When do house price bubbles burst?

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Structure of the presentation

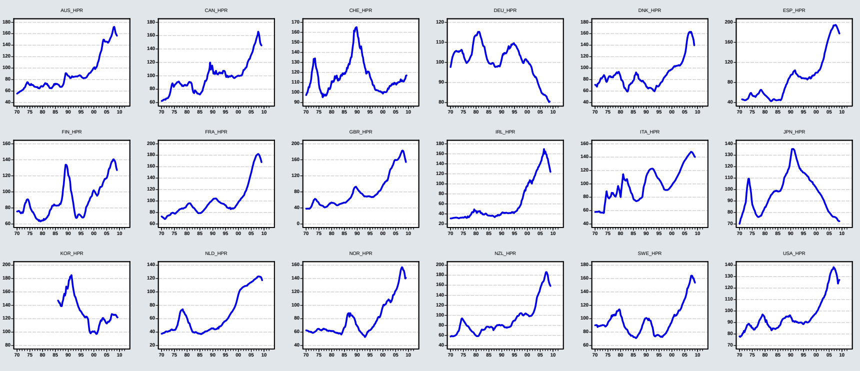
Research questions:

- What are the determinants of house price bubbles?
- Can we predict corrective behaviour in house prices?
- What is the role of misalignments in house prices?

Structure of the presentation:

- House price misalignments and bubbles
- Model uncertainty
- Empirical results: explaining house price bubble busts
- Predicting reversals under model uncertainty
- Conclusions

House price dynamics in the OECD, 1970-2009



House price dynamics in the OECD, 1970-2009

Characteristics of house price dynamics:

- Boom-bust dynamics within long-run trends
- Different size of price corrections

Explaining boom-bust dynamics:

- Equilibrium (fundamental-driven) and corrective dynamics
- Long-run equilibrium and busts depend on:
  - Monetary policy stance and credit variables
  - Real macroeconomic developments
  - Housing market developments
  - Financial and other asset market variables

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Modelling house price dynamics

A recent example: Gerdesmeier et al. (ECB-WP 2009)

- 45 variables are proposed as determinants of house price busts
- Monetary/Real/Financial/Price groups
- Bivariate and small probit models
- 78(!) models presented

Econometric problems

- Model uncertainty
- The role of model uncertainty in out-of-sample prediction

Bayesian Model Averaging

- Assume

$$P(y = 1|X_k) = F(X_k \beta_k),$$

and a set of competing models, $\{M_1, \ldots, M_M\}$ defined by the choice of variables in $\mathbf{X}$.

- Our quantity of interest is the effect of variable x_j, β_j

$$\mathrm{P}(\beta_j|\mathbf{Y}) = \sum_{m=1}^{M} \mathrm{P}(\beta_j|\mathbf{Y}, M_m)\mathrm{P}(M_m|\mathbf{Y}),$$

where $\mathrm{P}(M_k|\mathbf{Y})$ are the posterior model probabilities,

$$\mathrm{P}(M_k|\mathbf{Y}) = \frac{\mathrm{P}(\mathbf{Y}|M_k)\mathrm{P}(M_k)}{\sum_{m=1}^{M} \mathrm{P}(\mathbf{Y}|M_m)\mathrm{P}(M_m)}$$

Bayesian Model Averaging

- The Bayes factor summarizes the relative support given by the data to model j as compared to model k,

$$B_{jk} = \frac{\mathrm{P}(\mathbf{Y}|M_j)}{\mathrm{P}(\mathbf{Y}|M_k)},$$

which in turn can be approximated using

$$-2 \log B_{jk} = \mathsf{BIC}_j - \mathsf{BIC}_k$$

- Using $\mathrm{P}(M_k|\mathbf{Y})\ \forall k$ we can compute $\mathrm{P}(\beta_j|\mathbf{Y})$ and model-averaged predictions
- We can also obtain the posterior inclusion probability (PIP) of each variable as the sum of the probabilities of models including it
- The cardinality of the model space makes the computation of all posteriors often intractable: MC^3 methods

