



# **Twin peaks in equity and housing prices**

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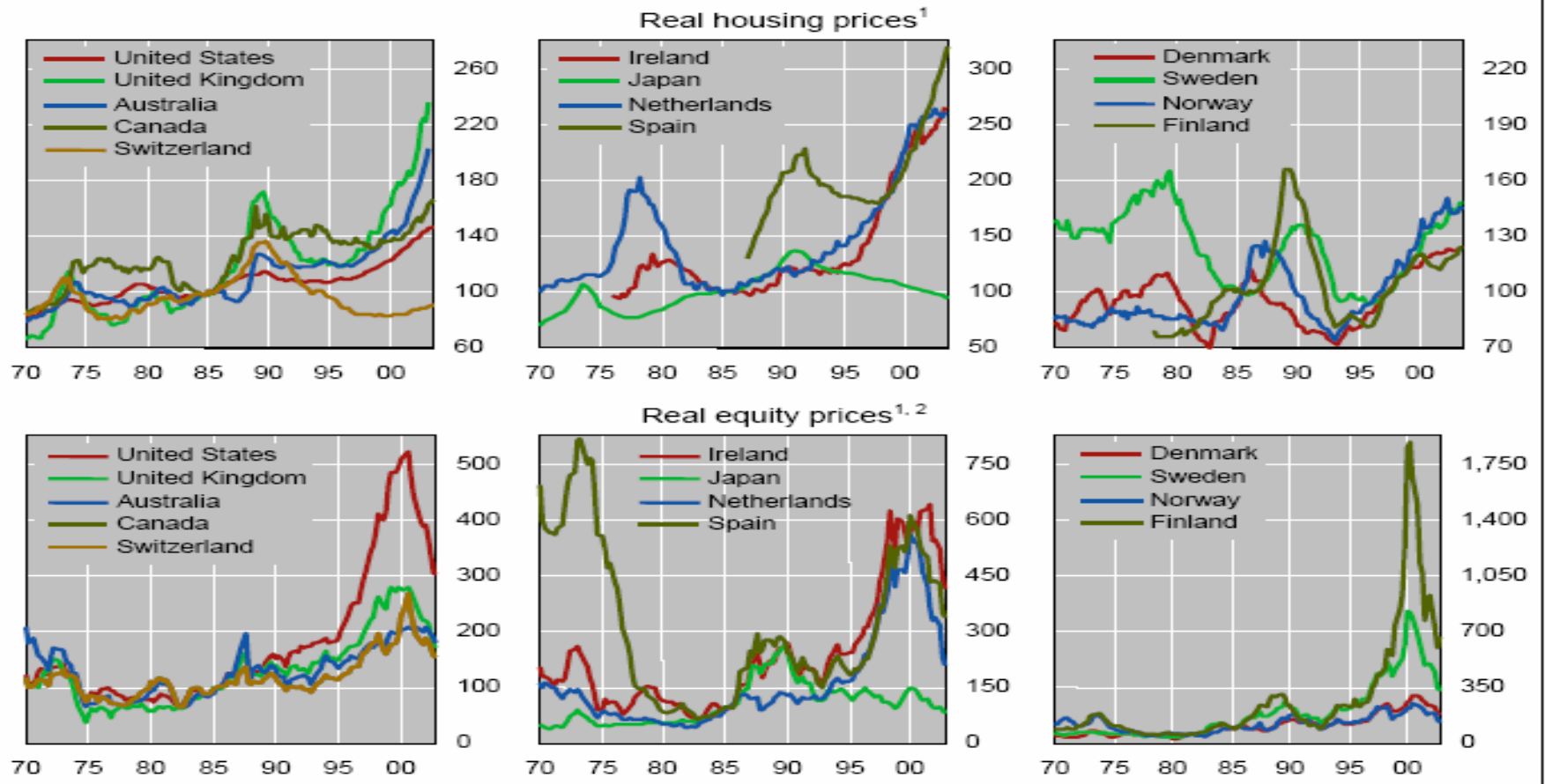
## Research Questions

- Three statistical inquiries:
  - **Q1:** Do equity peaks ***“predict”*** housing price peaks?
  - **Q2:** What explains ***lag length*** between equity and housing price peaks?
  - **Q3:** What explains the ***size of the downturn*** in a housing price bust?



