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Capital Flows, House Prices, and the Macroeconomy: Evidence from Advanced and Emerging Market Economies*

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Abstract

In this paper we build a new comprehensive, quarterly house price data set comprising 57 advanced and developing economies —representing more than 95 percent of world GDP— with varying time-coverage from 1970 to 2012. We show that house prices in emerging markets grow slower, are more volatile and less persistent, and are more correlated with the real effective exchange rate and the current account, than in advanced economies. We provide evidence that indicates that house price booms are much larger and are more closely associated with capital inflows, loose global liquidity conditions, shallow domestic financial systems in emerging economies than in advanced economies. Finally, we find that while an exogenous change in global liquidity has a sizable impact on consumption, house prices and the current account in emerging markets, it has a much smaller and economically not significant impact on the same variables in advanced economies. We interpret our empirical evidence as suggesting that while global imbalances would have played a lesser role in explaining house price boom in developed economies in the period previous to the Great Recession, the increase in global liquidity in response to it may be playing an important role explaining recent house price dynamics in emerging markets.

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1 Introduction

Housing is the quintessential non-tradable asset, and the non-tradable sector has often been at the core of financial crises. For instance, booms in the non-tradable sectors were at the epicenter of many of the banking and currency crises that emerging market economies (EMEs) experienced in the 1980s and the 1990s. In those cases, positive external factors, such as increases in commodity prices and large capital inflows, fueled booms in the non-tradable sector and credit. When those external factors were reversed, the currency collapsed, the non-tradable sector suffered a significant contraction (including a sharp drop in house prices), and investment felt down abruptly. A similar mechanism played an important role in the recent banking and external crises in some European countries (Figure 1).

At the same time, over the past several years —in Asia and other emerging markets first, and in the United States and other advanced economies (AEs) more recently— capital has been abundant and highly mobile, while the set of profitable investment opportunities has been limited with many developed economies countries recovering from a crisis state. On this backdrop, policy makers in emerging market economies have worried for sometime now about the side effects of large and volatile capital flows. Indeed, while some analysts have blamed (at least in part) the United States financial crisis on the glut of Asian saving that exerted downward pressure on United States long-term interest rates, emerging markets have blamed many of their recent policy challenges on the monetary policy stimulus enacted by the United States in response to the global financial crisis (Figure 2).

In this paper we explore empirically the relation among capital flows, house prices, and the broader macroeconomy using a new, quarterly data set on house prices for a large group of advanced and emerging market economies. We first build a new comprehensive, quarterly house price data set comprising 57 advanced and developing economies —representing more than 95 percent of world GDP— with varying time-coverage from 1970 to 2012. We then describe house prices characteristics and their boom and bust behavior, comparing advanced and emerging economies. Next, we explore the nexus between these boom-bust episodes, capital flows and a set of macroeconomic and policy variables. Taking advantage of the large cross section dimension of our data, we also explore how structural characteristics of the economy (such as financial market depth and the exchange rate regime) affect these episodes. Then, in the final part of the paper, we identify an external financial shock (i.e., a "global liquidity shock") in a panel VAR model and we explore its transmission to house prices, the current account and the real exchange rate.

The paper relates to several strands of literature. The first set of references belong to an early strand of literature on housing and macroeconomics focused on the impact of house prices and borrowing constraints over the business cycle —see for example Iacoviello (2005), Monacelli (2009), Iacoviello and Neri (2010). Iacoviello (2005) for instance, using VAR analysis, finds that lower interest rates increase real house prices and GDP in the United States, while Monacelli (2009) shows that house price shocks can have a significant impact on aggregate demand and particularly consumption. The theoretical analyses of Iacoviello (2005), Iacoviello and Neri (2010), and Monacelli (2009) indicate that collateral constraints significantly amplify the response of macroeconomic aggregates (such as output and consumption) to house price changes in a way consistent with the empirical evidence above. Therefore, the introduction of this type of collateral constraints seems to be useful to explain excess business cycle volatility in developed economies. Relative to this first group of papers, we introduce an open economy dimension to the analysis—a dimension that is particularly relevant for economies that are transiting from emerging market to advanced economy status.

A second strand of the literature has explored the relation between capital flows and house prices in an attempt to gauge the role played by global external imbalances during the global financial crisis. Using data for advanced economies, Laibson and Mollerstrom (2010), Favilukis et al. (2012), Adam et al. (2012) and Ferrero (2012) provide evidence of a robust association between real house price appreciations and a widening of the current account deficit. Similarly, using data for both AEs and EMEs in a panel setting, Aizenman and Jinjarak (2009) find that lagged changes in current account deficits are associated with an appreciation of real house prices. A similar analysis has been conducted in a VAR setting —and using data for AEs only— by Gete (2009), Sa and Wieladek (2010) and Sa et al. (2011). In particular, Sa et al. (2011) show that a capital inflow shock —identified with sign restrictions in a panel VAR— has a significant and positive effects on house prices in advanced economies.

Relative to these papers not only we compare systematically AEs and EMEs, but we also explore the cross section dimension of the data in a panel VAR analysis and an event study analysis. This allows us to investigate the role of financial development and the exchange rate regime in the transmission of an external financial shock to house prices and the broader macroeconomy in both advanced and emerging economies. In addition, rather than identifying a generic capital flow shock, which could be triggered by many different underlying drivers of capital flows, we focus on the identification of exogenous changes to one particular driver of capital flows—global liquidity conditions, arguably the most important factor driving international capital flows—and study their impact on house prices, consumption, current account, and the real exchange rate.

Finally, because it focuses on global liquidity as a driver of capital flows, this paper also relates to the ongoing debate on the side-effects of (and prospective exit from) ultra-easy monetary policies in advanced economies in response to the global financial crisis. Landau (2013) stresses the importance of understanding the consequences of AEs' monetary policies on (potentially harmful) cross-border movements of liquid assets, which are driven more and more by global risk appetite and, to a lesser extent, by interest rate differentials. Similarly, Rey (2013) highlights the impact of unconventional monetary policy in the United States on the nature and the direction of international capital flows which, in turn, affect credit conditions and asset price behavior, such as exchange rates, equities and house prices. Relative to these papers, we use alternative measures of global liquidity (including measures based on assets issued by the official and private sectors, as well as uncertainty-based measures of global liquidity such as the VIX index of uncertainty) and investigate the impact of an exogenous change in such measures on both house prices and the broader macroeconomy.

The analysis yields several novel empirical results. First we report a new set of house price stylized facts, showing that house prices in emerging markets grow slower and are more volatile and less persistent than in advanced economies, and are more correlated with the real effective exchange rate and the current account than in advanced economies. We then show that house price booms are much larger in EMEs than in AEs and are more closely associated with loose global liquidity conditions; also we find that they are larger the shallower the domestic financial system. Finally we show that while in emerging economies a global liquidity shock has an economically meaningful impact on consumption, house prices and the current account, its impact in advanced economies is qualitatively very similar but quantitatively negligible.

The empirical evidence reported in the paper is consistent with the closed economy view presented above that borrowing constraints, which are certainly tighter and more pervasive in EMEs than in AEs, amplify the response of macroeconomic aggregates (such as output and consumption) to shocks triggering house price movements. Given the quantitative differences uncovered in the response of a typical advanced and emerging economy, we interpret our empirical evidence as suggesting that while global imbalances would have played a lesser role in explaining house price boom in developed economies in the period previous to the Great Recession, the increase in global liquidity in response to it may be playing an important role explaining recent house price dynamics in emerging markets.

The rest of the paper is organized as follow. In section two we describe our new house price data set. In section three we report house price unconditional moments and correlations. In section four we conduct an event study of boom-bust cycles in advanced and emerging economies. In section five we explore the causal link between global liquidity, house prices and the macroeconomy with a relatively simple panel VAR analysis. Section six concludes. Additional information on the data and the details of the analysis is reported in appendix (not necessarily for publication).

2 A new global house price data set

An important contribution of the paper is the construction of a new, comprehensive house price data base comprising 57 advanced and developing economies —covering more than 95 percent of world GDP— at business cycle frequency.

Our data set merges data from the OECD house price database, the BIS new property price data set, national central banks, national statistical offices, and academic publications on housing markets. It is novel because, relative to its main building blocks —i.e., the OECD house price database and the BIS property price data set— it extends the time coverage of some series and it includes several additional countries. Relative to the OECD and BIS data sets, we collected data for the following countries: Argentina, Brazil, Chile, Colombia, Croatia, India, Peru, Taiwan, Ukraine and Uruguay. And we extended the existing series for Austria, Chile, Czech Republic, Estonia, Hong Kong, Hungary, Indonesia, Malaysia, Philippines, Poland, Serbia, Singapore, Slovakia, Slovenia, Thailand, and Uruguay.

The coverage of some existing series was extended with a backward extrapolation procedure. Specifically, consider a country i for which there exists a (quarterly, nominal) house prices series that has a longer coverage than the OECD or the BIS data sets. To construct the final house price index in the database, we use the quarterly growth rates of this new series to extrapolate backward the existing OECD or BIS data. To make sure that the two series are comparable we use any overlapping period to evaluate the quality of the extrapolation.[1]

In order to use most of the available data, we also interpolate annual data to quarterly frequency by using the following 3-step procedure. First, we compute the annual growth rates of the original annual series. Second, by assuming that house prices grow at a constant rate within the year, we back out the quarterly growth rate that yields the annual price increase computed in the first step. Finally, we extend the existing data with the backward extrapolation procedure described above.

All series are seasonally adjusted with Eviews (using the X12 procedure) and then deflated with a country-specific (seasonally adjusted) CPI measure. The seasonal adjustment is performed on the quarterly growth rate of the nominal house price series using additive option.

The resulting data set is an unbalanced panel of 57 quarterly time series with varying coverage from 1970.I–2012.IV.[2] To get a good sense of the time coverage of the data set, Figure 3 provides a data map. As we can see, most advanced economies are cov-

[1] This step of the process is not documented in the paper but the material is available on request from the authors.

[2] The data set is avaiable at sites.google.com/site/ambropo/ and is updated occasaionally. The specific data sources are listed in the data appendix.

ered from the 1970s, while the coverage for emerging market economies is much more heterogeneous, with most countries covered from the mid-1980s onward.

The unbalanced nature of this panel of house price series raises the question of which sample period to use in the empirical analysis. As we shall see, we will use different sample periods depending on the specific aspect of the analysis and (when possible) we will conduct robustness analysis to the choices made.

Figure A.1 and A.2 in appendix display the behavior of all house price series in our data set (advanced economies and emerging economies, respectively). The charts show the high degree of heterogeneity of house price behavior, reflecting the importance of country-specific developments in housing markets. For instance, note that in the 2000s —while many advanced and emerging economies were experiencing sustained house price growth— house prices were stagnant in several other countries. For instance, house prices in Germany and Japan fell in real terms during that period, while house prices in Austria and Switzerland were relatively flat. In fact, prices in Germany were depressed by the excessive supply of houses following the construction boom after the German unification, while Japan was still suffering from the bursting of the housing bubble in the early 1990s.

Heterogeneity is even higher in emerging economies' housing markets, as Figure A.2 shows. Quite strikingly, in fact, while some advanced economies started to experience sustained house price growth since the mid-1990s, most emerging markets house prices did not bottom out from their earlier slumps until the early 2000s. Indeed, virtually all Asian countries experienced a prolonged house price decline after the 1997-98 crises, while Latin American countries experienced house price declines with the crisis episodes of the early 2000s. However, in the run up to the global financial crisis of 2007-08, in the second half of 2000s, it is possible to see a common pattern across almost all emerging economies of rapid increases in the price of houses in the pre-Lehman period, followed by large drops in the most of the countries in the sample.

This is *prima facie* evidence of the absence of a strong global factor in house prices at least through the mid-2000s, and much stronger house price co-movement toward the end of the sample period. Indeed, as we shall see in section 5, capital flows and global liquidity are a significant source of movements in house prices, possibly explaining pattern of co-movement in global house prices documented by Hirata et al. (2012) and Rey (2013).

3 House prices in advanced and emerging economies

In this section we compare the main time series features of house prices in the two groups of countries that we consider, namely advanced (AEs) and emerging market economies

(EMEs).

3.1 Trend growth, volatility and persistence

To compare and assess the key properties of house price series across groups of countries, Table 1 reports summary statistics of annual growth rates of real house prices, real GDP, and real consumption. The group statistics are computed country by country over the period 1985.I–2012.IV. We then average these country specific statistics across countries within each group.

Note that the choice of the starting date of the sample over which these statistics are computed (i.e., 1985.I) reflects a trade-off between the amount of observations used for the analysis and the degree of comparability across groups. In fact, and as we already mentioned, only few house price series are available for EMEs during the 1970s. Computing the summary statistics over the full sample would therefore introduce a bias in the comparison across AEs and EMEs: we therefore choose —somewhat arbitrarily— to use the sample period 1985.I–2012.IV (our main findings are robust to alternative sample periods).

Turning to the statistics in Table 1, first note that the long-term trend in real house prices growth in emerging economies is lower than in advanced economies, especially if compared to higher trend output and consumption growth in these economies. Real house prices have grown at an average rate of 2 and 1.2 percent per year in advanced economies and in emerging economies, respectively. But while in advanced economies the average growth of house prices is broadly similar to the growth of real GDP and consumption, in emerging economies real GDP and consumption have grown much faster during the past 25 years.

Real house prices in emerging economies are also twice as volatile as in advanced economies and significantly less persistent. The standard deviation of real house price yearly returns has averaged about 6 and 12 percent in advanced economies and emerging economies, respectively; while persistence has averaged .92 and .86, respectively.

Figure 4 provides a visual characterization of the house price cycle in the two groups of economies. It plots 5-years rolling average and 5-years rolling standard deviation of real house prices annual returns in both advanced and emerging economies over the 1985.I–2012.IV period. The cross-country average of these moving statistics (solid line) is reported together with the 2 standard deviations confidence bands (shaded area).[3]

The house price cycle looks very different across these two groups of countries. Advanced economies experienced an exceptionally long expansion, starting from the

[3] The variance of the cross-section is calculated by taking the variance across countries and dividing it by $(N-1)$, where N is the number of countries. As Pesaran et al. (1996) prove, this adjustment yields a consistent estimate of the true cross-section variance.

mid-1990s and ending only with the outburst of the global financial crisis in 2007-08. As we shall see below, the average expansion phase in advanced economies lasts about 5-6 years, whereas this upturn had the exceptional duration of about 12 years. The expansion lost momentum at the end of 2006, when the United States housing market started to decline, leading to the global housing collapse that we observed in 2008. Finally note that the very long expansion in house prices was associated with a period of historically low volatility, as it is shown by panel (c) of Figure 4.

