

Identifying the real estate cycle. Are housing prices enough?¹

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2 Data and Methodology

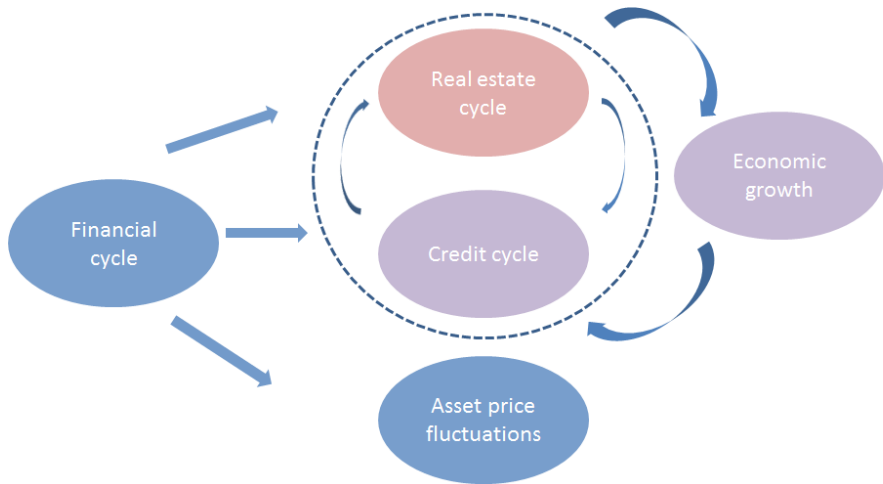
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The real estate cycle as a component of the financial cycle



Why is the real estate cycle particularly important?

- Housing price downturns can generate a significant negative impact on the economy by dampening consumption and investment Cerutti et al. (2017);
- The link between housing prices and the economy can be amplified through the financial accelerator mechanism (Bernanke et al., 1999, Kiyotaki and Moore, 1997);
- A correct identification of the real estate cycle phase helps policy makers better calibrate instruments intended to address risks to the financial system(Crowe et al., 2013).

Motivation of our paper

- Build a composite indicator that policy makers can use in order to assess the real estate cycle even in the context of low data availability on housing prices;
- Evaluate the real estate cycle using various methods and indicators, in order to assess how it can be further employed for the estimation of the financial cycle and/or the prediction of financial crises.

- Countries: 18 European countries, 6 emerging economies and 12 advanced economies;
- Period: 1995 - 2016, with quarterly frequency;
- Real estate market indicators: housing prices and a set of 11 variables which are used for the creation of the real estate index (RE index);
- Financial crises: real estate related crises (ESRB, 2015) and systemic crises (HOR);

Creating the RE index

- The real estate index (RE index) includes both supply- and demand-side indicators related to real estate market activity;
- Principal components analysis (PCA) to aggregate real estate market related data;
- PCA applied on quarterly first-difference and standardized data;
- The principal components (PC_1 to PC_n) with eigenvalues greater than one are aggregated into a PCA index, weighted by their respective corresponding variances (λ_1 to λ_n);
- The PCA index is aggregated back into level into the final RE index;

RE index

$$PCAindex = \lambda_1 * PC_1 + \lambda_2 * PC_2 + \dots + \lambda_n * PC_n$$

$$REindex_t = \sum_{k=1}^t PCAindex_k$$

Creating the RE index

Table: Variables considered for the creation of the RE index

Indicator	Unit of measurement	Source
Building permits, residential buildings	index, base=2010	Eurostat
Gross valued added (GVA) in construction	index, base=2010	Eurostat
Gross valued added (GVA) in real estate	index, base=2010	Eurostat
Labor cost index (LCI) in construction	index, base=2012	Eurostat
Labor cost index (LCI) in real estate	index, base=2012	Eurostat
Number of employees in construction	index, base=2010	Eurostat
Number of employees in real estate	index, base=2010	Eurostat
Real GDP/capita	millions of euro per capita	Eurostat
Unemployment rate	percentage	Eurostat
Interest rate, 3M interbank rate	percentage	Thomson Reuters Datastream
Consumer survey - purchase or build a home within the next 12 months	index	European Commission

¹Note: Variables selected for RE index creation are in bold.

