Unveiling the House Price Movements and Financial Development

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Abstract

Today, it is widely recognized that housing price boom-bust cycles lay at the heart of the latest global financial crisis. A housing boom is commonly defined as a period in which a housing price exceeds its fundamental value. Like most of the European Union member countries, many economies experienced the housing boom during the period of 2000–2006. Moreover, housing booms turned into busts in many countries at about the same period, causing a deep crisis. Our aim in this paper is to look for the determinants of housing price cycles and to investigate the relationship between housing boom-bust cycles and indicators of housing development. For this, we first detect the turning points of housing prices and identify housing price boom-bust cycles for 27 European countries and the US from 1995 to 2013 using quarterly data and a judgmentally augmented version of the dating procedure due to Ball (1994). Having obtained a categorization of boom versus boom-bust countries, in the second step, we reveal the relationships between housing cycles, macroeconomic factors and financial development by means of panel probit analysis.

Keywords: European Union; House prices; Boom-bust cycles; Financial development.

JEL Classification: E44; C51; C58; G01.

I.Introduction

Up to date numerous countries have faced with several economic problems and continue to encounter them. A part of these problems grew with the turning of an economic bubble (boom) to burst (bust) and caused serious crisis in the end. The United States (1984), Denmark (1987), Norway (1987), Finland (1991), Sweden (1991), Japan (1992) , France (1994), and the United Kingdom (1995) are some examples of countries that faced with boom-bust cycles in their economies (Reinhart and Rogoff, 2008:4-1). Most of crisis occurred as of 1980s has come about with large asset price decreases –that will be referred to as busts, which large increases in the asset prices –that will be referred to as booms– transform to. In fact, historically, many of asset price booms did not end in busts. In fact, asset price booms are experienced especially in the real estate and stock markets either separately or jointly. On the other hand, the liberalization of the markets, and the opening of the economy looking for the determinants of housing price cycles and the relationship between housing boom-bust cycles

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and indicators of housing development to the international markets, and the internationalization of the capital in increased manner, have caused asset price booms in more countries in the recent years. Moreover, when the boom-busts in an advanced country with a large economy and that country enters a crisis, the effects of the crisis is not limited to that country alone but spreads to other countries as well. As a matter of fact, this situation is verified with the boom-busts in the asset prices experienced in certain Southeast Asian countries in the 1990s and in the real estate markets in the US in the 2000s.

The asset price busts adversely affect the economies in many ways and initiate economic recessions. This was confirmed by IMF (2003) on the asset price boom-bust cycles experienced in the 1970s and the 1990s (IMF, 2003:63-68). Particularly, starting with the 1990s the asset markets have had a gradually growing role in the macroeconomic dynamics. This has led many researchers to focus on the revelation of the sources of the changes in the prices of assets, in measuring the changes in the prices, in determining the levels these changes can impose threat on the economy etc. In the literature while at first, most of studies were interested in the stock price fluctuations, in 2000s the attention increasingly shifted toward real estate price dynamics. An increasing interest generally stems from the housing price boom lying at the heart of the 2007-2008 global crisis, but also a bigger wealth loss caused by the larger price fluctuations in the housing markets than that of stock markets. For instance, during the dot-com bust, the value of American households' equity holdings declined by 44 percent (USD 5.4 trillion). The real estate bust that started at the end of 2006 has brought about a 15 percent decline in the value of real estate assets (USD 3.7 trillion). However, total wealth lost stood at USD 10 trillion for about three years (Crowe et al., 2012:4).

From 2000 up to 2006, many developed and developing countries have experienced simultaneous housing price booms at an unprecedented level. Again, the boom in many of these countries turned to bust, in the same period. Many of the European Union (EU) member countries took place among the advanced countries which experienced housing boom. Moreover, the EU was the primary region which was the most affected by the crisis which originated in the US, has faced with sovereign debt crisis in some of Eurozone countries as of the last quarter of 2009. The main reason of debt crisis in some countries was the house price bust, e.g. Ireland and Spain. In fact, the housing price bust did not occur in all the EU countries which faced with the housing price boom.

Owing to its everlasting importance, in this paper our aim is to examine the determinants of housing price cycles and to research on whether there is relationship between housing boom-bust cycles and financial development of 28 countries.[4] In specific, we elaborate the following questions: (1) what are the determinants of housing boom-bust cycles? (2) Is there

[4] Member countries of the EU (25), Iceland, Norway and the US. Croatia, Poland and Romania are not included in analysis due to data unavailability.

any linkage between housing boom-bust cycles and financial development? To this end, we first employ a judgmentally augmented version of the dating procedure due to Ball (1994)[5] and reveal that almost all of 28 countries considered have faced with housing price booms (26 boom countries) while more than half of them have experienced housing price busts (21 boom-bust countries). Consequently, we investigated the answers of the aforementioned questions by means of panel probit analyses, where we examined the determinants of housing price cycles and the association between housing boom-bust cycles and financial development for the period of 2000-2012.

Two things distinguish this study from the existing ones in the literature. First, we use a simple and transparent methodology, which is a judgmentally augmented version that of Ball (1994) to identify the turning points of housing price cycles. Our approach not only allows us to obtain a clear-cut dating of cycles but also to sub-divide the boom periods with respect to pace of price increases, i.e. rapid and slow. Second, to our best knowledge, this is the first paper that relates housing boom-bust cycles to financial development.

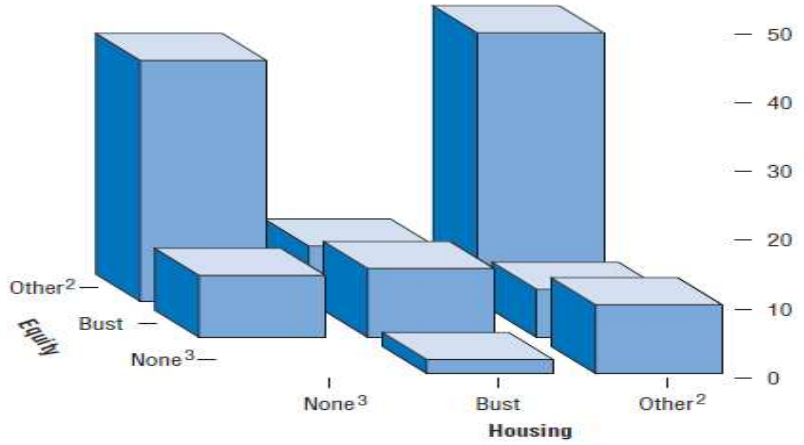
The remainder of the paper is structured as follows: Section II lays on the definition of housing boom-bust cycles while Section III explains how we identify boom countries and boom-bust countries. Section IV analyses the association between housing cycles and macroeconomic/financial variables and Section V concludes the paper.

II.Boom-Bust Cycles in Housing Markets

There are different terms used by economists to explain the behaviors of asset prices such as ‘bubble’, ‘boom’, ‘panic’, ‘bust’, ‘burst’, ‘crash’, and ‘irrational exuberance’. A housing boom (or bubble) is commonly defined as a period in which housing price exceeds its fundamental value (Kindleberger, 2005; Hebling, 2004; Ikromov and Yavas, 2012; Xiong, 2013). Inherent properties in housing markets can generate house price cycles and cause house prices to substantially deviate from their fundamental values in the short term. Minsky (1992) has defined a bubble on the basis of how an asset class is financed. For the housing market to meet Minsky’s definition of a bubble, three conditions must be met: increases in real (inflation-adjusted) housing prices and mortgage debt, along with persistent rental income losses (Minsky, 1992:7).

[5] Ball (1994) has introduced the method for determining disinflation episodes and calculating the associated sacrifice ratios in moderate- inflation OECD countries. Later on, this method has been used for identifying inflation episodes by Boschen and Weise (2003), Domac and Yucel (2005) and Vansteenkiste (2009). To the best of our knowledge, Ball (1994) methodology, that has been used to determine the peak and trough dates of consumer price up to now, is applied to housing prices for the first time in order to identify the housing boom-bust cycles. The approach in this paper is less complex and more practical than those of the previous studies.

Figure 1. Housing and Equity Prices Declines (number of cases)



Source: IMF (2003:68).

In IMF (2003:63-68), "a bust is defined as a peak-to-trough decline where the price change fell into the top quartile of all declines during bear markets; similarly, a boom is defined as a trough-to-peak rise where the price increase was in the top quartile of all increases. This procedure does not require booms to be followed by busts, as the two types of events are determined independently." In other words, a housing price boom comprises of large increases in housing prices (i.e. overvaluation of housing prices) while a housing price bust is a rapid drop of prices.

The past developments in financial markets show that there are relationships among asset prices and that especially stock and housing booms-busts are generally seemed together as confirmed by IMF (2003).[6] IMF (2003) finds that linkages between stock and housing prices within countries are very strong, as rising stock prices during a boom is likely to raise housing prices. Besides, it also finds that when the timing of the busts in the two asset groups is compared, it is seen that half of all the housing price crashes matched the stock price busts (Figure 1).

III.Identification of Boom and Boom-Bust Countries

A. Literature on Dating of Housing Boom-Bust Cycles

In this study, we are looking for the determinants of housing price cycles and the relationship between housing boom-bust cycles and indicators of housing development. Therefore, it is important to determine which of the countries considered had only a boom in the housing markets and which ones had both the boom and the burst. With this aim, the first step is to define and to identify housing price boom and bust periods in the countries considered, because housing boom or bust is commonly defined as a period. In other words, we firstly will detect turning points in the housing prices. Turning points are also called peaks and troughs

[6] IMF (2003:63-68) covers 14 industrial countries for the period of 1970-2003.

(peaks is the period immediately preceding a decline in real activity, or recession; troughs is the period immediately preceding an upturn, or expansion (Boldin, 1994:99). As it is seen, a turning point is a date that separates two phases of peaks and troughs in economic cycle.

It is seemed that the earliest studies have been interested in forecasting economic cycles (e.g. recession and recovery periods). Then, some have focused on measuring equity price cycles, but there are little attempts to date housing price boom and bust cycles. With striking increases in housing prices in many countries in the world from the middle of 1990s to of 2000s, the focus has shifted from equity price to housing price booms and busts, and determining the dates of housing boom and bust periods is getting more attractive.

Although determination of the turning points is an important issue in the analysis of the housing boom/bust cycles, however, there is not only one method that has been generally accepted. Many methods have been developed to measure the general economic cycles. Later, these methods have been used to determine the turning points of the fluctuations in the prices (i.e. consumer prices, stock prices and housing prices) by using them as they are or by making certain changes.

The purpose of all the studies mentioned above is to better estimate the turning points in the business cycles and in doing so to find a method which is less complex and which could be applied more easily in practice

When we look at studies on housing price movements and on determining the housing price cycles in the literature, it is seen that housing price bubble (boom) detection has been widely studied, and that studies on determining and quantifying housing price boom and bust cycles are getting increase in last decade, especially after the deep global financial crisis. This might be stemmed from the fact that the housing price boom-bust cycles experienced in the U.S. in 2007 had a prominent role in the latest global financial crisis, and also the fact that many countries had faced with housing boom and bust in the same periods and encountered with deep crisis. However, it is difficult to determine and identify housing price boom and bust periods**.** There are several approaches adopted and many studies based on different criteria and the different results found on this topic. In the same time, it is seemed that the statistical methods are used much more for dating periods of housing price cycles than the methods of modelling.[7]

In most of the studies on housing boom-bust cycles, the methods of identifying the cycles have indirectly been used with the aim of investigating the characteristics and determinants and implications of booms and busts in housing markets (e.g. Muth, 1981; IMF, 2004; BIS, 2005; Bordo and Wheelock, 2006; Burnside et al., 2011; Agnello and Schuknecht, 2012; Gerdesmeier et al., 2012; Igan and Loungani, 2012); or the macroeconomic and financial effects of these cycles (IMF, 2003, 2009; Gerdesmeier et al., 2010; Huang, 2013). In other side,

[7] See Harding (2008:2) and Gerdesmeier et al. (2012:4).

some of them on this topic look at the relationship between housing boom-bust cycles and policies implemented (Bordo and Jeanne, 2002) and the relationship between housing bubble and crisis (Baker, 2008; Cheng et al., 2013; Xiong, 2013) while some examine house price returns feeding into the short-run dynamics (Corradin and Fontana, 2013). In these studies, a boom (bust) in house prices is generally defined as a period to the annual growth rate of house prices, or as a house price gap or as a longer-lasting deviations with observations falling outside the certain interval.

Like the methods developed for analysis of business cycle, one of the common properties among them is that they are generally followed two steps to define the boom-bust cycles in the housing markets (see Harding and Pagan, 2002:367, Hebling, 2004:31). First step is to determine housing price cycles. Turning points in the housing prices are considered as a cycle. In the second step, it is identified the periods of booms and busts. In other words, it is decided which turning points (peaks and troughs) in housing prices will be evaluated as a boom (bust). It is important for this to be decided the threshold. Generally, it is defined that the threshold is fixed at a constant or it is selected a different multiple of the standard deviation. Similar way and also, similar criterion have been followed by most of researchers who examine housing markets.

Nevertheless, it is seemed that most of the methods developed for analysis of business cycle above mentioned have been applied in measuring housing boom-bust cycles by using a full way or by making certain changes. Just like Agnello and Schuknecht (2011), in order to define the periods of housing cycles for 55 countries (developed and emerging economies) over the period 1970-2007 Igan and Loungani (2012) have followed the method of Harding and Pagan (2002) and Harding (2003), who uses the NBER method as considering on quarterly basis. Then, Corradin and Fontana (2013) have applied the same method to 13 countries in European Economic Area (including eight Eurozone countries) for the period of 1980-2013Q1.

