Banc Ceannais na hÉireann
Central Bank of Ireland
Eurosystem

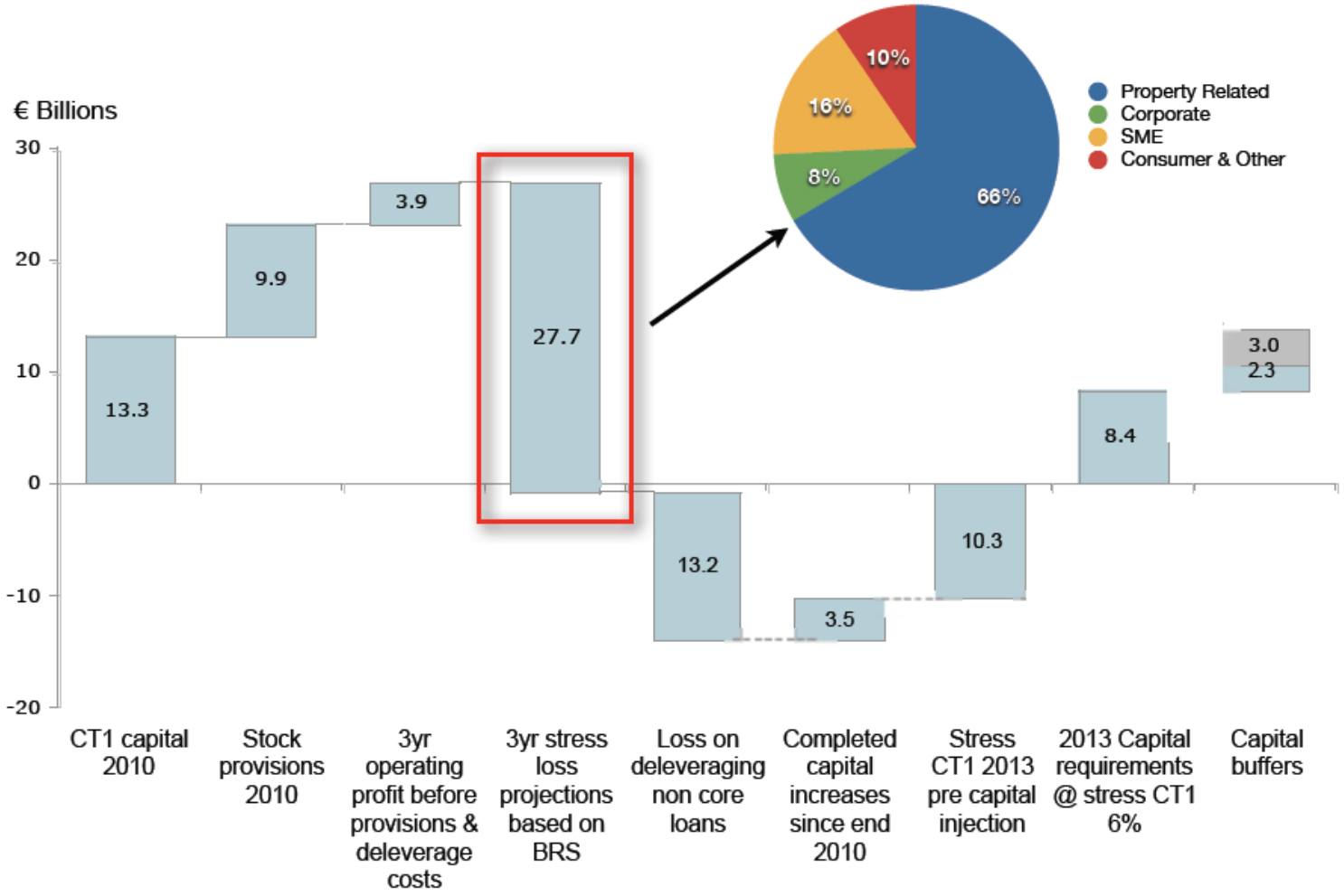
On the hook for impaired bank lending: Do sovereign-bank inter-linkages affect the fiscal multiplier?

Robert Kelly and Kieran McQuinn

Central Bank of Ireland

Nevin Economic Research Institute (NERI), May 15th 2013

Overview of PCAR 2011 results



Overview

- Financial crisis a searching test of the appropriate policy responses
- For example - on going debate about size of fiscal multiplier
- Domestically, mortgage crisis treated with micro-founded, prudential policies
  - Targeting cohorts of distressed loans and
  - Tailoring modification strategies accordingly
- Paper both highlights and quantifies a separate macroeconomic channel
- Which affects the sovereign's fiscal accounts

In particular:

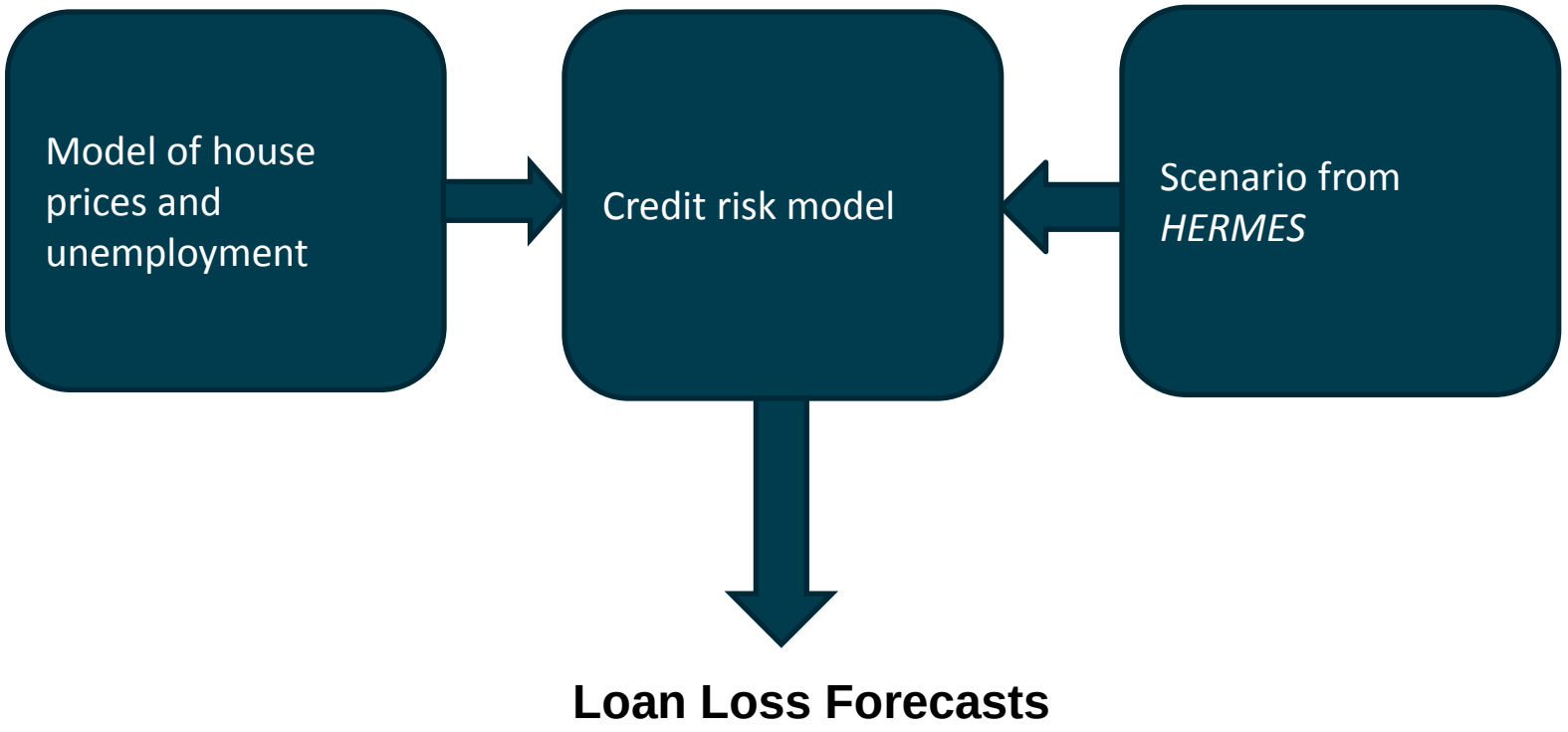
- Initially, we model relate labour market to house prices
- Then use a stress testing framework where mortgage arrears
  - Are a function of unemployment and house prices
- Generate loan loss forecasts (LLFs)
- Use *HERMES* to examine a €2 billion *increase* in public expenditure

General findings:

- Macroeconomic policies which reduce loan impairments on the balance sheets of the guaranteed banks
- Generate savings for the sovereign due to it's capitalisation obligations,
- To illustrate this, we take the case of a €2 billion stimulus (*HERMES*):
  - Reduces unemployment and subsequently mortgage arrears,
  - In turn, loan impairments decline as do future capital requirements,
- Saving can then be offset against the financing cost of such a policy,

