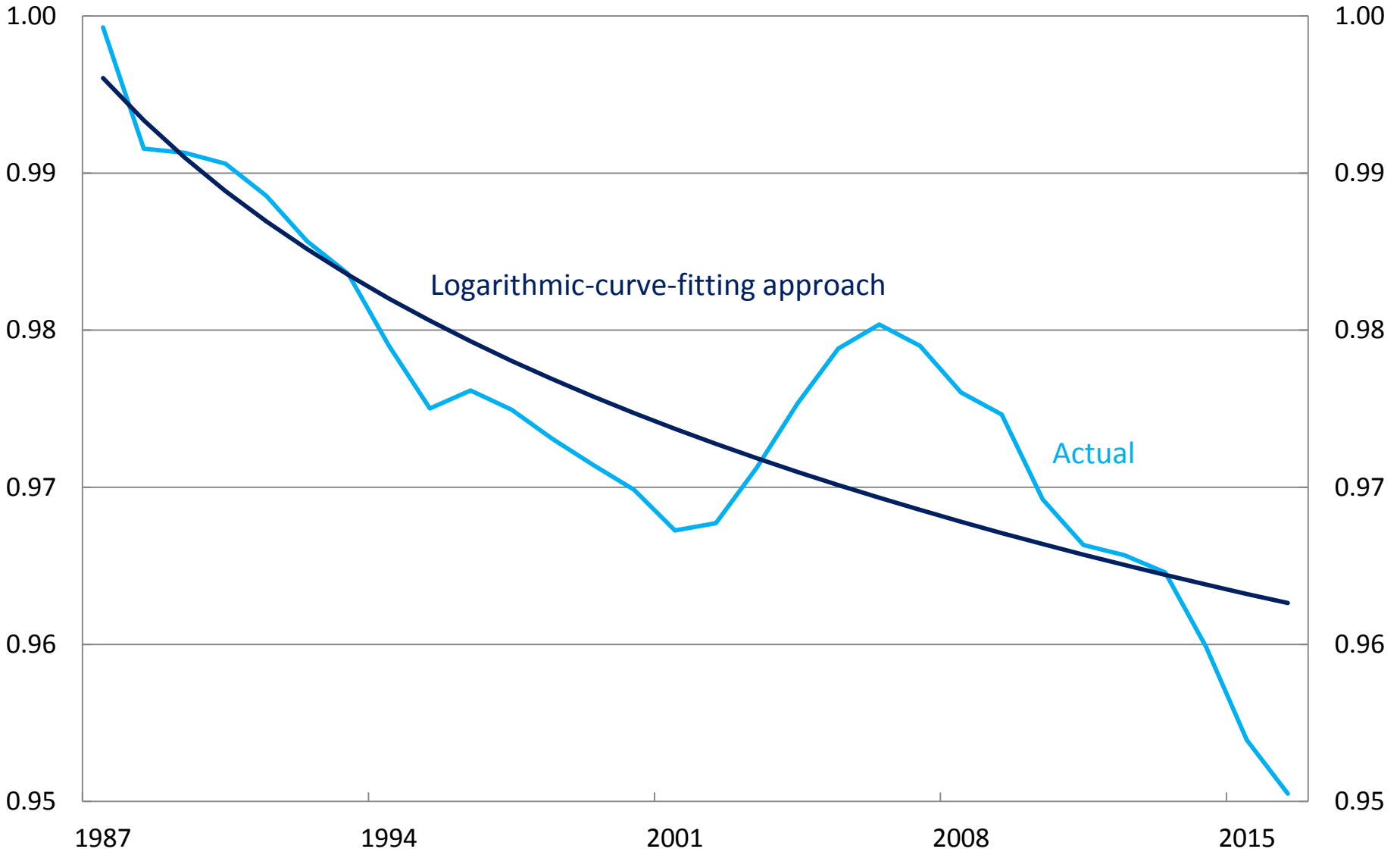


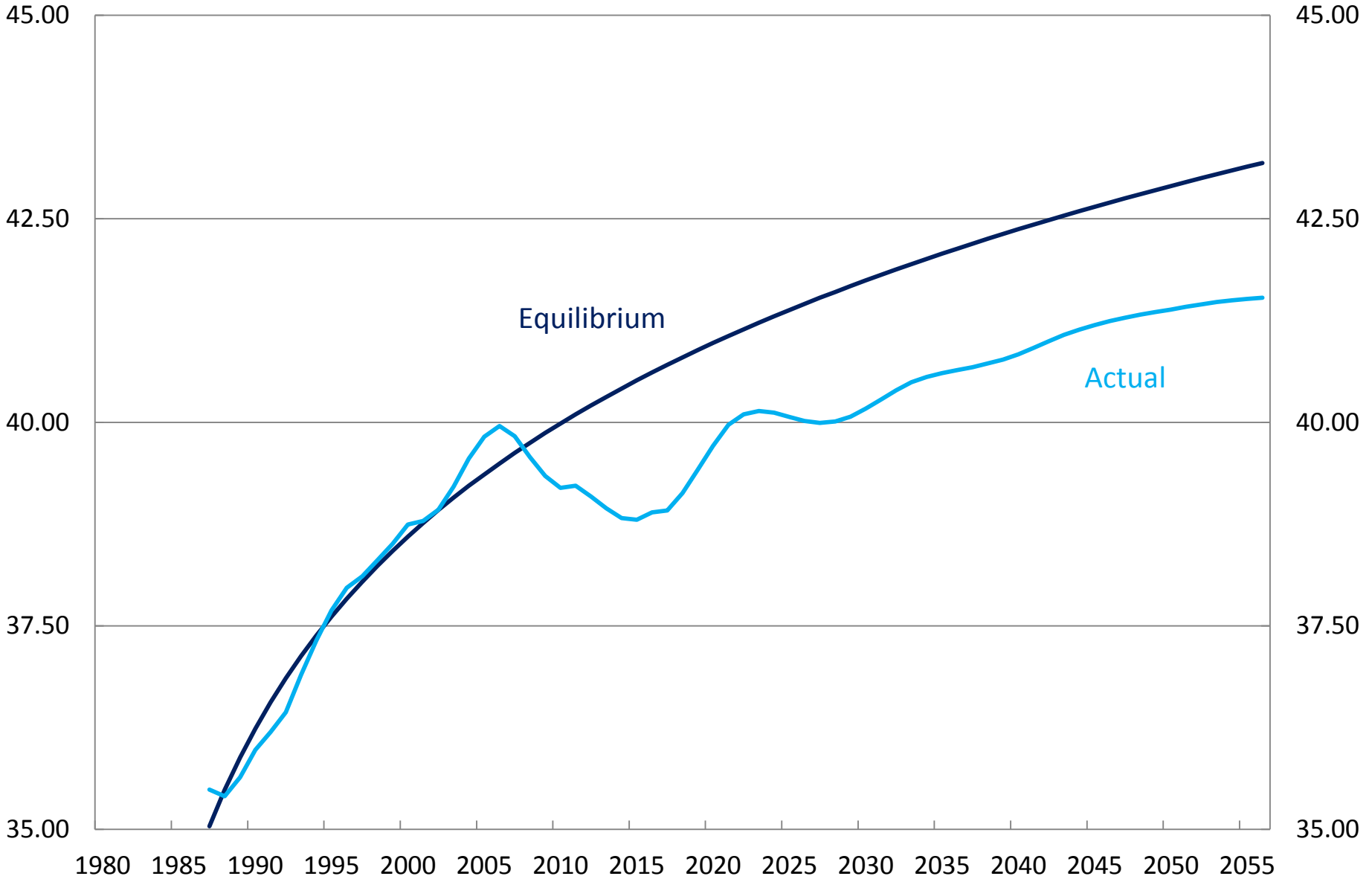
Chart A.1: NSW Housing Under-/Over-Supply