IMF (2003) in her study to determine when the bubbles in asset (both stock and housing) prices will burst, run the method of the Hebling (2004) who followed Pagan and Soussonov (2003), who slightly modified the NBER cycle dating procedure. Another method developed by Bordo and Jeanne (2002) to research into the relation between economic instability, money policy and asset price cycles has been frequently used for those studying the housing market (e.g. IMF, 2009), In other side, Gerdesmeier et al. (2010) also employ the method of Bordo and Jeanne (2002) but as a threshold by selecting a different multiple of the standard deviation.

Gerdesmeier et al. (2012) identify housing price boom-bust cycles by running the different technique (quantile regression technique) from those above explained This technique where booms/busts are represented by longer-lasting deviations from equilibrium, with

observations falling outside the [20,80] interval (for booms and busts, respectively) (Gerdesmeier et al., 2012:22).

While Yiu et al. (2012) was applying the new method (recursive regression technique) developed by Phillips et al. (2007) to detecting the bubble in Hong Kong residential property markets during the period 1993Q3-2011Q3, Gomez-Gonzales et al. (2013) used the same method in Colombia housing markets for the period 1994-2012Q1. They date stamp the origin and conclusion of the explosive behavior in housing prices as they are running this method.

B.Dating Procedure of House Price Cycles

Against the background provided in the earlier sections, it is apparent that the formation and bust of house price booms do not match the same pattern and timing in all countries that we examine in this study. In order to develop a solid understanding of the related issues and to obtain good statistical estimates, it is crucial to characterize the movements of house prices and to identify boom-bust cycles. Like Harding and Pagan (2002), Hebling (2004) and Igan and Loungani (2012), we follow two steps for dating housing price boom-bust cycles (Harding and Pagan, 2002:367; Hebling, 2004:31); (i) determination of housing price cycles and (ii) identification of booms and busts.

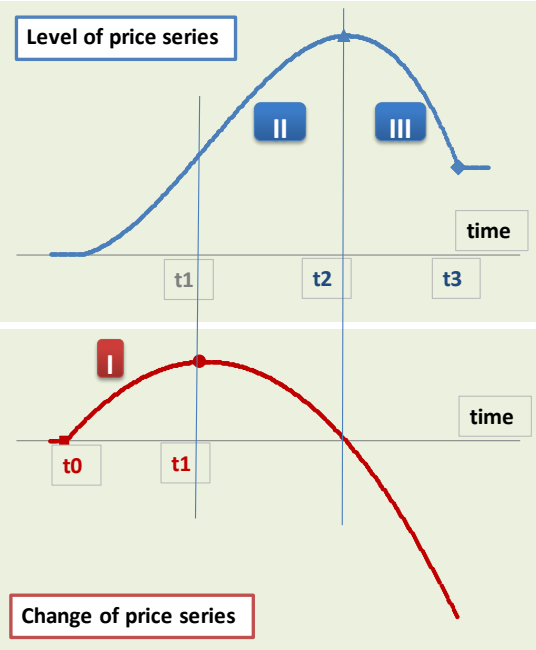
In this paper, a judgmentally augmented version of the dating procedure due to Ball (1994)[8] is used to find the trough and peak dates of real house prices and mark the price movements as rapidly increasing, slowly increasing and falling. The purpose of all the studies mentioned above is to better estimate the turning points in the business cycles and in doing so to find a method which is less complex and which could be applied more easily in practice The dating method due to Ball (1994) used in this paper to determine the housing price cycles is less complex and can be applied more easily in practice than that of previous studies on dating housing cycles.

Prior to implementing the dating procedure, quarterly real house prices were calculated as the ratio of nominal house prices to consumer prices index, both seasonally adjusted, for each country[9]. In seasonal adjustment we used the Census X12 procedure. The base year for the computed real house prices (seasonally adjusted) was set as 2005, for visual ease, with the exception of Luxembourg for which the base year was set as 2007. Data sources for nominal house prices and consumer price indices are listed in Appendix A.

[8] See Boschen and Weise (2003) and Domac and Yucel (2005).

[9] See Table 1 for a list and classification of the countries included in the study.

Figure 2. A Pictorial Overview of the Dating Procedure Employed



Identification of housing price episodes comprises of three stages: In stage I, using the approach due to Ball (1994) the trough (square) and peak (circle) points of change in prices are found – bottom panel. This allows us to mark the period (t0,t1) as a rapid increase (RAPID) period for the level series.

In stage II, the peak point (triangle) of the price series is identified – top panel. The period (t1,t2), hence, is marked a slow increase (SLOW) episode.

RAPID and SLOW episodes together, (t0,t2) are viewed as BOOM episodes.

Finally, in stage III, we seek for a period during which the prices series fall from its peak point to a tranquil state. This leaves us with (t2,t3) marked as a BUST episode – top panel.

In actual implementation, the top and bottom panels include the level of real housing prices and the seven-quarter centered moving average of the quarterly real housing price inflation rates, respectively.

Following Ball (1994) we first construct a trend real housing price inflation series, for each country, as the seven-quarter centered moving average of the quarterly real housing price inflation rates over the period of 1995Q1-2013Q3, wherever the data are available. Thus, a peak (trough) of housing price inflation is defined as a period in which the seven-quarter centered moving average of housing price inflation is the maximum (minimum) within a seven-quarter symmetric window. Our choice of seven-quarters instead of the nine-quarters as in Ball (1994) has been driven by data limitations and it limits losses in the final number of observations. Once the trend housing price inflation has been computed, the trough and peak dates of house price are identified as dates at which trend housing price inflation is lower (higher) than in the preceding and succeeding three quarters. It is important to note that such use of the procedure due to Ball (1994) provides us with the periods of sustained increases of real house prices. We name these periods as episodes of rapidly increasing real house prices (RAPID). By definition, the house prices keep increasing[10] after the peak dates of house price time series until reaching its maximum before falling or attaining a tranquil state. The episodes from the peak date of housing price inflation to the peak date of housing price are then marked as episodes of slowly increasing house prices (SLOW). RAPID and SLOW episodes, together, yield the price increase

[10] It is trivial that at a peak point suggested by Ball (1994) procedure, the smoothed rate of increase (trend inflation) of house prices reaches its maximum. Starting from a trough, house price series under consideration follows an accelerated course of increase. After the peak date of trend inflation, house prices enter a course of slower increase until the date at which trend inflation hits zero. Once this point is exceeded a fall in house prices is observed.

periods suggested by the popular four-quarter rule in the earlier literature.[11] The major advantage of our simple approach then is the ability to distinguish the increase in real house prices with respect to pace. Thus, RAPID and SLOW episodes together are accepted as a housing price BOOM period. See Figure 2 for a pictorial description of our procedure.

Regarding the numerical workings of our approach data availability forms a major obstacle. As our quarterly house price data set spans the period from 1995Q1 to 2013Q3, use of a seven-quarter centered moving average and consecutive choice of maximum and minimum trend housing price inflation figures based on seven-quarter time windows cause some data loss. In that it has been possible, in cases of couple of countries, to obtain peak dates at the beginning of data without their accompanying troughs. We enjoyed a limited liberty to mark such periods as house price upturns.[12]

Table 1. Classification of Countries

Eurozone		**Non-Eurozone**	**Other**
Austria*	Italy**	Bulgaria**	United States**
Belgium*	*Luxembourg*	Czech Republic**	Iceland**
Cyprus**	Malta**	Denmark**	Norway*
Estonia**	Netherlands**	Hungary**	
Finland*	Portugal**	Latvia**	
France**	Slovakia**	Lithuania**	
Germany	Slovenia**	Sweden*	
Greece**	Spain**	United Kingdom**	
Ireland**			

All countries but those marked with (*) experienced a BOOM. (**) indicates countries experienced a BUST.

Once the dating of upturns has been completed, the marking of downturns turns out to be an easier task. A period of downturn or BUST is basically one with starting at the peak point of real house prices and ending at a period where house prices tranquil or ending at the end of available data. Tabular and graphical presentations of our classification of real house price movements are presented in Appendix B and Appendix C, respectively.[13]

After process of identifying boom-bust cycles, we find that all countries (26 countries), except Germany and Luxembourg, experienced the boom and that, most of boom countries

[11] According to the four-quarter rule, four or more consecutive periods of price increase is considered as an upturn (boom period) and four or more consecutive periods of price decline as a downturn (bust period). See Igan and Loungani (2012) for a recent use of this approach.

[12] Regarding the rate of increase of real house prices during RAPID increase episodes, it is observed that house prices increase by an average of 1% per quarter. As the percentage increase in real house prices is the difference between percentage change in nominal house prices and rate of consumer price inflation, this figure indicates an increase in nominal house prices 1 percentage point in excess of consumer price inflation. This kind of a behavior of prices is a serious one once we take into account the sustained nature of house price increases during booms, see Appendix B and C.

[13] In the case of price downturns, we have repeated the procedure due to Ball (1994) in the reversed direction so as to mark the periods of falling house prices as periods of rapid fall (RAPIDFALL) versus slow fall (SLOWFALL). We have succeeded in this exercise to some extent and marked the slowly falling and rapidly falling house price episodes, as well. Although we analyze only the BUST episodes (RAPIDFALL and SLOWFALL together) in the subsequent sections, a full list of episodes is provided in Appendix B and C for convenience.

them (19 countries) faced with bust (Table 1). Our findings coincide with that of previous studies used different methods for defining the periods of housing boom-bust cycles.[14]

IV.Empirical Analysis

A.Macroeconomic Determinants of Housing Price Cycles

Against the background provided in the earlier sections, this section presents our empirical estimates on macroeconomic determinants of housing price cycles. This analysis first helps us to understand the basic mechanisms shaping the housing prices. Second, the results out of this section are intended as a basis for our analysis of financial development indicators of the next sub-section.

We consider four different paces here, namely BOOM, RAPID, SLOW and BUST where each of these has been defined as a separate binary dependent variable. For each of the RAPID, SLOW and BUST, we defined separate annual series of binary indicators following the simple rule that years with (without) the desired property are marked with 1 (0)[15] for years from 2000 to 2012[16]. In case a rapid increase episode (in quarterly data set) is followed by a slow increase episode within a year, that year has been marked with 1 in favor of slow increase. BOOM is defined as the sum of RAPID and SLOW in a straightforward manner. At the end, the data set was structured as a panel with 26 cross-sections[17] (countries) and 13 periods (years from 2000 to 2012). Numbers of BOOM, RAPID, SLOW and BUST cases against time are provided in Figure 3 and data sources for our explanatory variables related with financial sector are provided in Appendix A.

As mandated by the binary structure of our dependent variables and panel structure of our data, we use a random-effects probit regression framework[18] where our estimation strategy

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[14] In order to give some idea about the viability of the episodes extracted from data in this study, we compared them to those suggested by Agnello and Schuknecht (2011) and Igan and Loungani (2012) on an annual basis. Our simple counting exercise suggests that our boom episodes conform to those of Agnello and Schuknecht (2011) 59% and those of Igan and Loungani (2012) 89% of the time. When we consider both boom and bust episodes, these figures are revealed as 51% and 54%, respectively. Note that, the congruence between Agnello and Schuknecht (2011) and Igan and Loungani (2012) is 35% for boom periods and 23% for boom and bust periods together. So, despite the differences in data and dating procedures, our approach guarantees an adequate level of overlap with the recent studies in the literature.

[15] Preference over an annual frequency reflects a tendency toward avoiding data related complications like seasonal adjustment which might be quite problematic while using macroeconomic variables of many countries.

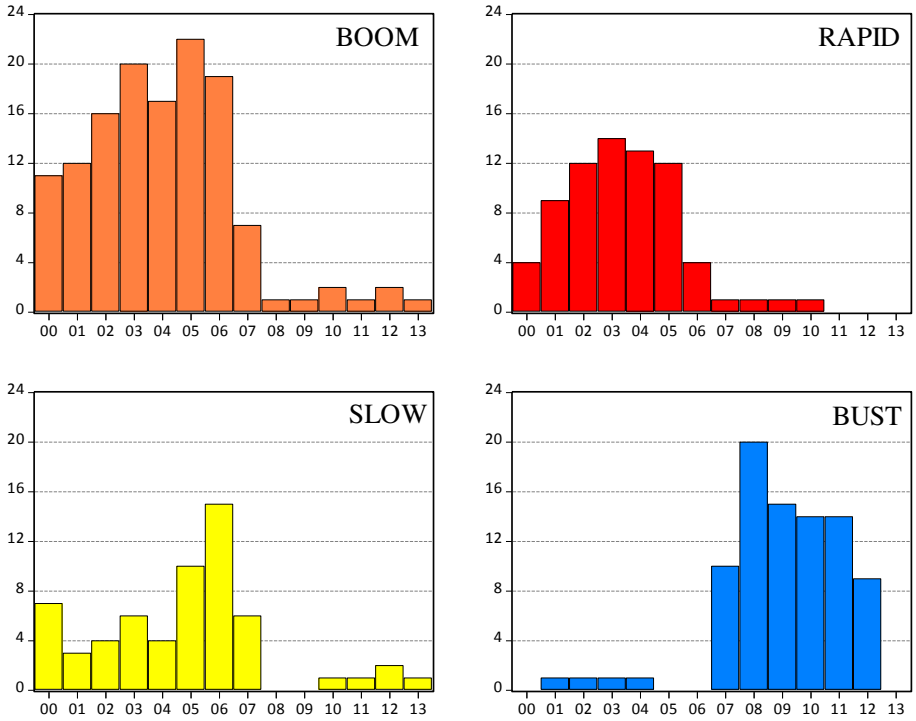
[16] As we focus on those years with ample global liquidity and on the global financial crisis of 2007 onwards, our annual dataset for probit analysis has been restricted to the period of 2000-2012.