While virtually all advanced economies' housing markets were booming, emerging economies witnessed a prolonged downturn, already in motion since the beginning of the 1990s, which tenured into a collapse by the late 1990s (likely driven by the financial crises of the mid- and late-1990s). As we shall see, many of these protracted busts were preceded by house price booms in the 1970s and 1980s. Note also that house price volatility in EMEs has been systematically higher than in AEs (panel c and d), with sharp time changes in the period under consideration.

From the early 2000s on, however, the two cycles show more similarities in both level and volatility. Interestingly, the volatility observed during the global financial crisis in both advanced economies and emerging economies is comparable to the volatility observed in the earlier parts of the sample, suggesting that house price volatility may recur again in the future.

3.2 Co-movement between house prices and the broader macroeconomy

We now turn to compare the co-movement between real house prices and some selected macroeconomic and financial variables. Note that the cyclical behavior of housing variables and their relation to the macroeconomy has been documented for advanced economies (see, among others, IMF (2004), Loungani (2010) and Andre (2010)). Two notable studies, namely Igan and Loungani (2012) and Claessens et al. (2012), also consider EMEs in their analysis. However, the empirical regularities between house prices exchange rates and capital flows for both advanced and emerging economies have not been explored yet, at least in a comprehensive and systematic way as presented in this section.

We compute the cross-correlation between the yearly growth rates of house prices and other macroeconomic and financial variables as,

$$\rho_i = \mathsf{COR}(RHP_{i,t}, x_{i,t\pm n}) \qquad n = 0, 1, ..., 4,$$

where $RHP_{i,t}$ is the annual growth rate of house prices in country i, $x_{i,t}$ is annual growth rate of the generic macroeconomic or financial variable in country i, and n stands for the lead/lag of the generic variable $x_{i,t}$ for which the correlation coefficient is computed.

Figure 5 displays the cross-correlation between house prices and all other variables considered. We consider output, consumption, labor productivity, equity prices, the real effective exchange rate, and the current account to GDP ratio.[4] As before, the cross-correlations are first computed on a country-specific basis and then averaged across advanced and emerging economies (dark dots), respectively. The heterogeneity within each group is taken into account by computing confidence bands (light shaded areas) as in Pesaran et al. (1996). The sample is, again, 1985.I–2012.IV.

Let's focus first on advanced economies, whose correlation are plotted in panel (a) of Figure 5. Consistent with the available evidence, house prices appear strongly procyclical. The correlation with GDP is, in fact, significantly positive at all leads and lags considered. The largest correlation is with GDP in $t + 1$ at a value of around 0.5. A similar pattern is observed for the cross-correlation with consumption for which the cross-country average of the contemporaneous correlation is even larger than for GDP, with a coefficient of about 0.6.

Movements in house prices are instead loosely connected with past and contemporaneous movements in consumer price inflation. The cross-country average of the contemporaneous correlation between year-on-year changes in consumer prices and house prices is, in fact, close to zero. If anything, house price inflation seems to lead consumer price inflation by approximately three to four quarters, consistent with the idea that house prices relax borrowing constraints and support consumption.

The correlation between the annual changes in house prices and labor productivity is slightly positive, averaging at around 0.2 contemporaneously. This low correlation (relative to GDP and consumption) is quite surprising, since labor productivity should be one of the fundamental factors driving house prices: an increase in productivity should lead to higher income expectations, therefore strengthening the current and future demand for housing.

The co-movement between house price and equity price returns is slightly positive and significantly different from zero. In theory one would expect that, at least in the long-run, the stock market and the housing market should be driven by the same fundamentals, namely income and productivity, although house price changes are much more persistent. The low level of the average correlation with real equity price may be due to the sample period used, which includes the stock market crash of 2001. During the burst of the dot-com bubble, in fact, equity prices collapsed while house prices kept on increasing.

[4] The macroeconomic and financial variables are defined in the data appendix, where we also list the data sources. Note that in this section we use a subset of our house price data set (including 40 out of 57 countries): this is partly due to the fact that the available sample period for some countries is too short to allow a meaningful business cycle analysis (such as 10 years rolling statistics or alike).

Changes in the short-term interest rate are positively correlated with changes in the price of housing. In particular, changes in house prices lead changes in the same direction in interest rates by three-to-four quarters. Of course, given the nature of the analysis, it is not possible to infer any causality between the evolution of house prices and short-term interest rates or, ultimately, monetary policy. The correlations analyzed above, however, show that house prices are procyclical, coincident, and lead inflation by a few quarters.

The cross-correlation between changes in the price of housing and in the real effective exchange rate shows that surges in the price of housing are followed by a slight appreciation of the exchange rate. Figure 5 also shows that changes in house prices are negatively correlated with changes in the current account to GDP ratio. The negative correlation between house prices and the current account balance in advanced economies—a measure of net capital flows— has been already pointed out by many empirical studies.[5] As we shall see this relation is even stronger for emerging markets.

The same cross-correlation coefficients, computed across emerging economies are displayed in panel (b) of Figure 5. The stylized facts identified for emerging economies are broadly in line with the ones identified for advanced economies, with some interesting quantitative and qualitative differences.

Like in advanced economies, house prices in emerging economies are strongly procyclical. However, the cross-country average of the contemporaneous correlation with consumption is lower than with output, at about 0.4. This is consistent with a lower degree of financial market development (and in particular housing finance) in emerging economies relative to advanced economies (see Warnock and Warnock, 2008, for example). For instance, home equity withdrawal —i.e., the decision of consumers to borrow money against the real value of their houses— has been found to be strongly positively correlated with the degree of mortgage market depth (see, for example, Klyuev and Mills, 2007). The financial liberalization and innovation that took place in AEs made such practice easier. In turn, home equity withdrawal increases the propensity to consume out of housing wealth and, ultimately, increases the co-movement between the house prices and consumption. Note, finally, that the larger confidence bands in panel (b) of Figure 5 show that there is a much higher degree of heterogeneity within emerging economies relative to advanced economies.

A second important difference is the cross-correlation of house prices with labor productivity, which averages at around 0.4 in EMEs compared to 0.2 in AEs, suggesting a much closer association between house prices and fundamentals in EMEs. Also, the co-movement with equity prices and the current account is stronger in EMEs than in

[5] Such negative correlation has been often associated to the global savings glut hypothesis (see Bernanke (2010) for example). According to the global savings glut hypothesis, excessive savings in EMs fuelled capital flows into AEs which, in turn, were an important reason why long-term interest rates were lower than expected in the early 2000s. See Bernanke (2005).

AEs, while the co-movement with inflation, short term interest rates and the exchange rate is weaker. This suggests more role for capital flows, but different role for monetary policy. In fact emerging markets exposed to strong capital inflows usually cannot raise interest rates to cool their domestic economy without attracting more capital.

Did the relation between the price of housing and the macro-financial variables documented above evolve over time? Figure 6 displays the cross-country average of the contemporaneous correlation between house prices and the variables considered above with a 10-years moving window (solid line). Consistently with the findings of IMF (2004), the average correlation between real house prices and output (and consumption) in advanced economies displays a steady decline since the mid-1990s. The two standard deviation error bands show that, for some countries, such correlation was close to zero before the onset of the global financial crisis. This fact, which goes against the typical theoretical consideration, is viewed as an indication of how atypical was the last house price boom in industrial countries: prices have soared for many years, while economic activity was weakening. However, the average correlation has started increasing from 2007 and has spiked after the financial crisis hit, pointing to increased synchronization of the housing markets. Notice, finally, that at the end of 2009 the average correlation had reverted to its level of the mid 1990s.

Note here that the documented relation between house prices and labor productivity strengthens the point made in the cross-correlation analysis. The average correlation between house prices and labor productivity remained very small and borderline insignificant till late 2000s in advanced economies, suggesting that house prices were very loosely connected to economic fundamentals.

The average correlation with equity prices, short-term interest rates and the real effective exchange rate has been fairly stable during the period under consideration. In contrast the average correlation with the current account balance over GDP seems to have decreased over time.

The same moving correlations are displayed for emerging economies in panel (b) of Figure 6. From the comparison with advanced economies some interesting facts stand out. First, the disconnect of house prices from changes in output and consumption observed in advanced economies is not present in emerging economies. The average correlation is, in fact, much more stable over time, averaging slightly below 0.5 for both GDP and consumption. Also, the correlation with labor productivity is always positive, significant and averages about 0.4, a value much higher relative to advanced economies. Second, the average correlation with the real effective exchange rate is fairly stable, positive and significant.

3.3 Boom-bust cycles in house prices

The definition of asset-price bubbles is somewhat controversial and their identification with econometric techniques is still an open issue in the literature.[6] To overcome these difficulties, many studies have focused on asset-price booms and busts, defined as periods in which the price of an asset exceeds a pre-determined threshold. The threshold is commonly defined in terms of deviations from a trend. Note, however, that the choice of the detrending procedure (first difference, HP filter, etc.) importantly affects the identification of the boom-bust episodes.

In this section, we use a simple methodology similar to that used by Bordo and Jeanne (2002).[7] An asset-price boom or bust is identified when the three-year moving average of the asset price annual real return rate falls outside a confidence interval defined by reference to the historical first and second moments of the series. Specifically, a boom (bust) occurs in a period when the three-year moving average of the annual return is larger (smaller) than a threshold, as specified by the following equation:

$$\frac{g_{i,t} + g_{i,t-1} + g_{i,t-2}}{3} \lesseqgtr g \pm x\sigma \tag{1}$$

where $g_{i,t}$ is the annual return of the asset price in country i; g is the average of the annual return across all periods and countries; σ is the average of the standard deviation of the annual return across all countries; and x is a parameter to be calibrated so as to select the notorious boom-bust episodes without selecting too many spurious events. Some of the advantages of using the methodology proposed by Bordo and Jeanne (2002) is that it is objective, easily reproducible, and, most importantly for this study, can be applied consistently across countries. This makes possible to analyze separately industrialized and developing economies and assess their differences.

The procedure described above is applied to 21 advanced and 19 emerging economies from 1970.I to 2012.IV (subject to data availability). However, to avoid identifying as booms or busts high-frequency movements in the data, we proceed as follows. First, we compute a centered moving average of our quarterly house price series, with a window of 4 quarters on each side (8 quarters in total). Then, since the procedure proposed by Bordo and Jeanne (2002) is applied to annual time series, we take the last quarterly value for each year.

Alternatively, to transform the quarterly data set into annual frequency, we could have simply used the average within the year (or the value of the last quarter for each year). Note here that, the number of boom-bust episodes and their dating is very robust to these alternative approaches.

[6] See Gurkaynak (2008) for a recent survey on econometric tests of asset price bubbles.
[7] This procedure was implemented recently by IMF (2009) and Barajas et al. (2008).

Following Bordo and Jeanne (2002), the parameter x is set to 0.8 so as to match few well known house price boom-bust episodes.[8] Note that when the condition in equation (1) holds, then the periods $t-2$ through t are labeled as a boom (bust). Moreover, a boom-bust episode is defined as a boom followed by a bust that starts no later than one-year after the end of the bust.

Across all countries, the procedure identifies 66 booms, 69 busts, and 28 boom-bust cycles. Figure A.3 and A.4 display the annual house price index, computed as described above (solid line), together with the identified booms (light shaded area) and the busts (dark shaded area). The procedure identifies some major well-known boom-bust episodes —such as the housing crash in Sweden and Finland in the late 1980s and in Spain and Ireland in recent years— but does not pick up many spurious events. Consistently with the notion that boom-bust episodes are rare events, the frequency of a boom-bust episode per year is of about 2 percent in advanced economies and emerging economies alike.

Three features of this exercise are worth noting. First, many countries experienced a boom in real house prices, but even though in some cases booms are followed by protracted busts, this is not always true. In the sample considered, only 28 booms out of the 66 identified episodes are followed by a bust, implying that only 40 percent of booms ends up in a bust. Second the average duration of a boom, bust, and boom-bust episode is around 5.6, 4.5 and 9.5 years, respectively.

Table 2 displays some summary statistics of the identified boom-bust episodes for house prices. As the sample period used for advanced economies is different from the sample period used for emerging economies, in this part of the analysis we shall not analyze the *number* of boom-bust episodes, but rather the frequency of occurrence of such episodes. The frequency probability of a boom converting into a bust is computed as the number of booms over the number of boom-bust cycles for each country.

Consistently with the findings of Bordo and Jeanne (2002) and Burnside et al. (2011), not all booms convert into a bust. Historically, across all asset prices and all groups, only 40 percent of the booms were followed by a bust. Also, consistently with the literature, boom-bust episodes are rare events. The frequency probability of observing a boom-bust cycle in a given year is 0.021 and the probability is comparable across advanced and emerging economies. Similar results are obtained for the probability of observing a boom in a given year, which is equal to about 0.05 with no significant differences across groups. Finally, concerning the duration, we observe that house price boom-bust episodes last on average 10 years.

[8] The value for x is significantly lower than the original value used by Bordo and Jeanne (2002). This is due to the fact that our sample period includes the global financial crisis which clearly increased the average standard deviation of house prices.

4 Capital flows and house prices: an event study

So far we looked at unconditional associations. In this section, we condition the analysis on a particular phase of the cycle, the boom episodes identified above. In the next section, we will condition on a particular shock to a typical capital flow driver: a global liquidity shock.

Specifically, we use the 66 boom episodes of real house price boom identified in the previous section to study systematically the behavior of relevant macroeconomic variables and country characteristics in this particular phase of the cycle. We concentrate on boom episodes because some of the bust episodes we have identified are still ongoing as of the time of writing. We first compare episodes in advanced and emerging economies, and then we investigate the role played by country characteristics.

4.1 House prices boom episodes

Figure 7, Panel (a) reports the average real house price increase during booms in advanced (AEs) and emerging economies (EMEs). For each episode, we take the average level of the real house price index during the boom phase and compare it with the average level of the index in the two years prior to the beginning of the boom. The chart shows that house prices booms in EMEs are twice as large as in AEs, with house prices increasing 70 percent relative to the average before the beginning of the boom in EMEs as compared to 35 percent in AEs.