Turning point analysis

- Turning point algorithm from Harding and Pagan (2002a), applied directly on the level of the series in levels;
- Parameters for the algorithm set according to the values recommended by Harding and Pagan (2002a): minimum phase length of 2 quarters and minimum cycle length of 5 quarters;
- Backward-looking methodology, it cannot be used to assess the position in the cycle in real time;
- For countries which did not experience significant fluctuations, the algorithm may be unable to render results.

- The Hodrick Prescott (HP) filter is a flexible standard statistical tool in the estimation of both the business cycle and the financial cycle;
- The assumption about the expected length of the resulting cycle (imposed through λ) carries a lot of importance in the final results;
- For our data sample we should expect to identify relevant fluctuations over short periods, therefore we opt for a value of 1600 for λ .

HP filter estimation

$$y_{it} = \tau_{it} + c_{it}$$

The trend component for country i is estimated through the following minimization process:

$$\min_{\tau} \sum_{t=1}^T (y_t - \tau_t)^2 + \lambda \sum_{t=2}^T -1(y_t - \tau_t)^2$$

Unobserved components model

- In an UC model framework one can decompose a series into trend and cycle without imposing a restriction on cycle length;
- We draw from Koopman and Lucas (2005) and model the trend as a random walk and the cycle as an AR(2) process;
- The method implies however a recurrent process of the cycle, which may not always correspond with reality.

Specification of the UC model

$$y_{it} = \mu_{it} + x_{it} + \epsilon_{it}$$

$$\mu_{i,t} = \mu_{i,t-1} + v_{it}$$

$$x_{i,t} = c + \rho_1 x_{i,t-1} + \rho_2 x_{i,t-2} + w_{it}$$

$$\epsilon_{it}, v_t, w_t \sim N(0, \sigma_{\epsilon, v, w})$$

Coincidence of the housing price cycle and the RE index cycle

- How close the housing price cycle and the RE index cycle indicators move together;
- We use cycle series obtained from the gap analysis employing both HP filter and UC model;
- We compute a concordance indicator (CI), as proposed by Harding and Pagan (2002b). CI takes values ranging from -100, meaning perfect inverse co-movement, to 100 which stands for perfect co-movement.

Concordance indicator

$$CI = T^{-1} \sum_{t=1}^T [S_t^i \cdot S_t^j + (1 - S_t^i)(1 - S_t^j)]$$

$$S = \begin{cases} 1, & \text{excessive/unsustainable period} \\ 0, & \text{otherwise} \end{cases}$$

Early warning features of the real estate cycle indicators

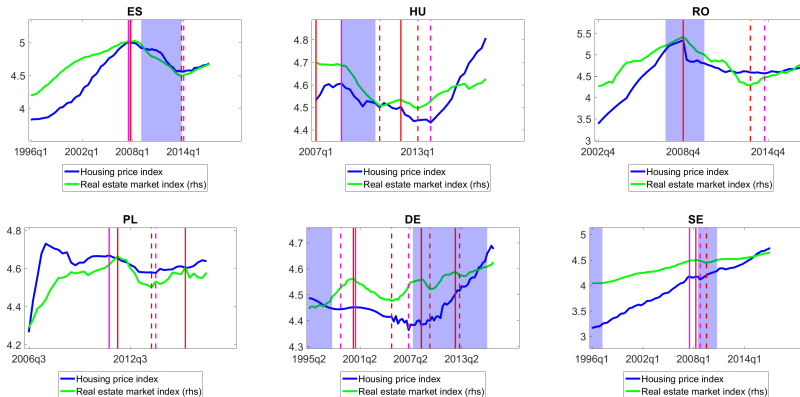
- Assess the predictability power of the real estate cycle indicators for financial crises;
- We employ a simple univariate logistic regression for the pool of countries for which we extracted the real estate cycle;
- We do not intend to develop a full-fledged early warning tool;
- We use two alternative crises databases: a very broad set of systemic financial crises (Heads of Research Group Banking Crises Database) compiled by the ESCB, and a data set of real estate-related banking crises, presented in the ESRB 2015 Report on residential real estate and financial stability in the EU.