[17] Germany and Luxembourg are excluded from statistical assessment due to the fact that no boom-bust pattern of house prices was observed in these two economies.

[18] The general form of our estimating equation is $Y_{it} = x_{it}\beta + u_{it}$, where Y_{it} is the binary dependent variable (BOOM, RAPID, SLOW or BUST), x_{it} is a matrix of observable explanatory variables with its coefficient vector β, u_{it} being the error vector for country i in year t. This equation is estimated by means of maximum likelihood. For more on probit analysis, see Baltagi (2005), Chapter 11.

involves a series of baseline models and two alternative sequences of models. In the baseline specifications, we first reveal associations between BOOM and GDPPCGR, M2GRREAL, POPGR, AGEDEPYOUNG, GROSSAVGDP and DOMCREGDP. Here, GDPPCGR is the annual growth rate of GDP per capita, M2GRREAL is the annual growth rate of real M2 aggregate of money, POPGR is the annual growth rate of population, AGEDEPYOUNG is the age dependency ratio for young population, GROSSAVGDP is the ratio of gross savings to GDP and DOMCREPRIVSEC is the ratio of domestic credit extended to private sector to GDP.[19] Then, we move to associations between the same regressors and RAPID, SLOW and BUST, one at a time. In this way, we obtain a rich set of estimates regarding different phases of house price cycles. In an attempt to establish a robust analytical framework, we estimate three versions of each probit regression, namely for the full sample, for boom-bust countries only and for non-boom-bust countries only, with the exception of BUST for which non-boom-bust sub-sample is degenerate. Baseline estimates are provided in Table 2.

Figure 3. Frequencies of Episodes (2000-2012)



Source: Authors' calculations.

In the first of the alternative sequences, we add VIX to our set of regressors and we add CROSSBORDER in the second one. VIX is the implied volatility of S&P 500 index options and it is viewed as a measure of investors' risk appetite, which formally is the opposite of risk aversion. CROSSBORDER, on the other hand, is defined as the annual growth rate of cross-border credit flows for the world economy. Our estimates including VIX and CROSSBORDER

[19] This specification is distilled out of a sequence of preliminary model estimates which are available from authors upon request.

are reported in Table 3 and Table 4, respectively. While interpreting the estimates presented these tables, we prefer to use the notation of (X/Y) where X is the Table number (i.e. 2 for Table 2) and Y is the specification number (running from 1 to 11 in each table). Unless otherwise noted, our examination of coefficient estimates is restricted to those having statistical significance and to significant models (provided in the last row of each table).

In our specifications, effects of liquidity have been considered by means of four variables, namely M2GRREAL, VIX, CROSSBORDER and DOMCREPRIVSEC. Among those variables, while M2GRREAL and DOMCREPRIVSEC are meant to handle domestic liquidity, VIX and CROSSBORDER are intended to control for international liquidity developments. The reader will notice that although VIX is not a direct measure of liquidity, it reflects global liquidity conditions in terms of an implied degree of risk aversion. A quick glance at coefficient estimates of these four variables reveal that house price cycles in our sample countries have a close association with liquidity, as expected. In the absence of VIX and CROSSBORDER, likelihood of a BOOM (BUST) is positively (negatively) associated with M2GRREAL (2/1, 2/2, 2/10, 2/11).

Two additional findings must be underlined as to the effects of real money growth in our specifications. First, the positive association between likelihood of a house price increase and real money growth does not preserve its statistical significance when we examine the cases of RAPID and SLOW separately (2/4 through 2/9). Second, when VIX or CROSSBORDER is included in a specification the relationship between BOOM and M2GRREAL disappears at all (3/1 through 3/9 and 4/1 through 4/9). The negative relationship between BUST and M2GRREAL, on the other hand, preserves its significance through Tables 2 to 4.

VIX has a negative association with increasing house prices (3/1 through 3/9) and a positive association with falling house prices (3/10 and 3/11). However, its association with BOOM seems to have been driven by SLOW rather than RAPID episodes. CROSSBORDER has, on the other hand, has a positive association with increasing house prices (4/1 through 4/9) and a negative association with falling house prices (4/10 and 4/11). It must be noted that, when episodes of rapid and slow increase are analyzed separately, it is observed that SLOW rather than RAPID episodes are related to cross-border credit flows.

Domestic credit to private sector has a negative sign consistently in the first three specifications and a positive sign in the last two specifications in Tables 2 to 4. Having a look at the association of DOMCREPRIVSEC with RAPID and SLOW episodes, it is seen that the relationship in the first three specifications are mainly driven by RAPID episodes.

An overall assessment of our coefficient estimates for liquidity-related indicators suggest that global rather than domestic liquidity has been fueling the house price booms of the last decade.

Since it may be indicative of an increase in life-time income growth, growth of per capita income has a special importance in our specifications. In Table 2 and Table 3, GDPPCGR has a robust positive association with BOOM, RAPID and SLOW and does not display any significant association with BUST episodes. This finding resembles that of the earlier literature. In Table 4, however, the positive coefficient of GDPPCGR is preserved only in the first two specifications, namely when we consider all BOOM episodes and those episodes of boom-bust countries and not in separate analyses of RAPID and SLOW episodes. Recalling the role of CROSSBORDER in Table 4, it is more likely that global financial linkages rather than a perception of life-time income expansion to drive house price booms.

Rate of population growth (POPGR), as a potential determinant of housing demand, has a significant positive association with BOOM episodes in Table 2 to Table 4, specifications 1 to 3. It must be underlined that this relationship is driven chiefly by RAPID episodes. Dependency ratio of young people (AGEDEPYOUNG) has a positive linkage with increasing house prices, as well.[20]

Finally, gross savings to income ratio (GROSSAVGDP) displays a positive relationship with increasing house prices and a negative relationship with falling house prices. When we examine its sign and significance in specifications 4 through 9 in Tables 2 to 4, GROSSAVGDP seems to be mainly associated with SLOW episodes.

Regarding the multi-collinearity of our regressors, it must be noted that the highest correlations exist between POPGR and DOMCREPRIVSEC (0.599) and between GDPPCGR and CROSSBORDER (0.608), both only coinciding with the conventional threshold of 60 percent. So, associations among our explanatory variables do not pose a serious threat to quality of our estimates. The high correlation of -0.66 between VIX and CROSSBORDER, which do not co-exist in any specification, can be noted for information (Appendix D).

[20] An increasing dependency ratio for young people has been interpreted as a sign of expanding households which might ultimately push housing demand upward. Note that exclusion of AGEDEPYOUNG does not considerably alter the directions of effect of other variables in our specifications.

Table 2. Baseline Estimates with Macroeconomic Variables

	Dependent Variable										
	BOOM (RAPID+SLOW)			RAPID			SLOW			BUST	
	1	2	3	4	5	6	7	8	9	10	11
Sample→	ALL	BB	NON-BB	ALL	BB	NON-BB	ALL	BB	NON-BB	ALL	BB
GDPPCGR	0.1912***	0.2508***	-0.0006	0.0742**	0.0817**	-0.0222	0.1326***	0.1672***	0.0450	-0.0223	-0.0289
	(0.000)	(0.000)	(0.996)	(0.028)	(0.042)	(0.801)	(0.002)	(0.004)	(0.683)	(0.470)	(0.348)
M2GRREAL	0.0169*	0.0211*	-0.0131	0.0086	0.0079	-0.0150	0.0032	0.0057	-0.0107	-0.0732**	-0.0715***
	(0.068)	(0.065)	(0.620)	(0.320)	(0.430)	(0.523)	(0.707)	(0.563)	(0.726)	(0.000)	(0.000)
POPGR	0.6552***	0.8849***	-3.3503	0.4953***	0.5908***	-2.4676*	0.2654	0.3938	-1.3358	0.2178	0.1361
	(0.007)	(0.003)	(0.195)	(0.009)	(0.004)	(0.107)	(0.191)	(0.116)	(0.355)	(0.533)	(0.672)
AGEDEPYOUNG	0.0909**	0.1135**	-1.6374	0.0498	0.0655	0.1599	0.0054	0.0058	-0.1239	-0.3677***	-0.3062***
	(0.031)	(0.030)	(0.124)	(0.132)	(0.162)	(0.299)	(0.855)	(0.881)	(0.407)	(0.000)	(0.002)
GROSSAVGDP	0.0760***	0.0936***	-0.0313	0.0171	0.0258	0.0495	0.0574***	0.0602**	0.1271	-0.0935***	-0.0612**
	(0.003)	(0.008)	(0.871)	(0.296)	(0.298)	(0.448)	(0.001)	(0.024)	(0.049)	(0.003)	(0.046)
DOMCREPRIVSEC	-0.0102***	-0.0122***	-0.1329	-0.0102***	-0.0120***	0.0148	0.0022	0.0020	-0.0094	0.0246***	0.0212***
	(0.002)	(0.002)	(0.14)	(0.001)	(0.004)	(0.301)	(0.353)	(0.489)	(0.504)	(0.000)	(0.000)
CONSTANT	-3.7694***	-4.7423***	59.6208	-1.7142**	-2.1272*	-6.0997	-2.9329***	-3.1874***	0.6243	7.3828***	5.9182***
	(0.002)	(0.003)	(0.156)	(0.042)	(0.090)	(0.151)	(0.000)	(0.005)	(0.880)	(0.001)	(0.008)
SAMPLE SIZE	291	234	57	293	236	57	291	234	57	291	234
GROUPS	26	21	5	26	21	5	26	21	5	26	21
LOG LIKELIHOOD	-150.49***	-111.34***	-27.91**	-136.20***	-100.38**	-31.18	-126.27***	-96.01**	-26.51	-98.67***	-93.31***
	(0.0000)	(0.0001)	(0.0491)	(0.0010)	(0.0176)	(0.6911)	(0.0023)	(0.0171)	(0.3613)	(0.0000)	(0.0000)

p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent, respectively.

Table 3. Estimates with Macroeconomic Variables After Controlling for Global Risk Appetite

	Dependent Variable										
	BOOM (RAPID+SLOW)			RAPID			SLOW			BUST	
	1	2	3	4	5	6	7	8	9	10	11
Sample→	ALL	BB	NON-BB	ALL	BB	NON-BB	ALL	BB	NON-BB	ALL	BB
GDPPCGR	0.1421***	0.1995***	-0.3696*	0.0745**	0.0808*	-0.1011	0.0845*	0.1055*	-0.0588	0.0612	0.0538
	(0.003)	(0.003)	(0.077)	(0.041)	(0.058)	(0.352)	(0.056)	(0.069)	(0.640)	(0.116)	(0.170)
M2GRREAL	0.0146	0.0178	-0.0361	0.0087	0.0079	-0.0224	-0.0005	0.0001	-0.0332	-0.0826***	-0.0811***
	(0.128)	(0.137)	(0.229)	(0.321)	(0.436)	(0.389)	(0.953)	(0.989)	(0.441)	(0.000)	(0.000)
VIX	-0.0466***	-0.0529***	-0.1452**	0.0003	-0.0011	-0.0486	-0.0530***	-0.0644***	-0.0647	0.0954***	0.0959***
	(0.003)	(0.005)	(0.018)	(0.981)	(0.950)	(0.178)	(0.001)	(0.001)	(0.123)	(0.000)	(0.000)
POPGR	0.5941**	0.8291***	-7.6508**	0.4959***	0.5899***	-3.5295*	0.1785	0.3072	-2.6869	0.2884	0.2240
	(0.017)	(0.006)	(0.020)	(0.009)**	(0.004)	(0.060)	(0.398)	(0.229)	(0.166)	(0.439)	(0.520)
AGEDEPYOUNG	0.1220***	0.1534***	-0.7224	0.0496	0.0664	0.2236	0.0263	0.0395	-0.0586	-0.4086***	-0.3590***
	(0.008)	(0.008)	(0.451)	(0.144)	(0.177)	(0.193)	(0.404)	(0.348)	(0.713)	(0.000)	(0.000)
GROSSAVGDP	0.0737***	0.0935***	0.2032	0.0172	0.0260	0.0470	0.0509***	0.0569**	0.1346**	-0.0814**	-0.0512*
	(0.006)	(0.010)	(0.256)	(0.297)	(0.299)	(0.492)	(0.004)	(0.033)	(0.050)	(0.015)	(0.102)
DOMCREPRIVSEC	-0.0133***	-0.0158***	-0.0752	-0.0102***	-0.0121***	0.0186	0.0004	-0.0009	-0.0057	0.0301***	0.0272***
	(0.000)	(0.000)	(0.420)	(0.001)	(0.006)	(0.240)	(0.870)	(0.788)	(0.705)	(0.000)	(0.000)
CONSTANT	-2.9754**	-3.9816**	29.0183	-1.7208*	-2.1162*	-6.2910	-1.8158**	-2.0224*	0.6991	5.1543**	3.9999*
	(0.023)	(0.018)	(0.431)	(0.053)	(0.095)	(0.174)	(0.040)	(0.086)	(0.870)	(0.021)	(0.061)
SAMPLE SIZE	291	234	57	293	236	57	291	234	57	291	234
GROUPS	26	21	5	26	21	5	26	21	5	26	21
LOG LIKELIHOOD	-145.87***	-107.20***	-24.38	-136.20***	-100.38**	-30.22	-120.50***	-90.20***	-25.18	-87.29***	-81.45***
	(0.0000)	(0.0000)	(0.2144)	(0.0021)	(0.0321)	(0.6865)	(0.0001)	(0.0006)	(0.3828)	(0.0000)	(0.0000)

p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent, respectively.