Empirical approach

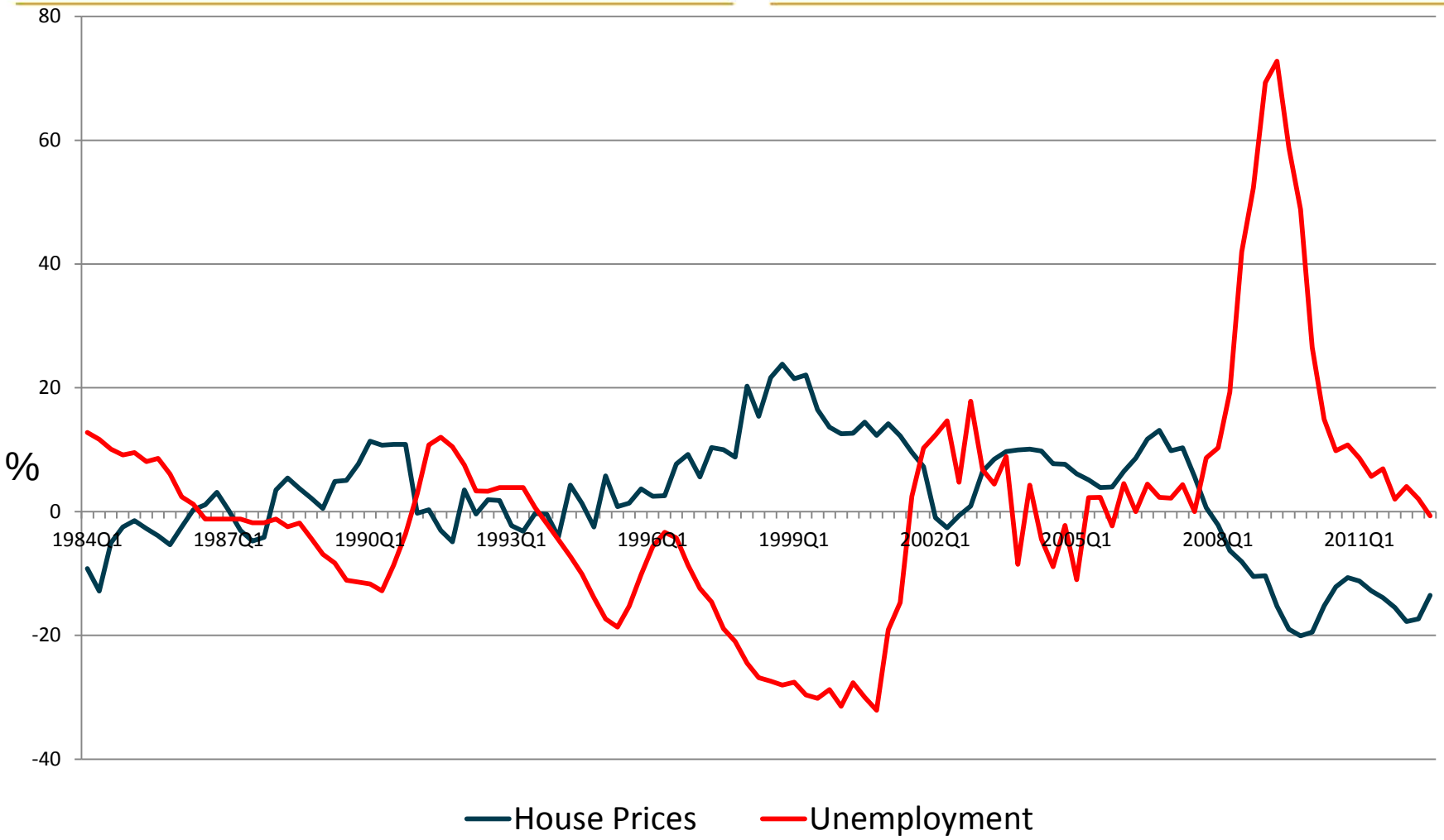
- Analysis draws on three different modelling frameworks:



Part 1

House prices and unemployment

Annualised changes in unemployment and real house prices: 1984:1 - 2012:3



House price model

- We examine the role of unemployment given other typical determinants
  - Include, income, interest rates, user cost and demographics
- Find a very strong role for unemployment
  - Affordability reasons – picks up the change in income,
  - Also a proxy for market sentiment, very relevant in the Irish case
- Model appears to explain Irish house prices better than other popular approaches
  - Compared with 4 alternatives in Kennedy and McQuinn (2012)

Modelling house prices

- Demand for housing:

- $$\ln\left(\frac{hc}{pop}\right) = \alpha_1 \ln\left(\frac{y}{pop}\right) - \alpha_2 \ln rent + \alpha_3 \ln pop - \alpha_4 \ln urx \qquad (1)$$

- In equilibrium:

- $$p\left(r - \frac{p^e}{p}\right) \equiv p \times uc \qquad (2)$$

- Inverted demand curve for housing:

- $$\ln p = \frac{\alpha_1}{\alpha_2} \ln\left(\frac{y}{pop}\right) - \frac{1}{\alpha_2} \ln\left(\frac{hc}{pop}\right) - \ln uc + \frac{\alpha_3}{\alpha_2} \ln pop - \frac{\alpha_4}{\alpha_2} \ln urx \qquad (3)$$

Initial long-run results for (3)

Table 1: Initial Long-Run Model Estimates: 1983:1 – 2011:3

Variable	OLS	DOLS	FM-OLS	ARDL
constant	-19.04 (-3.23)	-28.81 (-3.79)	-35.48 (-7.08)	-24.29 (-2.16)
Ln (*y/pop*)	0.56 (4.45)	-0.09 (-0.49)	-0.17 (-1.27)	0.42 (1.52)
Ln (*hc/pop*)	-0.09 (-0.21)	0.94 (1.60)	0.88 (2.11)	-0.28 (-0.31)
uc	0.001 (0.61)	0.01 (2.71)	0.01 (3.87)	0.01 (2.01)
Ln *urx*	-0.35 (-11.91)	-0.48 (-8.12)	-0.50 (-15.9)	-0.48 (-7.48)
Ln *pop*	1.78 (4.61)	2.25 (4.63)	2.66 (8.25)	2.06 (2.84)

Note: T-stats are in parentheses.

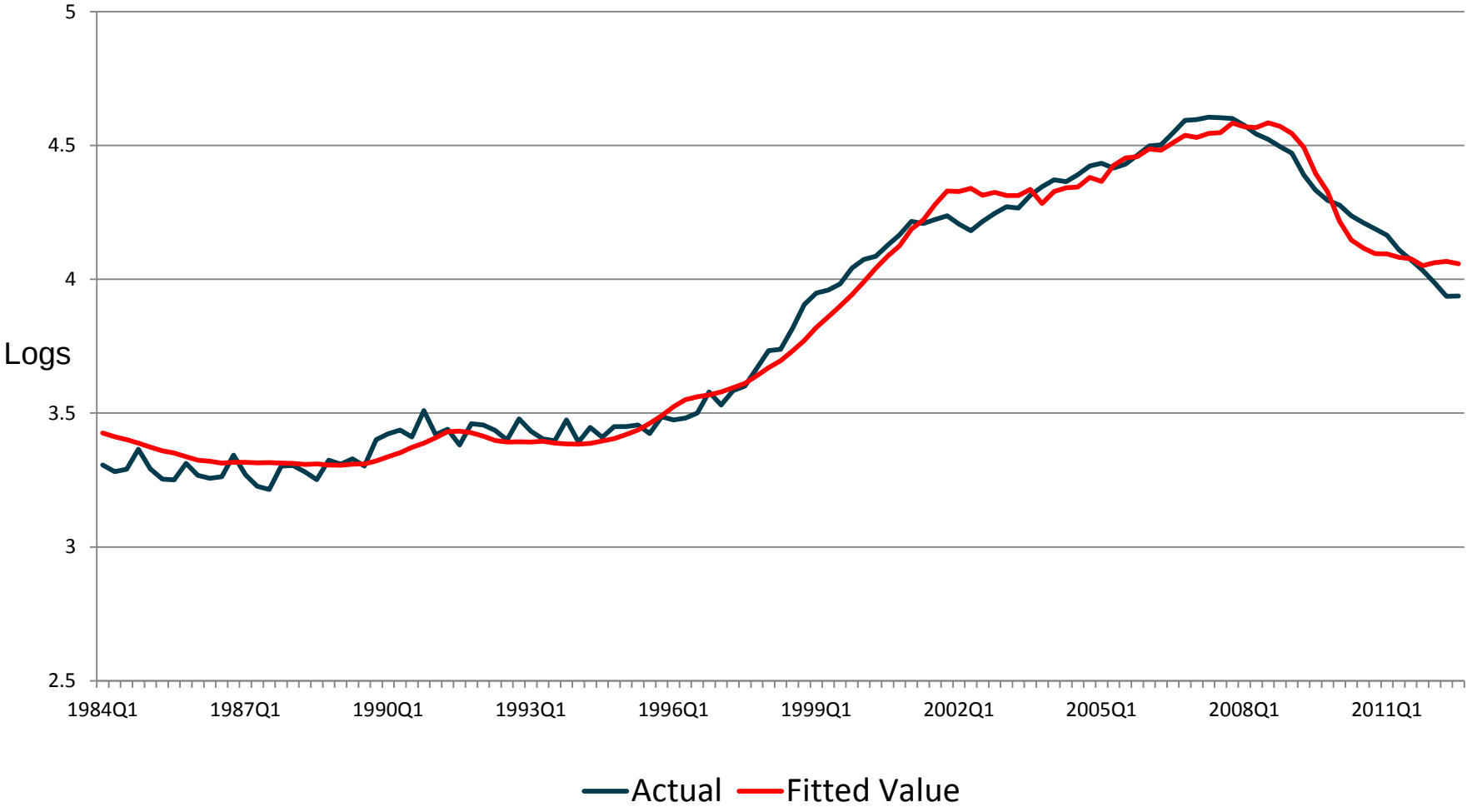
Parsimonious long-run results for (3)

Table 2: Parsimonious Long-Run Model Estimates: 1983:1 – 2011:3

Variable	OLS	DOLS	FM-OLS	ARDL
constant	-36.23 (0.00)	-42.21 (0.00)	-45.62 (0.00)	-33.39 (0.00)
Ln *urx*	-0.49 (0.00)	-0.44 (0.00)	-0.44 (0.00)	-0.53 (0.00)
Ln *pop*	2.71 (0.00)	3.10 (0.00)	3.32 (0.00)	2.53 (0.00)
Co-integration – ARDL Bounds Test				
				F-Test
				7.53 (0.00)

Note: P-values are in parentheses.

Actual and fitted house prices: 1984:1 - 2012:3



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  - Affordability reasons – picks up the change in income,
  - Also a proxy for market sentiment, very relevant in the Irish case
- Model appears to explain Irish house prices better than other popular approaches
  - Compared with 4 alternatives in Kennedy and McQuinn (2012)
- Given unemployment we can now forecast house prices

Potential endogeneity of unemployment?

- Disproportionate role of the property sector in the Irish economy
  - Particularly post 2000
- How exogenous is unemployment?
- Address this issue with an instrumental variables approach
  - 2 instruments,
  - UK unemployment and FDI flows
- UK unemployment motivated by a lot of ESRI macro modelling!

IV Long-Run Model Estimates: 1983:1 – 2011:3

Variable	OLS	IV
constant	-36.23 (0.00)	-33.29 (0.00)
Ln *urx*	-0.49 (0.00)	-0.54 (0.00)
Ln *pop*	2.71 (0.00)	2.53 (0.00)
H_o: Variable is exogenous		
F-Test		24.03 (0.00)
x^2		18.58 (0.00)
First-stage regression summary statistics		
Partial R^2		0.76
F-Test		127.54 (0.00)

Note: P-Values are in parentheses.