Relative Housing Stock Per Capita New South Wales Vs. Rest of Australia



NSW Housing Stock Per Capita



Behavioural Equations

Fitted vs Actual Values and Equation
Residuals

Chart 2.3: Relative Housing Price Equation

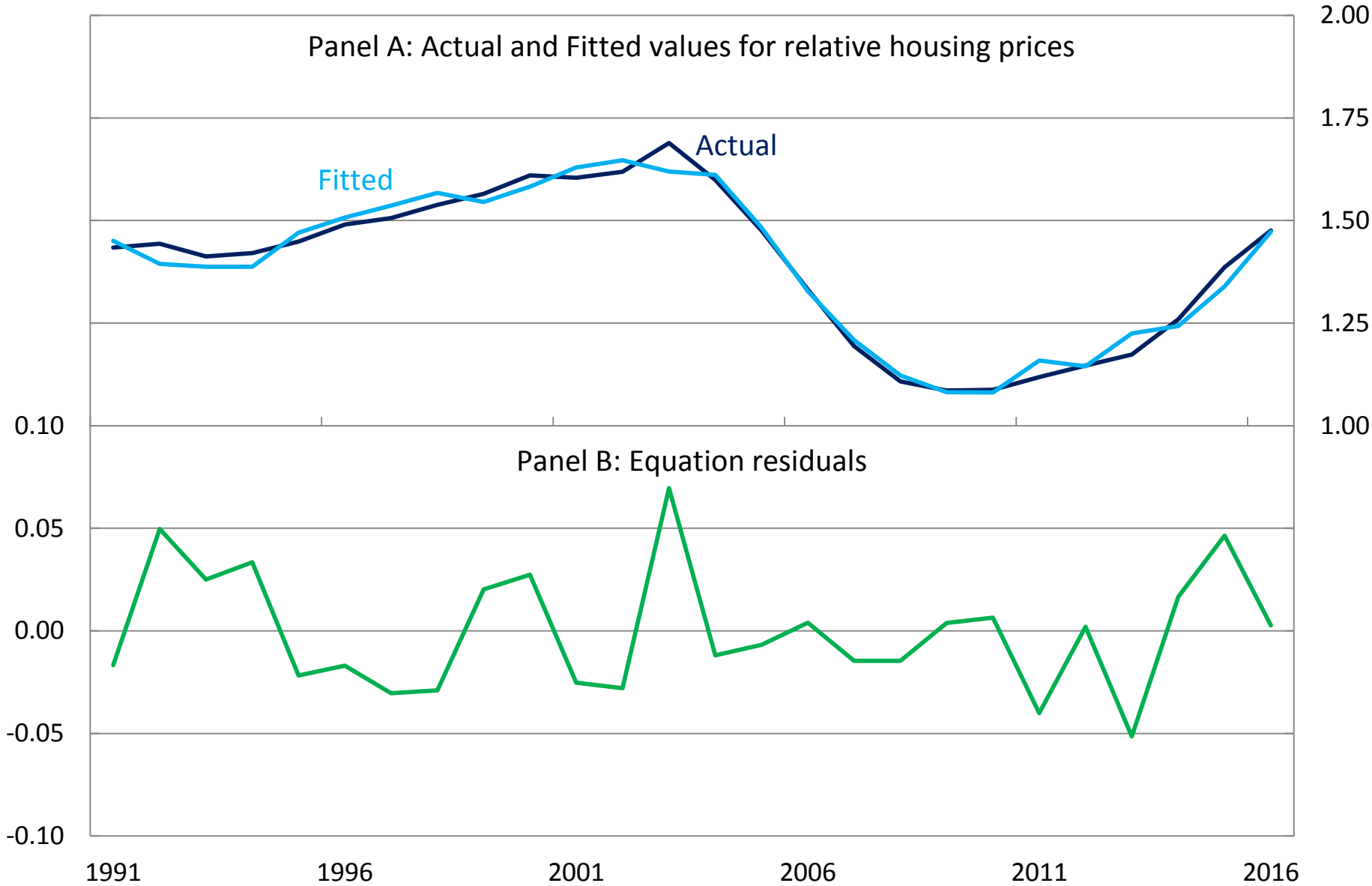


Chart 2.5: NOM Share Equation

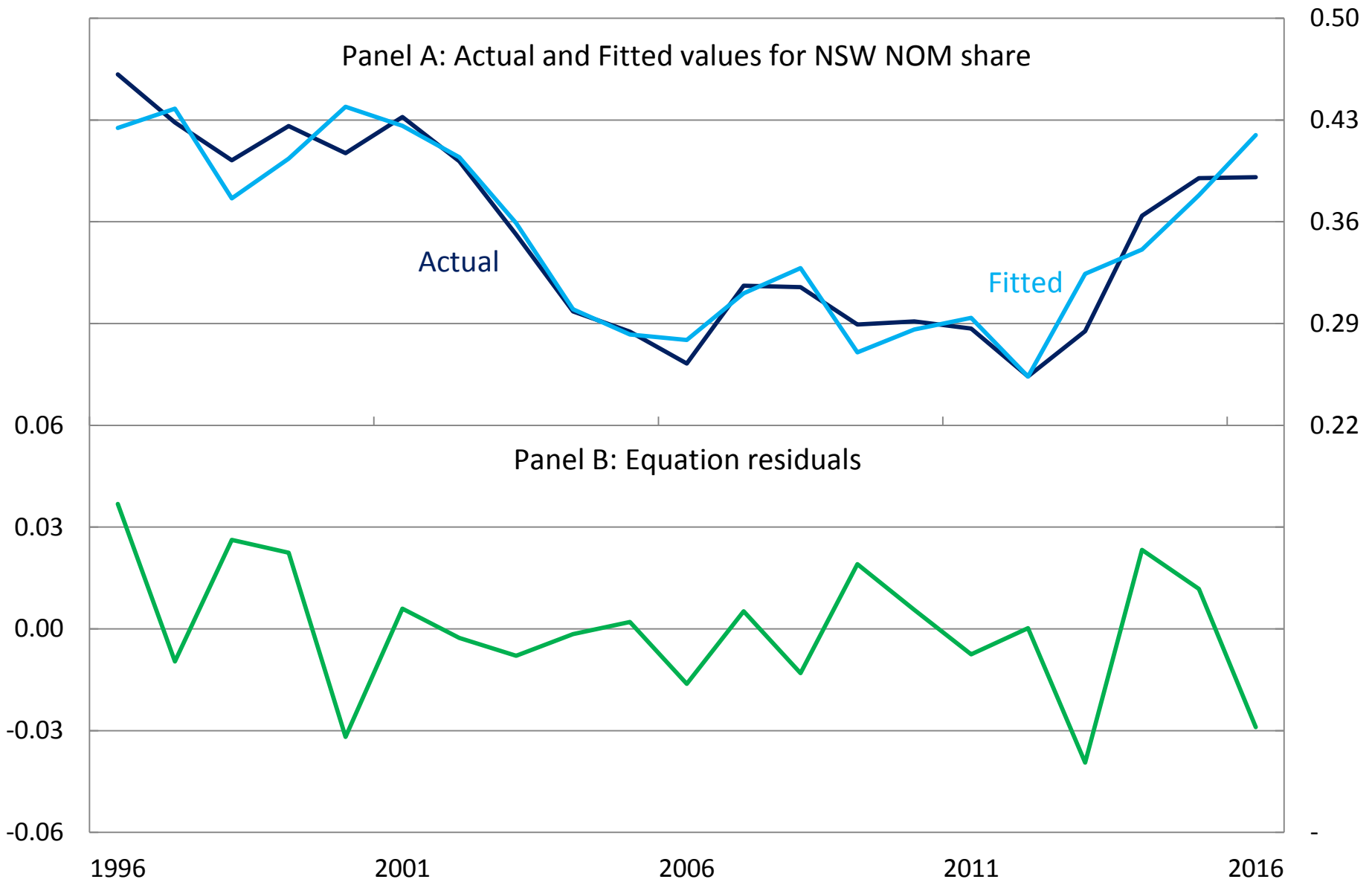
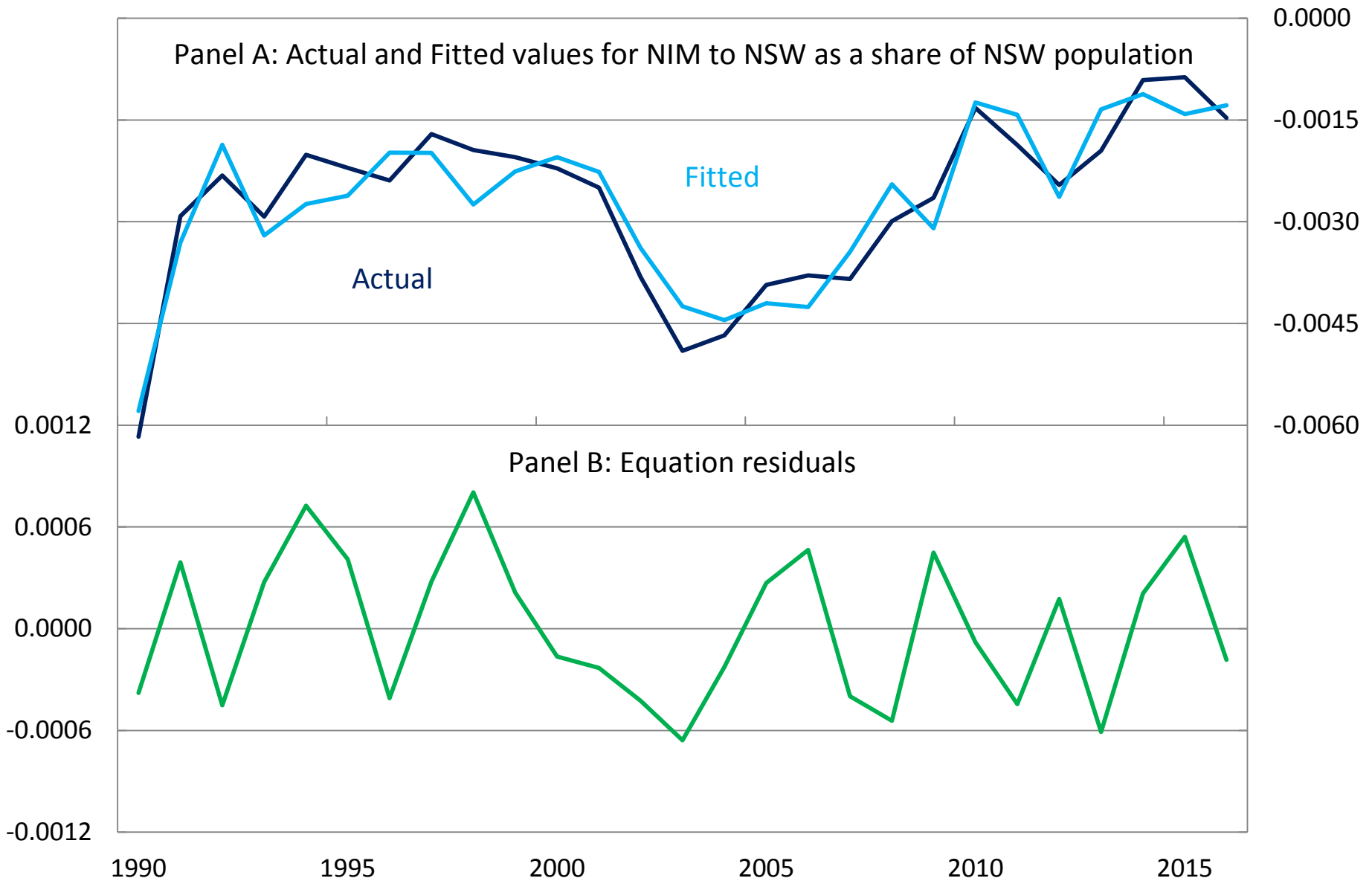