Table 4. Estimates with Macroeconomic Variables After Controlling for Cross-Border Credit Flows

	Dependent Variable										
	BOOM (RAPID+SLOW)			RAPID			SLOW			BUST	
	1	2	3	4	5	6	7	8	9	10	11
Sample→	ALL	BB	NON-BB	ALL	BB	NON-BB	ALL	BB	NON-BB	ALL	BB
GDPPCGR	0.1018**	0.1242*	-0.2165	0.0489	0.0569	-0.2228*	0.0563	0.0386	0.0523	0.0161	0.0278
	(0.039)	(0.074)	(0.287)	(0.209)	(0.206)	(0.080)	(0.196)	(0.493)	(0.693)	(0.676)	(0.445)
M2GRREAL	0.0092	0.0130	-0.0332	0.0070	0.0066	-0.0644	-0.0034	-0.0012	-0.0086	-0.0673***	-0.0603***
	(0.317)	(0.250)	(0.351)	(0.426)	(0.505)	(0.164)	(0.715)	(0.911)	(0.819)	(0.000)	(0.000)
CROSSBORDER	0.0599***	0.0768***	0.1378*	0.0228	0.0235	0.1330**	0.0693***	0.0994***	-0.0050	-0.0350*	-0.0565***
	(0.001)	(0.001)	(0.076)	(0.219)	(0.299)	(0.027)	(0.000)	(0.000)	(0.922)	(0.095)	(0.006)
POPGR	0.4495*	0.5902**	-4.1528	0.4314**	0.5270***	-3.9322**	0.0379	0.0157	-1.2761	0.2924	0.1363
	(0.057)	(0.036)	(0.184)	(0.025)	(0.009)	(0.038)	(0.850)	(0.947)	(0.411)	(0.405)	(0.619)
AGEDEPYOUNG	0.0891**	0.1189**	-2.5172***	0.0516	0.0703**	0.2581*	0.0148	0.0343	-0.1284	-0.3496***	-0.2241**
	(0.025)	(0.017)	(0.000)	(0.117)	(0.027)	(0.076)	(0.615)	(0.358)	(0.412)	(0.000)	(0.018)
GROSSAVGDP	0.0637***	0.0827***	-0.2362*	0.0146	0.0254	0.0318	0.0520***	0.0622	0.1282**	-0.0841***	-0.0358
	(0.006)	(0.008)	(0.095)	(0.367)	(0.245)	(0.638)	(0.003)	(0.011)**	(0.049)	(0.007)	(0.164)
DOMCREPRIVSEC	-0.0100***	-0.0124***	-0.2008***	-0.0104***	-0.0124***	0.0291*	0.0020	0.0010	-0.0100	0.0236***	0.0170***
	(0.002)	(0.002)	(0.000)	(0.001)	(0.000)	(0.065)	(0.409)	(0.747)	(0.508)	(0.000)	(0.002)
CONSTANT	-3.5923***	-4.7256***	93.7903***	-1.7695**	-2.2904**	-9.2655**	-3.2656***	-4.0923***	0.7435	6.9823***	4.1925**
	(0.001)	(0.001)	(0.000)	(0.032)	(0.013)	(0.031)	(0.000)	(0.000)	(0.863)	(0.001)	(0.037)
SAMPLE SIZE	291	234	57	293	236	57	291	234	57	291	234
GROUPS	26	21	5	26	21	5	26	21	5	26	21
LOG LIKELIHOOD	-145.39***	-105.94***	-25.47***	-135.45***	-99.84***	-28.15	-119.36***	-86.97***	-26.51	-97.28***	-89.79***
	(0.0000)	(0.0000)	(0.0000)	(0.0009)	(0.0000)	(0.4207)	(0.0000)	(0.0001)	(0.4626)	(0.0000)	(0.0000)

p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent, respectively.

B.Financial Development and Housing Price Cycles

Financial sector has a vital role for economic development. According to both World Bank and OECD[21] "Financial sector is the set of institutions, instruments, and markets. It also includes the legal and regulatory framework that permits transactions to be made through the extension of credit". There are many studies suggesting that a strong and well-functioning financial sector helps economic growth and job creation. Hence, financial development has paved the way for economic development. Because of this, a good measurement of financial development is very important by evaluating the progress of financial development. But it is not easy to measure to measure financial development because the financial sector has been getting increase complexity.

To measure financial development, it has been use different sets of indicators. The most comprehensive set of indicators has been prepared by Cihak et al. (2012). They have developed several measures four characteristics of financial markets and institutions in order to measure and benchmark financial systems; financial depth, financial stability, financial efficiency and financial access[22]; they have presented a 4x2 matrix of financial system characteristics (Cihak et al., 2013:9).

By following Cihak et al. (2012), we use the set of indicators in 4x2 matrix of financial system to investigate the relationship between housing boom-bust cycles and financial development for 26 countries that we determine housing boom-bust cycles for these countries and group them into two categories (boom countries and boom-bust countries) in the first section of the paper as well GIIPS (Greece, Ireland, Italy, Portugal and Spain). We also look at the correlation between housing boom-bust cycles and financial development for four different paces of housing price movements here, namely BOOM, RAPID, SLOW and BUST.

Having built an overall understanding of the factors associated with housing price cycles, we have extended our analysis so as to take into consideration the measures of financial development. In that, we maintained a simple specification where BOOM, RAPID, SLOW and BUST are regressed against GDPPCGR, CROSSBORDER and one financial development measure[23] at a time[24]. Results of this exercise are summarized in Table 5 for the whole sample and for the GIIPS countries, namely Greece, Ireland, Italy, Portugal and Spain. The emphasis on

[21] www.worldbank.org, www.oecd.org

[22] Financial access data have not been used as data are not available for all countries of interest.

[23] See Appendix A for metadata related to financial development measures considered.

[24] Using the same notation as in Section IV.A., we now use an equation of the form $Y_{it} = x_{it}\beta + z_{it}\gamma + u_{it}$, where Y_{it} is the binary dependent variable, x_{it} is a matrix of macroeconomic determinants with its coefficient vector β (not reported in Table 5) and z_{it} is the matrix of financial development variables with the corresponding coefficient vector γ.

the GIIPS economies here originates from the apparent difficulties they experienced during the last five years.

Table 5. Estimates with Financial Development Variables

		BOOM		RAPID		SLOW		BUST	
		All	GIIPS	All	GIIPS	All	GIIPS	All	GIIPS
	FINANCIAL DEPTH								
	Financial Institutions								
1	**PCDMBGDP**	-0.0095**	-0.0256***	-0.0074***	-0.0183	0.0004	-0.0073	0.0196***	0.0141***
2	**PCDMBAFIGDP**	-0.0082**	-0.0256***	-0.0062***	-0.0183	0.0003	-0.0073	0.0188***	0.0141***
3	**FSDGDP**	-0.0071*	-0.0524***	-0.0050*	-0.0521***	-0.0004	-0.0087	0.0321**	0.0356***
4	**DMBAGDP**	-0.0088**	-0.0285***	-0.0063***	-0.0252*	0.0002	-0.0078	0.0194***	0.0173***
5	**OFIAGDP**	-0.0056**	NA	-0.0038	NA	-0.0010	NA	0.6890	NA
6	**DMBABA**	-0.0024	-0.3140**	-0.0138	-0.0909	0.0180	-0.0466	0.0271	0.1102
	Financial Markets								
7	**SMCGDP**	0.0012	-0.0045	-0.0035	-0.0004	0.0058***	0.0023	0.0006	0.0029
8	**SMTVTGDP**	-0.0002	0.0050	-0.0021	0.0032	0.0025*	0.0026	0.0037*	-0.0012
9	**PRIVBMCGDP**	-0.0036	-0.0127	-0.0022	-0.0082	0.0005	-0.0057	0.0134***	0.0169**
10	**PUBBMCGDP**	0.0081	0.0268**	0.0063	0.0179**	0.0024	0.0058	-0.0005	-0.0115
11	**IDUGDP**	-0.0085**	-0.0531***	-0.0059**	-0.0326**	-0.0002	-0.0309*	0.0103***	0.0228***
	FINANCIAL EFFICIENCY								
	Financial Institutions								
12	**NIM**	-0.0992	0.7689*	0.0426	0.3869	-0.2355***	0.0252	-0.0891	-0.6144*
13	**BCI**	0.0267***	0.0247	0.0215***	0.0111	0.0109	0.0091	-0.0325***	-0.0220*
14	**BOCTA**	0.0413	0.9886**	0.1276*	0.2947	-0.1437*	0.1205	-0.5893***	-0.8745***
	Financial Markets								
15	**SMTR**	0.0011	0.0046	-0.0018	0.0029	0.0040**	0.0036	0.0035	-0.0023
	FINANCIAL STABILITY								
	Financial Institutions								
16	**BZ**	0.0190	0.0288	0.0188*	0.0217	0.0049	0.0033	-0.0698**	-0.0372
17	**LLGDP**	-0.0090*	-0.0508***	-0.0051**	-0.0496***	-0.0022	-0.0091	0.0421***	0.0327***
	OTHER								
18	**BROA**	0.0188	1.5893*	0.0402	1.1125**	-0.0305	0.2937	-0.2504**	-0.9181*
19	**BROE**	0.0150	0.0518	0.0101	0.0394	0.0078	0.0018	-0.0198**	-0.0299

All and GIIPS indicate the whole sample and the GIIPS sub-sample, respectively. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent (also shown in shades), respectively. Model details and p-values are not provided for visual ease and they are available from authors upon request.

While elaborating the findings of Table 5, we follow the original grouping of financial development indicators due to Cihak et al. (2012) and consider four categories, namely financial depth, financial efficiency, financial stability and others. Whenever possible, we extend our discussion so as to make separate references to financial institutions and financial markets. Such an approach, we believe, provides us with a better understanding of the underlying economic story.

Financial Depth

Financial depth is one of the indicators of financial development in an economy. It shows the size of the financial sector (e.g. size of banks, other financial institutions, and financial markets) relative to the economy.[25] If a country has well-developed financial system, its financial system is deep and provides the economy with adequate credit and other financial services.

In this paper to measure financial depth for financial institutions, we take the ratio of private credit by deposit money banks to GDP (PCDMBAFIGDP), and the ratio of assets to (for both deposit banks and other financial institutions) GDP. While measuring financial depth for financial markets, we focus on the two main segments of the financial markets (i.e. the size of stock markets and bond markets). Thus as a measure of depth of financial markets, the financial variables that we consider are the ratio of stock market capitalization to GDP (SMCGDP), stock market total value traded to GDP (SMTVTGDP) and private as well as public bond market capitalization to GDP (PRIVBMCGDP and PUBMCGDP).

Having a look at the association of financial depth indicators related to financial institutions with our episodes, it is seen that the Private Credit by Deposit Money Banks to GDP ratio has a negative association with BOOM and RAPID episodes and a positive association with BUST episodes (Row 1). The same is valid when we consider the private credit provided by other financial institutions in relation to GDP (Row 2), financial system deposits to GDP ratio (Row 3) and deposit money bank assets to GDP ratio (Row 4). Findings about the other financial institutions' assets to GDP ratio[26] (Row 5) and deposit money bank assets to bank assets ratio (Row 6) are congruent with these observations, yet they lack statistical significance. Hence, there is a clear-cut association between housing price episodes and depth indicators of financial institutions. The observation that price increases (decreases) in housing sector are negatively (positively) related to depth of financial institutions is indicative of the stabilizing, or correcting, role of more developed financial institutions on housing prices. In other words, the deeper the markets with respect to financial institutions, the smaller the house price movements are; i.e. a large sale of housing will not move the housing prices much.

The same picture, nevertheless, is not valid in the case of the depth of stock markets. As compared to depth of financial institutions, which yielded a clear-cut conclusion, the evidence in the case of stock market depth is mixed. Here, the stock market capitalization in relation to GDP (Row 7) has a significant and positive sign in the case of SLOW episodes in the whole sample; whereas the stock market total value traded to GDP ratio is positively associated with SLOW and BUST episodes and in the whole sample only (Row 8). Such lack of a strong

[25] See.www.econ.worldbank.org
[26] For this variable, the likelihood function turned out to be non-convergent in the GIIPS sub-sample.

association between these indicators and housing price episodes are not surprising though, since bank finance, rather than equity finance, is the dominant mode of finance in Europe.

Turning our attention to bond issues by private and public sectors and to international debt issues, interesting findings come out. Having a look at the capitalization of bond market in relation to GDP, it is observed that private bond market capitalization has a positive linkage with the BUST episodes for both the whole sample and the GIIPS sub-sample (Row 9). Public bond market capitalization, on the other hand, is positively linked to BOOM and RAPID episodes in the case of GIIPS economies only (Row 10).