Probability of crisis

$$Prob_{crisis} = \frac{1}{1+e^{-(\alpha+\beta \cdot x)}} \quad \text{where } x = \begin{cases} \text{housing price cycle estimated with HP filter (1600)} \\ \text{housing price cycle estimated through UC model} \\ \text{RE index cycle estimated with HP filter (1600)} \\ \text{RE index cycle estimated through UC model} \end{cases}$$

The RE index and the real estate cycle

Figure: The real estate cycle using housing prices and the RE index



¹Note: The purple lines indicate turning points for housing prices and red lines refer to turning points for the real estate market index. The continuous lines mark the peaks and the interrupted lines mark the troughs. The shaded areas represent systemic crises, as defined by Heads of Research Group Banking Crises Database.

Features of the housing price cycle

Table: Features of the housing price cycle

Country	Expansion phase (no. quarters)	Contraction phase (no. quarters)	Expansion amplitude (%)	Contraction amplitude (%)	Expansion vs contraction (amplitude ratio)
FR	20	7	56	(6)	9
RO	25	23	602	(27)	22
FI	16	18	29	(3)	9
UK	51	6	236	(18)	13
AT	5	16	2	(9)	0
IE	50	23	341	(53)	6
PT		22		(14)	-
DK	30	4	108	(10)	11
PL	20	11	59	(8)	8
DE	7	21	1	(6)	0
SI	7	11	10	(12)	1
HU	7	21	8	(14)	1
ES	51	26	232	(36)	7
SE	51	5	176	(4)	47
CZ	11	8	35	(4)	8
NL	55	19	191	(18)	11
BG	31	20	339	(34)	10
average	27	15	144	(16)	9
standard deviation	18	7	166	13	11

¹ Note: Results for Italy are not reported because the algorithm could not estimate turning points for the series.

Features of the RE index cycle

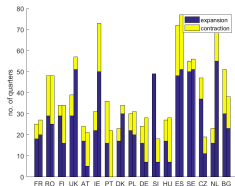
Table: Features of the RE index cycle

Country	Expansion phase (no. quarters)	Contraction phase (no. quarters)	Expansion amplitude (%)	Contraction amplitude (%)	Expansion vs contraction (amplitude ratio)
FR	18	7	27	(5)	5
RO	29	19	246	(65)	4
FI	29	5	25	(1)	18
UK	29	10	32	(5)	7
AT	17	7	19	(4)	4
IE	22	9	48	(18)	3
PT	16	20	29	(19)	2
DK	17	6	23	(6)	4
PL	22	8	36	(14)	3
DE	16	8	9	(4)	2
SI	49		75		-
HU	17	10	28	(10)	3
ES	48	24	128	(41)	3
SE	50	5	59	(5)	13
CZ	37	10	73	(6)	12
NL	16	7	19	(4)	5
BG	30	21	122	(25)	5
IT	25	11	26	(8)	3
average	27	11	59	(14)	5
standard deviation	12	6	59	17	5

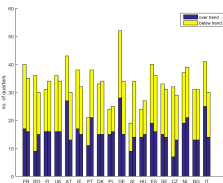
Features of the real estate cycle

Figure: Length of real estate cycles

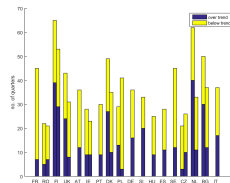
(a) Turning point analysis



(b) HP filter (1600)



(c) UC model



¹ Note: In the case of each graph, the first bar corresponds to results for housing prices and the second bar to results for the RE index.

Coincidence of the housing price cycle and the RE index cycle

Table: Coincidence of the housing price cycle and the RE index cycle

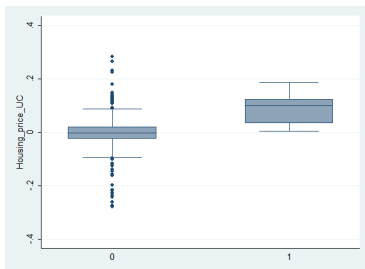
	HP 1600	UC model	HP 1600	UC model		
Country	$CI_{t,t}$		$CI_{t,t\pm k}$		k	k
FR	67		71	(2)		
RO	78	78			85*	(2)
FI	70	86	79	(2)	94*	4
UK	65	79	70	2	83*	(2)
AT	51		60	(1)		
IE	81	93*	84	1		
PT	76		83	(2)		
DK	80	88	96*	(2)	92	5
PL	59	41	82*	(3)	58	(5)
DE	59		69	3		
SI	66	100*	74	2		
HU	54	79	5			
ES	58					
SE	75		84*	(3)		
CZ	71	88*	76	(7)		
NL	87*	69			78	(7)
BG	66	53	76	(7)	80*	(8)
IT	69	59	70	1	71*	4