Short-run house price model

- General to specific approach

- $$\Delta \ln p_t = \gamma\left(\ln p_{t-1} - \widehat{\ln p_{t-1}}^{IV}\right) + \sum_{i=1}^{4} \theta_i \Delta \ln p_{t-i} + \sum_{i=0}^{4} \theta_{i+5} \Delta \ln urx_{t-i} + \sum_{i=0}^{4} \theta_{i+9} \Delta \ln pop_{t-i} + \varepsilon_t$$

Variable	Estimate	P-Value
ECT_{t-1}	-0.20	(0.00)
$\Delta \ln p_{t-4}$	0.72	(0.00)
$\Delta \ln urx_t$	-0.23	(0.00)
$\Delta \ln urx_{t-2}$	-0.23	(0.00)
$\Delta \ln urx_{t-2}$	0.19	(0.00)
R^2	0.68	

Part 2

Credit risk model

Loan loss forecasting (LLF) model

- Builds on the work of Kelly (2011)

Expected Loss = Prob of Default x Exposure x Loss Given Default

Prob of Default

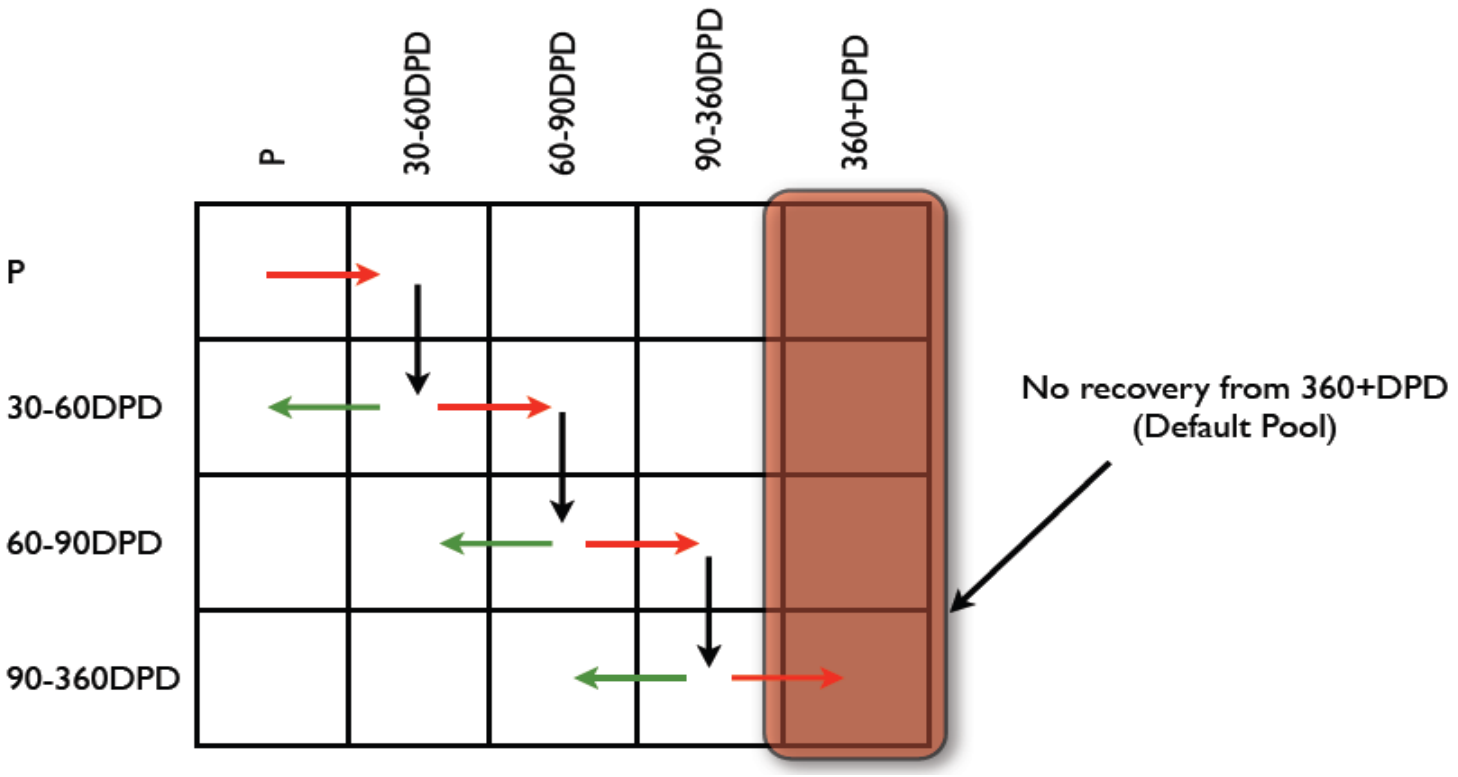
1) Vintage
2) Type of Loan
3) LTV
4) Unemployment

Loss Given Default

1) Negative Equity
2) Fixed Cost

LLF model

- Examines 5 different states a mortgage can be in



LLF model (PDH and BTL)

One Year Unconditional Transition Probabilities

PDH

	P	30-60DPD	60-90DPD	90-360DPD	360+DPD
P	95.14%	1.98%	0.88%	1.66%	0.34%
30-60DPD	57.12%	3.32%	3.83%	25.82%	9.91%
60-90DPD	15.07%	2.28%	4.51%	51.60%	26.54%
90-360DPD	1.85%	1.00%	3.36%	55.28%	38.52
360+DPD	0%	0%	0%	0%	100%

BTL

	P	30-60DPD	60-90DPD	90-360DPD	360+DPD
P	92.34%	2.20%	1.22%	3.28%	0.96%
30-60DPD	45.77%	1.78%	2.56%	31.41%	18.48%
60-90DPD	6.54%	0.66%	2.35%	50.88%	39.56%
90-360DPD	0.61%	0.28%	1.75%	48.35%	38.52
360+DPD	0%	0%	0%	0%	100%

Estimation period and forecasting

- Credit risk model:
  - Arrears from one state to another,
  - Function of loan type, loan seasoning, house prices and unemployment.
  - Estimated using loan level data – 600,000 loans over the period June 2008 – December 2011.
- A loan loss rate is forecast from 2012 - 2014
- Baseline and scenario forecasts
  - Forecasts required for unemployment and population
- Baseline unemployment rate as outlined in IMF Article 4.

Estimated Coefficients

	PDH		BTL	
	LTV	UN	LTV	UN
Deteriorating Transitions				
P to 30-60DPD	0.0063*	0.012*	0.007*	0.028*
	(0.0062,0.0066)	*(0.010,0.013)*	*(0.006,0.008)*	*(0.024,0.031)*
30-60DPD to 60-90DPD	0.0017*	-0.001	0.0036*	0.00449*
	(0.0014,0.0020)	*(-0.0036,0.0005)*	*(0.0031,0.0041)*	*(0.0001,0.009)*
60-90DPD to 90-360DPD	0.0002	-0.001*	0.0019*	0.0028
	(-0.0001,0.0005)	*(-0.004,0.0004)*	*(0.0013,0.0024)*	*(-0.0022,0.0078)*
90-360DPD to 360+DPD	0.0001	0.0033*	0.0013*	0.0119*
	(-0.0001,0.0002)	*(-0.0004,0.044)*	*(0.0004,0.00023)*	*(0.003,0.020)*
Improving Transitions				
30-60DPD to P	-0.0033*	-0.009*	-0.004*	0.002
	(-0.0035,-0.0031)	*(-0.01,-0.007)*	*(-0.005,-0.003)*	*(-0.002,0.006)*
60-90DPD to 30-60DPD	-0.0041*	-0.007*	-0.0046*	-0.0075*
	(-0.0045,-0.0037)	*(-0.0102,-0.0037)*	*(-0.0056,-0.0037)*	*(-0.008,-0.006)*
90-360DPD to 60-90DPD	-0.0062*	-0.019*	-0.007*	-0.012*
	(-0.0067,-0.0056)	*(-0.0234,-0.015)*	*(-0.008,-0.006)*	*(-0.022,-0.001)*