Figure 7, Panel (b) to (h), shows the behavior of relevant external and domestic macro variables during the typical boom episode. Panel (b) shows the behavior of the (ex post) US real federal funds interest rate during the boom episodes. In particular, the figure plots the average (ex post) US real federal funds rate during the real house price boom *minus* the average (ex post) real federal funds rate in the two years prior to the beginning of the boom. In AEs, during a boom, this measure of the US real interest rate is almost one full percentage point lower than in the two years prior the boom. In contrast, in EMEs, there is almost no difference in this measure of the real US interest rate compared to the period right before the boom. Inspection of individual episodes, however, reveals that in many cases in which there is no significant change between this interest rate relative to the previous period, the (ex post) US real federal funds rate was already in an expansionary position at the beginning of the boom phase. The fact that there is no significant difference between the US real interest rate during the boom compared to the previous period does not mean that international financial conditions were not expansionary during those episodes.

The behavior of global liquidity provide direct evidence regarding this fact. Panel (c) plots a global liquidity index increase during the boom episode relative to the average value of this index in the two years prior to the beginning of the boom.[9] Interestingly, the behavior of this index indicates that, in both AEs and EMEs, global liquidity conditions faced by the countries that experienced a real house price boom in our sample were significantly higher than in the period preceding the boom. And the global liquidity conditions are much looser in the case of the EMEs booms relative to the AEs booms. Interestingly, the results also indicate that during the real house price boom episodes in EMEs, uncertainty —as measured by the VIX index— was also lower than in the period proceeding the beginning of the episode. In contrast, the behavior of the VIX index in the case of AEs does not exhibit a significant difference to the period prior to the boom.

Consistently with this broader picture, in the context of relatively lower US interest rates, higher global liquidity and lower uncertainty, capital inflows are larger in EMEs during episodes of house price booms. Capital inflows are constructed as the sum of the change in international reserves as a percentage of GDP minus the current account balance. Indeed, the average capital inflows as a percentage of GDP during the boom episode minus the average capital inflows in the two years prior to the beginning of the boom is significantly higher in the case of emerging market economies and only slightly positive in the case of developed economies during the boom episodes (Panel (d)).

We now turn to the behavior of domestic macro variables during the real house price booms. Figure 12, Panel (e) shows the behavior of the output gap, constructed using the HP filter, during the boom episodes in developed and emerging market economies. We display the average output gap during the boom episodes for developed and emerging market economies minus the average output gap over the 2 years prior to the episode. The results are consistent with the correlation analysis above, in the sense that real house prices are positively correlated with economic activity. During the boom episodes, economic activity increases above trend. This increase is significantly larger in emerging market economies.

Panel (f) shows that also private consumption increases more strongly in emerging market economies during the real house price booms compared to more developed economies. The private consumption increase corresponds to the percentage change of average private consumption during the boom episode with respect to average private consumption in the two years prior to the beginning of the boom.

The difference in the behavior of the current account during the boom episodes in emerging market economies compared to developed economies is quite significant as panel (g) shows. The current account increase corresponds to the average current account balance as a percentage of GDP during the boom episode minus the average

[9] This global liquidity index is defined as the sum of world official reserves (excluding gold) plus US M0 deflated by the US CPI. See the next section of the paper for a discussion and a comparison with other measures of global liquidity.

current account balance in the two years prior to the beginning of the boom. In the case of emerging market economies, the current account deteriorates more than 3.5 percent during the real house price booms while in developed economies the deterioration in the current account balance is less than 1 percent of GDP on average.

Finally, the evolution of the real exchange rate during the house price boom episodes is presented in Panel (h). The evidence, consistent with the preliminary evidence presented in the correlation analysis, indicates that during the real house price booms the real exchange rate appreciates more in emerging market than in developed economies . This evidence is consistent with previous literature that documents the behavior of the real exchange rate in the context of capital inflows.

While suggestive, what reported thus far are simple associations. Also, averages are interesting, but they do hide substantial heterogeneity in individual experiences. Individual episodes have to be conditioned on the actual change in real house prices and potential determinants of house price booms needs to be assessed in the same framework, which is what we are going to do in the next subsection.

4.2 The determinants of real house prices during boom episodes

In order to explain the cross-section variation of real house prices during our boom episodes, we estimate different versions of the following equation:

$$\Delta P_i = \alpha + \beta\left(\mathcal{ECI}_i\right) + \gamma Z_i + \delta(\mathcal{ECI}_i \times Z_i),$$

where ΔP_i corresponds to the increase in real house price in episode i as discussed previously, $\mathcal{ECI}_i$ corresponds to an external condition index of choice (namely, either the change in the real federal funds interest rate during the episode, the global liquidity index change during the episode, capital inflows during the episode and our proxy for risk premium, the VIX index). The vector Z_i contains two potentially key variables in the amplification of external financial shocks in real house prices: financial market depth and the exchange rate regime. The vector Z_i also includes a dummy variable that that takes value 1 if the episode corresponds to a developed economy and 0 if corresponds to an emerging market economy. We allow for the interaction between the external condition index and the vector Z in order to capture the potential amplification of these shocks through channels associated to financial constraints and the exchange rate flexibility as discussed previously.

Regarding the external condition index we use two variables to capture this effect, the change in capital inflows during the episode and the global liquidity index change during the episode defined before. Using capital inflows is more problematic because it is a country specific variable and is endogenous to the domestic factors pulling capital in. So we report these results, but then also use an arguably more exogenous determinant of country-specific capital inflows, namely our global liquidity measure (and discussed in details in the next section of the paper). The exchange rate regime variable comes from Ilzetzki, Reinhart and Rogoff (2008)'s exchange rate system classification.[10] In order to measure financial development, we use the variable credit to the private sector (as percentage of GDP) in the year prior to the beginning of the episode.

Results are reported in Table 3. The results indicate that there is a significant impact of the capital inflows on the real house price dynamics during the boom episode. For the whole sample, an increase of 3 percent of GDP in capital inflows is associated with an increase of almost 7 percent on average in real house prices during the boom. This effect differs significantly once we control for the classification of the country. In particular, the increase in real house prices during a boom episode almost double in the case of emerging market economies, while for developed economies the impact of capital inflows on real house prices is close to zero.

Our results also indicate that the impact of capital inflows on real house prices during our episodes is larger the less developed financial markets are and the less flexible exchange rate regimes are (the interaction effects between capital inflows and these variables are also significant).

Acknowledging the endogeneity problem that arises in this estimation by using capital inflows, we use our global liquidity measure to study the impacts of capital inflows in real house prices. The results (also reported in Table 3) indicate that the change in the global liquidity index is a significant determinant of real house prices dynamics. A global liquidity increase of 25 percent (as the one observed on average in the real house prices boom occurred in emerging market economies) is associated with an average 23 percent increase in real house prices in the estimations we present. The impact of the same increase in global liquidity is reduced to 6 percent increase in the case of developed economies.

Also, the interaction of financial market depth and global liquidity index is significant and negative, which indicates that the impact of global liquidity of real house prices is lower in the cases of more developed financial markets. The interaction between the exchange rate flexibility and the global liquidity variable is not found to be significant in these estimations.

In sum, these results show that the impact of capital inflows, and less controversially of our global liquidity index, is positively related with real house prices during episodes of house price boom in emerging markets, but much less during the same episodes in advanced economies. Moreover, we show that more financial developed markets tend

[10] In our analysis we use the 13 different categories constructed by these authors, indexing countries from 1 to 13 according to the degree of exchange rate flexibility, with higher values indicating more flexibility.In our analysis we use the 13 different categories constructed by these authors, indexing countries from 1 to 13 according to the degree of exchange rate flexibility, with higher values indicating more flexibility.

to mitigate the impact of global liquidity conditions on the economy, with more mixed evidence in the case of insulation property of exchange rate flexibility.

5 Global liquidity and house prices: a panel VAR analysis

Empirical models of international capital flows typically include "push" (i.e., global) and "pull" (i.e., local) drivers such as interest rates differentials, growth differentials, as well as competitiveness measures reflecting differences in productivity and production costs between the home economy and the he rest of the world (e.g., Calvo et al. (1996)). To investigate the causal link from capital flows to house prices and the broader macroeconomic dynamics, in this section, we specify and estimate a panel vector autoregression (VAR) model that embeds both typical "pull" and "push" factors, although we shall identify only exogenous changes to one particular push factor: global liquidity, broadly defined as the total world availability of US dollar-denominated liquid assets and measured in alternative ways as we discuss below. Hence, in the rest of this section, we first discuss issues related to global liquidity and the identification of an exogenous change in this variable. We then present the panel VAR model we use and finally we report and discuss the empirical results that we find.

5.1 Global liquidity

We focus on global liquidity for several reasons.[11] Global liquidity, broadly defined as the total, world availability of US dollar-denominated liquid assets is a proxy for the monetary policy stance in whole world economy, as opposed to any individual economy pulling in capital flows or the rest of the world economy pushing them to a particular country Like in a closed economy, when global monetary conditions are looser, global credit expands and financing conditions loosen, and capital flows across borders to individual countries (like different sectors of a closed economy) with varying intensities and in the form of different instruments (such as loans, bonds, equities, or direct investments). Indeed, as Figure 2 suggests, the recent synchronized boom-bust cycle in house prices described in section 2 is associated with an unprecedented increase in global liquidity. We also find that global liquidity is an important determinant of house price booms in our event study. Last but not least, it is relatively simple to identify an exogenous change to global liquidity in our panel VAR model.

[11] See Landau (2013) for a recent analysis and policy discussion.

5.1.1 Alternative measures of global liquidity

We measure global liquidity in three different ways (plotted in Figure 8). The first measure that we use is the sum of world international reserves (excluding gold) evaluated in current US dollar plus the US M0, deflated by the US CPI. We will call this measure "official global liquidity" and Figure 2 plots its two key components: US M0 and total official reserves. It is meant to capture "the funding that is unconditionally available to settle claims through the monetary authorities". Thus, this measure of global liquidity captures official reserve accumulation associated with the "global trade imbalances", such as for instance the high and growing saving rate of emerging Asian economies and oil exporters. But also encompasses both interest rate policy as well as non-conventional monetary policy in the US.[12] This is the measure most often used by practitioners—see for example The Economist magazine (2005) and Deutsche Bank (2007).

The two alternatives that we consider are a measure of "private" global liquidity suggested by the BIS (2011) and the VIX index of uncertainty as suggested by Matsumoto (2011). BIS (2011) notes that liquid assets are issued and held by both private intermediaries and official entities. BIS (2011) suggests to measure global liquidity with the sum of the net cross-border lending positions in foreign currencies to residents of all BIS reporting banks (BIS (2011)). Matsumoto (2011) instead notes that, in addition to the availability of funds for settling transactions in safe assets measured by the official or private liquidity measures above, there is another aspect of global liquidity related to the availability of funds for settling trade in risky assets, measured by its corresponding price—the market price of risk or risk premium. Following this author, we use the VIX index as a proxy for the global market price of risk.[13]

These three measures are plotted in Figure 8, in both levels and first differences (with official and private liquidity deflated by the US CPI). As Table 4 shows, private and official liquidity co-move very well in first differences throughout the sample period, except for the very short period 2008.III–2009.I at the peak of the global financial crisis. After 2009.I, official liquidity grows much faster than private liquidity. As a result, the level correlation between these two variables breaks down after the peak of the crisis, but the correlations in first differences continues to be positive and sizable. The VIX index co-moves well in both levels and first differences before 2008.II with both official and private liquidity. After the peak of the crisis, however, the correlation between the VIX index and the other two measures in first differences changes sign. This suggests that the VIX index is not a good measure of liquidity after the peak of the crisis. Also, while reserve accumulation after the peak of the crisis continued at a comparable rate

[12]Note that under the fed fund targeting procedure that the Fed has followed during our sample period, money is endogenous.

[13]Rey (2013) also focuses on the VIX as a measure of global liquidity and finds that the VIX index is closely related to a global factor in international flows of risky assets, credit, and leverage. This is consistent with the view that global liquidity captures global monetary conditions.

with the pre crisis period, there is a clear structural break in US M0 (Figure 2) due to the adoption of non conventional measures. We will therefore use private liquidity in our baseline VAR specification, and we conduct extensive robustness checks to the choice of the sample period as well as the other two measures of global liquidity discussed.

5.1.2 Identification of an exogenous global liquidity shock

The identification of an exogenous change to global liquidity (i.e. a global liquidity shock) is relatively simple and naturally follows from the global nature of this variable. As this variable is global in nature, we can reasonably assume that no individual country is large enough to affect it significantly within a given quarter. It follows that it is possible to assume that this variables does not respond to innovations to any other country specific variable in the VAR system within a given quarter. For instance, as Figure 2 shows, in the case of official liquidity, even for a country like the United States, US M0 averaged only 28 percent of the measure we constructed over the period 1985.I–2006.IV, declining to only 17 percent by 2006.IV and climbing back up to 23 percent by only by 2012.IV.[14]

A similar argument hold for the private global liquidity measure that we use, while assuming that the VIX index is exogenous relative to other macroeconomic variable at quarterly frequency is a standard assumption in the growing literature on uncertainty and macroeconomic dynamics. Note finally that, given the relatively large size of our cross section of countries, any individual impulse response will have a limited impact on the panel estimate that we report below. So if the identification assumption made were not to be satisfied in any particular country like the US or China, the panel bias on the panel estimate would of the order $1/N$ where N is the cross section size.

A global liquidity shock therefore is easily identified in our model by assuming that, within a quarter, it is not affected by any other variable in the country-specific VAR systems. Given this assumption, a global liquidity shock and associated impulse responses of all other variables in the system can be obtained from the Cholesky decomposition of the variance covariance matrix of the estimated reduced form residuals of each country-specific VAR, with global liquidity ordered first in the system. In fact, for the purpose of identifying the effects of the global liquidity shock, the order of the other endogenous variables in the VAR system does not matte.

[14]Note also that, given the relatively large size of our cross section of countries, individual IRFs will have a limited impact on the panel estimate that we report below. This is an advantage of the estimation approach taken.

5.2 The panel VAR Model

5.2.1 Specification

In addition to a measure of global liquidity, the panel VAR model that we specify includes two external variables and three domestic variables. The external variables are the real effective exchange rate and the current account to GDP. The domestic variables are a short term interest rate, real private consumption, and real house prices.

The real effective exchange rate is a measure of relative competitiveness that reflects movements in trade partners inflation rates and costs as well as bilateral nominal exchange rates. The current account is a measure of net capital flows identically equal to the gap between domestic saving and investment. Both domestic and global shocks therefore (i.e., pull and push factors in empirical models of capital flows) typically drive these variables.