### Equity and housing prices around the world

1985 = 100



<sup>1</sup> Nominal prices deflated by the personal consumption deflator. <sup>2</sup> National benchmark indices.

Sources: Japan Real Estate Institute; national data.

Graph 1



## Empirical Methodology

- Sample of 13 industrialized countries (1970-2003)
  - AU, CA, DK, FI, IE, JP, NL, NO, ES, SE, CH, UK and US
  - Choice of countries driven by data availability
- Algorithm identifies equity and housing price peaks
  - 13 quarter window for housing; 21 quarter window for equity
  - 1970-1999 since current cycle hasn't finished
    - 26 “peak pairs” (equity and housing)
    - 1 independent housing peak (US 1979Q2)
    - 6 independent equity peaks
- Empirical analysis: probit/OLS regressions using identified peaks



## Q1: Do equity peaks predict housing peaks?

- Probability (unconditional) of a housing price peak...
  - Any 4 quarter window: 0.09
  - Any 8 quarter window: 0.18
  - Any 12 quarter window: 0.27
- But greater if conditioned on an equity price peak?
  - **Probit regression**
    - **Dep var:**
      - Dummy for housing peak within 4, 8, 12 quarter windows.
    - **Indep Vars:**
      - Equity peak dummy
      - output growth and changes in interest rates and unemployment
      - Financial imbalance dummy:
        - Set to one if credit/GDP > 4% of trend **and** Equity > 60% of trend



## Q1: Do equity peaks predict housing peaks?

Predicting housing price peaks based on equity price peaks <sup>1</sup>							
Horizon of dependent variable	Combination of predictive variables					Probability of peak	
	Equity peak <sup>2</sup>	Interest rates	GDP growth	Unemployment			
					Unconditional	Conditional <sup>3</sup>	
Four quarters	0.18***				0.09	0.27	
	0.16***	0.02***				0.25	
	0.12**	0.02***	0.01**	-0.10***		0.21	
Eight quarters	0.33***				0.18	0.50	
	0.30***	0.03***				0.48	
	0.25***	0.02**	0.03***	-0.15***		0.43	
Twelve quarters	0.38***				0.27	0.65	
	0.36***	0.03***				0.63	
	0.33***	0.01	0.04***	-0.18***		0.60	

<sup>1</sup> Based on quarterly data (1971 to end-1999) for 13 developed countries. Control regressors include single lags of GDP growth, changes in short-term nominal interest rates and changes in unemployment. The coefficients on these controls can be interpreted as the change in the probability of a peak in housing prices given a marginal change in the regressor from its sample mean. One, two and three asterisks denote significance at the 10%, 5% and 1% level respectively. All regressions were run with four lags of these control variables, with qualitatively and quantitatively similar results. <sup>2</sup> The coefficient on the binary regressor capturing peaks in equity prices can be interpreted as the change in the probability of a housing price peak given a discrete change in the regressor. <sup>3</sup> The conditional probability given a peak in equity prices is the sum of the unconditional probability and the coefficient on the equity peak regressor.

Table 2



## Q1: Do equity peaks predict housing peaks?

Predicting housing price peaks based on financial imbalances <sup>1</sup>					
	Change in the unconditional probability of a peak in housing prices				
Unconditional probability	Equity price peak <sup>2</sup>	Financial imbalance <sup>2, 3</sup>	Interest rates <sup>4</sup>	GDP growth <sup>4</sup>	Unemployment <sup>4</sup>
0.09	0.17***	0.21***			
0.09	0.11**	0.19***	0.02***	0.01**	-0.10***

<sup>1</sup> Results from probit regressions, with the dependent variable defined as a zero/one dummy corresponding to the occurrence/non-occurrence of a peak in housing prices within the next four quarters. One, two and three asterisks denote statistical significance at the 10%, 5% and 1% level respectively. The results are robust to changes in the horizon over which the peak in housing prices is predicted, eg eight and 12 quarters ahead. <sup>2</sup> The change in the probability of a peak in housing prices conditional on either a peak in equity prices or a financial imbalance having occurred. <sup>3</sup> The financial imbalance dummy is set to one if the credit gap is larger than 4 percentage points and the equity gap is larger than 60 percentage points eight quarters prior to the equity price peak. With no control variables, the coefficients on this variable under alternative lag specifications are 0.08\*\*, 0.20\*\*\* and 0.15\*\*\* for four, six and 10 quarters prior to the equity price peak respectively. With controls, the corresponding coefficients are 0.05, 0.15\*\*\* and 0.14\*\*\* respectively. <sup>4</sup> Control regressors include single lags of GDP growth, the change in short-term nominal interest rates and the change in the unemployment rate. The coefficients on these controls can be interpreted as changes in the probability of a housing price peak given a marginal change in the corresponding regressor from its sample mean. All regressions were run with four lags of these control variables, with qualitatively and quantitatively similar results.