It is viable that declining housing prices (BUST) causes a decline in housing supply, suppresses the collateral values of mortgages, hence jeopardizing the receivables of private institutions. A higher capitalization of private bond market in relation to GDP is then likely to follow such financing difficulties (Row 9). The case of the public bond market, on the other hand, calls for a different story. We know that loose fiscal policy, high public debt and the associated roll-over requirements induced higher wage increases in GIIPS economies than EU average. These developments resulted in elevation of purchasing power and expansion of consumption demand especially directed toward durables/housing. The positive association between public bond market capitalization and BOOM/RAPID episodes in GIIPS economies (Row 10) can be seen as a direct consequence.

Finally, international debt issues to GDP ratio (Row 11) has a negative association with the BOOM and RAPID episodes and a positive association with the BUST episodes. This observation is valid for the whole sample as well as the GIIPS economies. As the ability to issue international debt helps economies to extend their average debt maturity, it might have a tranquilizing effect on housing prices, i.e. decreasing the probability of a housing price increase (BOOM) and increasing the probability of a housing price decrease (BUST).

Financial Efficiency"

In an ideally efficient banking system, lower bank cost-to-income and bank overhead costs to total assets ratios are expected. These two, indeed, boil down to a narrower net interest margin, i.e. a smaller difference between the lending and borrowing rates. In Table 5, net interest margin (Row 12) has a significant positive relationship with the likelihood of a BOOM (GIIPS sub-sample), a significant negative relationship with the likelihood of SLOW episodes (whole sample) and a strong negative association with the likelihood of BUST episodes (GIIPS sub-sample). This lends support to the view that financers had to operate within wider interest margins in order to overcome various costs they faced. In parallel with this finding, bank overhead costs in relation to their total assets (Row 14) have a positive linkage with BOOM and RAPID episodes where the coefficient estimate for the former is significant in the case of GIIPS

economies and for the latter in the case of whole sample. As to BUST episodes a strongly negative relationship between overhead costs and the likelihood of a BUST has been estimated.

The stock market turnover ratio (Row 15); however, does not suggest any strong pattern of relationships, except that it is positively associated with SLOW episodes in the whole sample. Dominance of bank rather than equity finance can be seen as the main driver of this finding again.

Financial Stability

Bank z-score (Row 16) is positively associated with RAPID episodes and negatively associated with BUST episodes in the whole sample. This indicator does not display any significant relationships in the GIIPS sub-sample. The positive linkage of z-score to RAPID episodes is quite intuitive, as more attractive and stable rates of return accompanied, or resulted from, the fast upward trend of housing prices in the earlier phase of BOOMs. In that, the disappearance of the relationship between bank z-scores and housing prices in SLOW episodes is also meaningful and it might be read as a signal of satiation for returns once the RAPID phase of booms has been over. As bank returns fall and volatility of returns increase during BUSTS, the negative association of z-scores and the likelihood of BUST episodes is intuitive, as well.

Ratio of the liquid liabilities to GDP (or M3/GDP, Row 17) display a significant negative association with BOOM and RAPID episodes and significant positive association with BUST episodes, for both the whole sample and GIIPS economies. It must be noted that this is the only counter-intuitive finding among all, as higher liquidity is supposed to have fuelled the fast increase of house prices in the first half of the last decade.

Other Indicators

Banks' return on assets and on equity (Row 18 and 19) are positively associated with BOOM and RAPID episodes and negatively associated with the BUST episodes. Return on assets has a significant positive sign in the cases of BOOM and RAPID and a significant negative sign in the case of BUST for the whole sample as well as the GIIPS sub-sample. Return on equity has a significant negative linkage only with the BUST episodes in the whole sample. These findings agree with the aggressive credit expansion and net worth building by banks during the sustained hike of house prices. Although the return on assets and return on equity remain outside of the dataset due to Cihak et al. (2012), they are included in the analysis owing to their high relevance.

V.Conclusion

Economic dynamics related to housing sector gained an ever high visibility during and in the aftermath of the latest global financial crisis. Owing to high income multiplier in the

construction sector and capability of housing sector to mobilize tremendous volume of credits as well as stock market transactions, the recent boom-bust experience in housing sector resulted in the deepest economic crisis since the Great Depression. Having appeared initially in the second half of 2007, the global crisis was officially declared in 2008. The following years, then, witnessed a deep global recession, persistently high unemployment rates and unsuccessful public sector action. It is then evident that asset price busts affect the economies adversely over many dimensions, as was earlier reported by IMF (2003). So we focus on the formation (BOOM) and dissolution (BUST) of asset price bubbles and analyze the factors associated with them using a slightly different perspective than that of the recent literature.

Regarding the erratic behavior of asset prices a number of alternative terms were coined earlier, among which bubble, boom, panic, burst, crash and irrational exuberance have utmost popularity. These terms commonly define a period in which housing price exceeds its fundamental value as a boom or bubble. In this study, we also share this common conceptualization of erratic movements of asset prices. Our numerical approach, though, differs from those in existing literature as (1) we use a simple and transparent methodology, which is nothing but a judgmentally augmented version of Ball (1994), to identify the turning points of housing price cycles and to sub-divide the boom periods with respect to pace of price increases as rapid and slow, (2) this is the first paper that relates housing boom-bust cycles to financial development. Note that, in an attempt to understand what has happened in the case of the most problematic economies, we developed our analysis regarding financial development in a way to treat GIIPS economies separately.

Using quarterly data from 1995Q1-2013Q3 for 28 countries we identify the housing price cycles and categorize our sample countries as boom countries and boom-bust countries. Then, we use a panel probit approach to reveal the factors associated with housing price booms and busts from 2000 to 2012 (on an annual data basis) for 26 countries for which at least a boom period has been identified.

All in all, our findings point at the broad and intuitive observation that both macroeconomic factors and the level of financial development are important in the formation as well as dissolution of housing price booms. At a glance, these are of an expected nature, i.e. increases in economic activity, liquidity, population or cross-border capital flows must be positively associated with boom periods. In the financial development front, we can highlight (1) financial institutions' depth has a stabilizing or correcting role, whereas the same is not valid in the case of stock market depth, as bank finance, rather than equity finance, represents the dominant mode of finance in Europe. In other words, large sales of housing will not move the housing prices much, (2) public bond market capitalization has been revealed to be de-stabilizing in the case of GIIPS economies, where (3) financial efficiency, financial stability and

other measures of interest have their expected signs. The higher the financial efficiency and financial stability are, the less volatile are the housing price movements.

On the reverse side of the coin, it is revealed that some of the reported relationships which are valid for boom periods as a whole are not preserved for the periods with rapid and slow increase in housing prices. A similar observation holds for the GIIPS versus non-GIIPS sub-samples in our analysis of financial development, where some relationships have been revealed for the sample of all countries, some relationships are underlined in the case of GIIPS economies only. Therefore, it is quite possible to obtain some generally acceptable conclusions as to the factors associated with housing price cycles. Yet it is hard to reach a characterization of housing price cycles which is valid for every different period and/or different group of countries; a conclusion which by itself poses further questions. These questions, indeed, are left as part of our future research agenda.

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Appendix A: Data Sources and Definitions

Data sources and metadata are given below in Table A1. Consumer prices are obtained at monthly frequency and transformed to quarterly frequency as average of observations in order to ensure compatibility with house prices. Each macroeconomic or institutional indicator was compiled from the same source whenever possible.

Table A1.Data Sources and Definitions

House Prices and Consumer Prices	
Austria	Nominal house prices: ECB: RPP.Q.AT.N.TD.00.3.00, Residential property prices, New and existing dwellings, Whole country, ECB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.AT.N.000000.4.INX, Neither seasonally nor working day adjusted
Belgium	Nominal house prices: ECB: RPP.Q.BE.N.ED.00.2.00, Residential property prices, Existing dwellings, Whole country, NCB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.BE.N.000000.4.INX, Neither seasonally nor working day adjusted
Bulgaria	Nominal house prices: ECB: RPP.Q.BG.N.EF.LC.1.00, Residential property prices, Existing flats, Large cities, NSI, Residential property in good and poor condition, Average of observations through period (A), [2007=100]
	Consumer prices: Eurostat: ICP.M.BG.N.000000.4.INX, Neither seasonally nor working day adjusted
Cyprus	Nominal house prices: ECB: RPP.Q.CY.N.TD.00.2.00, Residential property prices, New and existing dwellings, Whole country, NCB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.CY.N.000000.4.INX, Neither seasonally nor working day adjusted
Czech Republic	Nominal house prices: ECB: RPP.Q.CZ.N.EF.00.1.00, Residential property prices, Existing flats, Whole country, NSI, Residential property in good and poor condition, Average of observations through period (A) [2007=100]; Eurostat
	Consumer prices: Eurostat: ICP.M.CZ.N.000000.4.INX, Neither seasonally nor working day adjusted
Denmark	Nominal house prices: ECB: RPP.Q.DK.N.TH.00.1.00, Residential property prices, New and existing houses, Whole country, NSI, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.DK.N.000000.4.INX, Neither seasonally nor working day adjusted
Estonia	Nominal house prices: ECB: RPP.Q.EE.N.TF.00.1.00, Residential property prices, New and existing flats, Whole country, NSI, Residential property in good and poor condition, Average of observations through period (A) [2007=100]; National Statistics Office
	Consumer prices: Eurostat: ICP.M.EE.N.000000.4.INX, Neither seasonally nor working day adjusted
Finland	Nominal house prices: ECB: RPP.Q.FI.N.ED.00.3.00, Residential property prices, Existing dwellings, Whole country, ECB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.FI.N.000000.4.INX, Neither seasonally nor working day adjusted
France	Nominal house prices: ECB: RPP.Q.FR.N.ED.00.1.00, Residential property prices, Existing dwellings, Whole country, NSI, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.FR.N.000000.4.INX, Neither seasonally nor working day adjusted
Germany	Nominal house prices: ECB: RPP.Q.DE.N.TH.00.5.00, Residential property prices, New and existing houses, Whole country, Other, Residential property in good and poor condition, Average of observations through period (A) [2007=100]; Bundesbank
	Consumer prices: Eurostat: ICP.M.DE.N.000000.4.INX, Neither seasonally nor working day adjusted
Greece	Nominal house prices: ECB: RPP.Q.GR.N.TF.00.3.00, Residential property prices, New and existing flats, Whole country, ECB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.GR.N.000000.4.INX, Neither seasonally nor working day adjusted
Hungary	Nominal house prices: ECB: RPP.Q.HU.N.ED.CC.1.00, Residential property prices, Existing dwellings, Capital city, NSI, Residential property in good and poor condition, Average of observations through period (A) [2007=100]; FHB Bank
	Consumer prices: Eurostat: ICP.M.HU.N.000000.4.INX, Neither seasonally nor working day adjusted
Iceland	Nominal house prices: National Statistics Office, Residential property market price index from 2000
	Consumer prices: National Statistics Office, Consumer price index from 1939 [1988=100]
Ireland	Nominal house prices: ECB: RPP.Q.IE.N.TD.00.3.00, Residential property prices, New and existing dwellings, Whole country, ECB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.IE.N.000000.4.INX, Neither seasonally nor working day adjusted
Italy	Nominal house prices: ECB: RPP.Q.IT.N.TD.00.2.00, Residential property prices, New and existing dwellings, Whole country, NCB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.IT.N.000000.4.INX, Neither seasonally nor working day adjusted
Latvia	Nominal house prices: ECB: RPP.Q.LV.N.TF.00.2.00, Residential property prices, New and existing flats, Whole country, NCB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.LV.N.000000.4.INX, Neither seasonally nor working day adjusted
Lithuania	Nominal house prices: ECB: RPP.Q.LT.N.TD.00.2.00, Residential property prices, New and existing dwellings, Whole country, NCB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.LT.N.000000.4.INX, Neither seasonally nor working day adjusted
Luxembourg	Nominal house prices: ECB: RPP.Q.LU.N.TF.00.1.00, Residential property prices, New and existing flats, Whole country, NSI, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.LU.N.000000.4.INX, Neither seasonally nor working day adjusted

Table A1.Data Sources and Definitions (continued)