Chart 2.6: NIM Share Equation



Repayments on New Housing Loans

Per cent of household disposable income

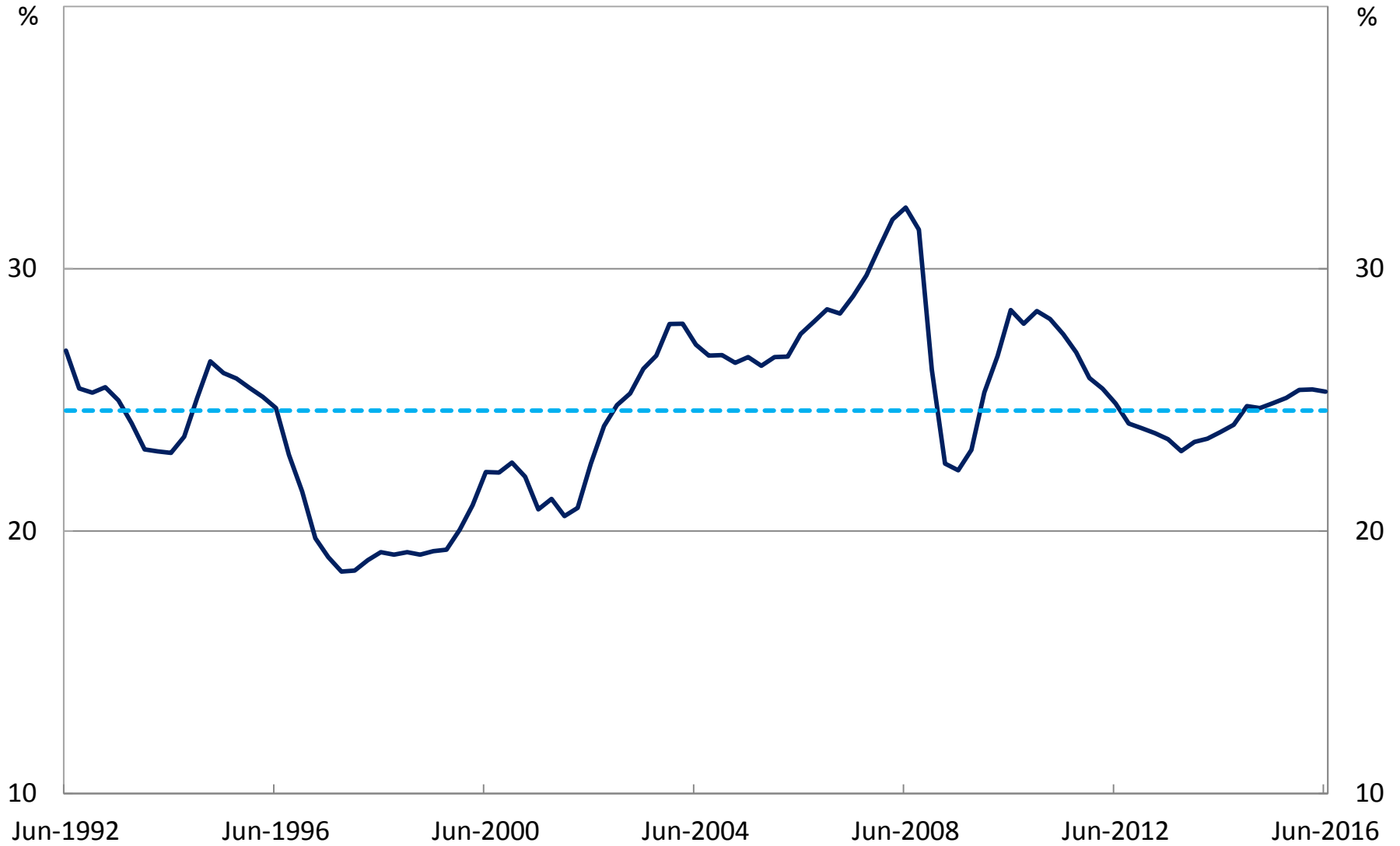
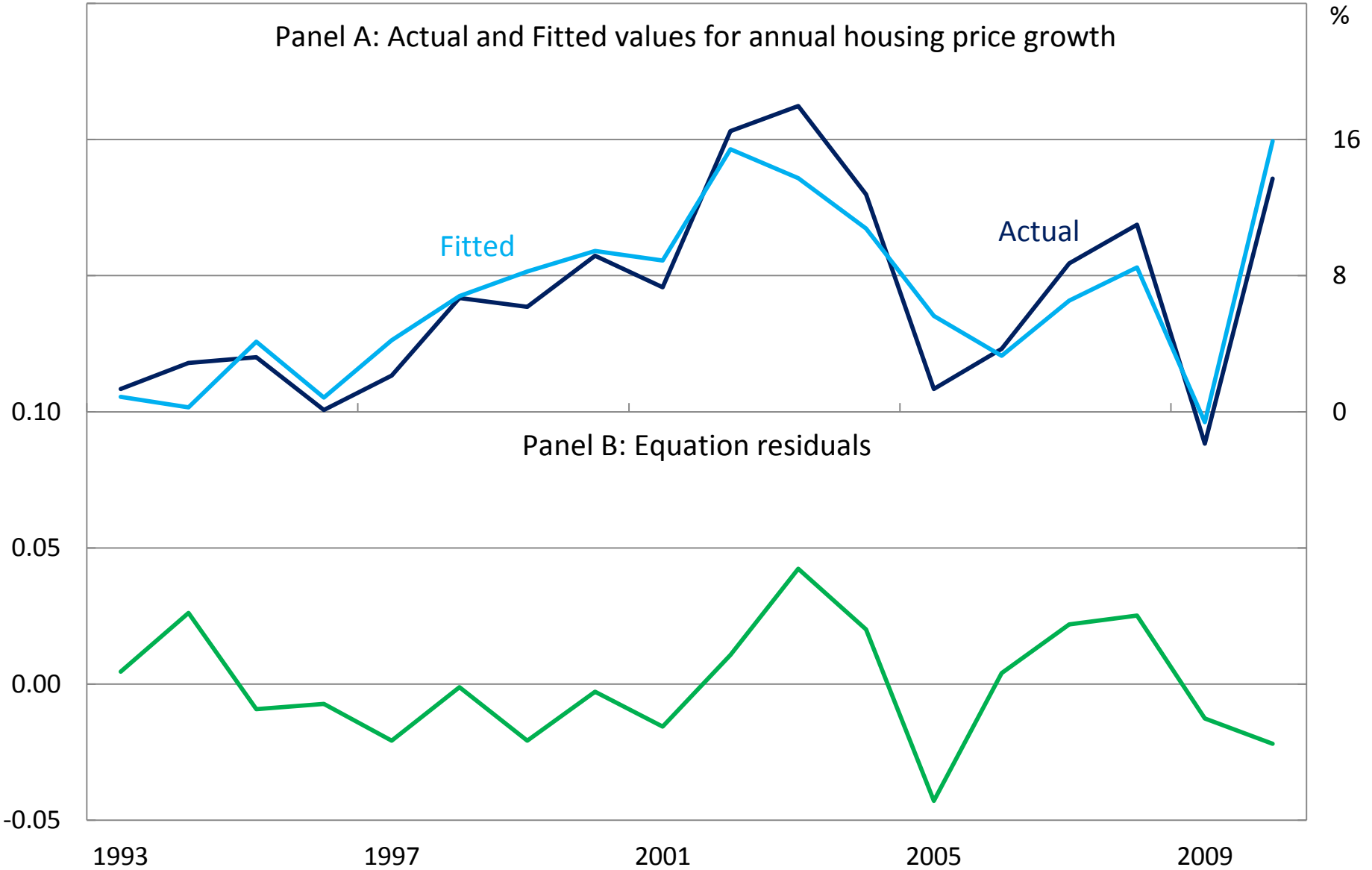