The domestic variables that we include in our VAR model are the level of domestic economic activity (represented by consumption rather than GDP),[15] a short term interest rate, and real house prices. These three domestic variables can be seen as the reduced form of a typical New Keynesian monetary model, with an IS curve, a house price pricing equation and a policy rule (see Iacoviello (2005) and Iacoviello and Neri (2010), for example). To keep the system small, we do not include CPI inflation and we include instead the real house price, which is the relative price of a durable good in the DSGE models with housing of Iacoviello (2005) and Iacoviello and Neri (2010). Indeed, house prices are the amplification mechanism that we want to study. Ideally one would want to include both a price and a quantity variable to describe the domestic housing sector —real house prices and real residential investment, respectively, for instance. As we noted however there are no data for EMEs.[16] We therefore include real house prices as a proxy for housing demand as an amplification mechanism of shocks to global liquidity.

All variables considered enter the VAR in (log) levels, except the current account to GDP as they are either real variables, relative prices or nominal variables at constant prices. Following Sims et al. (1990), we estimate the systems in levels, without explicitly modeling any possible cointegration relationships.[17] The specification is balanced, in the sense that all series have the same expected order of integration. In addition to a

[15] Theory suggests that house prices affect the broader economy primarily through their wealth effect on consumption or a Tobin's Q effect on residential investments. As we do not have data on residential investments for emerging markets, an alternative specification would include both consumption and GDP (or labor productivity). To keep the size of the VAR model as small as possible, we prefer to include only one variable at the time.

[16] Note also that IMF WEO (2008) finds that the role of housing supply shocks is marginal in house price dynamics.

[17] Sims et al. (1990) show that if cointegration among the variables exists, the system's dynamics can be consistently estimated in a VAR in levels.

constant, a linear and a quadratic time trends are also included to capture the gradual decline of inflation rates and nominal policy interest rates over time as well as any secular trend in consumption, real house prices, and the real pace of reserve accumulation that has accelerated sharply in the second part of the sample period.

The VAR specification is the same for all countries to avoid introducing differences in country responses due to different model specifications, and because it would be practically difficult to search for a data-congruent specification for each considered country. In particular, somewhat arbitrarily, we include one lag of each variable in every system (determined by using standard specification tests on the VAR for the United States).

5.2.2 Estimation

To estimate the model above, we use the mean group estimator of Pesaran and Smith (1995) and Pesaran et al. (1996). This is because fixed effect, random effect, and instrumental variable estimators are inconsistent in a dynamic panel data model under slope heterogeneity. This is a standard technique for the estimation of dynamic panel data models with heterogenous slope coefficients (i.e., slope coefficients that vary across countries).[18] The technique involves estimating the VAR model above country-by-country, with ordinary least squares, and then taking averages of the estimates (e.g., impulse responses or variance decompositions) across countries. We use arithmetic averages, but one could also compute weighted averages, weighting by the inverse of the standard error of the individual estimate or the size of the unit in the cross section, usually yielding similar results. The variance of the mean group estimator can be calculated by taking the variance across individual units (i.e., across countries for each time horizon in the case of the impulse responses and the variance decompositions) and dividing it by $(N-1)$. As Pesaran et al. (1996) prove, this adjustment yields a consistent estimate of the true cross-section variance of the mean group response. Note that if an estimated VAR has unstable roots or less than 40 observations, the VAR is not included in the impulse response.

In our application, this VAR systems is estimated separately at the country level for 21 AEs and 19 EMEs, using quarterly data for the period 1985.I to 2012.IV, with choice of the starting date consistent with the considerations made in sections 2 and 3. For robustness, we will also cut the sample period in 2006.IV to avoid contaminating our global liquidity variable with the policy response to the crisis as some of the correlation reported above between the three global liquidity variables we use break down after 2008.II.

[18] The literature that extends this estimation approach to PVAR models is surveyed by Coakley et al. (2006) and Canova and Ciccarelli (2013). Rebucci (2010) provides Monte Carlo evidence on the superior performance of this estimator relative to a fixed effect estimator and instrumental variable estimator for the dimensions of the panel that we have.

5.3 Empirical results

To make sure that the estimation results are not inconsistent with the identification assumptions made, we first look at the variance decomposition of global liquidity itself. The average forecast variance decomposition in Figure 10 shows that global liquidity is largely explained by itself within the first year after the shock, thus confirming the validity of the identification assumptions made. Over a longer forecast horizon, however, Figure 10 shows that it is also affected also by other factors. This is the case in both advanced and emerging economies, and even in the case of the United States. Our identification assumptions, therefore, do not seem inconsistent with these results.

Next we compare the impulse responses of all variables in the model to our global liquidity shock. Figure 9 reports the impulse responses to a global liquidity shock of 3 percent on impact in the typical (i.e., average) advanced and emerging economy—panel (a) and panel (b), respectively.[19] As we noted earlier, error bands for the mean group estimator are computed following Pesaran et al. (1996): specifically, the dark and light shaded areas represent the 1 and 2 standard deviations confidence intervals. These results are obtained with the private liquidity measure over the full sample, namely 1985.I–2012.IV.

In the typical advanced economy, both real consumption and house prices increase in response to the global liquidity shock in a statistically significant manner, but the effect is relatively short-lived relative to the high persistence of the shock, losing statistical significance after about 2 years. Specifically, both real consumption and real house prices increase by 0.1 percent on impact and stay significantly different from 0 for about 8 quarters. The short-term interest rate also increases on impact, and keeps raising for about 8 quarters: this is consistent with a monetary policy authority reacting countercyclically to the acceleration of economic activity. Finally, the real effective exchange rate jumps slightly on impact, possibly driven by changes in the nominal exchange rate and then reverts to its equilibrium level over time. The current account displays a slight improvement on impact and then deteriorates over time but its response is statistically not different from zero.

Albeit statistically significant, the impact of the shock on consumption and house prices is economically very small: for a 1 percent increase in global liquidity, the peak increase in house prices is less than 7 basis points. This means that global liquidity has to more than triple (a 300 percent increase) to generate a peak increase in house prices of about 10 percent from their long-term equilibrium. These impulse responses also imply that house prices have to increase about 30 percent to generate a 1 percent increase in real consumption.

[19] As all variables are in logs and the model is linear, we can divide all impulse responses by the size of the shock to obtain implied elasticities.

The response of the typical emerging market economy to a global liquidity shock is qualitatively similar to the typical advanced economy except for the exchange rate. Quantitatively, however, there are large differences. Both consumption and real house prices increase on impact and display a significant response for about 8 quarters. The consumption response is twice as large as in AEs while the house price response is 4-5 times as strong: so it would take a 60 percent increase in global liquidity to generate a 10 percent increase in house prices in the typical emerging market economy. Despite the stronger response of consumption and house prices, the short-term interest rate increases by about the same in emerging markets in AEs for about 8-10 quarters. The current account deficit widens twice as much in EMEs. The average response of the current account, however, musks a lot of heterogeneity as the error bands for this response are quite large.

Interestingly, in emerging markets, the real effective exchange rate appreciates only gradually over time, without responding on impact. This may reflect EMEs' fear of exchange rate flexibility and gradually higher domestic inflation in response to a relatively weaker domestic monetary policy response to the global shock (for fear of attracting more capital and experiencing even larger external imbalances). In quantitative terms, the peak effect on the real exchange rate in emerging markets is comparable to the impact effect in advanced economies. Given a comparable monetary policy response, this suggests that the stronger effect of a global liquidity shock on consumption and house prices in emerging markets, may be coming from a different exchange rate policy. The even study in the previous section, however, did not provide support for this conjecture.

We obtain similar results if we cut the sample through 2006.IV. If instead we use official rather than private liquidity, we obtain exactly the same results if we cut the sample in 2006.IV, but slightly less clear cut results if we use the full sample. Results with the VIX index are similar, but less clear cut in both the full and the shorter sample.[20]

Overall, these results are consistent with the idea that house prices are an amplifier of external financial shocks in advanced and emerging economies alike. In advanced economies, however, a global liquidity shocks has effects that are quantitatively much smaller than in emerging markets. This evidence is consistent with the closed economy models of housing and the macroeconomy discussed in the introduction. This evidence is also consistent with the fact that credit constraints, which in those models amplify the response of macroeconomic aggregates (such as output and consumption) to changes in house prices, are certainly tighter and more pervasive in EMEs than in AEs. This evidence is consistent with the view that global imbalances would have played a lesser role in explaining house price boom in developed economies in the period previous to the Great Recession. Nonetheless, the increase in global liquidity in the years following the

[20]The results for the robustness checks conducted are in a separate Appendix not necessarily for publication.

beginning of the Great Recession may be playing an important role explaining recent house price dynamics in emerging markets.

6 Conclusions

In this paper we analyze the relation between house prices and capital flows with a new house price data set for 57 advanced and emerging economies. First, we provide a comprehensive empirical characterization of house prices at business cycle frequency over the 1970.I–2012.IV period for 57 countries. We describe house price characteristics, systematically comparing advanced and emerging economies, their relation with the broader macroeconomy, and their boom and bust behavior. Second, we explore the nexus between house prices, capital flows and a set of macroeconomic variables in an event study on 66 identified episodes of house price booms. Third, and finally, we explore the transmission of a global liquidity shock to consumption, house prices, the current account and the real exchange rate in a panel VAR model.

There are there sets of results. First, the descriptive analysis shows that real house prices in emerging economies grew slower and are more volatile and less persistent than in advanced economies over the past twenty years or so, even though the two cycles became more homogenous in the run up to (and in the aftermath of) the recent global financial crisis. In both advanced and emerging economies, house prices are subject to boom-bust dynamics with a probability of observing a boom-bust episode of about 2 percent per year in both groups of countries. Second, the event study uncovers a strong association between capital inflows (or our measure of official liquidity) and episodes of real house prices booms in emerging markets, without finding a similar connection in advanced economies. We also find that more financially developed markets tend to mitigate the impact of global liquidity conditions on the economy, with more mixed evidence in the case of more exchange rate flexibility. And third, the VAR analysis of an exogenous change in global liquidity confirms that while the transmission mechanism is qualitatively similar in advanced and emerging economies, the effects of a global liquidity shock are economically significant only in the case of emerging markets.

This empirical evidence is consistent with the idea that the nexus between house price and capital flows is tighter in emerging markets, possibly because borrowing and collateral constraints that are relaxed by capital inflows are much more pervasive in emerging economies than in advanced economies. We interpret our empirical evidence as suggesting that while global imbalances would have played a lesser role in explaining house price boom in developed economies in the period previous to the Great Recession, the increase in global liquidity in response to it may be playing an important role explaining recent house price dynamics in emerging markets.