Malta	Nominal house prices: ECB: RPP.Q.MT.N.TD.00.2.00, Residential property prices, New and existing dwellings, Whole country, NCB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.MT.N.000000.4.INX, Neither seasonally nor working day adjusted
Netherlands	Nominal house prices: ECB: RPP.Q.NL.N.ED.00.1.00, Residential property prices, Existing dwellings, Whole country, NSI, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.NL.N.000000.4.INX, Neither seasonally nor working day adjusted
Norway	Nominal house prices: National Statistics Office, House price index [2005=100]
	Consumer prices: National Statistics Office, Consumer Price Index [1998=100]
Portugal	Nominal house prices: ECB: RPP.Q.PT.N.TD.00.5.00, Residential property prices, New and existing dwellings, Whole country, Other, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.PT.N.000000.4.INX, Neither seasonally nor working day adjusted
Slovakia	Nominal house prices: ECB: RPP.Q.SK.N.ED.00.2.00, Residential property prices, Existing dwellings, Whole country, NCB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.SK.N.000000.4.INX, Neither seasonally nor working day adjusted
Slovenia	Nominal house prices: ECB: RPP.Q.SLOW.N.ED.00.1.00, Residential property prices, Existing dwellings, Whole country, NSI, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.SLOW.N.000000.4.INX, Neither seasonally nor working day adjusted
Spain	Nominal house prices: ECB: RPP.Q.ES.N.TD.00.3.00, Residential property prices, New and existing dwellings, Whole country, ECB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.ES.N.000000.4.INX, Neither seasonally nor working day adjusted
Sweden	Nominal house prices: ECB: RPP.Q.SE.N.ED.00.1.00, Residential property prices, Existing dwellings, Whole country, NSI, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.SE.N.000000.4.INX, Neither seasonally nor working day adjusted
UK	Nominal house prices: ECB: RPP.Q.GB.N.TD.00.3.00, Residential property prices, New and existing dwellings, Whole country, ECB, Residential property in good and poor condition, Average of observations through period (A) [2007=100]
	Consumer prices: Eurostat: ICP.M.GB.N.000000.4.INX, Neither seasonally nor working day adjusted
US	Nominal house prices: FRED: USSTHPI
	Consumer prices: FRED: CPIAUCSL
Macroeconomic and Financial Variables	
GDPPCGR	Annual growth rate of GDP per capita (%) World Bank, World Development Indicators
M2GRREAL	Annual growth rate of real M2 aggregate of money (%) World Bank, World Development Indicators, Authors' calculations
POPGR	Annual growth rate of population (%) World Bank, World Development Indicators
AGEDEPYOUNG	Age dependency ratio for young population (%) World Bank, World Development Indicators
GROSSAVGDP	Ratio of gross savings to GDP (%) World Bank, World Development Indicators
DOMCREPRIVSEC	Ratio of domestic credit extended to private sector to GDP (%) World Bank, World Development Indicators
VIX	Global risk appetite (%, average) Chicago Board Options Exchange Market Volatility Index, implied volatility of S&P 500 index options
CROSSBORDER	Annual growth rate of cross-border credit flows (world, %, average) IMF, International Financial Statistics, BIS, Bank of International Settlements, BIS calculations
Unless otherwise specified, the following have been taken from the World Bank, The Global Financial Development Database. See Cihak et al. (2012) for detailed descriptions of data items.	
PCDMBGDP	Private credit by deposit money banks to GDP (%)
PCDMBAFIGDP	Private credit by deposit money banks and other financial institutions to GDP (%)
FSDGDP	Financial system deposits to GDP (%)
DMBAGDP	Deposit money bank assets to GDP (%)
OFIAGDP	Other financial institutions assets to GDP (%)
DMBABA	Deposit money bank assets to (deposit money + central) bank assets (%)
SMCGDP	Stock market capitalization to GDP (%)
SMTVTGDP	Stock market total value traded to GDP (%)
PRIVBMCGDP	Private bond market capitalization to GDP (%)
PUBBMCGDP	Public bond market capitalization to GDP (%)
IDUGDP	International debt issues to GDP (%)
NIM	Net interest margin (%)
BCI	Bank cost to income ratio (%)
BOCTA	Bank overhead costs to total assets (%)
SMTR	Stock market turnover ratio (%)
BZ	Bank z-score
LLGDP	Liquid liabilities to GDP (%)
BROA	Bank ROA
BROE	Bank ROE

Appendix B: Real House Price Episodes – Tabular Presentation

A full list of the house price episodes is given below in Table B1. In each row, start and end dates are given with the corresponding values of real house prices and trend inflation (left panel). Total and episode average changes in prices and trend inflation are also displayed (right panel). RAPID, SLOW, BUST, SLOWFALL and RAPIDFALL denote the pace of change of real house prices (RAPID: rapidly increasing, SLOW: slowly increasing, BUST: falling, RAPIDFALL: rapidly falling, SLOWFALL: slowly falling). Asterisks on start dates indicate use of judgment in determining the corresponding episodes. Note that, in our analysis, RAPID and SLOW are together called BOOM.

Table B1. Real House Price Episodes

									Changes in			
		Dates		Prices (Index value)		Trend housing price (%)			Prices (%)		Trend housing price (percentage points)	
	Type	Start	End	Start	End	Start	End	Duration (quarters)	Total	Average (Per quarter)	Total	Average
Austria	RAPID	2004Q3*	2006Q1	95.8	104.4	0.33	1.76	7	8.98	1.50	1.44	0.24
	RAPID	2007Q3	2010Q1	109.8	121.2	0.23	1.67	11	10.37	1.04	1.44	0.14
	SLOW	2010Q2	2013Q2	123.3	156.9	1.36	0.00	13	27.25	2.27	-1.36	-0.11
Belgium	SLOW	1997Q2	1999Q3	66.0	74.7	0.71	1.06	10	13.21	1.47	0.35	0.04
	RAPID	2001Q1	2005Q2	77.1	99.0	0.38	2.54	18	28.44	1.67	2.15	0.13
	SLOW	2005Q3	2007Q3	101.2	118.8	2.46	1.13	9	17.49	2.19	-1.33	-0.17
Bulgaria	RAPID	2002Q1*	2004Q2	49.9	73.2	-0.61	8.85	10	46.81	5.20	9.46	1.05
	SLOW	2004Q3	2005Q4	81.2	101.6	8.38	2.60	6	25.24	5.05	-5.78	-1.16
	RAPID	2006Q1	2007Q2	103.1	125.8	2.06	4.48	6	22.07	4.41	2.42	0.48
	SLOW	2007Q3	2008Q2	129.4	146.0	4.43	-0.20	4	12.89	4.30	-4.62	-1.54
	BUST	2008Q3	2013Q3	145.7	80.9	-2.01	0.00	21	-44.48	-2.22	2.01	0.10
	RAPIDFALL	(2008Q3)	2009Q2	145.70	110.57	-2.01	-5.32	4	-24.11	-8.04	-3.31	-1.10
	SLOWFALL	(2009Q3*)	2012Q1	104.04	84.11	-5.58	-1.43	11	-19.16	-1.92	4.15	0.41
	RAPIDFALL	(2012Q2)	2013Q3	83.68	80.89	-1.16	0.00	6	-3.33	-0.67	1.16	0.23
Cyprus	RAPID	2005Q1	2007Q2	97.8	132.6	1.89	4.63	10	35.61	3.96	2.73	0.30
	SLOW	2007Q3	2008Q2	137.0	151.0	4.32	1.16	4	10.23	3.41	-3.16	-1.05
	BUST	2008Q3	2013Q2	150.6	109.9	0.47	0.00	20	-27.00	-1.42	-0.47	-0.02
	RAPIDFALL	(2008Q3)	2009Q2	150.61	141.02	0.47	-1.06	4	-6.37	-2.12	-1.52	-0.51
	SLOWFALL	(2009Q3)	2010Q1	143.15	140.11	-1.19	-0.89	3	-2.12	-1.06	0.30	0.15
	RAPIDFALL	(2010Q2)	2013Q2	138.44	109.95	-0.99	0.00	13	-20.58	-1.71	0.99	0.08
Czech Republic	RAPID	2005Q4*	2007Q3	100.3	139.3	0.84	5.19	8	38.85	5.55	4.34	0.62
	SLOW	2007Q4	2008Q3	141.6	152.5	4.40	-1.07	4	7.71	2.57	-5.47	-1.82
	BUST	2008Q4	2013Q2	149.4	111.0	-1.51	0.00	19	-25.71	-1.43	1.51	0.08
	RAPIDFALL	(2008Q4)	2009Q2	149.38	128.38	-1.51	-2.64	3	-14.06	-7.03	-1.13	-0.57
	SLOWFALL	(2009Q3)	2010Q4	126.46	119.82	-3.02	-0.76	6	-5.25	-1.05	2.26	0.45
	SLOWFALL	(2011Q2)	2011Q4	119.39	116.37	-1.00	-0.83	3	-2.53	-1.26	0.16	0.08
	RAPIDFALL	(2012Q1)	2013Q2	114.37	110.98	-0.89	0.00	6	-2.96	-0.59	0.89	0.18
Denmark	RAPID	1995Q1*	1997Q3	52.6	65.5		2.25	11	24.55	2.46	2.25	0.22
	SLOW	1997Q4	2001Q1	66.1	78.3	1.88	0.82	14	18.32	1.41	-1.06	-0.08
	RAPID	2002Q2	2005Q3	79.3	101.6	0.16	4.51	14	28.16	2.17	4.35	0.33
	SLOW	2005Q4	2007Q1	108.3	123.8	4.36	0.82	6	14.31	2.86	-3.54	-0.71
	BUST	2007Q2	2013Q2	123.0	90.6	-0.05	0.00	25	-26.35	-1.10	0.05	0.00

Table B1. Real House Price Episodes (continued)

									Changes in			
		Dates		Prices (Index value)		Trend housing price (%)			Prices (%)		Trend housing price (percentage points)	
	Type	Start	End	Start	End	Start	End	Duration (quarters)	Total	Average (Per quarter)	Total	Average
Denmark	RAPIDFALL	(2007Q2)	2008Q2	122.97	116.52	-0.05	-2.96	5	-5.24	-1.31	-2.91	-0.73
	SLOWFALL	(2008Q3)	2010Q1	112.47	99.05	-3.26	-0.03	7	-11.93	-1.99	3.23	0.54
	RAPIDFALL	(2010Q2)	2013Q2	99.11	90.56	-0.07	0.00	13	-8.62	-0.72	0.07	0.01
Estonia	RAPID	2003Q3	2006Q1	61.9	130.8	2.95	8.61	11	111.36	11.14	5.66	0.57
	SLOW	2006Q2	2007Q1	136.2	160.9	7.71	1.03	4	18.13	6.04	-6.68	-2.23
	BUST	2007Q2	2009Q4	160.1	74.3	-0.41	-4.55	11	-53.62	-5.36	-4.14	-0.41
	RAPIDFALL	(2007Q2)	2008Q2	160.09	127.26	-0.41	-8.90	5	-20.50	-5.13	-8.49	-2.12
	SLOWFALL	(2008Q3)	2009Q4	114.22	74.26	-9.04	-4.55	6	-34.99	-7.00	4.50	0.90
Finland	RAPID	1996Q1*	1997Q1	56.3	66.5	1.20	3.35	5	18.26	4.56	2.15	0.54
	SLOW	1997Q2	2000Q3	68.3	82.6	3.27	-0.27	14	20.90	1.61	-3.54	-0.27
	SLOW	2002Q1	2004Q2	82.5	95.3	0.93	1.53	10	15.55	1.73	0.60	0.07
	RAPID	2005Q2	2006Q1	99.0	104.6	1.34	1.58	4	5.64	1.88	0.24	0.08
France	RAPID	1998Q1*	1999Q4	55.2	60.8	0.58	1.74	8	10.26	1.47	1.16	0.17
	SLOW	2000Q1	2001Q1	62.1	66.0	1.51	1.45	5	6.26	1.56	-0.06	-0.01
	RAPID	2001Q2	2004Q4	66.8	92.5	1.37	3.17	15	38.41	2.74	1.80	0.13
	SLOW	2005Q1	2007Q4	95.6	116.2	3.06	-0.09	12	21.57	1.96	-3.16	-0.29
	BUST	2008Q1	2009Q3	115.5	103.8	-0.61	-0.59	7	-10.09	-1.68	0.02	0.00
	RAPIDFALL	(2008Q1)	2008Q3	115.47	112.06	-0.61	-1.50	3	-2.95	-1.48	-0.89	-0.44
	SLOWFALL	(2008Q4)	2009Q3	109.49	103.82	-1.59	-0.59	4	-5.19	-1.73	1.00	0.33
Germany	BUST	2001Q1	2002Q2	105.1	101.7	-0.52	-0.56	6	-3.23	-0.65	-0.04	-0.01
	SLOW	2012Q4	2013Q3	96.4	97.9	0.42	0.00	4	1.58	0.53	-0.42	-0.14
Greece	SLOW	1997Q1	1999Q1	59.4	69.1		1.61	9	16.32	2.04	1.61	0.20
	RAPID	1999Q2	2001Q3	70.3	85.2	1.60	2.66	10	21.20	2.36	1.06	0.12
	SLOW	2001Q4	2003Q1	86.6	94.5	2.45	0.78	6	9.17	1.83	-1.66	-0.33
	RAPID	2003Q4	2006Q1	94.1	106.6	-0.08	2.30	10	13.26	1.47	2.38	0.26
	SLOW	2006Q2	2006Q4	108.7	113.3	1.85	1.38	3	4.24	2.12	-0.47	-0.23
	BUST	2007Q1	2013Q3	112.5	68.6	0.72	0.00	27	-39.01	-1.50	-0.72	-0.03
	RAPIDFALL	(2007Q1)	2009Q3	112.53	103.62	0.72	-1.87	11	-7.92	-0.79	-2.59	-0.26
	SLOWFALL	(2009Q4*)	2012Q1	102.96	79.90	-2.27	-3.24	10	-22.40	-2.49	-0.97	-0.11
	RAPIDFALL	(2012Q2)	2013Q3	78.05	68.63	-3.17	0.00	6	-12.07	-2.41	3.17	0.63
Hungary	RAPID	1998Q3*	2000Q1	49.3	70.6		6.55	7	43.06	7.18	6.55	1.09
	RAPID	2001Q3	2003Q1	80.7	96.1	1.77	3.07	7	19.13	3.19	1.30	0.22
	SLOW	2003Q2	2003Q4	99.2	104.2	1.85	1.59	3	5.03	2.52	-0.27	-0.13
	BUST	2008Q1	2012Q2	96.0	63.0	-0.91	0.00	18	-34.32	-2.02	0.91	0.05
	RAPIDFALL	(2008Q1)	2008Q4	96.00	92.49	-0.91	-2.60	4	-3.65	-1.22	-1.69	-0.56
	SLOWFALL	(2009Q1)	2010Q4	88.86	75.20	-2.84	-1.19	8	-15.38	-2.20	1.64	0.23
	RAPIDFALL	(2011Q1)	2012Q2	73.65	63.05	-2.19	0.00	6	-14.39	-2.88	2.19	0.44
Iceland	RAPID	2001Q4*	2002Q4	68.2	70.8	-0.26	1.77	5	3.80	0.95	2.02	0.51
	SLOW	2003Q1	2004Q1	72.9	78.3	1.98	2.13	5	7.47	1.87	0.15	0.04
	RAPID	2004Q2*	2005Q2	79.5	98.7	2.82	4.83	5	24.14	6.04	2.00	0.50
	SLOW	2005Q3	2006Q1	103.7	110.4	4.42	2.77	3	6.45	3.23	-1.64	-0.82
	BUST	2007Q4	2010Q1	118.0	80.2	-0.39	-2.20	10	-32.05	-3.56	-1.81	-0.20
	RAPIDFALL	(2007Q4)	2008Q3	118.03	105.55	-0.39	-3.84	4	-10.58	-3.53	-3.45	-1.15
	SLOWFALL	(2008Q4*)	2010Q1	98.66	80.20	-4.85	-2.20	6	-18.71	-3.74	2.65	0.53
Ireland	RAPID	1995Q3*	1997Q4	35.9	45.5		5.03	10	26.60	2.96	5.03	0.56
	SLOW	1998Q1	2001Q1	47.7	78.0	4.75	1.59	13	63.36	5.28	-3.16	-0.26
	RAPID	2002Q1	2003Q2	76.5	86.2	0.76	2.43	6	12.81	2.56	1.68	0.34
	SLOW	2003Q3	2004Q3	87.7	95.8	2.33	1.66	5	9.26	2.31	-0.68	-0.17
	RAPID	2004Q4	2006Q2	95.8	109.5	1.53	2.70	7	14.32	2.39	1.17	0.19