Table 3



## Q2: What determines the lag length between peaks?

- Lag length regressed on...
  - Average change in interest rates between peaks
  - Output growth, unemployment and financial imbalance dummy
- Only 23 observations!!
- Only interest rates seem to matter





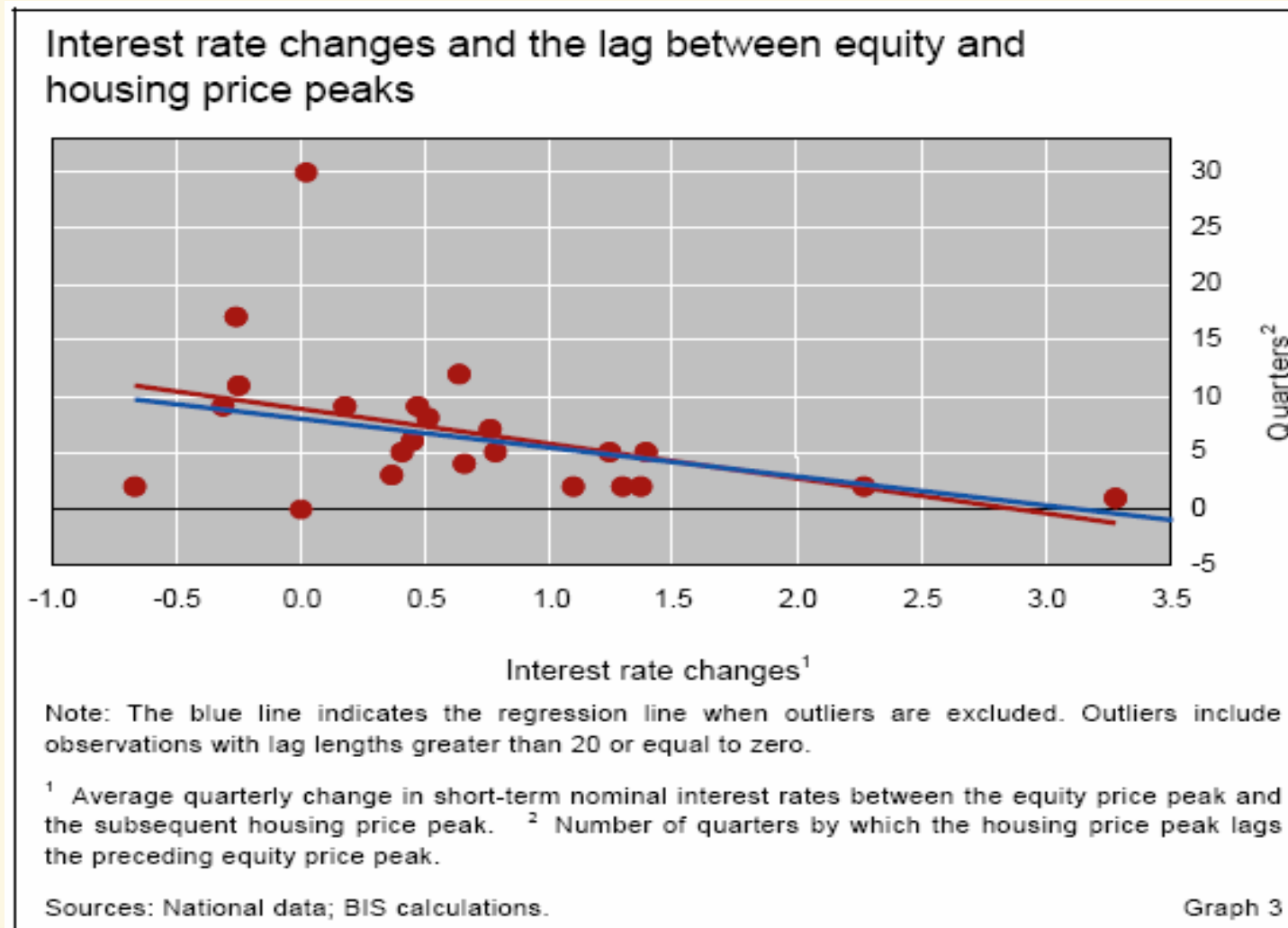
### Housing and equity price peaks: stylised facts