Chart 2.7: Australian Housing Price Growth Equation

Panel A: Actual and Fitted values for annual housing price growth



Behavioural Equations

Coefficient Estimates and Diagnostic
Statistics

Table B.1 – Relative Housing Price Equation

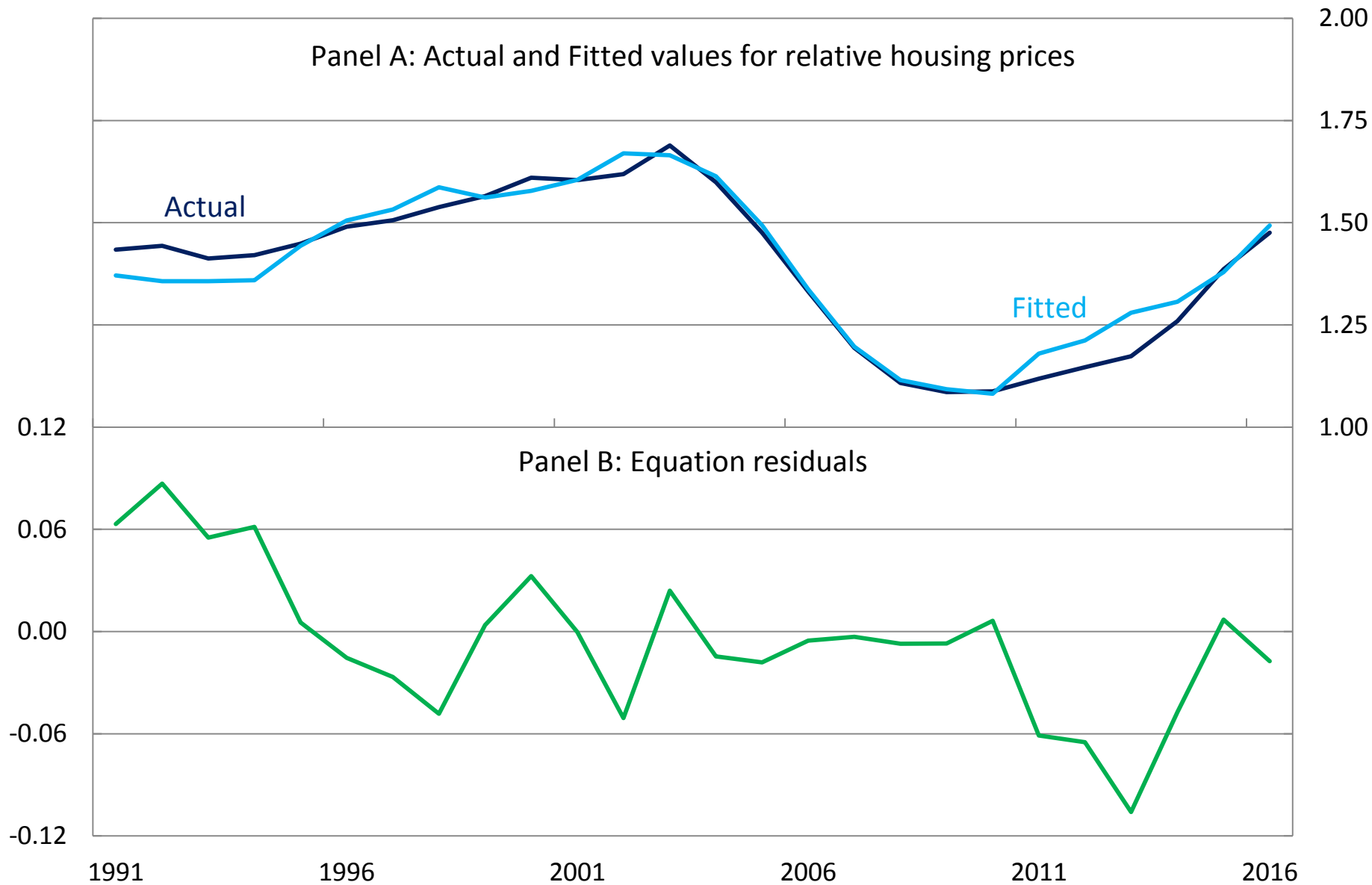
$$HPrel_t = \beta_0 + \beta_1(HspcRelDiseq_{t-1} + HspcRelDiseq_{t-3}) + \beta_2PopRelTTY_t + \beta_3(AWErel_t + AWErel_{t-1} + AWErel_{t-2} + AWErel_{t-3}) + \varepsilon_t$$

$$\varepsilon_t = \beta_4\varepsilon_{t-1}$$

Coefficient	Value	t-statistic
β_0	-1.477	-2.701
β_1	-15.586	-12.200
β_2	8.493	1.264
β_3	0.686	5.239
β_4	0.528	4.536
Summary Statistics	Value	
R^2	0.975	
Adjusted R^2	0.971	
Standard error of the regression	0.032	
Durbin-Watson statistic	2.055	

Note: The estimation sample is 1991 to 2016 ($n = 26$)

Chart 2.4: Relative Housing Price Equation without AR(1) Error Process



Statistical Output for the Quarterly Relative Housing Price Equation

Dependent Variable: HP_REL

Method: Least Squares

Date: 06/06/17 Time: 09:50

Sample: 12/01/1989 6/01/2016

Included observations: 107

Convergence achieved after 14 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.003626	0.564317	-1.778480	0.0783
HSPC_REL_DISEQ(-4)+HSPC_REL_DIS...	-10.91962	1.963645	-5.560893	0.0000
POP_REL_TTY+POP_REL_TTY(-4)+POP...	0.047554	0.016534	2.876196	0.0049
AWE_REL_HP+AWE_REL_HP(-4)+AWE_...	0.587720	0.134647	4.364894	0.0000
DUMMY_GST	0.043716	0.010780	4.055185	0.0001
AR(1)	0.840273	0.042802	19.63166	0.0000
R-squared	0.983413	Mean dependent var	1.394388	
Adjusted R-squared	0.982592	S.D. dependent var	0.184328	
S.E. of regression	0.024320	Akaike info criterion	-4.540569	
Sum squared resid	0.059739	Schwarz criterion	-4.390691	
Log likelihood	248.9205	Hannan-Quinn criter.	-4.479811	
F-statistic	1197.607	Durbin-Watson stat	1.945164	
Prob(F-statistic)	0.000000			
Inverted AR Roots	.84			

Table B.2 – NSW NOM Share Equation

$$NOMshare_{NSW,t} = \delta_0 + \delta_1 UED_t + \delta_2 MiningTTY_t + \delta_3 HPrel_{t-1} + \delta_4 AWErel_t + \delta_5 (\Delta AWErel_{t-1} + \Delta AWErel_{t-2} + \Delta AWErel_{t-3}) + \delta_6 DumGFC_{t-1}$$

Coefficient	Value	t-statistic
δ_0	-0.770	-2.247
δ_1	-7.370	-6.138
δ_2	-3.408	-4.327
δ_3	-0.316	-4.169
δ_4	1.463	3.598
δ_5	0.706	1.909
δ_6	-0.049	-1.791
Summary Statistics	Value	
R^2	0.909	
Adjusted R^2	0.869	
Standard error of the regression	0.024	
Durbin-Watson statistic	2.304	
Note: The estimation sample is 1996 to 2016 ($n = 21$)		

Table B.3 – NSW NIM Share Equation

$$NIMshare_{NSW,t} = \theta_0 + \theta_1 MiningTTY_t + \theta_2 UED_t + \theta_3((HPrel_t + HPrel_{t-1})/2) + \theta_4(DumHP_{NSW})(HPrel_t + HPrel_{t-1})/2)$$

Coefficient	Value	t-statistic
θ_0	0.0069	7.446
θ_1	-0.0614	-4.024
θ_2	-0.1725	-8.597
θ_3	-0.0072	-10.401
θ_4	-0.0014	-5.757
Summary Statistics	Value	
R^2	0.88	
Adjusted R^2	0.859	
Standard error of the regression	0.0005	
Durbin-Watson statistic	1.864	
Note: The estimation sample is 1990 to 2016 ($n = 27$)		