Table B1. Real House Price Episodes (continued)

									Changes in			
		Dates		Prices (Index value)		Trend housing price (%)			Prices (%)		Trend housing price (percentage points)	
	Type	Start	End	Start	End	Start	End	Duration (quarters)	Total	Average (Per quarter)	Total	Average
Ireland	SLOW	2006Q3	2007Q2	114.0	118.8	2.43	0.48	4	4.20	1.40	-1.95	-0.65
	BUST	2007Q3	2012Q2	117.5	57.6	-0.54	-2.80	20	-50.95	-2.68	-2.26	-0.12
	RAPIDFALL	(2007Q3)	2008Q4	117.49	100.92	-0.54	-4.09	6	-14.10	-2.82	-3.55	-0.71
	SLOWFALL	(2009Q1)	2010Q3	95.98	77.48	-4.16	-3.08	7	-19.28	-3.21	1.08	0.18
	RAPIDFALL	(2010Q4)	2012Q2	75.12	57.63	-3.33	-2.80	7	-23.28	-3.88	0.54	0.09
Italy	RAPID	1999Q1*	2002Q2	77.5	88.6	0.00	1.77	14	14.38	1.11	1.77	0.14
	RAPID	2003Q2	2005Q1	91.0	98.5	0.66	1.27	8	8.24	1.18	0.61	0.09
	SLOW	2005Q2	2008Q1	99.6	106.4	1.18	-0.21	12	6.91	0.63	-1.38	-0.13
	BUST	2008Q2	2013Q2	106.2	87.7	-0.15	0.00	21	-17.39	-0.87	0.15	0.01
	RAPIDFALL	(2008Q2)	2009Q4	106.22	103.52	-0.15	-0.46	7	-2.54	-0.42	-0.31	-0.05
	SLOWFALL	(2010Q1*)	2011Q4	102.00	97.68	-0.60	-1.26	8	-4.23	-0.60	-0.66	-0.09
	RAPIDFALL	(2012Q1)	2013Q2	96.63	87.75	-1.49	0.00	6	-9.19	-1.84	1.49	0.30
Latvia	RAPID	2001Q4*	2002Q4	35.4	78.0	9.78	14.50	5	120.16	30.04	4.72	1.18
	RAPID	2003Q4	2006Q3	83.7	169.5	0.82	11.69	12	102.54	9.32	10.87	0.99
	SLOW	2006Q4	2007Q3	187.1	217.4	10.35	0.75	4	16.22	5.41	-9.59	-3.20
	BUST	2007Q4	2009Q3	199.9	86.6	-2.21	-7.90	8	-56.66	-8.09	-5.69	-0.81
	RAPIDFALL	(2007Q4)	2008Q2	199.90	175.48	-2.21	-9.07	3	-12.22	-6.11	-6.86	-3.43
	SLOWFALL	(2008Q3)	2009Q3	157.20	86.64	-11.61	-7.90	5	-44.89	-11.22	3.71	0.93
Lithuania	RAPID	2002Q4	2005Q1	53.1	87.8	2.59	10.70	10	65.55	7.28	8.11	0.90
	SLOW	2005Q2	2007Q3	91.8	183.7	10.55	4.62	10	100.03	11.11	-5.93	-0.66
	BUST	2008Q2	2010Q3	184.5	97.3	-4.27	-2.02	10	-47.24	-5.25	2.25	0.25
	RAPIDFALL	(2008Q2)	2009Q1	184.45	127.88	-4.27	-7.31	4	-30.67	-10.22	-3.04	-1.01
	SLOWFALL	(2009Q2)	2010Q3	116.16	97.32	-8.01	-2.02	6	-16.22	-3.24	5.99	1.20
Luxembourg	SLOW	2012Q2	2013Q2	101.3	104.7	0.44	0.00	5	3.36	0.84	-0.44	-0.11
Malta	RAPID	2001Q4*	2004Q2	68.2	96.8	0.79	4.45	11	42.00	4.20	3.66	0.37
	BUST	2007Q4	2009Q1	99.0	85.5	-1.31	-1.40	6	-13.64	-2.73	-0.08	-0.02
	RAPIDFALL	(2007Q4)	2008Q1	98.95	98.18	-1.31	-1.92	2	-0.78	-0.78	-0.61	-0.61
	SLOWFALL	(2008Q2)	2009Q1	96.27	85.45	-2.60	-1.40	4	-11.23	-3.74	1.21	0.40
Netherlands	RAPID	1997Q3	1999Q3	60.7	76.3	2.17	3.69	9	25.76	3.22	1.53	0.19
	SLOW	1999Q4	2008Q1	79.7	106.7	3.67	0.19	34	33.85	1.03	-3.48	-0.11
	BUST	2008Q2	2013Q3	106.3	77.4	-0.11	0.00	22	-27.15	-1.29	0.11	0.01
	RAPIDFALL	(2008Q2)	2009Q3	106.25	100.79	-0.11	-0.93	6	-5.14	-1.03	-0.83	-0.17
	SLOWFALL	(2009Q4)	2010Q2	99.95	99.31	-0.96	-0.77	3	-0.64	-0.32	0.19	0.10
	RAPIDFALL	(2010Q3)	2013Q3	98.92	77.41	-0.81	0.00	13	-21.75	-1.81	0.81	0.07
Norway	RAPID	1995Q1*	1997Q2	50.2	59.8		2.53	10	19.16	2.13	2.53	0.28
	RAPID	1998Q2	1999Q3	65.9	72.7	1.67	2.88	6	10.23	2.05	1.20	0.24
	SLOW	1999Q4	2002Q2	76.0	87.1	2.84	0.30	11	14.63	1.46	-2.54	-0.25
	RAPID	2002Q3	2006Q3	85.9	113.1	0.04	3.11	17	31.70	1.98	3.07	0.19
	SLOW	2006Q4	2007Q3	116.9	125.6	2.93	1.09	4	7.41	2.47	-1.84	-0.61
	RAPID	2010Q4	2011Q4	127.5	136.2	1.27	1.61	5	6.77	1.69	0.34	0.08
	SLOW	2012Q1	2013Q2	137.7	144.5	1.35	0.00	6	4.98	1.00	-1.35	-0.27
Portugal	RAPID	1996Q3*	1999Q3	90.8	102.4	0.03	1.54	13	12.77	1.06	1.51	0.13
	SLOW	1999Q4	2001Q2	103.2	107.5	1.40	-0.01	7	4.20	0.70	-1.41	-0.24
	BUST	2001Q3	2005Q1	107.0	99.0	-0.19	-0.11	15	-7.47	-0.53	0.09	0.01
	BUST	2010Q2	2013Q3	101.1	88.3	-0.24	0.00	14	-12.62	-0.97	0.24	0.02

Table B1. Real House Price Episodes (continued)

									Changes in			
		Dates		Prices (Index value)		Trend housing price (%)			Prices (%)		Trend housing price (percentage points)	
	Type	Start	End	Start	End	Start	End	Duration (quarters)	Total	Average (Per quarter)	Total	Average
Slovakia	RAPID	2005Q2*	2007Q3	97.9	140.3		5.51	10	43.34	4.82	5.51	0.61
	SLOW	2007Q4	2008Q1	151.6	158.5	4.72	3.61	2	4.53	4.53	-1.11	-1.11
	BUST	2008Q2	2012Q3	164.8	118.4	1.94	-0.74	18	-28.14	-1.66	-2.68	-0.16
	RAPIDFALL	(2008Q2)	2009Q1	164.79	148.23	1.94	-2.12	4	-10.05	-3.35	-4.06	-1.35
	SLOWFALL	(2009Q2)	2010Q3	141.30	134.51	-2.69	-1.23	6	-4.81	-0.96	1.46	0.29
	RAPIDFALL	(2010Q4)	2012Q3	131.67	118.41	-1.35	-0.74	8	-10.07	-1.44	0.61	0.09
Slovenia	RAPID	2003Q1*	2006Q3	80.4	118.2		4.54	15	47.06	3.36	4.54	0.32
	SLOW	2006Q4	2007Q4	120.3	137.4	4.00	1.55	5	14.18	3.55	-2.45	-0.61
	BUST	2008Q1	2009Q3	134.1	118.8	-0.29	-1.25	7	-11.41	-1.90	-0.97	-0.16
	RAPIDFALL	(2008Q1)	2008Q3	134.06	133.40	-0.29	-1.81	3	-0.49	-0.25	-1.52	-0.76
	SLOWFALL	(2008Q4*)	2009Q3	128.86	118.76	-2.04	-1.25	4	-7.84	-2.61	0.79	0.26
Spain	RAPID	1997Q4*	1999Q1	50.5	54.6	0.91	1.67	6	8.02	1.60	0.76	0.15
	RAPID	1999Q3	2003Q4	56.2	83.9	1.11	3.39	18	49.34	2.90	2.28	0.13
	SLOW	2004Q1	2007Q3	86.8	112.1	3.38	-0.15	15	29.14	2.08	-3.53	-0.25
	BUST	2007Q4	2013Q2	109.8	62.5	-0.72	0.00	23	-43.13	-1.96	0.72	0.03
	RAPIDFALL	(2007Q4)	2008Q2	109.84	105.72	-0.72	-1.51	3	-3.75	-1.88	-0.79	-0.39
	SLOWFALL	(2008Q3)	2010Q1	103.50	95.62	-1.86	-1.12	7	-7.61	-1.27	0.75	0.12
	RAPIDFALL	(2010Q2)	2013Q2	95.22	62.47	-1.42	0.00	13	-34.39	-2.87	1.42	0.12
Sweden	RAPID	1996Q4*	1999Q3	56.2	69.0	0.88	2.33	12	22.69	2.06	1.46	0.13
	SLOW	1999Q4	2001Q1	70.1	79.1	2.19	1.32	6	12.86	2.57	-0.87	-0.17
	RAPID	2002Q1	2005Q2	79.7	98.7	0.92	2.37	14	23.71	1.82	1.45	0.11
	SLOW	2005Q3	2007Q4	100.9	123.2	2.35	0.86	10	22.19	2.47	-1.49	-0.17
United Kingdom	RAPID	1998Q2	1999Q2	47.7	49.6	0.71	2.12	5	3.96	0.99	1.41	0.35
	SLOW	1999Q3	2000Q1	51.5	55.2	1.97	2.01	3	7.10	3.55	0.04	0.02
	RAPID	2001Q1	2002Q1	56.3	64.7	1.60	4.68	5	14.87	3.72	3.09	0.77
	SLOW	2002Q2	2004Q3	67.8	99.4	4.40	2.41	10	46.67	5.19	-1.98	-0.22
	RAPID	2005Q3	2006Q3	100.1	105.7	0.85	1.87	5	5.67	1.42	1.02	0.25
	SLOW	2006Q4	2007Q3	109.1	115.0	1.72	-0.27	4	5.42	1.81	-1.99	-0.66
	BUST	2007Q4	2012Q4	112.7	78.4	-1.73	0.13	21	-30.40	-1.52	1.86	0.09
	RAPIDFALL	(2007Q4)	2008Q2	112.66	103.38	-1.73	-3.57	3	-8.23	-4.11	-1.84	-0.92
	SLOWFALL	(2008Q3)	2009Q2	96.14	86.42	-3.98	-2.00	4	-10.11	-3.37	1.99	0.66
United States	SLOW	1996Q4	1998Q4	69.3	73.5	0.14	0.76	9	6.03	0.75	0.63	0.08
	RAPID	1999Q1	2001Q4	73.9	81.7	0.64	1.22	12	10.49	0.95	0.59	0.05
	SLOW	2002Q1	2002Q3	82.7	84.6	1.11	1.04	3	2.33	1.17	-0.07	-0.03
	RAPID	2002Q4	2004Q3	85.2	94.5	0.97	1.89	8	10.95	1.56	0.92	0.13
	SLOW	2004Q4	2006Q4	95.3	104.8	1.81	-0.04	9	10.00	1.25	-1.85	-0.23
	BUST	2007Q1	2012Q4	103.9	76.6	-0.49	0.27	24	-26.32	-1.14	0.76	0.03
	RAPIDFALL	(2007Q1)	2007Q3	103.92	101.89	-0.49	-1.32	3	-1.95	-0.97	-0.83	-0.41
	SLOWFALL	(2007Q4)	2009Q3	99.65	87.20	-2.03	-1.06	8	-12.49	-1.78	0.97	0.14
	RAPIDFALL	(2009Q4)	2012Q4	85.27	76.56	-1.10	0.27	13	-10.21	-0.85	1.37	0.11

Appendix C: Real House Price Episodes – Graphical Presentation

The episodes of rapid increase (RAPID, shaded in red), slow increase (SLOW, shaded in yellow) and fall (BUST, shaded in blue) are displayed below for the countries in our sample. For each country, the upper and lower panels show the real house prices and the trend inflation of house prices used in Ball (1994) procedure, respectively.