Pairs of equity price and housing price peaks							
Period <sup>1</sup>	Country	Housing price peak		Period <sup>1</sup>	Country	Housing price peak	
		Date	Lag			Date	Lag
1970–74	Denmark	1973 Q3	2	1985–91	Finland <sup>2</sup>	1985 Q1	45
	United Kingdom	1973 Q3	5		Denmark	1986 Q1	9
	Japan	1973 Q3	2		Norway <sup>2</sup>	1987 Q2	30
	United States	1973 Q4	4		Canada	1989 Q1	6
	Canada	1974 Q2	5		Australia	1989 Q2	7
	Norway	1974 Q4	5		Finland	1989 Q2	0
	Average lag length		3.8		United Kingdom	1989 Q3	8
1979–82	Denmark	1979 Q2	11		Switzerland	1989 Q4	9
	Ireland	1979 Q2	2		United States	1989 Q4	9
	United Kingdom	1980 Q3	5		Sweden	1990 Q1	2
	Canada	1981 Q1	1		Netherlands	1990 Q2	3
	Australia	1981 Q2	2		Ireland	1990 Q3	2
	Switzerland	1982 Q1	12		Japan	1991 Q1	5
	Average lag length		5.5		Spain	1991 Q4	17
				Average lag length		10.9	

Note: The lag is the number of quarters between consecutive equity and housing price peaks. Independent equity price peaks, ie those followed by a second peak in equity prices prior to a peak in housing prices, occurred in the Netherlands (1986 Q3), Denmark (1980 Q1), Norway (1990 Q2), Australia (1994 Q1), Denmark (1994 Q1) and Spain (1994 Q1). An independent housing price peak, ie a peak where the previous peak in housing prices happened after the previous peak in equity prices, occurred in the United States (1979 Q2). Other peaks in housing prices are associated with equity price peaks which occurred prior to the start of the sample period. These include Switzerland (1973 Q3), Australia (1974 Q1), the Netherlands (1978 Q2) and Sweden (1979 Q3).