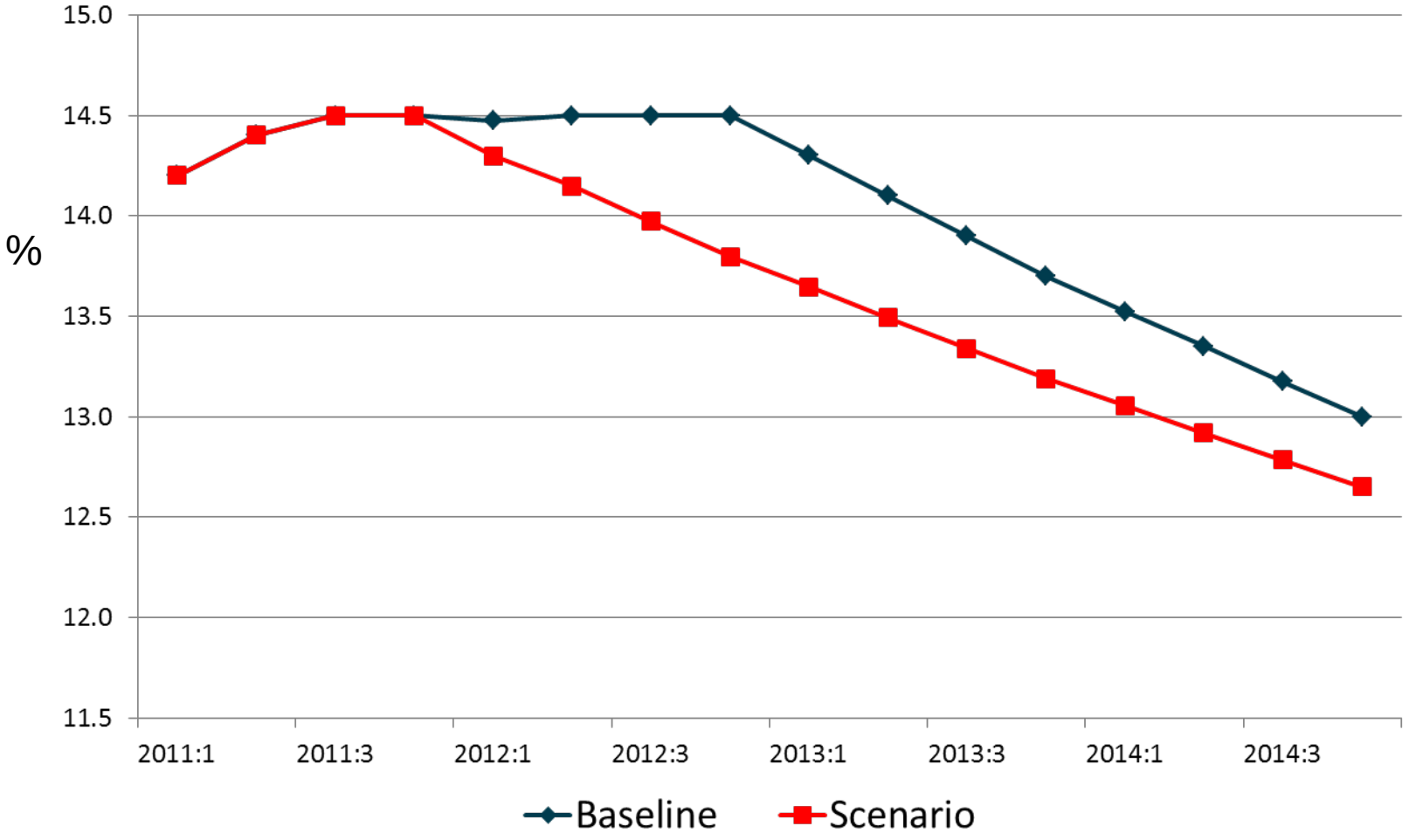
Part 3

Results and macroeconomic scenario

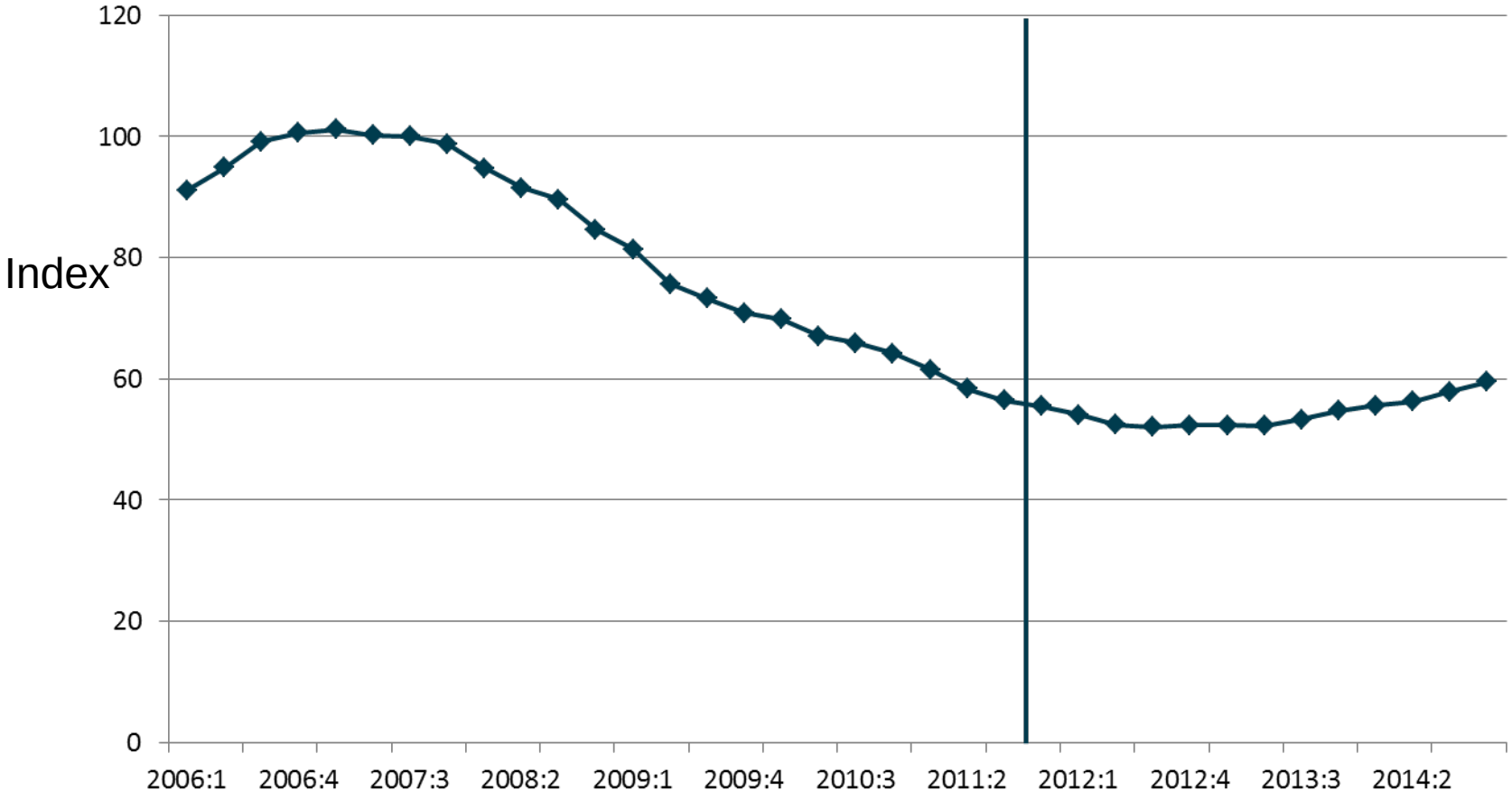
Whole economy scenario

- Use *HERMES* macro-economic model
  - Bergin, Conefrey, Fitzgerald and Kearney (2010)
- To examine an increase in fiscal expenditure of €2 billion
  - Assume results are linear and symmetric
- In particular, we take the unemployment results of the scenario
- Note, implicit fiscal multipliers are quite conservative

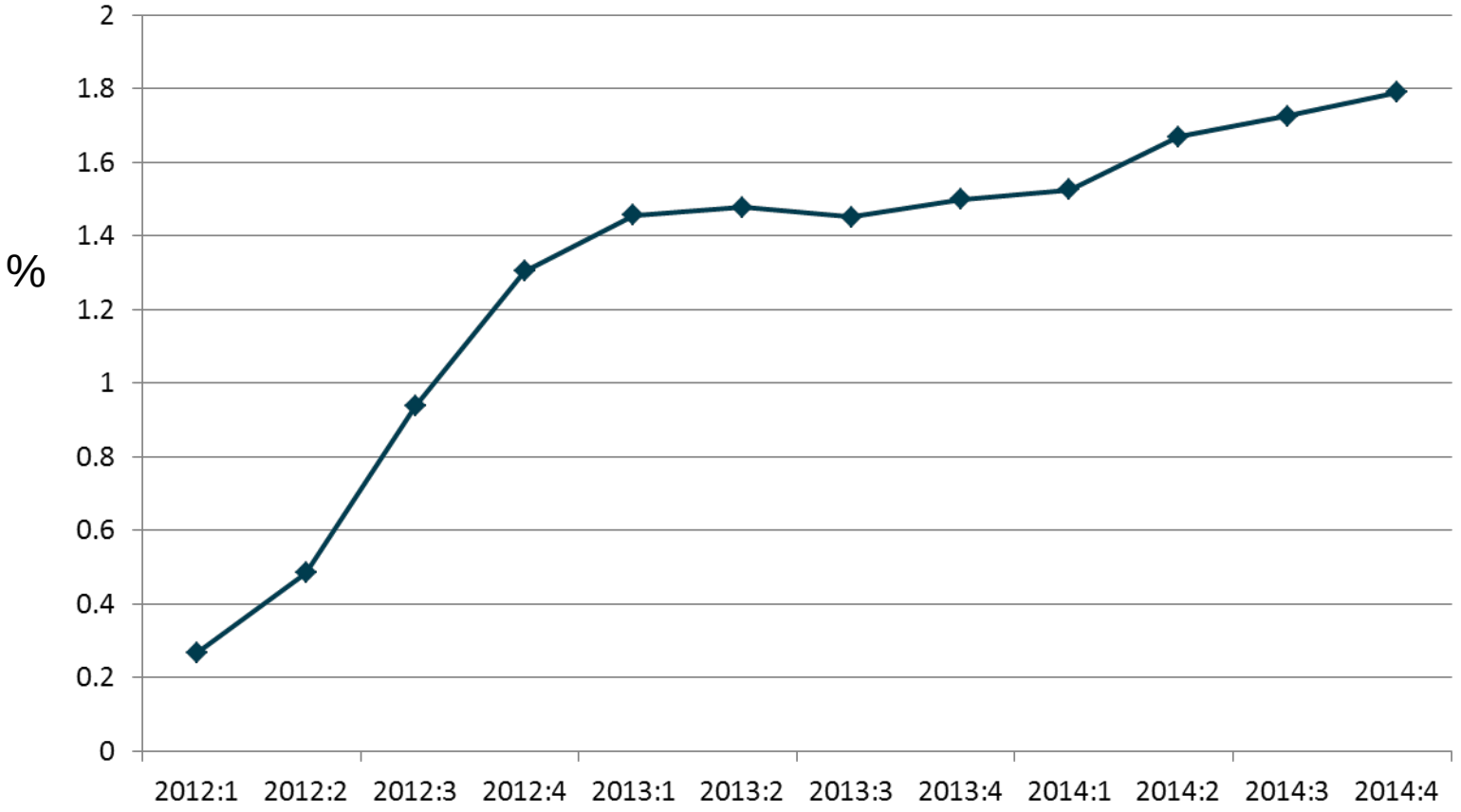
Baseline and scenario unemployment forecasts: 2012 - 2014



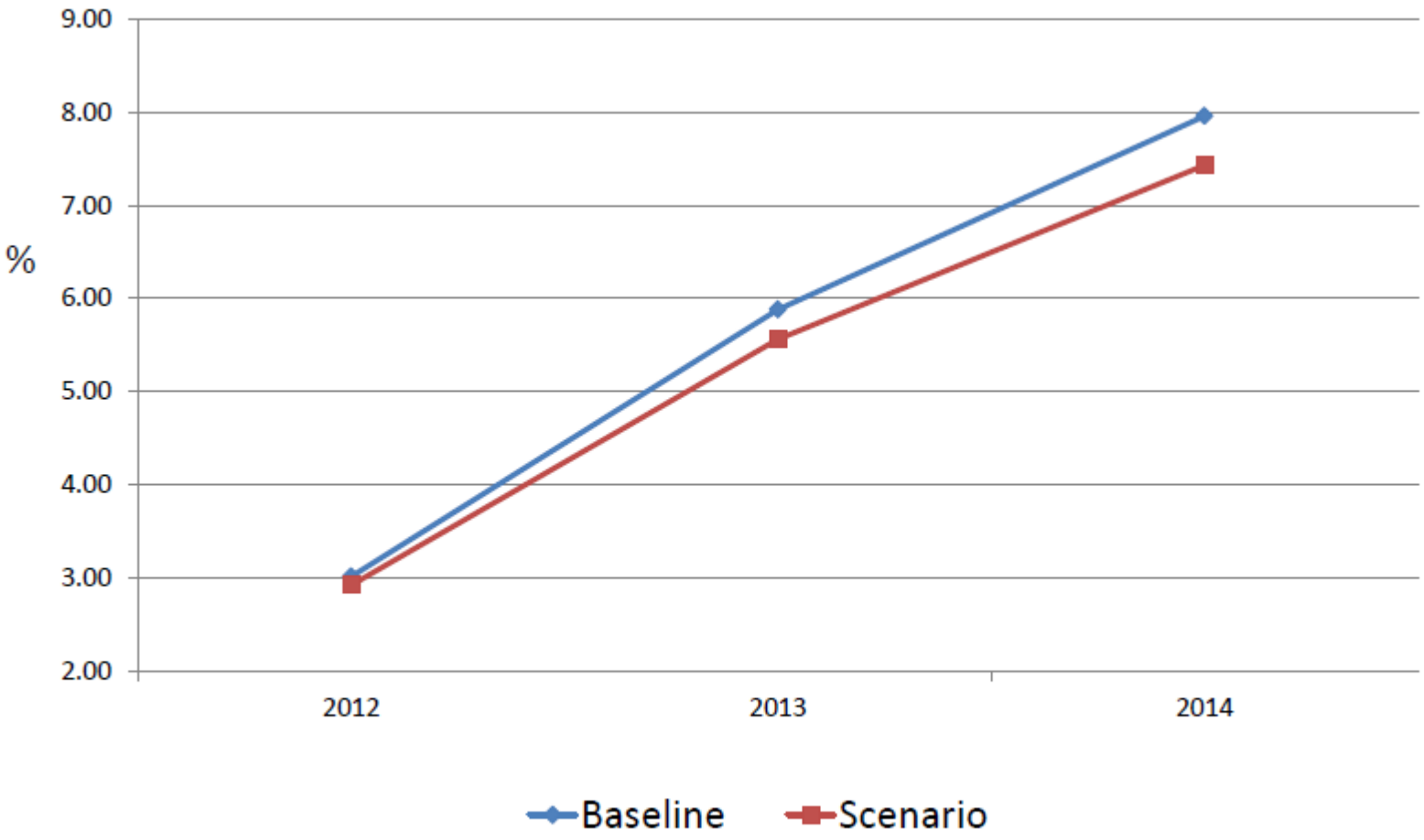
Baseline real house price forecast: 2012 - 2014