7 Figures

Figure 1 Real house prices & Current account to GDP ratio

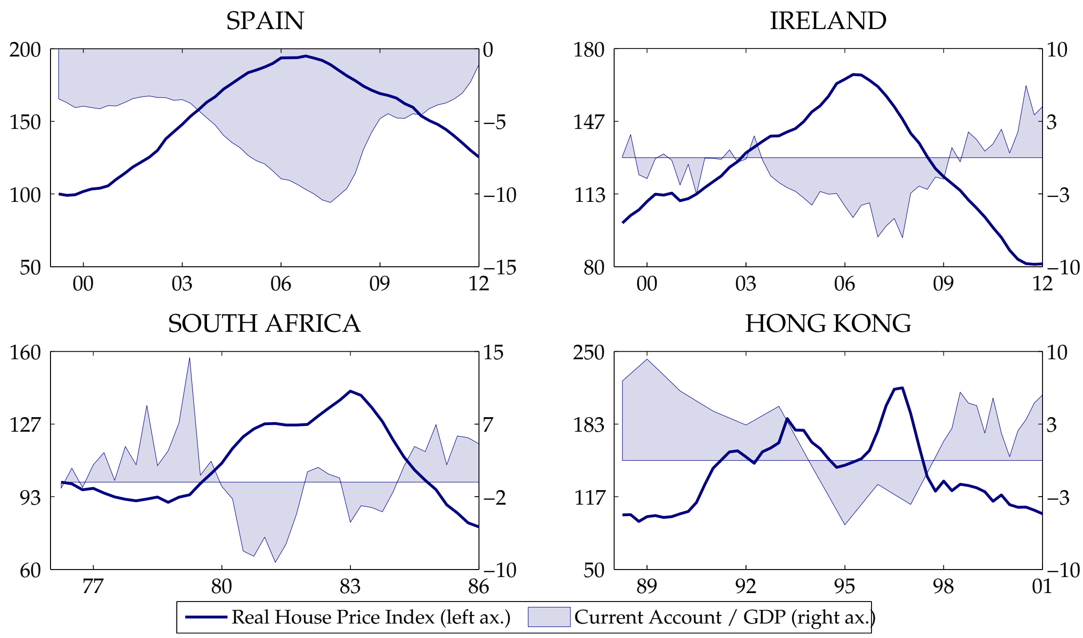


Figure 2 US M0 & Emerging economies reserves

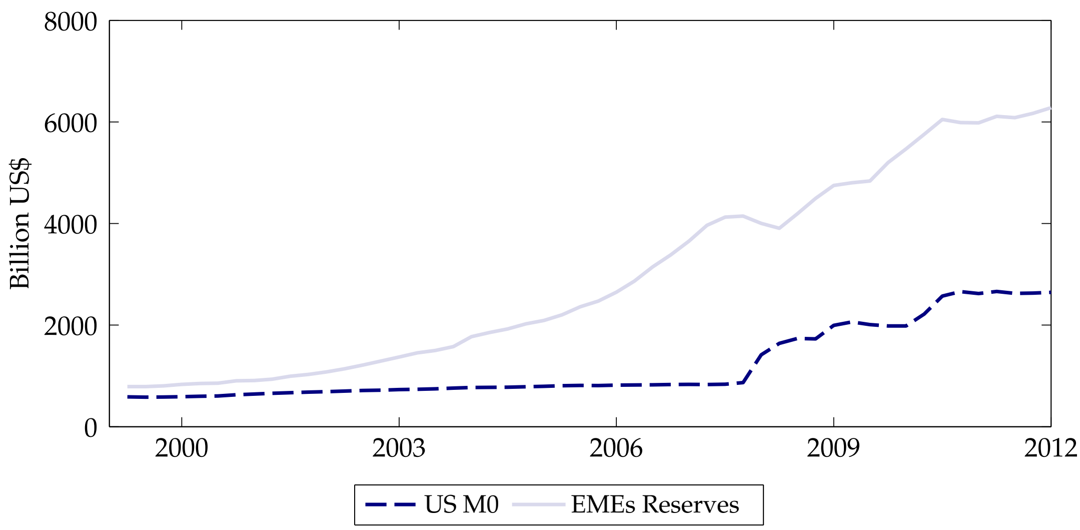


Figure 3 Real house prices – Data map

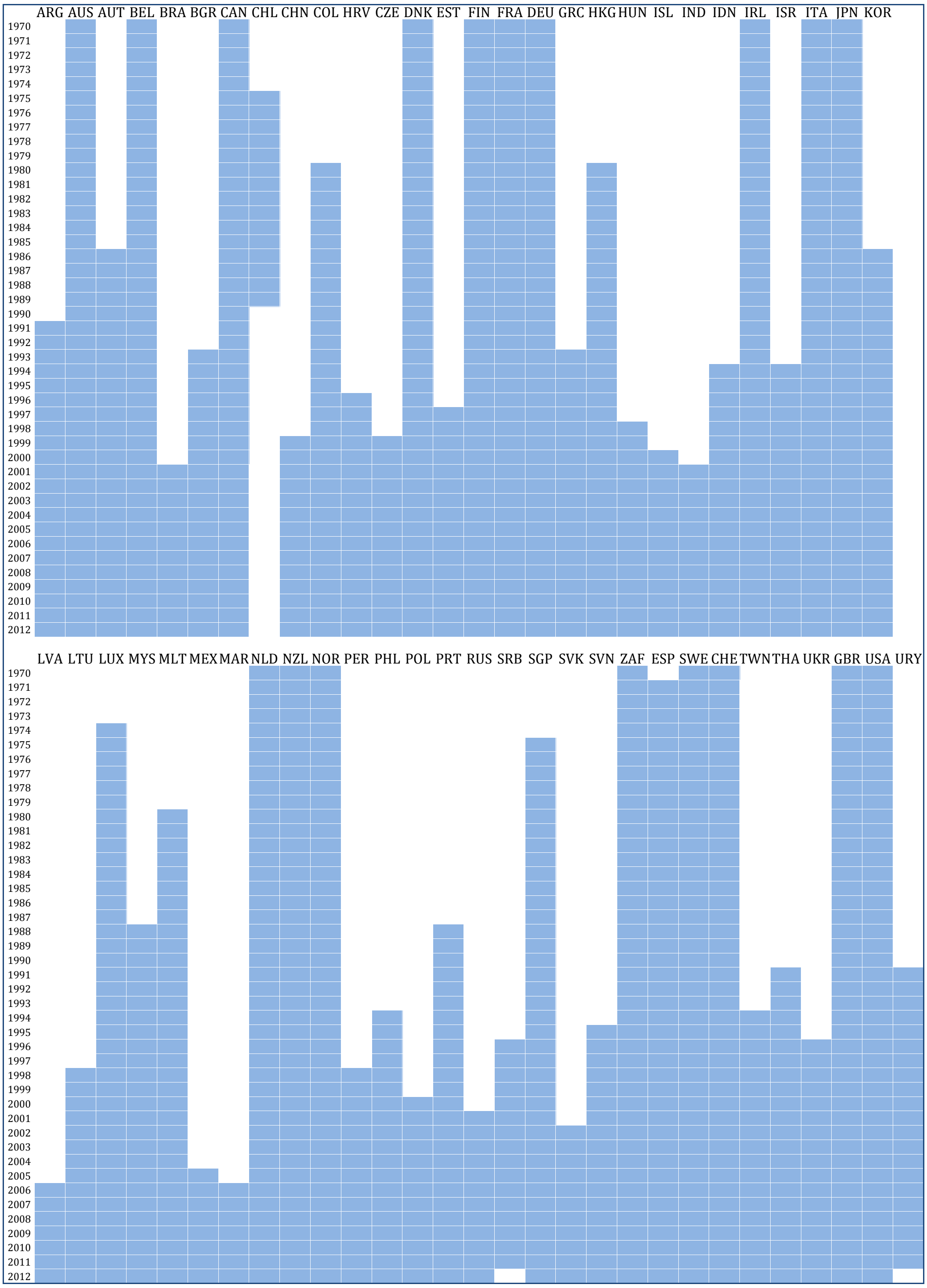
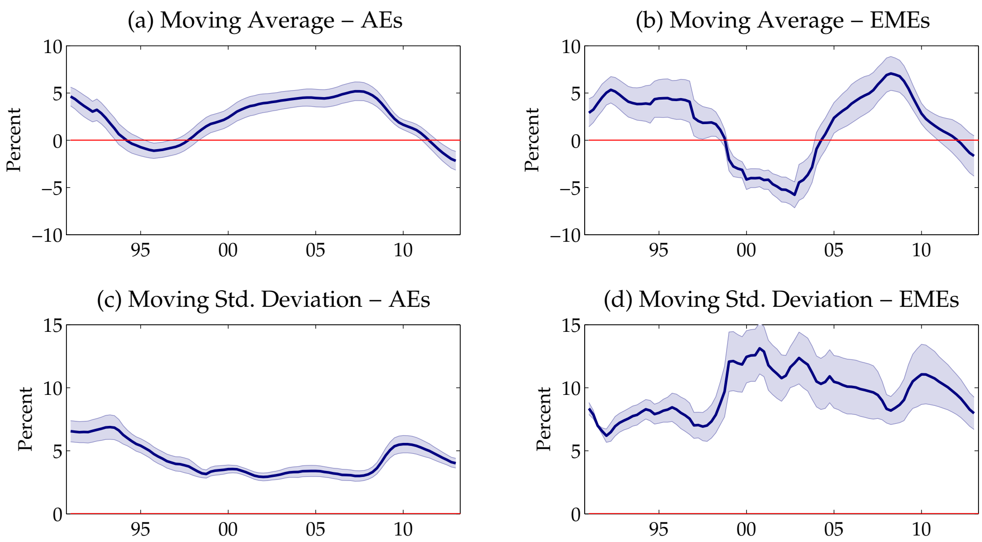


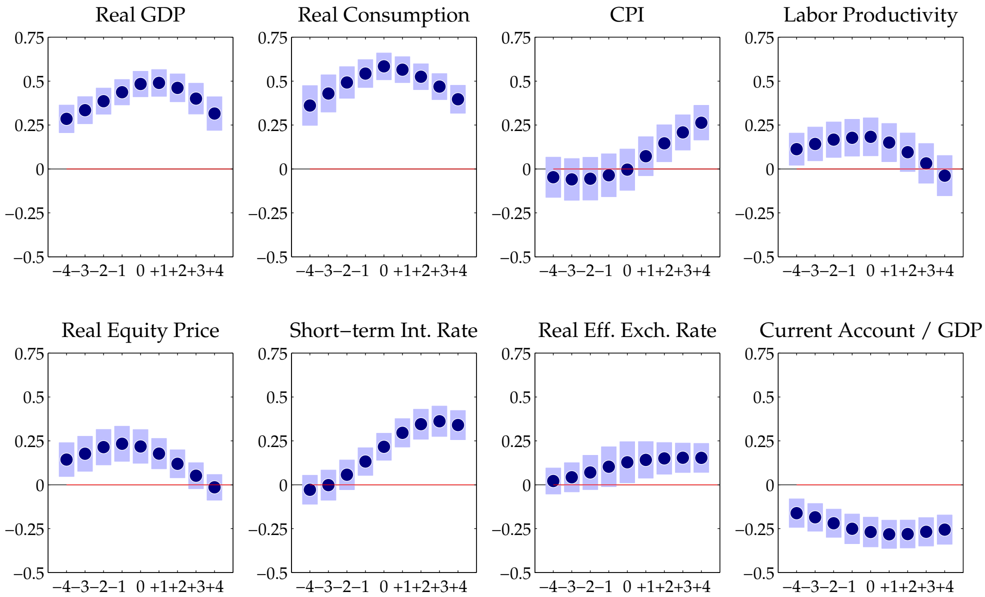
Figure 4 Evolution of the average and the standard deviation of real house price annual returns



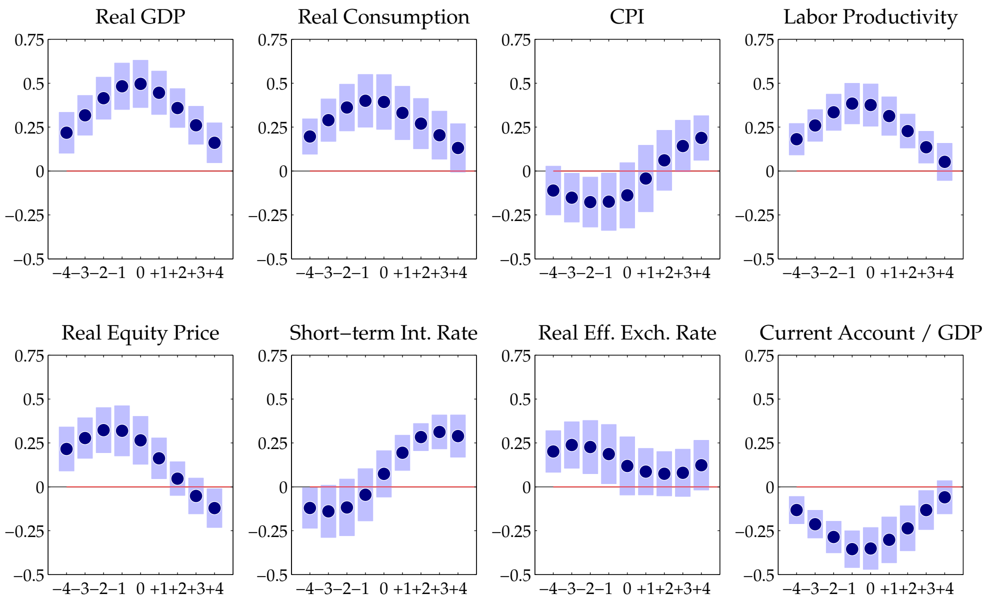
Note. The moving averages and moving standard deviations are computed with a rolling window of 5 years over the sample 1985.I–2012.IV. The solid lines graph the cross-country average of the moving average and moving standard deviation of house price annual returns. The shaded areas graph the cross-country two standard deviations confidence bands.

Figure 5 Cross-correlations of real house price annual returns

(a) Advanced Economies



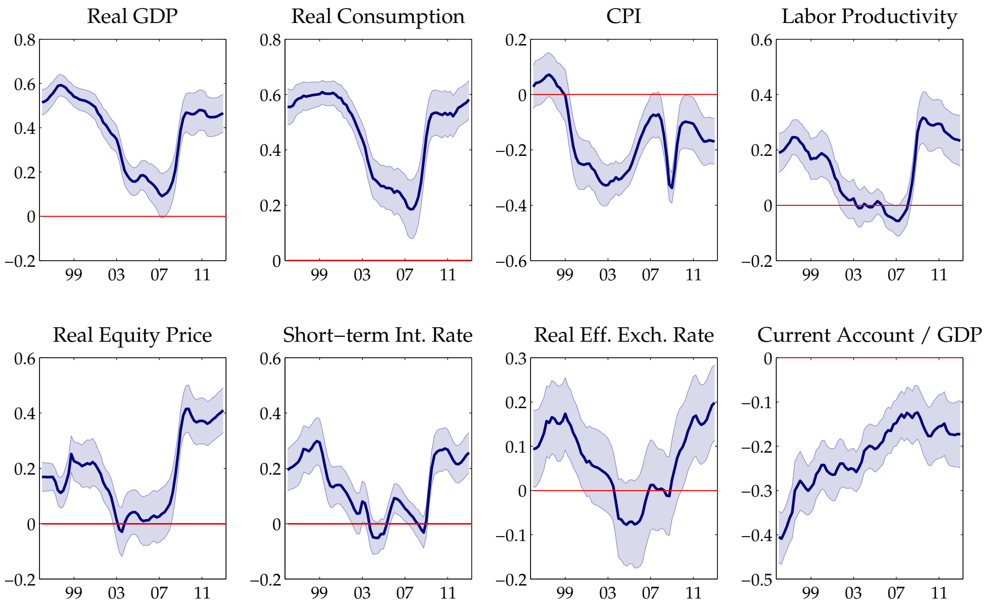
(b) Emerging Economies



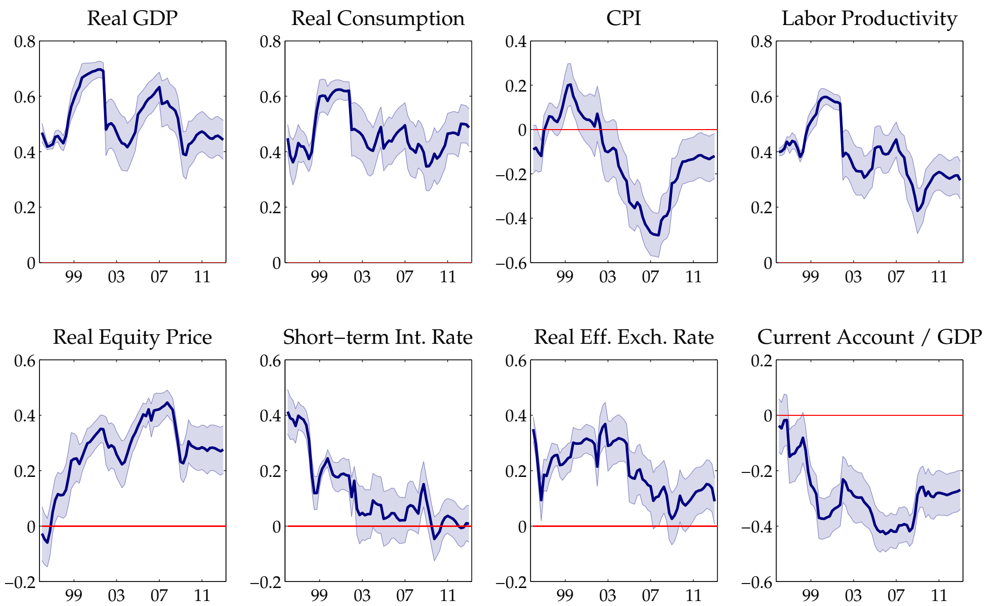
Note. The correlation coefficients are computed over the sample 1985.I–2012.IV. Each dot graphs the cross-country average of the correlation coefficient. The shaded areas graph the cross-country two standard deviations confidence bands.