¹Note: In bold CI values over 70 percent. Maximum values marked *. $CI_{t,t}$ is concordance computed contemporaneously, while $CI_{t,t\pm k}$ is concordance where k is the number of quarters by which the RE index cycle leads(+) or lags(-) the cycle of the housing price index.

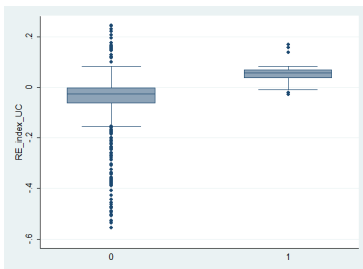
The power of the real estate cycle in signaling crises

Figure: Real estate cycle in normal and pre-crisis times

(a) Housing prices - UC model



(b) RE index - UC model

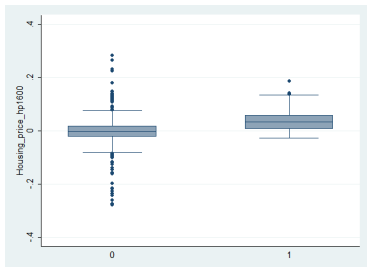


¹Note: Distribution of values around the trend in normal times marked by zero and distribution of values around the trend in the period preceding systemic crises (1 year) marked by 1.

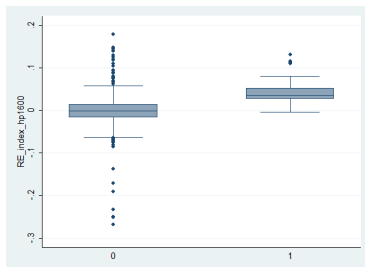
The power of the real estate cycle in signaling crises

Figure: Real estate cycle in normal and pre-crisis times

(a) Housing prices - HP filter (1600)



(b) RE index - HP filter (1600)



¹ Note: Distribution of values around the trend in normal times marked by zero and distribution of values around the trend in the period preceding systemic crises (1 year) marked by 1.

The power of the real estate cycle in signaling crises

Table: Estimation of probability of a real estate related crisis over 1 year horizon

Indicator	ROC	Unconditional probability	Rsq	No. obs.
Housing price cycle - HP1600	80%	1.9%	6%	1 068
Housing price cycle - UC	91%	2.3%	15%	406
RE index cycle - HP1600	91%	1.9%	14%	1 089
RE index cycle - UC	96%	1.9%	26%	900

The power of the real estate cycle in signaling crises

Table: Estimation of probability of a systemic crisis over 1 year horizon

Indicator	ROC	Unconditional probability	Rsq	No. obs.
Housing price cycle - HP1600	78%	4.9%	10%	976
Housing price cycle - UC	85%	4.6%	13%	436
RE index cycle - HP1600	88%	4.9%	15%	1 007
RE index cycle - UC	91%	4.9%	21%	822

Conclusions and issues for discussion

- Our results reveal the usefulness of the RE index as a complementary tool for the evaluation of the real estate market cycle;
- For a time horizon of roughly 20 years, the real estate cycle is on average around 10 years long. These results are in line with other studies which use data on developed countries and with longer estimation periods (Bracke, 2013, Drehmann et al., 2011);
- Results for the RE index are more consistent across the two estimation methods and the behavior of the RE index appears to be more harmonized across countries, while developments in housing prices are more heterogeneous;
- The real estate cycle performs well in signaling crisis events, particularly when using the RE index;
- Future extension of our work may include other specifications for the cycle in a UC model and an assessment of the effects of real estate cyclical fluctuations on economic growth.

Thank you!