Scenario house price percentage improvement relative to baseline: 2012 - 2014



Loan loss forecast (LLF) rate: 2012 - 2014



Scenario results

- Apply the loss rates to both PDH and BTL components of the books
- Difference between baseline and scenario levels

  = Saving from the policy

	Outstanding	Difference between scenarios
	€ million	
PDH	111,989	303
BTL	29,487	360
Total		663

Implications for debt financing

- Not all benefits are captured in the approach
  - Stimulus would benefit SMEs and Corporates
  - Also have significant loan impairments
- Bergin et al. (2010) estimate borrowing requirement at €1,290 million
  - Over three years
- Given a saving of €660 million – suggests cost could be halved

Conclusions

- Strong relationship between house prices and unemployment
  - Affordability and indicator of market sentiment
- Given the unique capital obligations of the Irish state
- Using a comprehensive empirical framework, we demonstrate how
- Even with a moderate fiscal multiplier,
- The significant impact on the fiscal accounts through this new channel.

Annex slides

In particular:

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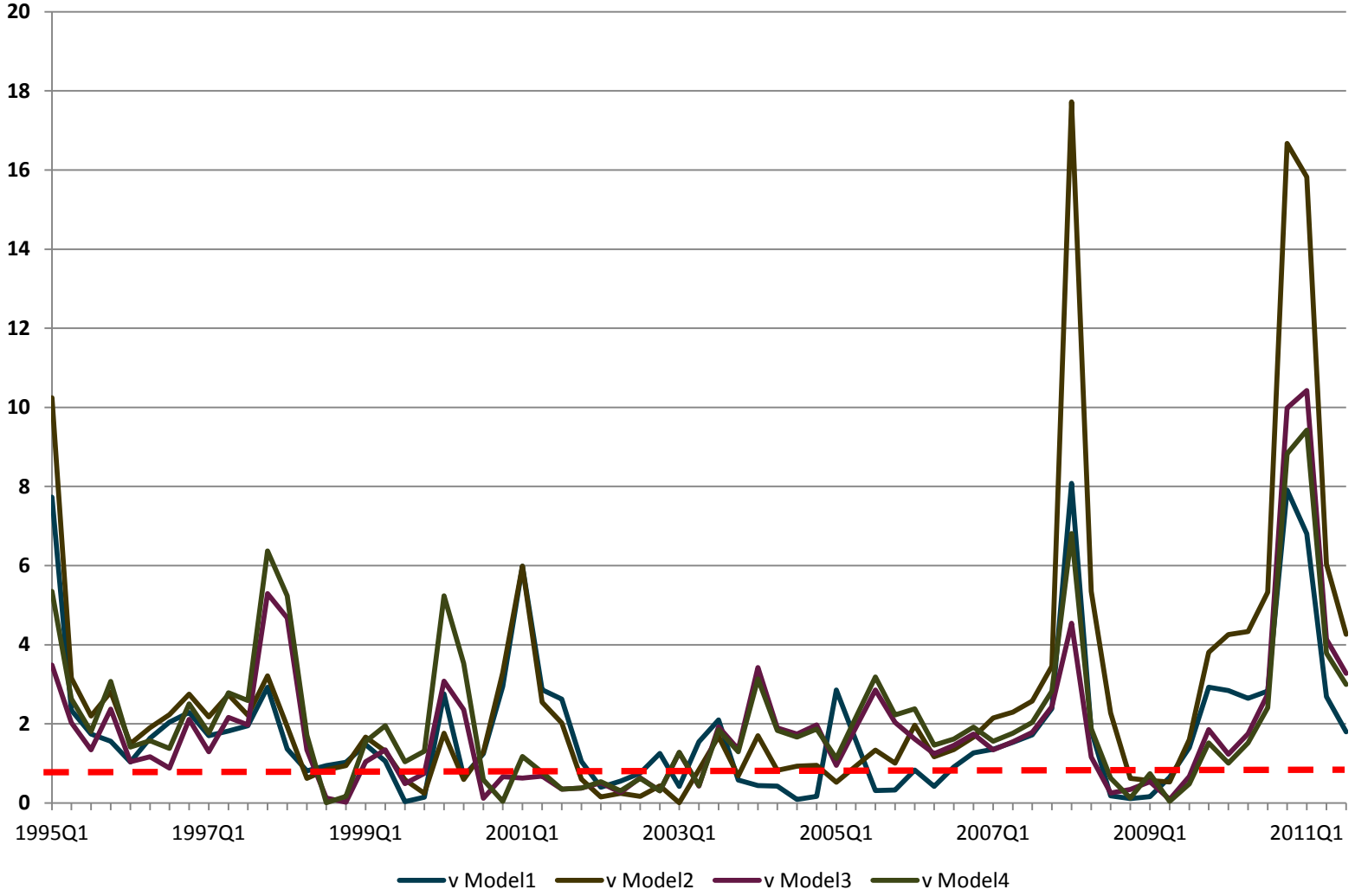
Co-integration – ARDL Bounds Test				
				F-Test
				7.53 (0.00)

Note: P-values are in parentheses.

Comparison of residuals with other models: 1995:1 - 2011:3



Potential endogeneity of unemployment?

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  - Particularly post 2000
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- Address this issue with an instrumental variables approach
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x^2		18.58 (0.00)
First-stage regression summary statistics		
Partial R^2		0.76
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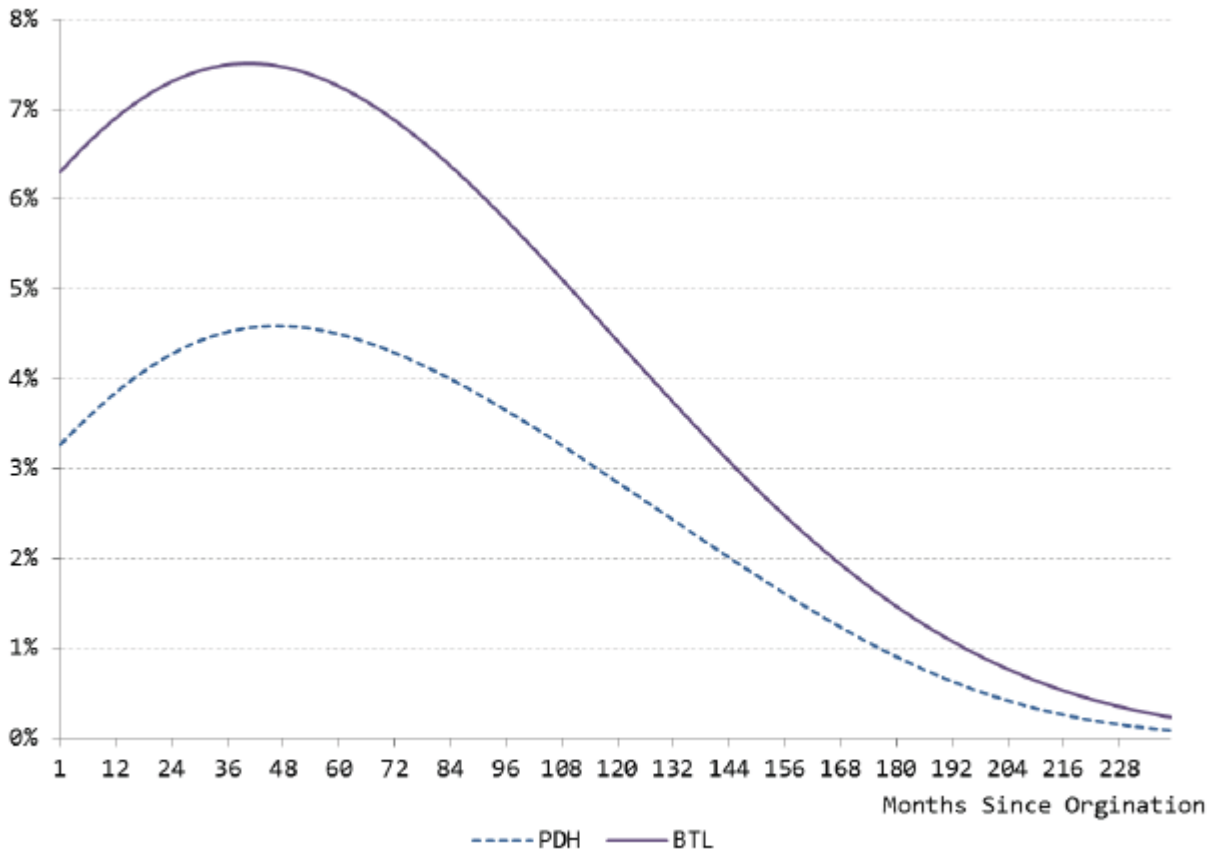
Note: P-Values are in parentheses.