Figure 6 Moving correlations of real house price annual returns

(a) Advanced Economies

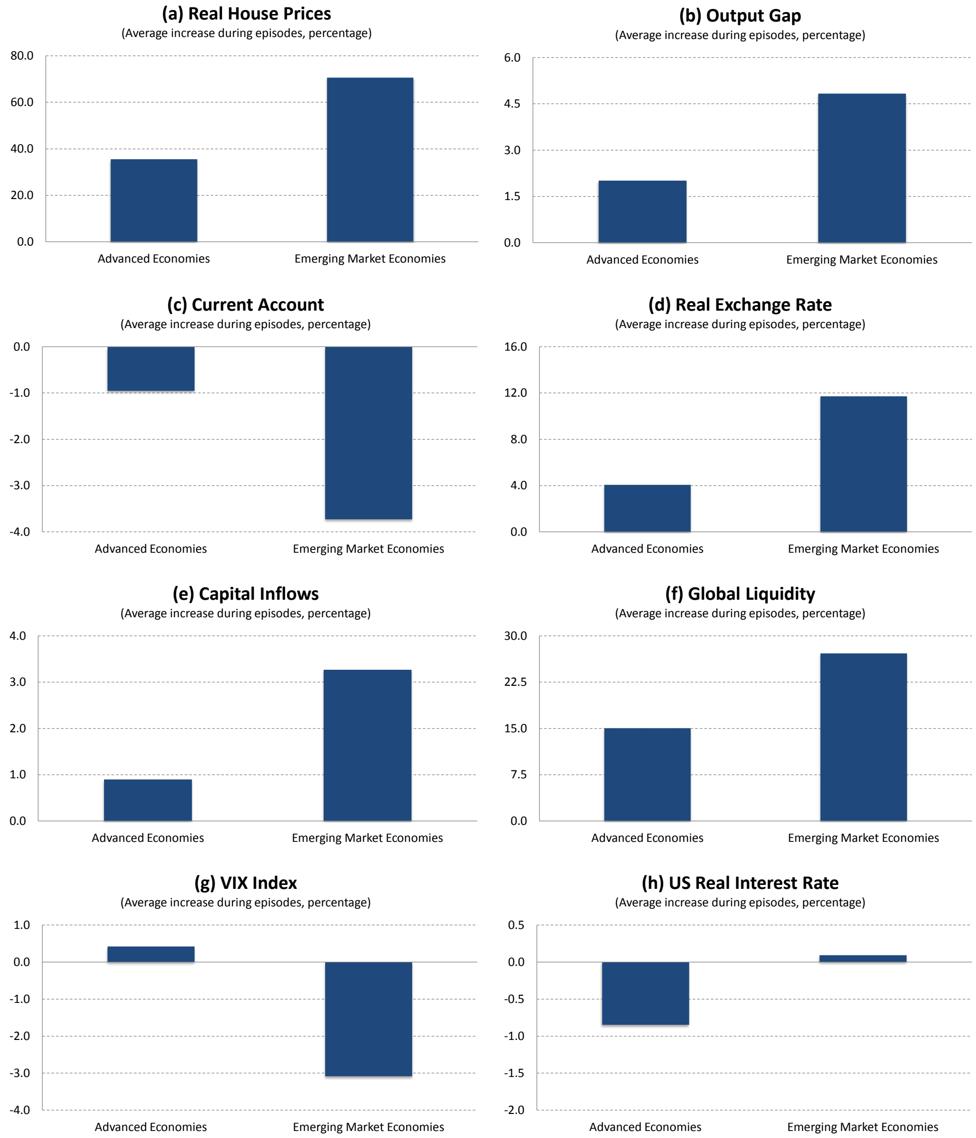


(b) Emerging Economies



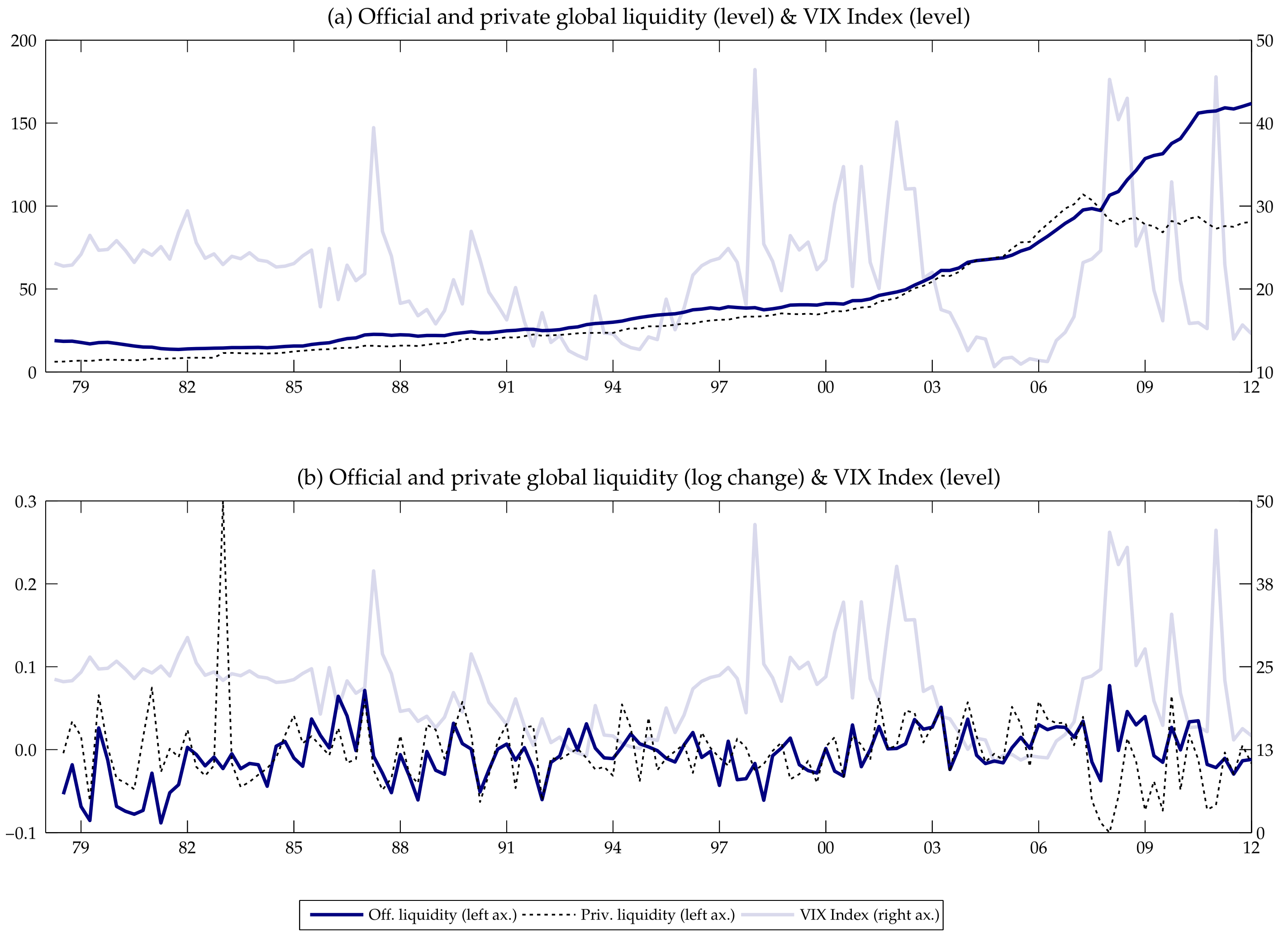
Note. The moving correlations are computed with a rolling window of 10 years over the sample 1985.I–2012.IV. The solid lines graph the cross-country average of the moving correlation of house price annual returns. The shaded areas graph the cross-country two standard deviations confidence bands.

Figure 7 Real house prices boom-bust episodes – Event study



Note. Note here.

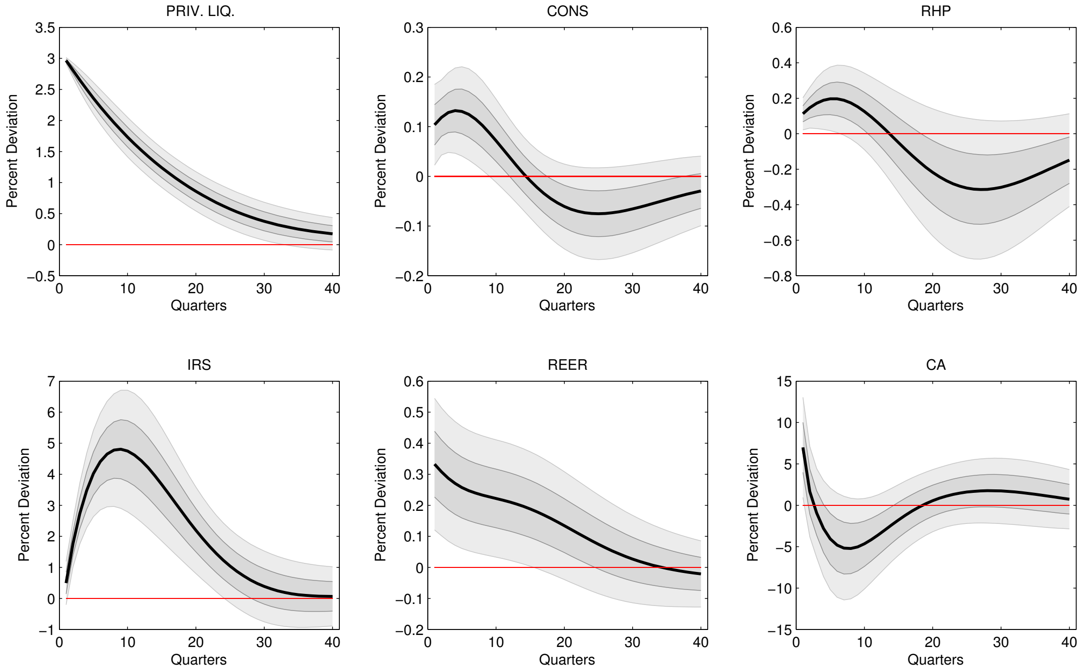
Figure 8 Global liquidity measures & VIX index



Note. Official liquidity (Index, 2008=100) is the sum of world international reserves (excluding gold) plus the US M0 both measured in US dollar, then deflated by the US CPI. Private liquidity (Index, 2008=100) is the external positions of BIS reporting banks for all countries vis--vis the non-bank sector (measured in millions of US dollars), then deflated by the US CPI.

Figure 9 Impulse response function – Global liquidity shock

(a) Advanced Economies



(b) Emerging Economies

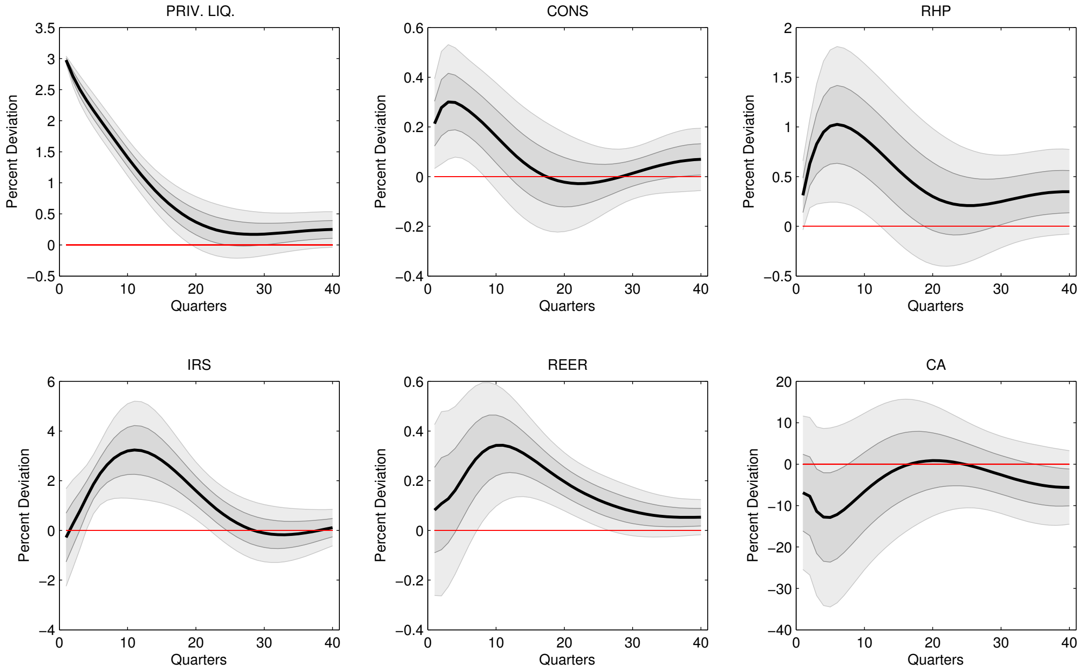
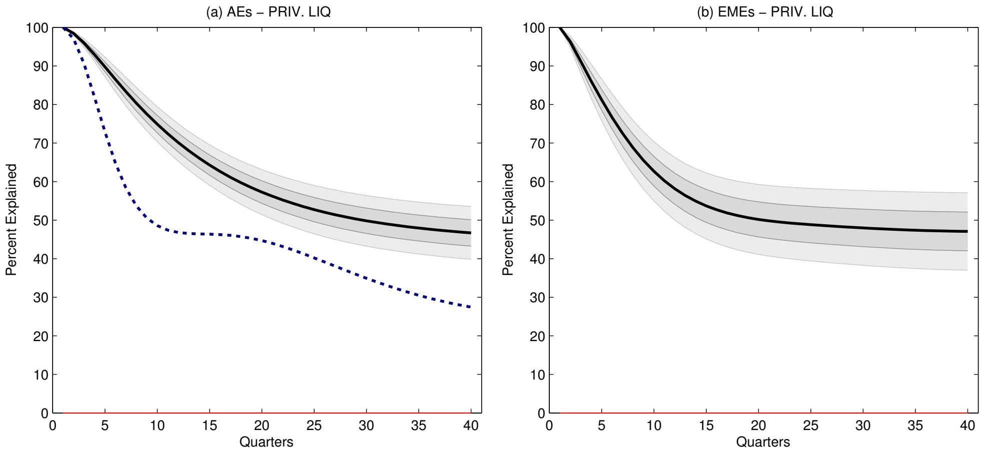


Figure 10 Forecast error variance decmoposition – Global liquidity shock



Note. Mean group estimator of the FEVD of PRIV. LIQ. to a PRIV. LIQ. shock in advanced (AE) and emerging (EME) economies (panel (a) and (b), respectively). The dotted line in panel (a) displays the FEVD of PRIV. LIQ. to a PRIV. LIQ. shock in the US model.