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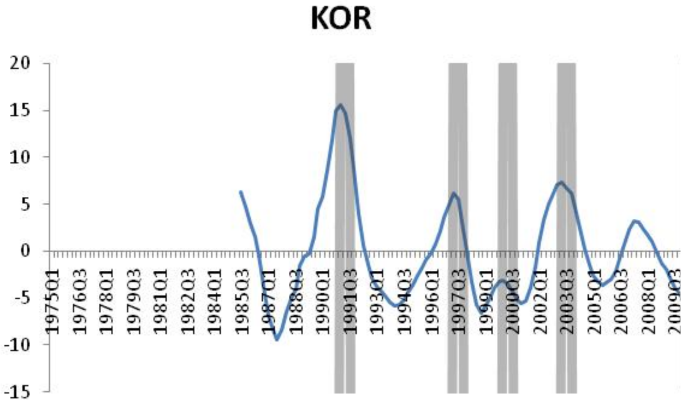
Defining house price busts

Defining turning points

- We use a variant of the Bry-Boschan procedure (Bry and Boschan, NBER 1971, Avouyi-Dovi and Matheron, BIS 2005)
  - Compute deviation cycle (MA-smoothed HP-filtered data, z_t),
  - Define potential peaks if $z_{t-j} < z_t > z_{t+j}$ for $j = 1, , w$, and potential troughs in a similar fashion,
  - Impose a minimum length for peak-to-trough and trough-to-peak phases (p) and for full peak-to-peak and trough-to-trough cycles (c).
- For our main results we use a very liberal setting: w=2, p=1 and c=3
- We define a corrective period as the observation corresponding to a peak, as well as the previous and following quarter

House price busts



House price misalignments

Defining house price misalignments

- Cointegration relationship between real house prices, GDP per capita and real long run interest rates
- Estimates based on Stock-Watson method
- Iterative estimates, to replicate real-time approach
- Interaction terms

House price busts

Variables	Source
Misalignment	
Asset price misalignment estimate	Own calculation as residual from a cointegration relationship between real house prices, income per capita and the real interest rate.
Demographic and real economy variables	
Population growth	OECD
Share of working age to total population	OECD
Real effective exchange rate	BIS
Current account balance as % of GDP	OECD
GDP per capita growth	OECD
Labor productivity growth	OECD
Private credit growth	OECD
Real short term interest rate	OECD
Monetary variables	
Growth in M1 monetary aggregate	OECD
Long term nominal interest rate	OECD
Short term nominal interest rate	OECD
Financial/Asset market variables	
Housing investment as % of GDP	OECD
Stock market returns	Datastream
Dividend yield	OECD
Price earnings ratio	OECD
House price-income ratio	OECD