Loan Type & Vintage Effects

Default probabilities



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90-360DPD to 60-90DPD	-0.0062*	-0.019*	-0.007*	-0.012*
	(-0.0067,-0.0056)	*(-0.0234,-0.015)*	*(-0.008,-0.006)*	*(-0.022,-0.001)*

Sensitivity of model to unemployment and house prices

- If unemployment returns to 7%
  - 57% improvement in cure rates from 90 to 360 DPD

- If we take LTVs as of December 2011
  - A similar improvement would require house prices to increase by 85%

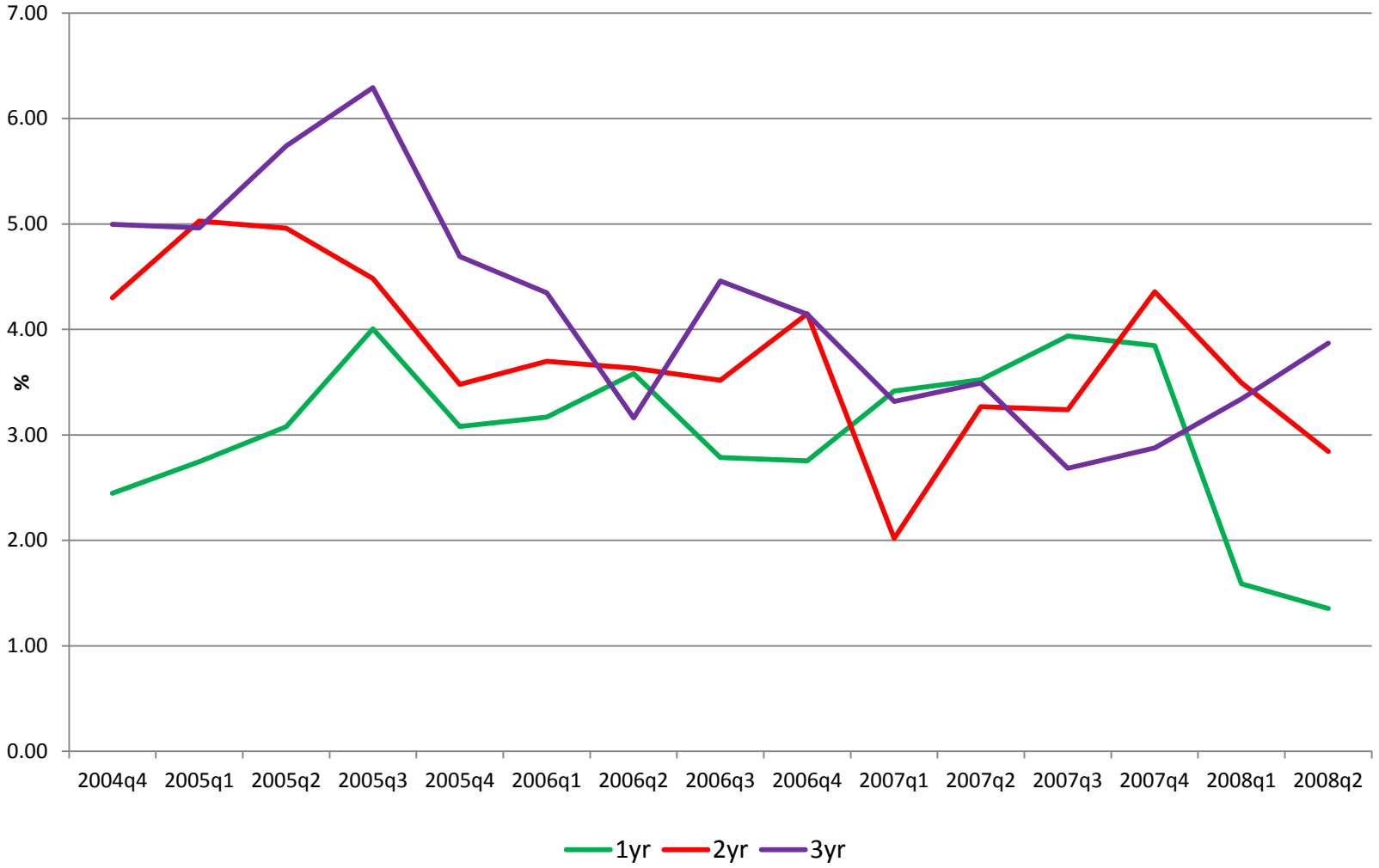
- Or,

	€ million	%
Total loan book	111,989	
90 DPD+	16,479	14.7
Balance reduction required to match unemployment scenario	7,546	6.8

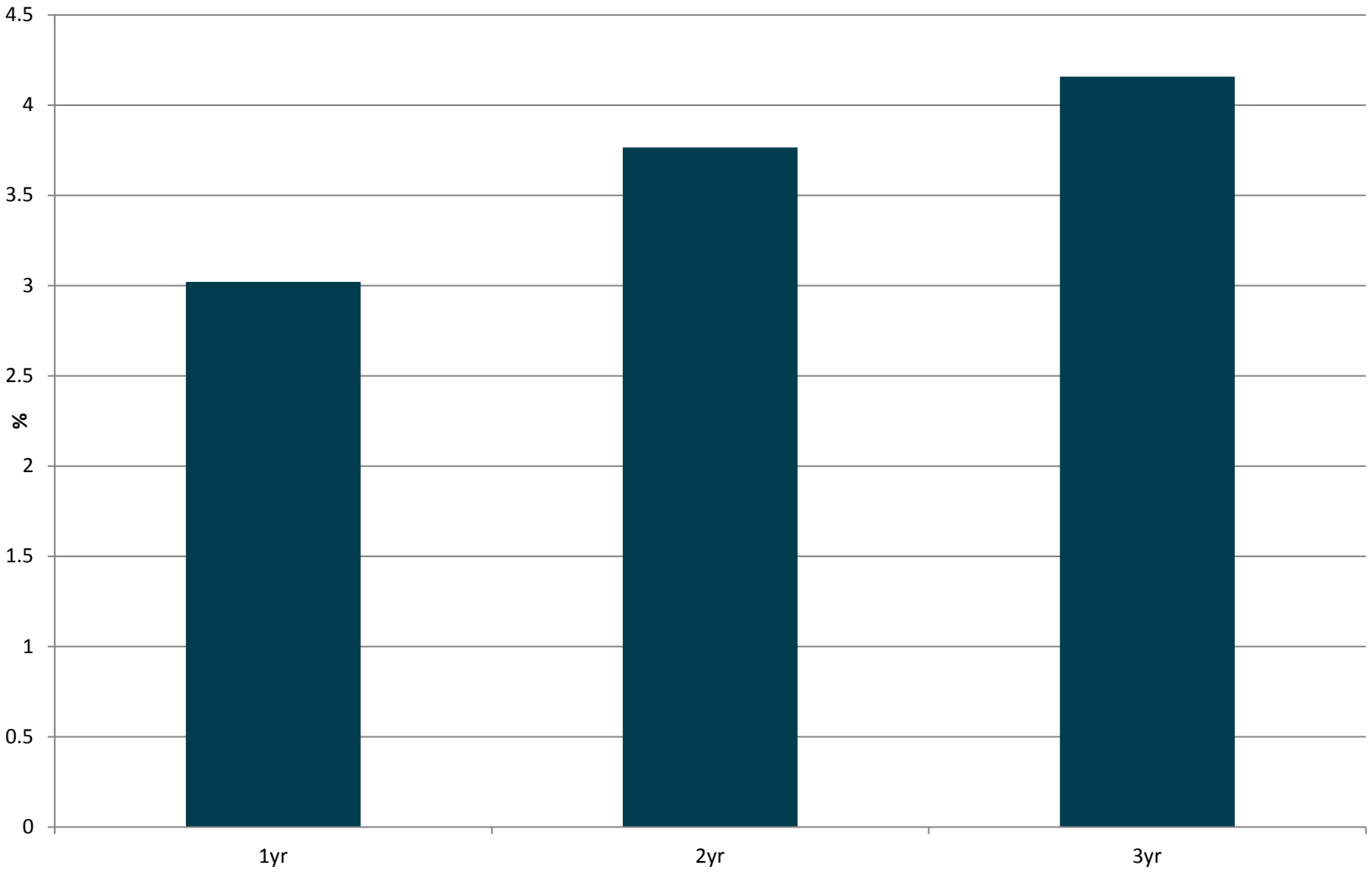
Fan charts

- Number of ways to do this
  1. Generate distributions of independent variables,
  2. Examine the forecast errors of underlying model,
- We do the latter
  - Take the 1,2,3 and 4 year ahead forecast error,
- Take 10,000 random draws for each period's error
  - Underlying distribution is assumed to be normal
- For the forecast horizon
  - Put this distribution around the point forecast
  - Pull out the fractiles to generate the fanchart

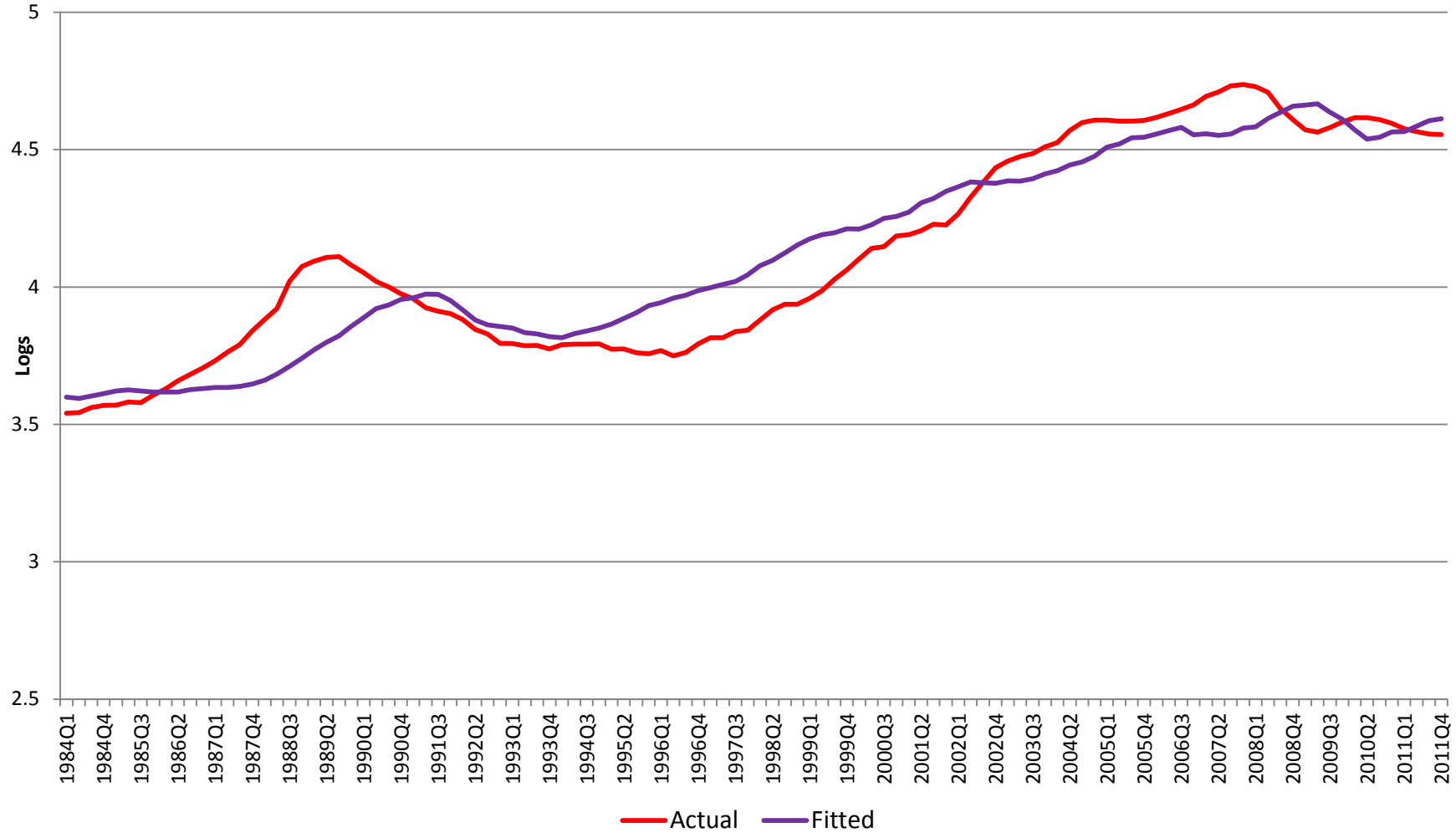
1, 2, & 3 year forecast errors from recursive estimation