8 Tables

Table 1 Summary statistics of the annual growth rates of real house prices, real GDP, and real consumption in advanced economies and emerging economies

	Real House Price		*Real GDP*		*Real Consumption*	
Group	*AEs*	*EMEs*	*AEs*	*EMEs*	*AEs*	*EMEs*
Mean	2.0%	1.2%	2.2%	3.8%	2.3%	4.0%
Median	2.1%	1.5%	2.5%	5.0%	2.4%	4.7%
Max	18.3%	27.5%	7.0%	13.3%	7.5%	16.7%
Min	-12.5%	-34.5%	-5.8%	-13.3%	-3.9%	-16.4%
St. Dev.	6.4%	12.5%	2.3%	5.1%	2.2%	5.9%
Auto Corr.	0.92	0.86	0.83	0.87	0.81	0.79
Skew.	0.10	-0.44	-1.00	-1.12	-0.31	-0.67
Kurt.	3.20	4.34	4.91	6.15	3.88	6.12

Note. The country-specific summary statistics are averaged across each group, namely advanced economies (AEs) and emerging economies (EMEs) and are computed across the common sample 1985.I–2012.IV.

Table 2 Boom-bust cycles – Summary statistics

Group	*Probability of Boom into Bust*	*Probability of Boom-Bust per year*	*Probability of Boom per year*	*Duration of Boom-Bust (years)*	*Duration of Boom (years)*
AEs	0.442	0.022	0.051	10.1	5.5
EMEs	0.450	0.020	0.044	8.9	5.6
ALL	0.444	0.021	0.048	9.5	5.6

Note. The probability and the duration are computed as averages across countries. AEs are advanced economies, EMEs are emerging economies, and ALL refers to all countries in the data set. The boom-bust cycles are computed for each country using real house prices, equity prices and real effective exchange rates on the largest available sample.

Table 3 Real house price determinants in boom episodes

	Dependent variable: change in real house price during boom							
Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Capital inflows	2.26	4.23	4.05	4.59				
	$(2.35)^{**}$	$(2.47)^{**}$	$(1.91)^{*}$	$(2.53)^{**}$				
Global liquidity					0.58	0.88	1.21	1.01
					$(3.04)^{***}$	$(2.87)^{***}$	$(3.77)^{***}$	$(2.13)^{**}$
Dummy AEs								
Financial market depth			-0.09				0.02	
			(-0.73)				-0.14	
Exchange rate flexibility				-0.55				0.66
				(-0.51)				-0.44
Dummy AEs × Capital inflows		-5.27						
		$(-2.73)^{***}$						
Financial market depth × Capital inflows			-0.05					
			$(-1.73)^{*}$					
Exchange rate flexibility × Capital inflows				-0.38				
				$(-1.90)^{*}$				
Dummy AEs × Global liquidity						-0.70		
						$(-2.21)^{**}$		
Financial market depth × Global liquidity							-0.01	
							$(-1.95)^{*}$	
Exchange rate flexibility × Global liquidity								-0.06
								(-1.10)
R2	0.06	0.16	0.19	0.11	0.14	0.22	0.28	0.16
Number of observations	60.00	60.00	58.00	60.00	66.00	66.00	62.00	66.00
F test	5.51^{**}	3.73^{**}	1.66	2.30^{*}	9.25^{***}	4.17^{**}	5.89^{***}	3.11^{**}

Note. All regressions are estimated using a constant, t-test in parenthesis. Significance levels at 1%, 5%, and 10% is denoted by $()^{***}, ()^{**}, ()^{*}$, respectively.

Table 4 Correlation between global liquidity measures

	Off. Liquidity (level) *Priv. Liquidity (level)*	*Priv. Liquidity (level)* *VIX index (level)*	*Off. Liquidity (level)* *VIX index (level)*
Full Sample	0.92	-0.05	0.01
Pre-Crisis	0.99	-0.30	-0.28
Post-Crisis	-0.12	0.00	-0.41
	Off. Liquidity (log diff.) *Priv. Liquidity (log diff.)*	*Priv. Liquidity (log diff.)* *VIX index (level)*	*Off. Liquidity (log diff.)* *VIX index (level)*
Full Sample	0.29	-0.18	-0.06
Pre-Crisis	0.38	-0.13	-0.23
Post-Crisis	0.43	0.12	0.32

Note. Note here.

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A Appendix. Data Sources

A.1 House Prices

The OECD Nominal House Price (Subject: HP.Index. Measure: Index) was collected for the following countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States.

The BIS property price database was used to collect data fro the following countries: Bulgaria, China, Estonia, Hong Kong, Hungary, Iceland, Indonesia, Latvia, Lithuania, Malaysia, Mexico, Morocco, Poland, Russia, South Africa, and Thailand.

Data provided by national central banks or national statistical offices was used for Brazil, Croatia, Colombia, Malta, Peru, Serbia, Singapore, and Uruguay.

For the remaining countries we used alternative sources: Argentina (ARKLEMS), Ukraine (Blagovest), Philippines (Colliers International), India (National Housing Bank), Chile (Morande and Soto (1992)), Taiwan (Synyi).

All house price indices, together with their sources, are displayed in Table A.1. Seasonal adjustment was performed using Eviews applying the National Bureau's X12 program on the change of the logged house price series, using the additive option. The nominal seasonally adjusted indices were then deflated with country-specific CPI indices (described below).

A.2 Other variables

To construct the database we relied on three main sources: the OECD Analytical Database, the IMF International Financial Statistics (IFS) Database and Bloomberg. The variables used are real gross domestic product ($RGDP$), consumer price index (CPI), real consumption ($CONS$), labor productivity of employed persons ($LPROD$), real equity prices (EQ), short-term interest rates (IRS), real effective exchange rates ($REER$), and current account balance as a percent of GDP (CA). Data were collected in June2013 to cover the period from 1970.I to 2012.IV, unless otherwise specified. In what follows, we shall refer to the data set as the "2012 Vintage".

Real GDP

For those countries for which OECD data is available, the OECD Real GDP (Subject: B1_GE: Gross domestic product - expenditure approach. Measure: VPVOBARSA. Millions of US dollars, volume estimates, fixed PPPs, OECD reference year, annual levels, seasonally adjusted) is used. These countries are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States.

The IFS Real GDP (Subject: 99BVRzf. Measure: Index GDP VOL., 2005 = 100, seasonally adjusted) was collected for South Africa. The IFS Real GDP (Subject: 99BVPzf. Measure: Index GDP VOL., 2005 = 100, not seasonally adjusted) was collected for the remaining countries, namely Argentina, Bulgaria, Colombia, Croatia, Hong Kong, Indonesia, Lithuania, Malaysia, Peru, Singapore, Thailand.

For China, a quarterly seasonal adjusted real GDP index was constructed with data from the National Bureau of Statistics (NBS) of China. As no institution publishes a quarterly real GDP Index for China, it has to be derived by a nominal GDP series. The National Bureau of Statistics (NBS) of China releases a quarterly nominal GDP not seasonally adjusted. we constructed a quarterly real GDP index as follows. First, we seasonally adjusted (with the procedure described above) the nominal GDP from NBS. Then, we used the following formula

$$\begin{aligned} \log(RGDP_1) &= \log\left(\frac{GDP_1}{CPI_1}\right) && \text{for } t = 1 \\ \log(RGDP_t) &= \log(RGDP_{t-1}) + \log\left(\frac{GDP_t}{GDP_{t-1}}\right) - \log\left(\frac{CPI_t}{CPI_{t-1}}\right) && \text{for } t \geq 2 \end{aligned}$$

where CPI is defined in the next subsection. The series displays noisy features in the first part of the sample and starts to behave better from 1994.I, providing a natural cut-off date. Therefore, we used the new quarterly series from 1994.I to 2012.IV.

For Philippines, a quarterly seasonal adjusted real GDP index was obtained from Bloomberg (Ticker: PHNAGDPS Index).

Where the inception date of the quarterly real GDP series above was posterior to House Price Index inception date, quarterly series were interpolated linearly from the corresponding IFS annual series (the interpolation procedure is the same used for house prices). Interpolated data were used in the following periods: Bulgaria from 1990.I to 2001.IV, Colombia from 1988.I to 1993.IV, Indonesia from 1994.I to 1996.IV, Singapore from 1975.I to 1984.II, Thailand from 1991.I to 1992.IV.

Seasonal adjustment was performed using Eviews applying the National Bureau's X12 program on the change of the $\log(RGDP)$ using the additive option.

Consumer Price Index

The OECD Consumer Price Index (Subject: Consumer prices - all items. Measure: Index, 2005=100, not seasonally adjusted) was collected for the following countries: Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Indonesia, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Slovenia, South Africa, Spain, Sweden, Switzerland, UK, and US. Note that Hungary and Ireland were extended backward using the rates of change of IFS Consumer Price Index (Subject: 64zf series. Measure: Index, 2005=100, not seasonally adjusted), which has a longer coverage.

The IFS Consumer Price Index was used for the remaining countries namely, Argentina, Bulgaria, Colombia, Croatia, Hong Kong, Lithuania, Malaysia, Peru, Philippines, Singapore, and Thailand.

Seasonal adjustment was performed using Eviews applying the National Bureau's X12 program on the change of the $\log(CPI)$ using the additive option.

Real Private Consumption

In order to create the 2012 Real Private Consumption Vintage we relied on OECD Analytical Database, IFS Database and Bloomberg.

For those countries for which OECD data is available, the OECD Real Private Consumption (Subject: P31S14_S15: Private final consumption expenditure. Measure: Millions of U.S. dollars, volume estimates, fixed PPPs, OECD reference year, annual levels, seasonally adjusted) was collected, namely for Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. Seasonal adjustment was performed using Eviews applying the National Bureau's X12 program on the change of the $\log(CONS)$ using the additive option.

For the remaining countries, Argentina, Bulgaria, China, Colombia, Croatia, Hong Kong, Indonesia, Lithuania, Malaysia, Peru, Philippines, South Africa, Thailand, as no real index was available, IFS Nominal Private Consumption (Subject: code 96F..zf. Measure: Billions of National Currency, not seasonally adjusted) was used. After performing seasonal adjustment, the IFS Nominal Private Consumption was deflated by Consumer Price Index (described above) in order to obtain the 2012 Real Private Consumption Vintage.

For Singapore, for which neither OECD nor IFS data is available at quarterly frequency, we use Bloomberg Real Private Consumption (Subject: SIFCPTE Index. Measure: GDP Private Consumption Expenditure, Constant 2000 Prices, Millions of national currency, not seasonally adjusted) after adjusting the series for seasonality.

Labor Productivity Of Employed Persons

The Labor Productivity Index is constructed with data from HAVER and form the Conference Board Total Economy Database from Groningen University.[21]

The HAVER quarterly Labor Productivity Index (Subject: Productivity: Output per Employed Person (SA, 2000=100). Measure: Index) is collected for the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK, US.

For the remaining countries, annual values for Total Persons Employed (in thousands) are collected from the Conference Board Total Economy Database from 1970 to 2012. Quarterly series for Employed Persons then were interpolated linearly with the procedure used above. Finally, the Labor Productivity Index is computed as real output divided by number of persons employed, using the real output described above.

Equity Price Index

The OECD Equity Price Index (Subject: Share Prices. Measure: Index 2005 = 100) was collected for the following countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Indonesia, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.

As IFS data has a longer coverage, Belgium, Denmark, Indonesia, Korea, Norway, and Spain have been extended backward with IFS Equity Price Index (Subject: 62zf, Share Price Index. Measure: Index 2005 = 100.). Moreover, as quarterly data for Korea were not available from 1973.I to 1977.IV, a quarterly series was interpolated linearly

[21] See the Conference Board Total Economy Database here.

from the corresponding IFS annual series.

IFS Equity Price Index has been used as well for Hong Kong, Colombia, Malaysia, Philippines, Singapore, and Thailand. The series for Malaysia, Singapore, and Thailand have been extended backward with Dees et al. (2007) data set, which has a longer coverage for these countries.

Short-term Interest Rate

The OECD Short-term interest rate (Subject: Short-term interest rates. Measure: Per cent per annum) was collected for the following countries: Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

Where the OECD does not have complete coverage, the changes in short-term interest rates from IFS were used to extend the series backward. The following IFS rates (Measure: Per cent per annum) were used from 1979.I to the date in brackets: Discount Rate (Subject: IFS 60zf series) for New Zealand, Norway, Spain, and Switzerland; Money Market Rate (Subject: IFS 60Bzf series) for Italy; Deposit Rate (Subject: IFS 60Lzf series) for Ireland, and Korea; and Treasury Bill Rate (Subject: IFS 60Czf series) for Greece.

For the countries for which OECD data was not available, the following IFS short-term interest rates were used: Discount Rate for Colombia, Peru, Croatia, and Hong Kong; Money Market Rate for Estonia, Indonesia, Singapore, and Thailand; Treasury Bill Rate for Malaysia, Philippines, and South Africa; Deposit Rate for Argentina, Bulgaria, Lithuania, and Slovenia.

Real Effective Exchange Rate

The IFS real effective exchange rate (Subject: RECZF. Measure: Index) is used for the following countries: Australia, Austria, Belgium, Bulgaria, Canada, China, Colombia, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Malaysia, Netherlands, New Zealand, Norway, Philippines, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Ukraine, United Kingdom, and United States. Note that the IFS real effective exchange rate is derived from the nominal effective exchange rate index, adjusted for relative changes in consumer prices.[22]

We used the indices provided by national central banks for Bulgaria (Subject: Deflator - Consumer Price Index - Quarterly Data. Measure: Index), Estonia (Subject: Real effective exchange rate of the Kroon. Measure: Percentage change on the previous quarter) and for Lithuania (Subject: Real Effective Exchange Rate Indices of the Litas. Measure: Index).

Finally, we relied on Bloomberg for the remaining countries and, when possible, to extend backward the previous series with the JP Morgan Real Effective Exchange Rate: Argentina (Ticker: JBXRARS Index), Bulgaria (extended to 1994.I. Ticker: JBXRBGN Index), Hong Kong (Ticker: JBXRHKD Index), Indonesia (Ticker: JBXRIDR Index), Korea (Ticker: JBXRKRW Index), Peru (Ticker: JBXRPEN Index), and Slovenia (Ticker: JBXRSIT Index).

[22]Note that the real effective exchange rate is constructed such that a decline of the index is a depreciation (or a gain in competitiveness).

Current Account to GDP Ratio

In order to create the 2012 Current Account to GDP Ratio Vintage we relied on OECD Analytical Database, IFS Database and Bloomberg.

The OECD Current Account Balance to GDP ratio (Subject: Current Account Balance, as a percentage of GDP. Measure: Percentage) is used for the following countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.

For all other countries we use IFS data, with the following procedure. First, we download the IFS Current Account balance (Subject: ALDZF. Measure: Millions of USD) and IFS nominal GDP in local currency (Subject: 99BZF. Measure: Millions of National Currency). After performing seasonal adjustment, we download the IFS Exchange Rate (Subject: AE.ZF. Measure: units of foreign currency per 1 USD) and we transform seasonally adjusted GDP in current USD. Finally, we compute the ratio between the Current Account balance and GDP in current USD.