Table B.4 – Australian Housing Price Growth Equation

$$HPgr_{Aus,t} = \varphi_0 + \varphi_1 MtgeToHHDiratio_{Aus,t-1} + \varphi_2 HspcDiseq_{Aus,t-1} + \varphi_3 DumGFC2_t + \varphi_4 (HspcDiseq_{Aus,t-1} - HspcDiseq_{Aus,t-2}) + \varphi_5 MtgeRateReal_{t-1} + \varepsilon_t$$

$$\varepsilon_t = \varphi_5 \varepsilon_{t-1}$$

Coefficient	Value	t-statistic
ϕ_0	0.434	3.460
ϕ_1	-1.088	-2.211
ϕ_2	-3.752	-0.585
ϕ_3	-0.091	-3.084
ϕ_4	-17.011	-1.361
ϕ_5	-1.904	-2.500
ϕ_6	0.573	1.553
Summary Statistics	Value	
R^2	0.862	
Adjusted R^2	0.786	
Standard error of the regression	0.027	
Durbin-Watson statistic	1.696	
Note: The estimation sample is 1993 to 2010 ($n = 18$)		

Model Results

Baseline Case

Chart 3.2: Ratio of NSW Housing Prices to RoA Housing Prices
Baseline model results

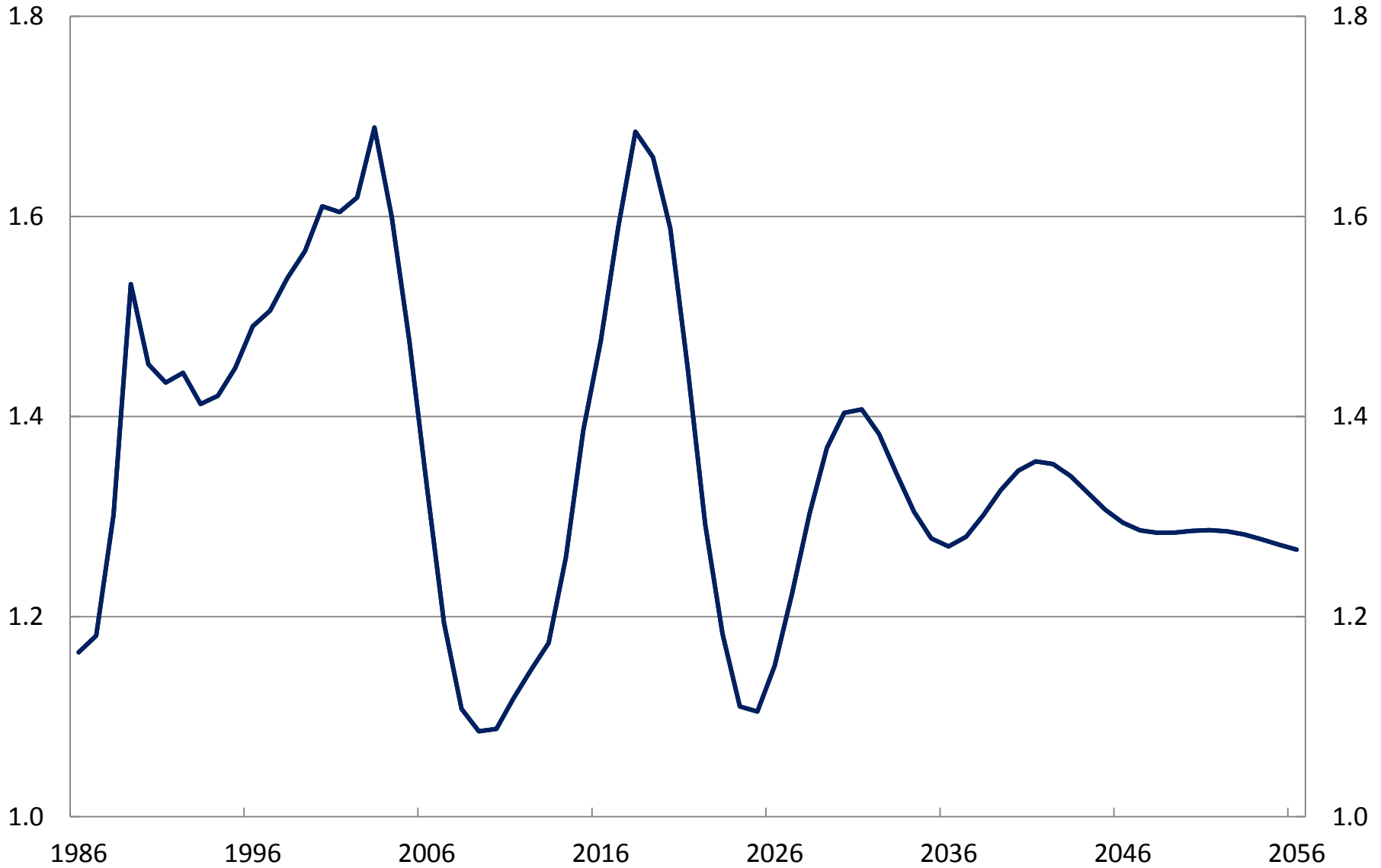


Chart 3.3: NOM and NIM to NSW
Baseline model results

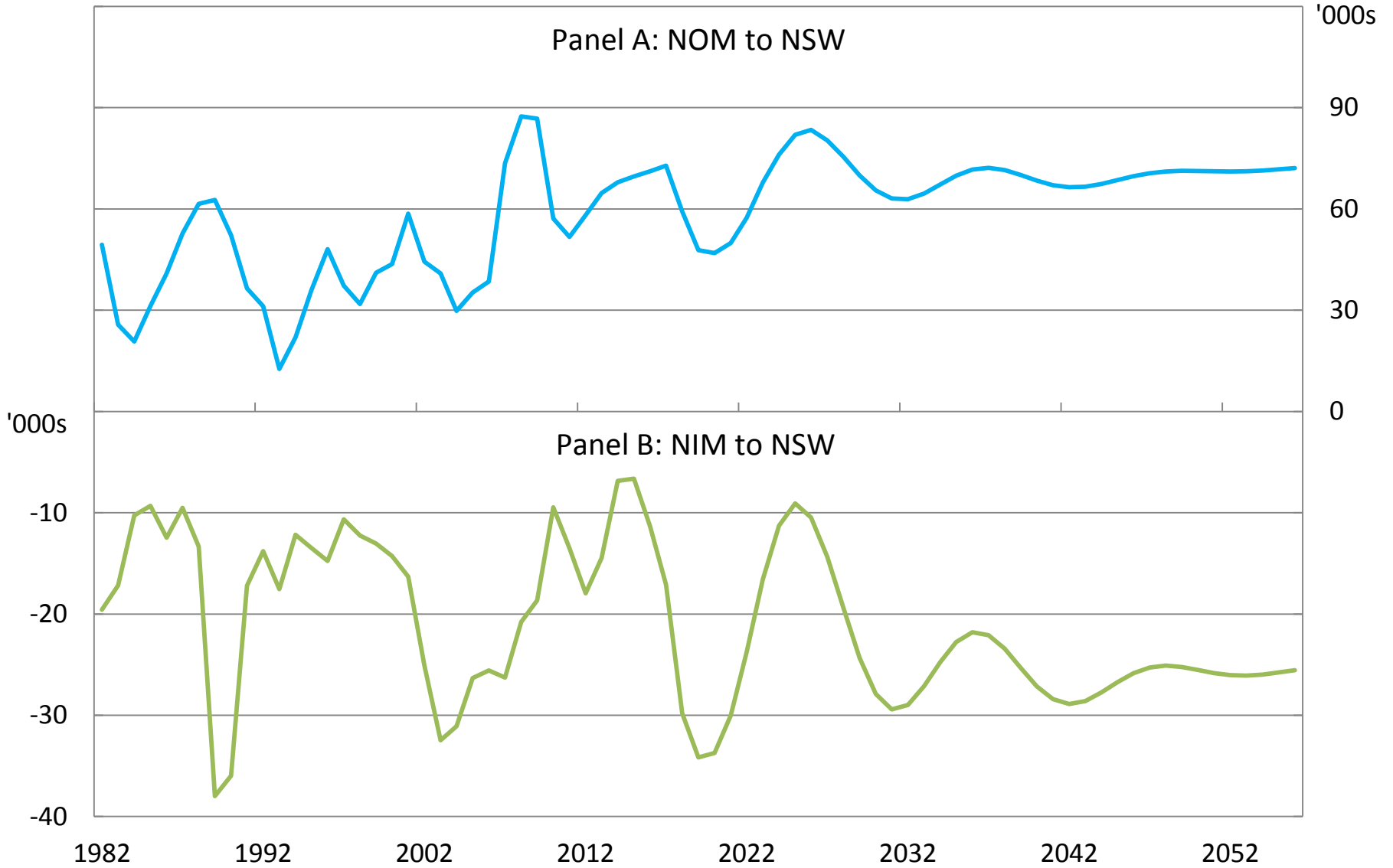
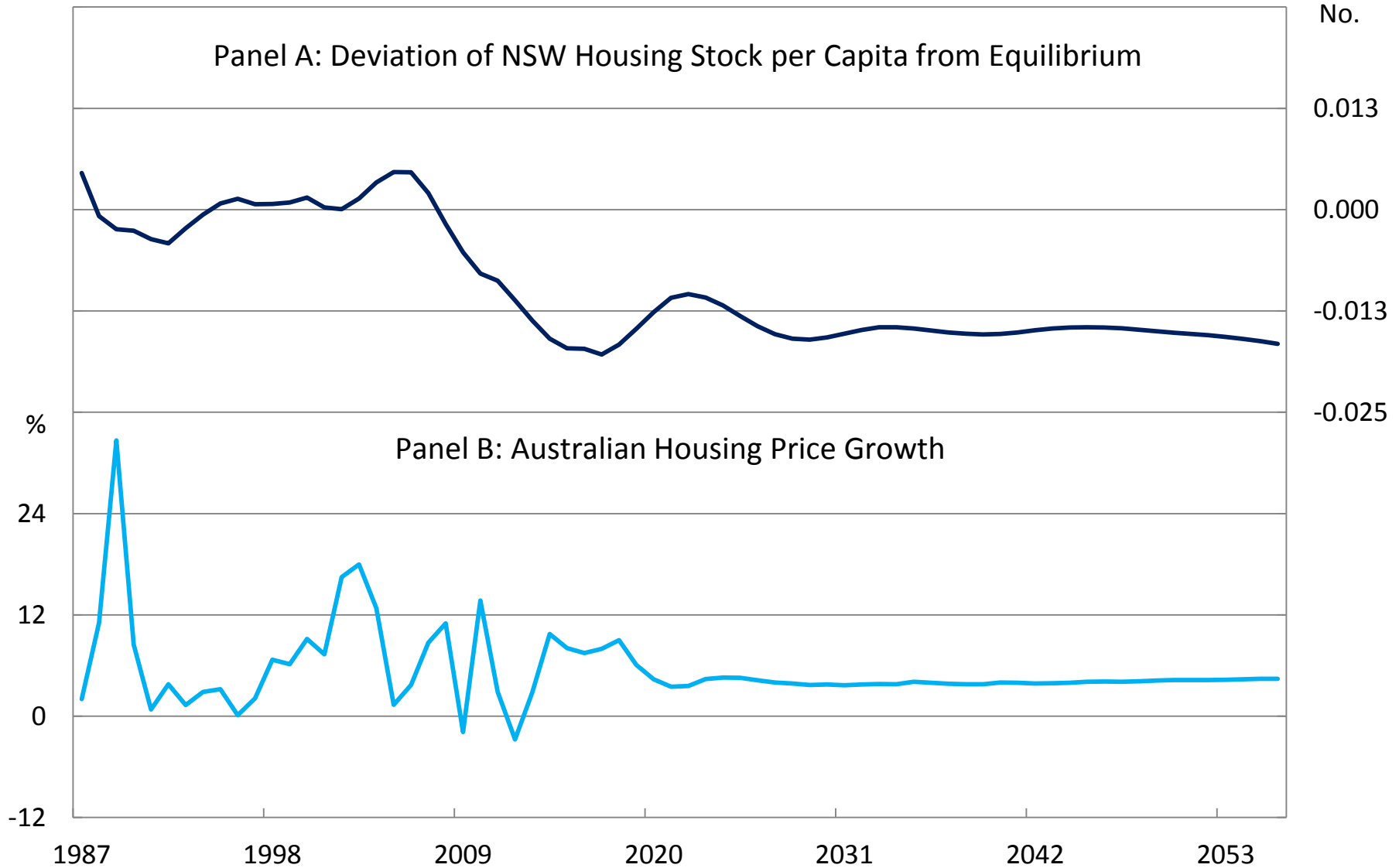