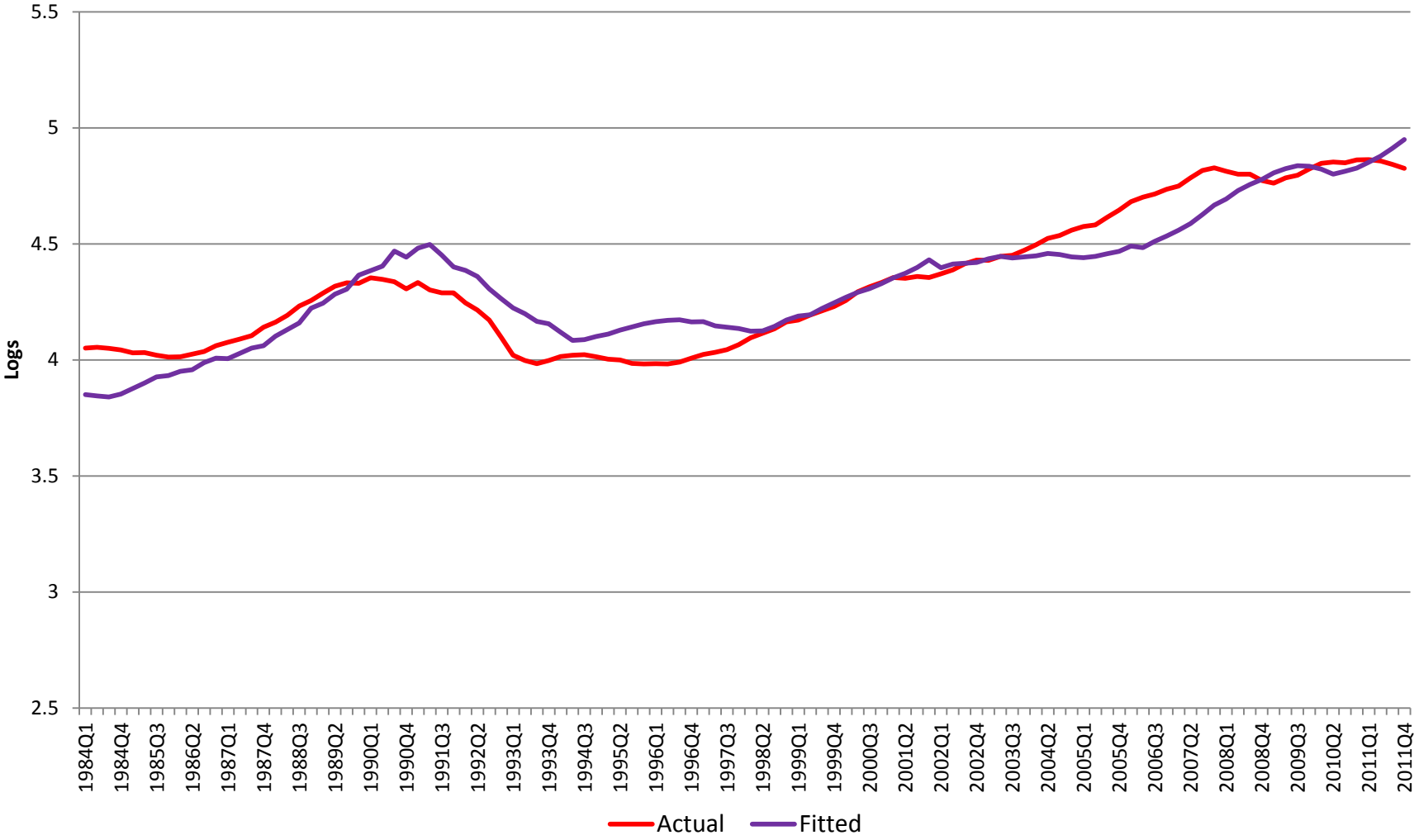
Average 1, 2, & 3 year forecast errors from recursive estimation



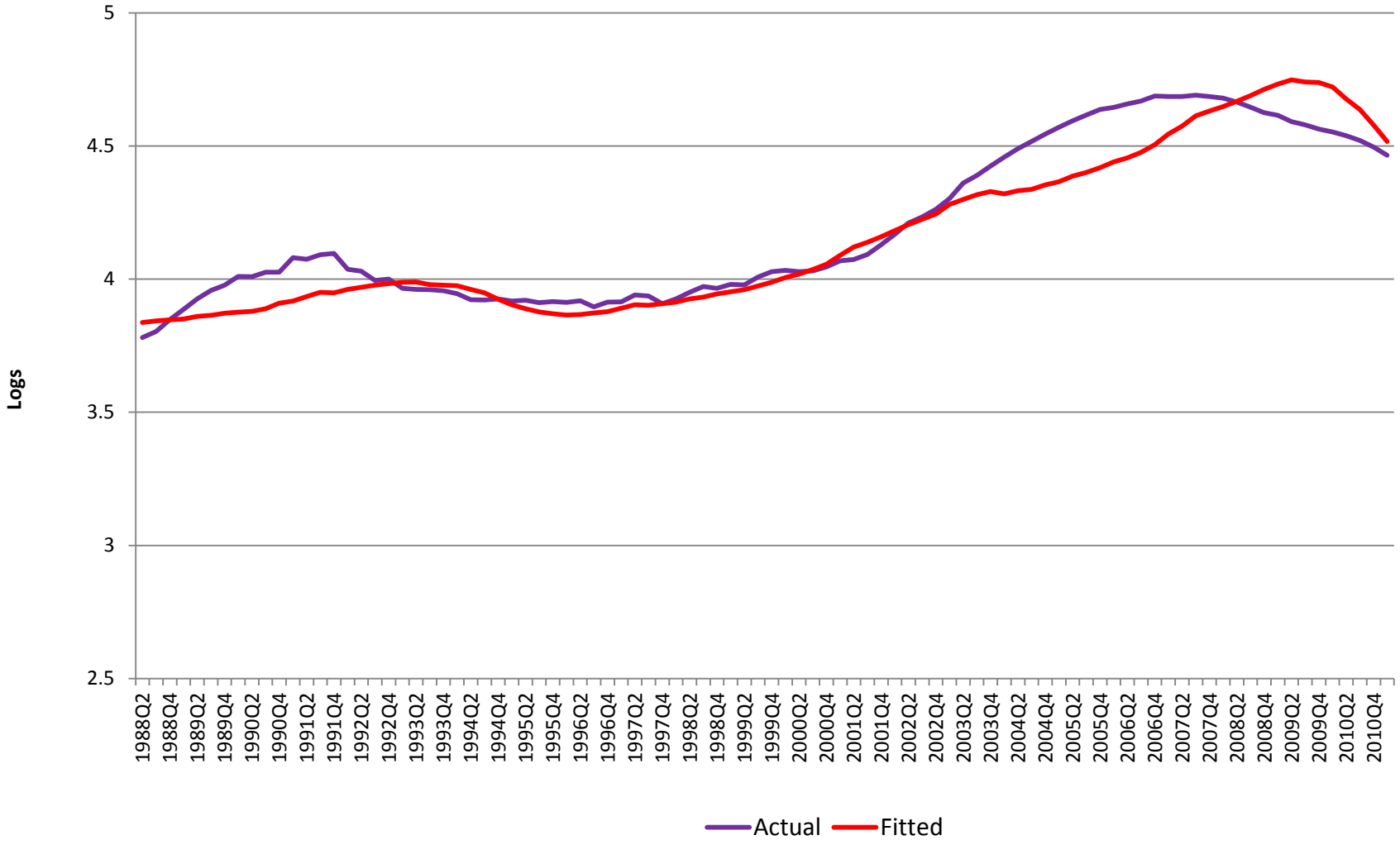
Actual and Fitted UK House Prices: 1984:1-2011:4