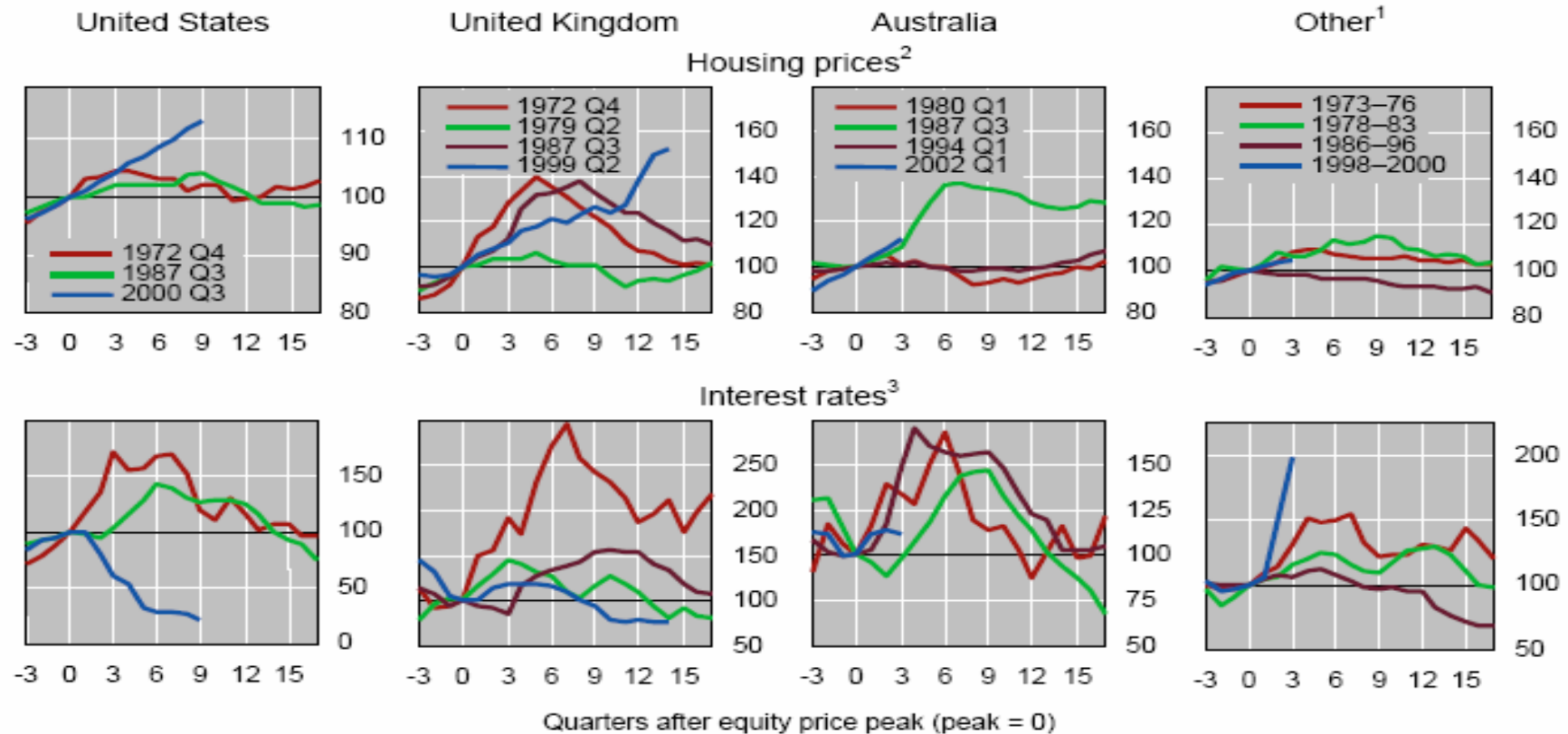


## Q2: What determines the lag length between peaks?





### Housing prices and interest rates around equity price peaks



Note: In each panel, the blue line indicates the developments since the most recent equity price peak.

<sup>1</sup> Simple average in the periods indicated of Canada, Denmark, Finland, Ireland, Japan, the Netherlands, Norway, Spain and Sweden. <sup>2</sup> Housing price = 100 at each equity price peak. <sup>3</sup> Short-term nominal interest rates; in percentages.

Sources: Office of Federal Housing Enterprise Oversight; national data; BIS calculations.

Graph 2



## Q3: What determines the size of the bust?

- Most important question in some respects!! (IMF WEO 2003)
- Housing prices dynamics:
  - Average boom: 40% trough to peak
  - Average bust: 20% peak to trough (sample range 3-50%)
  - Example: HP starts at 100 → booms at 140 → busts at 110
- OLS regressions:
  - **Dep Var:** Percent change in housing prices (peak to trough)
  - **Indep Vars:**
    - Size of housing boom
    - Size of equity boom
    - Size of equity bust
    - Change in interest rates and output prior to HP peak



### Q3: What determines the size of the bust?

Predicting the size of the housing price bust <sup>1</sup>								
Dependent variable: percentage peak-to-trough fall in housing prices								
Housing price boom	Equity price <sup>2</sup>		Financial imbalance <sup>3</sup>	Interest rate change <sup>4</sup>		Output growth <sup>4</sup>		R-squared
	Boom	Bust		To peak	After peak	To peak	After peak	
-0.34***								0.35
-0.31***	-0.02							0.38
-0.34***		0.16						0.39
-0.27***			-22.22***					0.54
-0.21**			-24.02***	-0.15	-2.12***			0.71
-0.21***			-27.18***	-0.51	-2.21***	-0.04	3.17***	0.80

<sup>1</sup> Results from OLS regressions of the peak-to-trough percentage change in housing prices on various regressors. <sup>2</sup> The equity price changes are calculated as the percentage variation in equity prices from the previous trough to the peak in equity prices, and from the peak in equity prices to the following trough. <sup>3</sup> The financial imbalance dummy is set to one if the credit and equity gaps (deviations from ex ante recursive trends) exceed 4 and 60 percentage points in the sixth quarter prior to the equity price peak. <sup>4</sup> The change in interest rates and GDP growth is calculated over four periods prior to and following the peak in housing prices. Neither the change in nor the level of the unemployment rate (before and after the peak in housing prices) entered significantly.