BMA results

	1-quarter lag				4-quarter lag			
	PIP	**PM**	**PSD**	**PM/PSD**	**PIP**	**PM**	**PSD**	**PM/PSD**
Misalignment	0.001	0.000	0.006	-0.007	0.000	0.000	0.005	-0.011
Current account balance	**0.697**	**-0.268**	**0.207**	**-1.295**	**0.999**	**-0.521**	**0.136**	**-3.826**
Working age share	0.001	0.000	0.004	-0.013	0.001	0.000	0.005	-0.017
Population growth	0.001	0.000	0.006	0.015	0.000	0.000	0.004	-0.014
Housing investment	0.066	0.029	0.119	0.246	0.001	0.000	0.007	0.019
Labor productivity growth	0.003	-0.001	0.023	-0.047	0.000	0.000	0.004	0.014
GDP p.c. growth	**0.828**	**0.417**	**0.241**	**1.731**	0.002	0.000	0.012	0.039
Long term interest rate	**0.998**	**0.520**	**0.147**	**3.531**	0.000	0.000	0.002	-0.003
House price-income ratio	**1.000**	**0.888**	**0.211**	**4.210**	**1.000**	**1.161**	**0.191**	**6.087**
Short-term nominal interest rate	0.000	0.000	0.005	0.011	0.000	0.000	0.003	-0.005
Short-term real interest rate	0.003	0.001	0.019	0.049	0.001	0.000	0.005	0.016
Credit growth	0.002	0.000	0.010	0.028	0.001	0.000	0.005	-0.022
Real exchange rate	0.003	0.000	0.011	0.042	0.001	0.000	0.006	-0.024
M1 growth	0.000	0.000	0.003	0.006	0.000	0.000	0.001	0.000
Price-earnings ratio	0.001	0.000	0.005	0.025	0.008	0.001	0.018	0.081
Dividend yield	0.000	0.000	0.002	0.002	0.000	0.000	0.002	-0.004
Stock returns	0.001	0.000	0.004	0.011	0.011	0.003	0.027	0.094
Misalignment × Current account balance	0.089	-0.026	0.092	-0.288	0.001	0.000	0.005	-0.019
Misalignment × Working age share	0.001	0.000	0.005	-0.009	0.000	0.000	0.005	-0.011
Misalignment × Population growth	**0.999**	**-0.910**	**0.249**	**-3.662**	**1.000**	**-1.216**	**0.225**	**-5.414**
Misalignment × Housing investment	0.000	0.000	0.005	-0.001	0.000	0.000	0.005	-0.003
Misalignment × Labor productivity growth	0.001	0.000	0.005	0.011	0.000	0.000	0.003	-0.006
Misalignment × GDP p.c. growth	0.000	0.000	0.003	0.002	0.001	0.000	0.006	0.018
Misalignment × Long term interest rate	0.181	-0.104	0.235	-0.440	**1.000**	**0.789**	**0.204**	**3.874**
Misalignment × House price-income ratio	**0.812**	**-0.403**	**0.247**	**-1.632**	0.002	-0.001	0.015	-0.041
Misalignment × Short-term interest rate	0.125	0.103	0.288	0.358	0.001	0.000	0.015	0.017
Misalignment × Short-term real interest rate	0.086	0.057	0.203	0.283	**0.740**	**-0.491**	**0.348**	**-1.412**
Misalignment × Credit growth	**0.971**	**0.515**	**0.173**	**2.983**	0.000	0.000	0.004	0.011
Misalignment × Real exchange rate	0.033	0.009	0.051	0.169	0.000	0.000	0.002	-0.002
Misalignment × M1 growth	0.000	0.000	0.003	-0.003	0.000	0.000	0.004	0.009
Misalignment × Price-earnings ratio	0.000	0.000	0.003	0.000	0.000	0.000	0.002	-0.001
Misalignment × Dividend yield	0.000	0.000	0.003	0.000	0.000	0.000	0.002	0.001
Misalignment × Stock Returns	0.000	0.000	0.002	0.002	0.000	0.000	0.003	0.013
Observations		830				796		

Best models

	Explanatory variables lagged one quarter		Explanatory variables lagged four quarters	
	Estimate	(standard dev.)	Estimate	(standard dev.)
Intercept	-1.4975	(0.1194)	-1.8091	(0.1223)
GDP p.c. growth	0.6029	(0.1663)		
Long term interest rate	0.5414	(0.1418)		
House price-income ratio	0.6422	(0.1908)	1.1437	(0.1925)
Misalignment × Long term interest rate	-0.8106	(0.2022)		
Misalignment × House price-income ratio	-0.6269	(0.1761)		
Misalignment × Short-term real interest rate	1.1351	(0.2698)		
Misalignment × Credit growth	0.4491	(0.1247)		
Current account balance			-0.4835	(0.1333)
Misalignment × Population growth			-1.1643	(0.2228)
Misalignment × Long term interest rate			0.8630	(0.1657)
Misalignment × Short-term real interest rate			-0.6990	(0.2233)
Observations	830		796	
McFadden R-squared	0.137		0.109	

First conclusions

- The misalignment measure by itself is not a robust determinant of price reversals (partly because of the inclusion of price-income ratios)
- External disequilibria (measured through current account deficits) contribute robustly to the bursting of house price bubbles
- Large misalignments can be sustainable in societies whose population is growing at a faster path
- Large misalignments lead to higher correction probabilities in economies with relatively high credit growth / interest rate spread
- Corrections tend to happen in periods of high economic growth
- In the monetary policy discussion, emphasis should be put on the interaction of misalignments and monetary stance
- *Supermodel effect* (Feldkircher and Zeugner, IMF-WP 2009) and the role of BMA