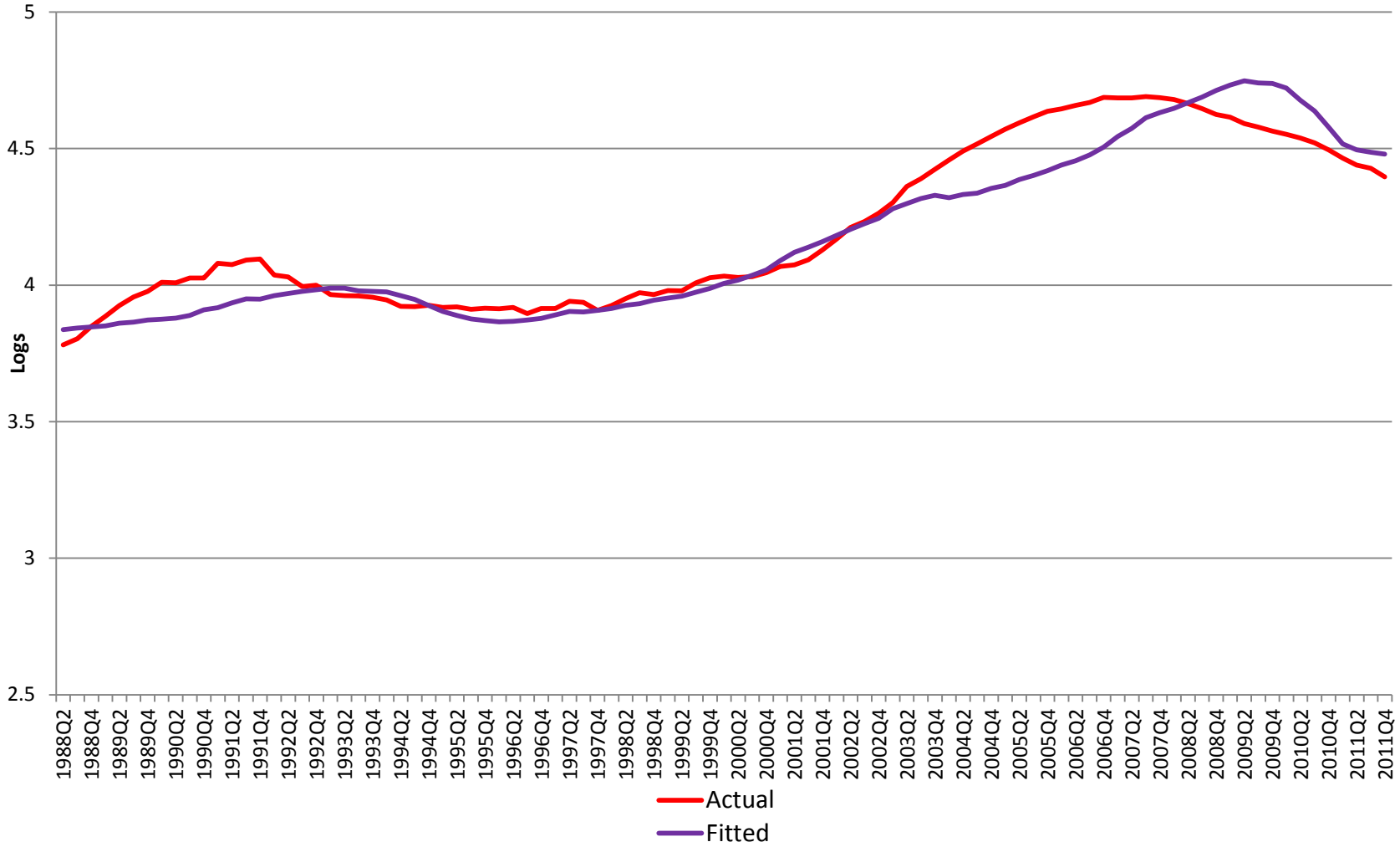
Actual and Fitted Swedish House Prices: 1984:1 - 2011:4



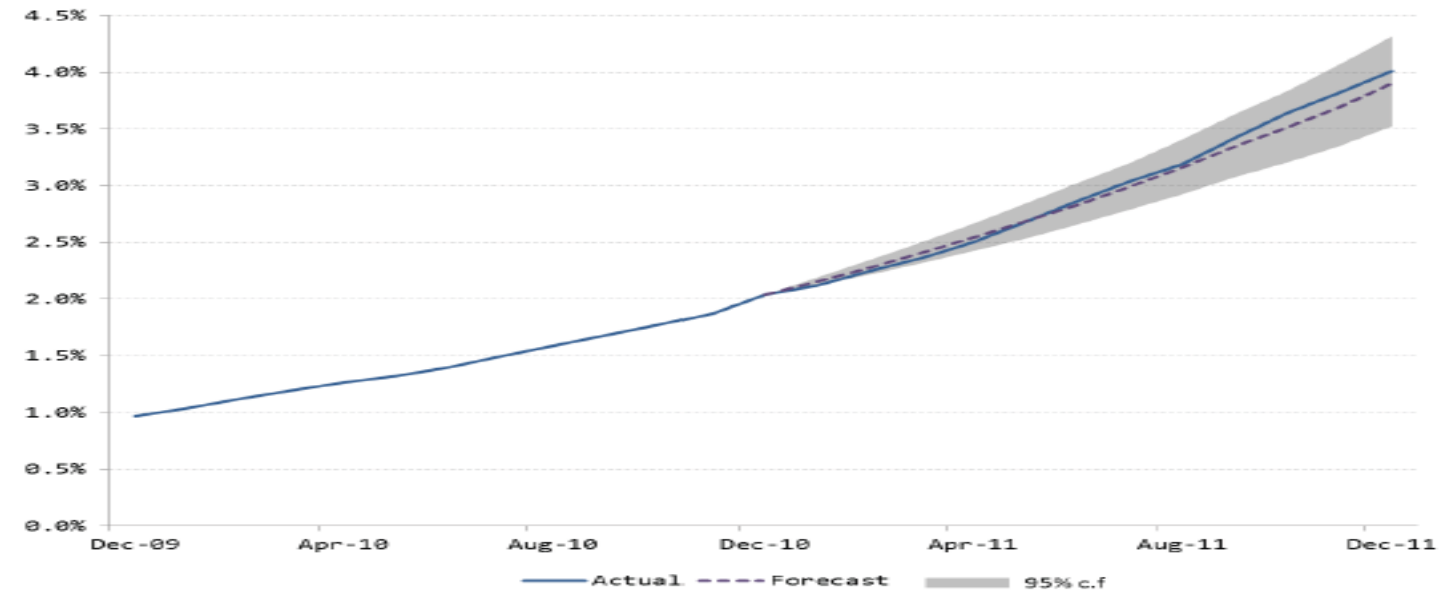
Actual and Fitted Finnish House Prices: 1988:1-2011:4

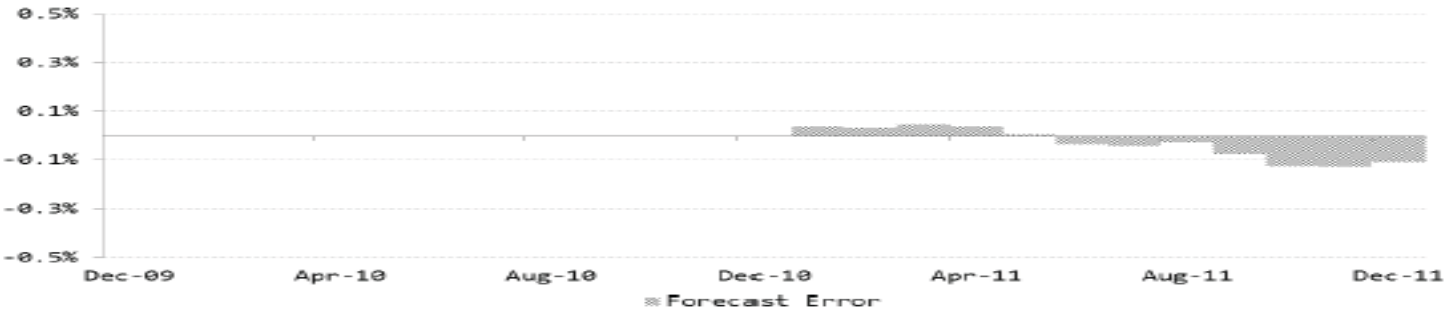


Actual and Fitted Spanish House Prices: 1988:1-2011:4



Out of Sample Forecast

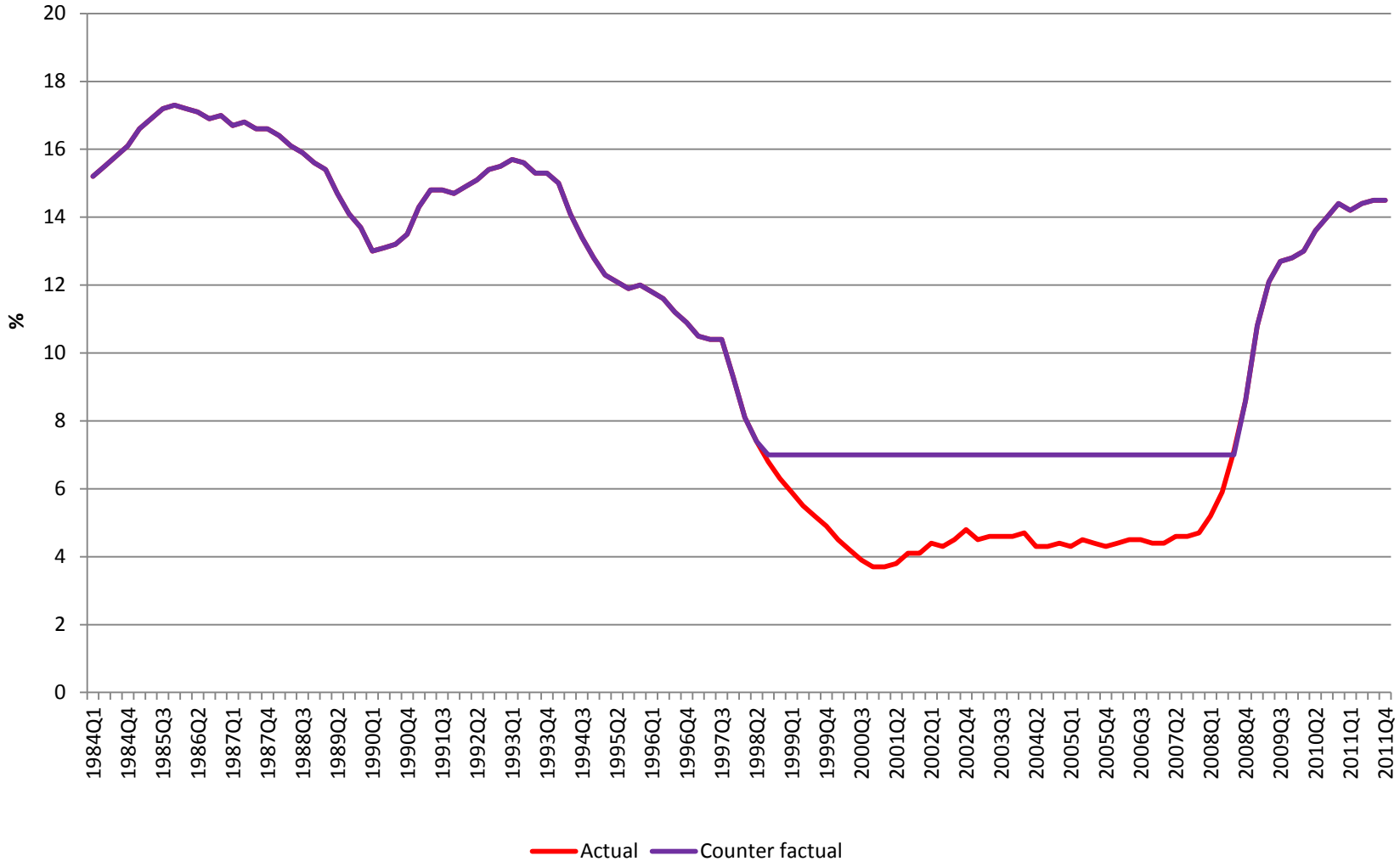




Bubble in Irish house prices?

- Common manner of examining “the state of the market”
- Compare actual prices with solution to the model
- If the model performs very well post 2000
- No bubble in house prices?
- Not quite – unemployment may be well below structural level
- Examine implications if unemployment had been higher (>2000)

Actual and Counter factual Unemployment: 1983:1 - 2011:4



% Difference Between Actual and Counter factual House Prices, 1999:1-2011:4