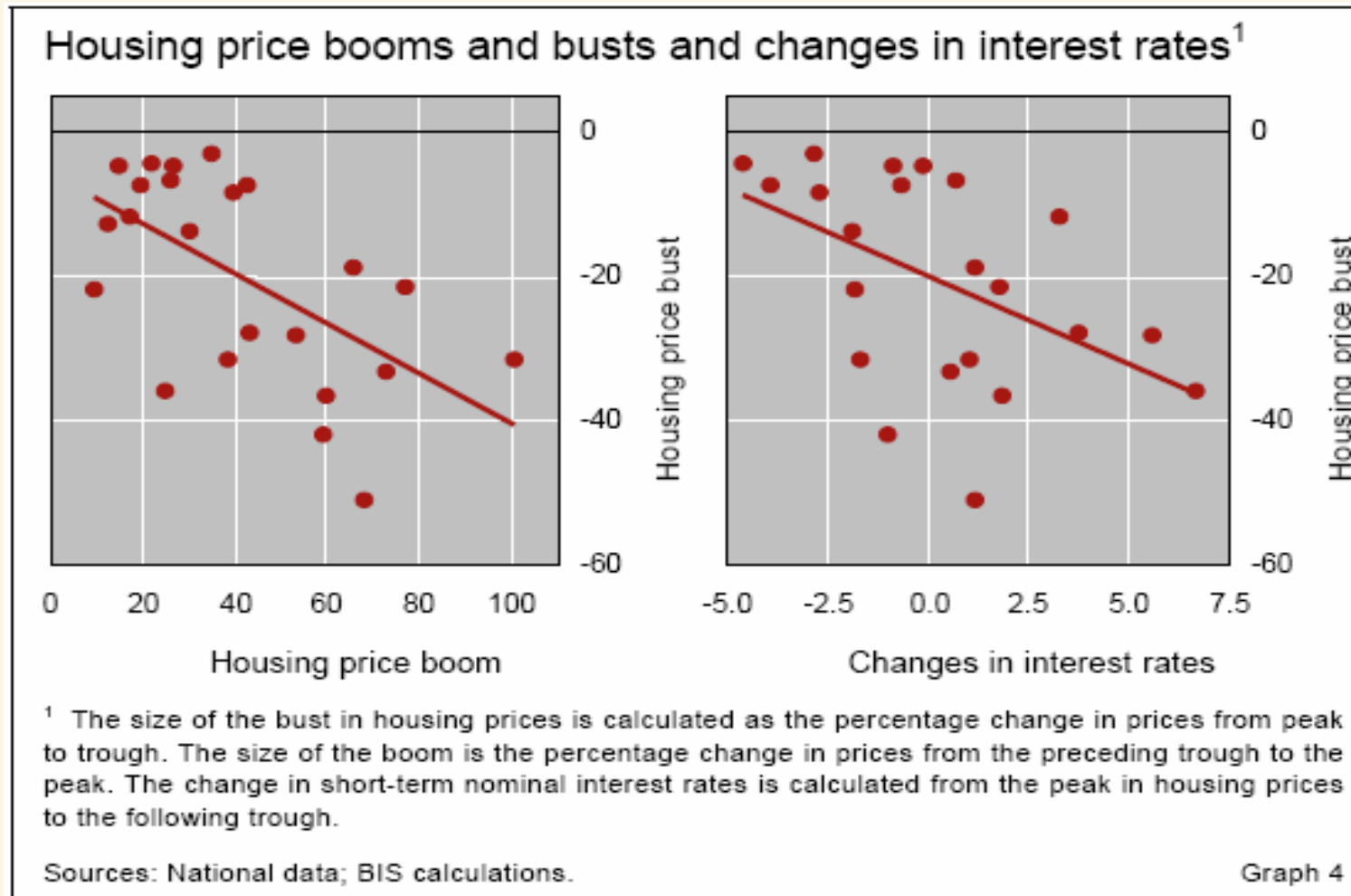
Table 4

**One std dev rise in boom adds 8 percentage points to size of bust**

**With index of 100: boom of 66% (100 to 166) → leaves index at 120 at bust**



### Q3: What determines the size of the bust?



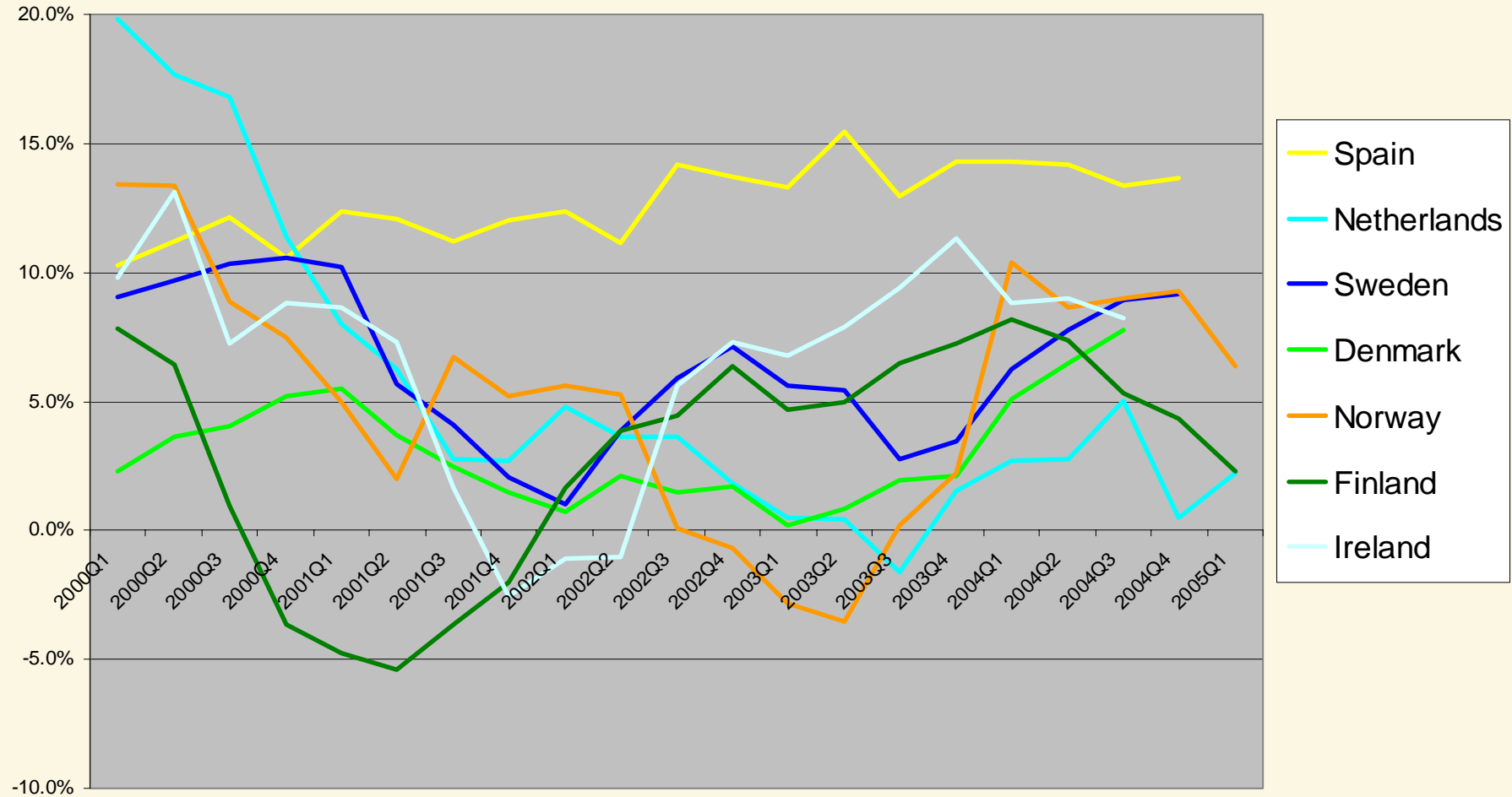


## Conclusions

- Housing peaks tend to follow equity peaks
  - Average lag: 2 years (increased over the years)
- Interest rates have small but significant effect on lag length
  - 1970s and early 1980s inflation fighting
  - Current cycle:
    - rates fell after 2000 equity peak → longer lag between peaks
- The bigger the boom, the bigger the bust



### Real Housing Prices (Y-on-Y changes)







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