Figure C1. Real House Price Episodes

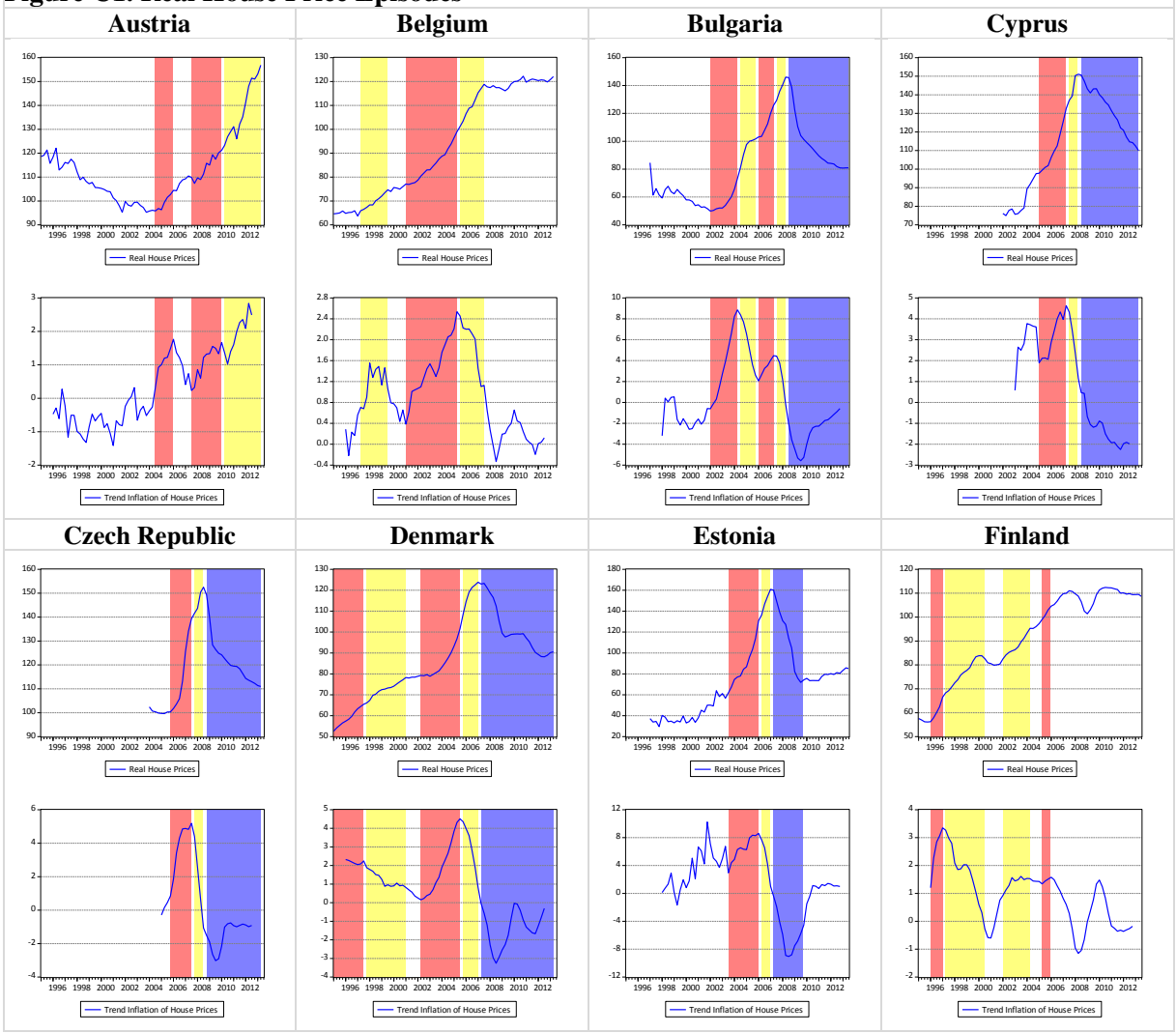


Figure C1. Real House Price Episodes (continued)

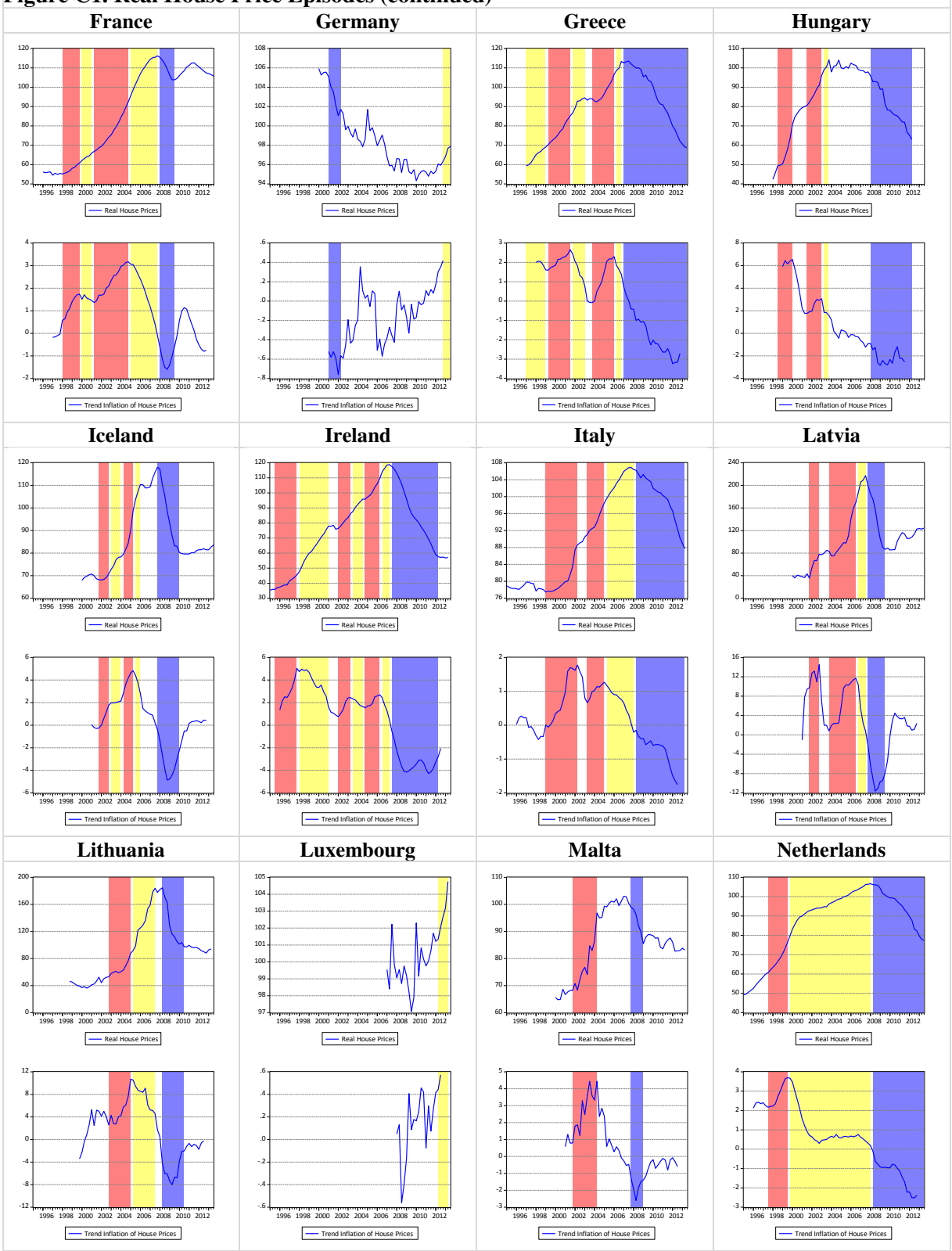
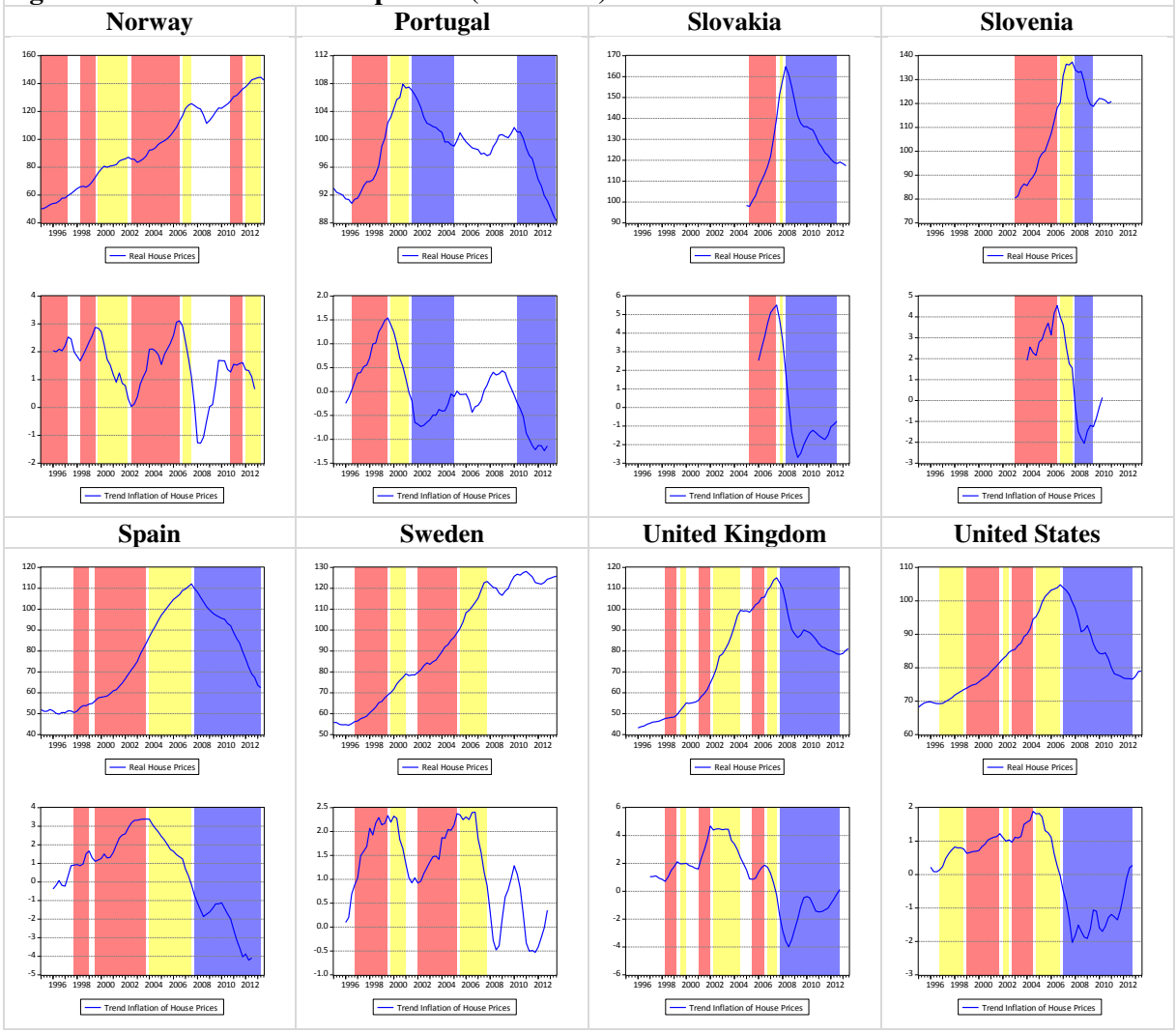


Figure C1. Real House Price Episodes (continued)



Appendix D: Correlations Among Variables

Table D1. Correlations

	GDPPCGR	M2GRREAL	POPGR	GROSSAVGDP	DOMCREPRIVSEC	VIX
M2GRREAL	0.4285	1.0000				
POPGR	-0.2508	-0.0157	1.0000			
GROSSAVGDP	0.1388	0.0680	-0.0237	1.0000		
DOMCREPRIVSEC	-0.3839	-0.1229	0.5991	-0.2372	1.0000	
VIX	-0.3896	-0.2210	-0.0404	-0.1025	-0.0163	1.0000
CROSSBORDER	0.6083	0.3859	0.0700	0.2025	-0.1349	-0.6561