Chart 3.4: Other Key Indicators
Baseline model results



Appendix C

Permanent 80,000 Reduction in Annual
Net Overseas Migration to Australia

Chart C.2: Net Overseas Migration to NSW

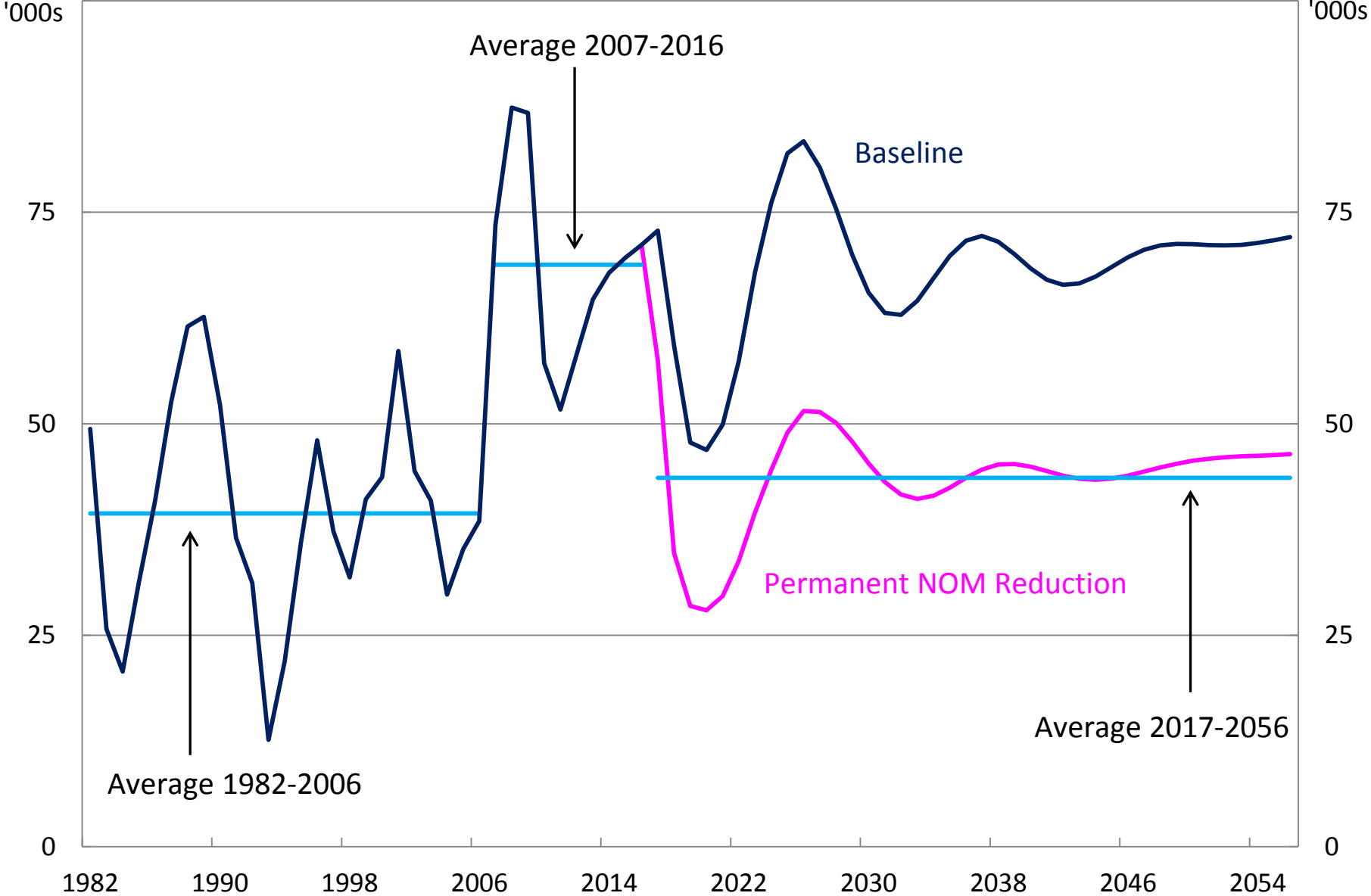


Chart C.1: Annual Australian Housing Price Growth
Impact of a sustained decrease in net overseas migration to Australia

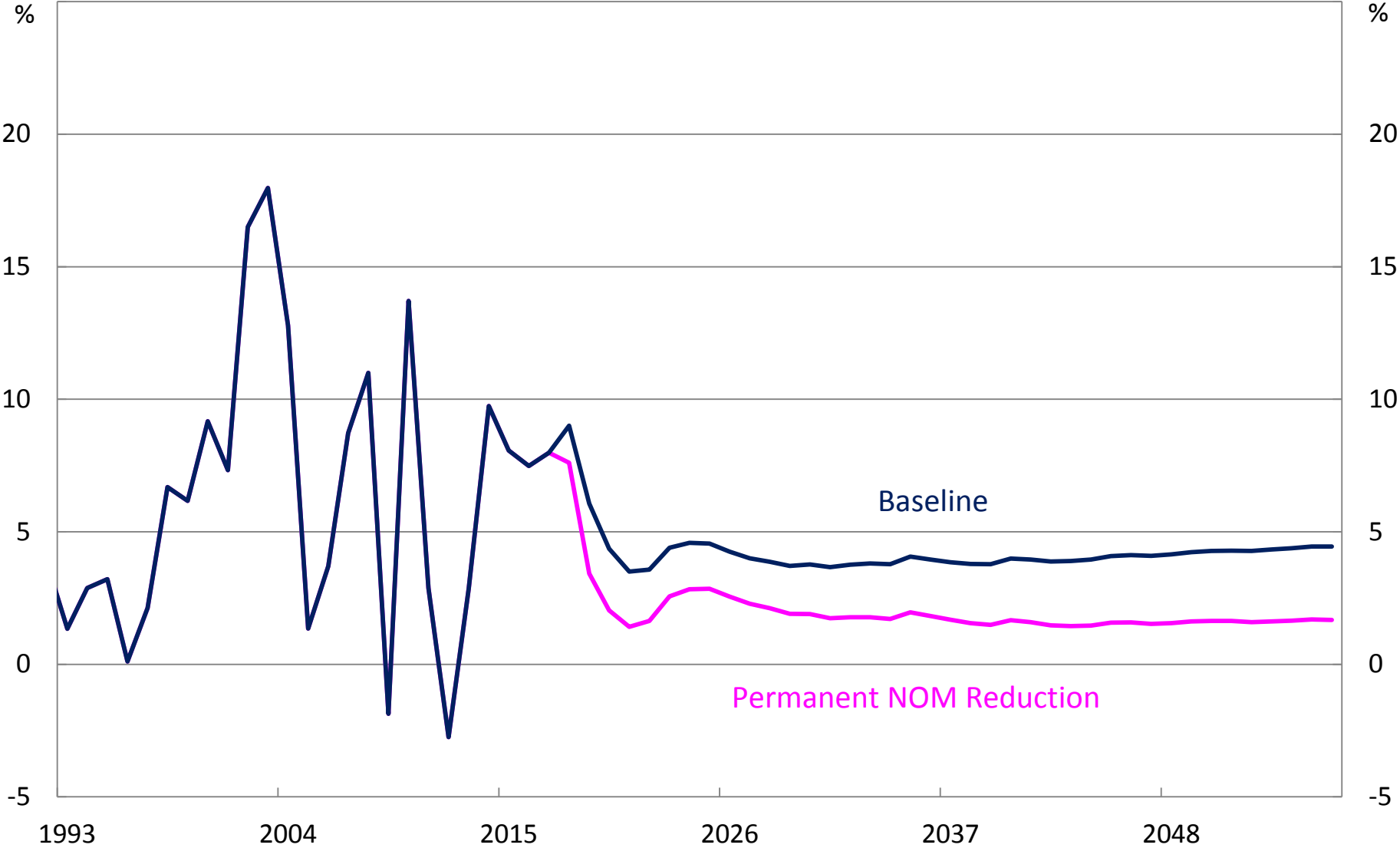


Chart C.3: Ratio of NSW Housing Prices to RoA Housing Prices
Impact of a sustained decrease in net overseas migration to Australia