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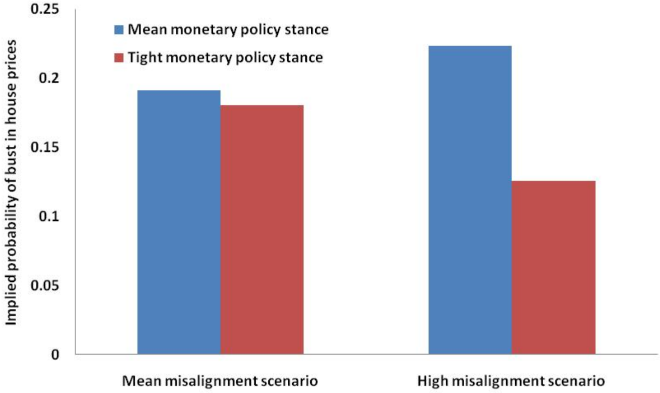
The role of monetary policy



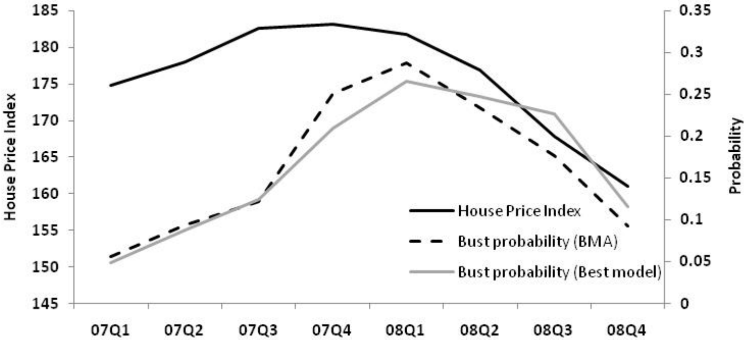
Prediction exercise

Out-of-sample period: 2000/1 - 2007/1

BMA	Best model	BMA	Best model	BMA	Best model
Busts correctly predicted divided by total busts (a)		Busts correctly predicted divided by total busts (a)		Busts correctly predicted divided by total busts (a)	
0.945	**0.709**	**0.945**	**0.963**	**0.145**	**0.509**
Non-busts correctly predicted divided by total non-bust obs. (b)		Non-busts correctly predicted divided by total non-bust obs. (b)		Non-busts correctly predicted divided by total non-bust obs. (b)	
0.328	**0.558**	**0.328**	**0.241**	**0.817**	**0.663**
False alarms divided by total alarms		False alarms divided by total alarms		False alarms divided by total alarms	
0.816	**0.796**	**0.816**	**0.795**	**0.887**	**0.806**
Value of loss function		Value of loss function		Value of loss function	
0.726	**0.733**	**0.209**	**0.217**	**0.351**	**0.376**
Cut-off threshold		Cut-off threshold		Cut-off threshold	
0.205	**0.200**	**0.205**	**0.195**	**0.250**	**0.230**
Loss function		Loss function		Loss function	
(1-a)+(1-b)		**0.75×(1-a) + 0.25× (1-b)**		**0.25× (1-a) + 0.75× (1-b)**	

Predicting house price corrections

UK data 2007/1-2008/4



Robustness of robustness

- Including population in the cointegration relationship
- Duration and scope of misalignments
- Non-filtered burst data and w=3, p=2 and c=12 $\rightarrow$ long term interest rates and credit growth $\times$ misalignment
- Subsample stability checks: Are earlier busts different?
- Strong heredity prior for interaction term (Crespo Cuaresma, JAppEctrics 2010) and the supermodel effect

Conclusions

- Misalignments in house prices do not necessarily lead by themselves to corrective dynamics
- In times of credit growth and high spreads, misalignments matter
- Overheating and external imbalances also matter!
- Model uncertainty is an important issue to take seriously, especially for forecasting

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