Figure A.1 Real house price indices - Advanced economies

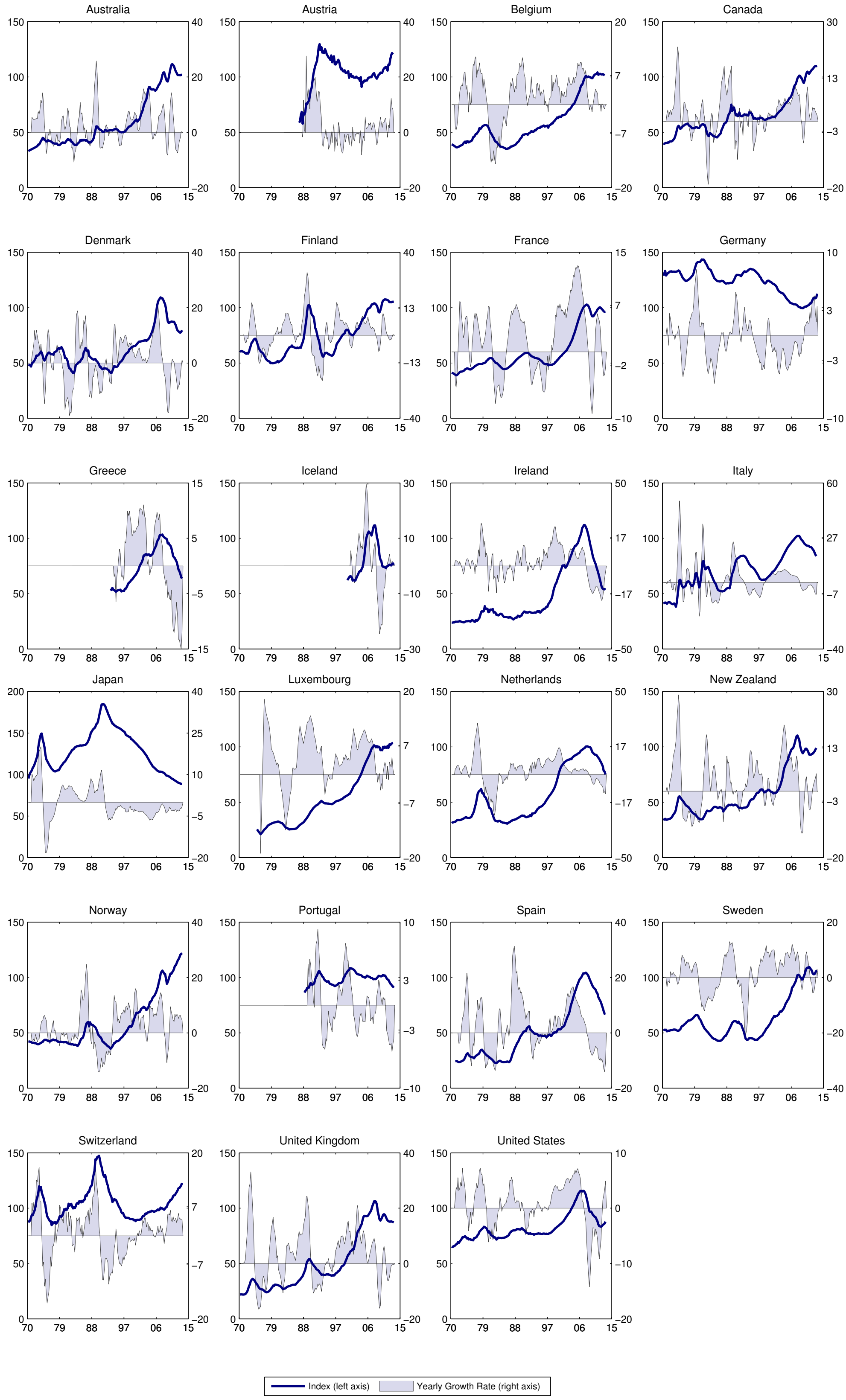

Figure A.2 Real house price indices - Emerging economies

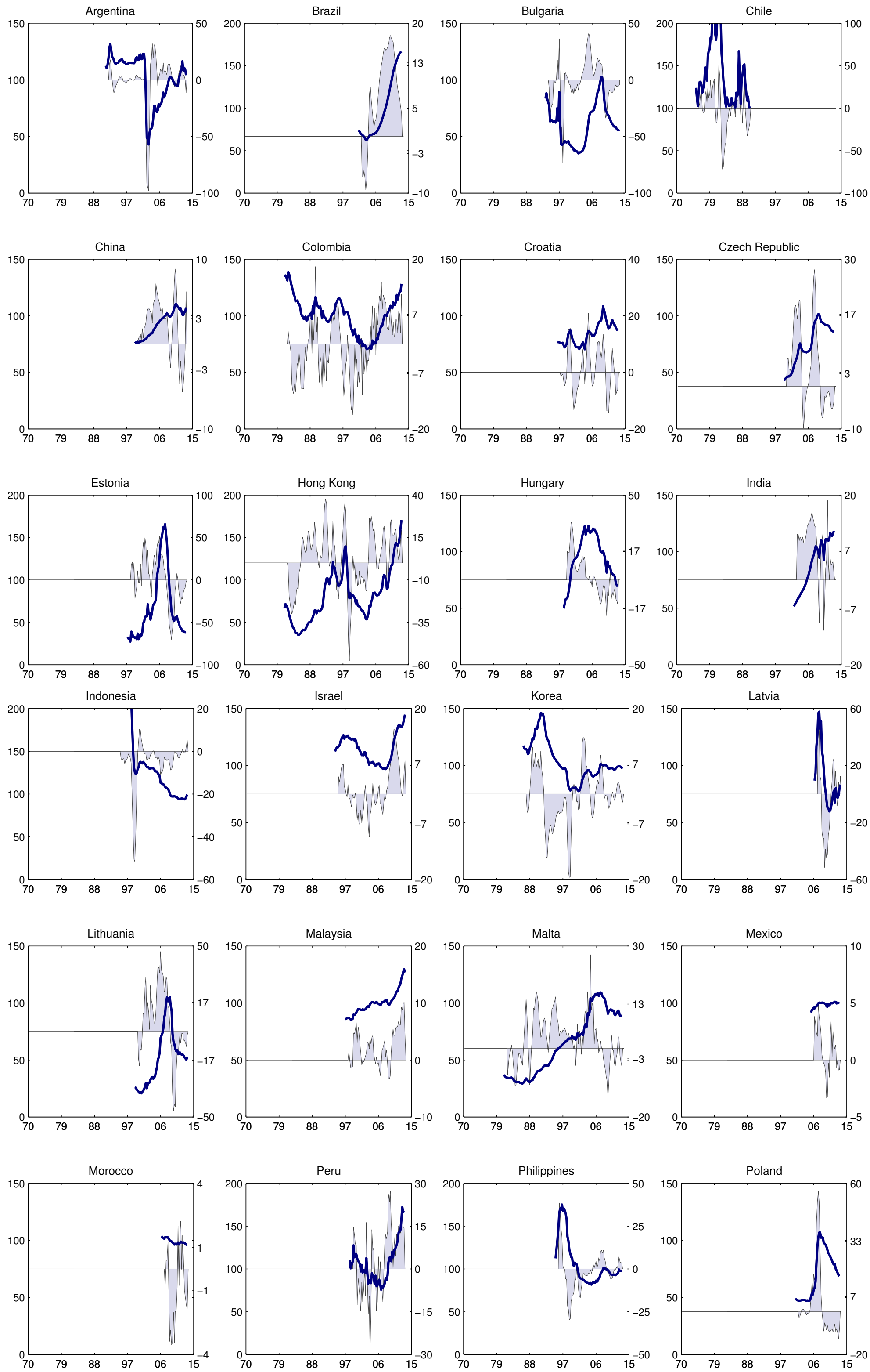

Figure A.2 Real House Price Indices - Emerging Economies (Cont'd)

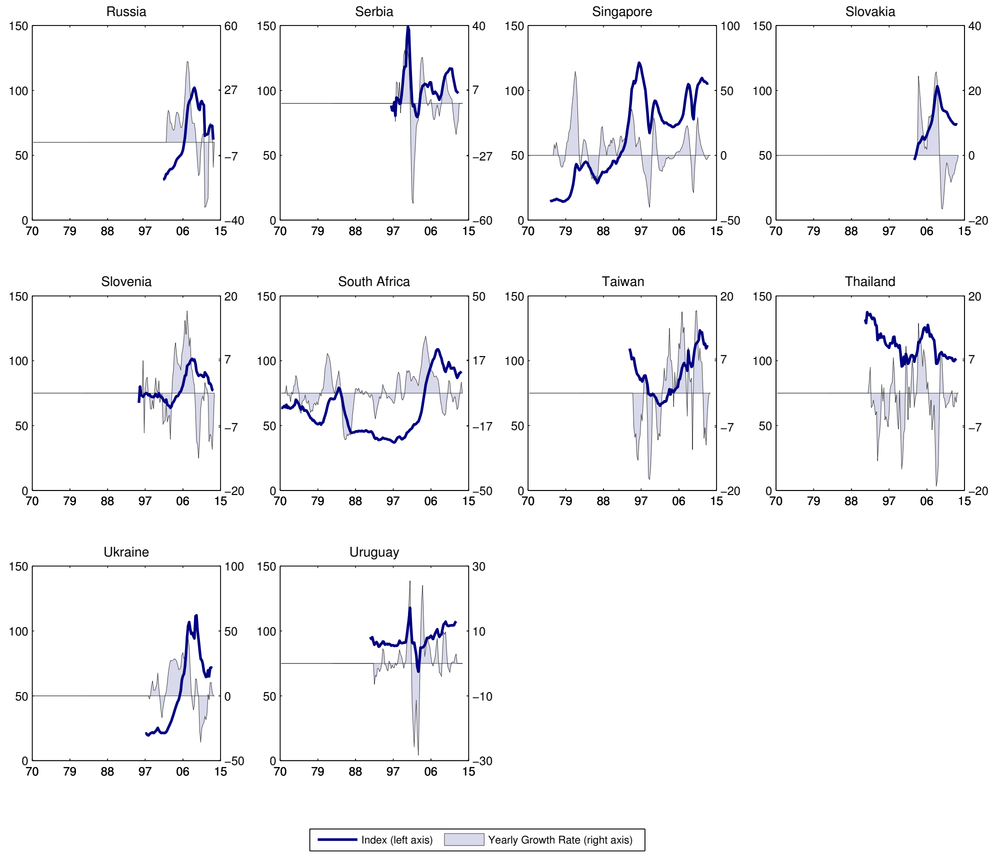

Figure A.3 Boom-bust in real house prices – Advanced economies

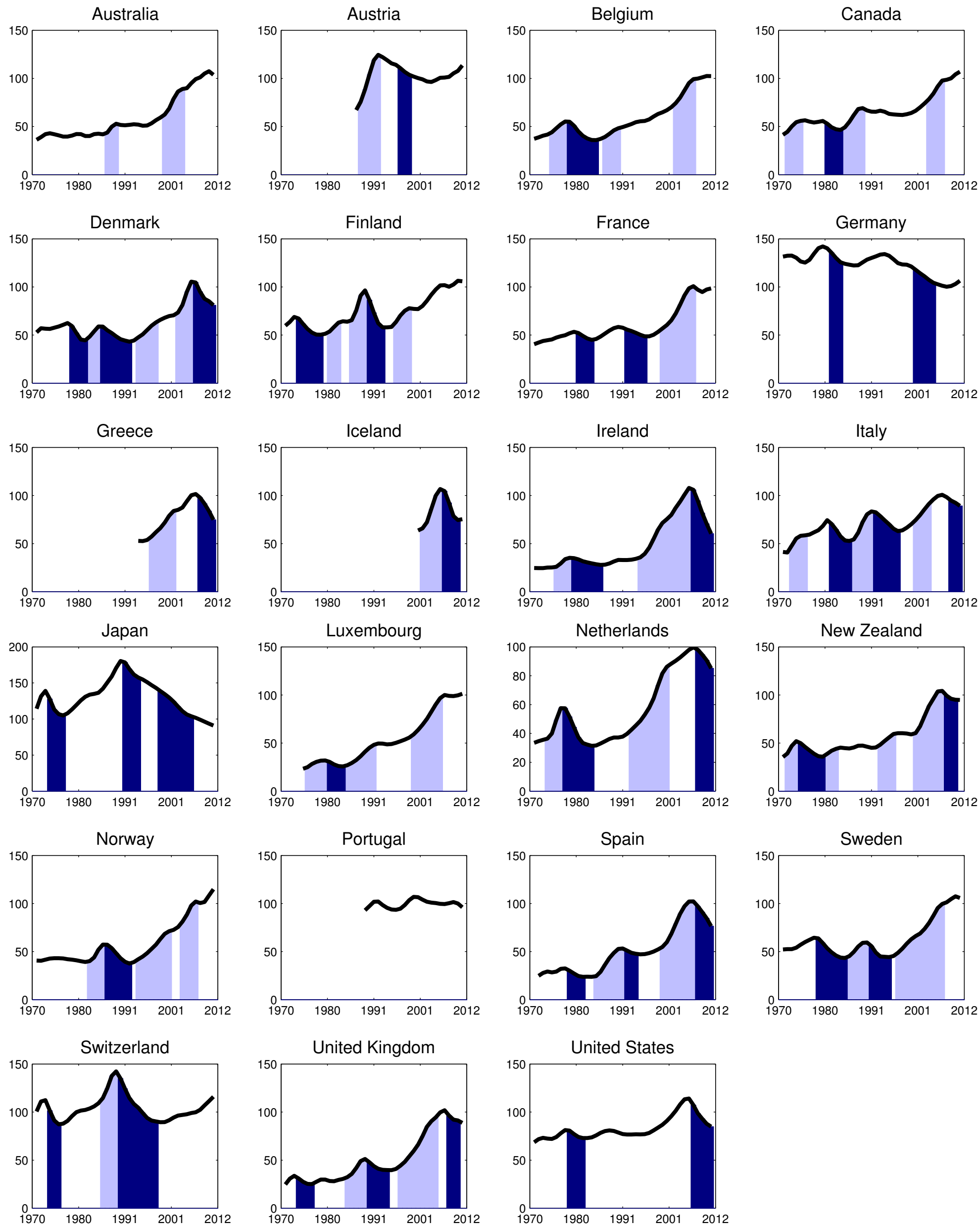

Figure A.4 Boom-bust in real house prices – Emerging economies

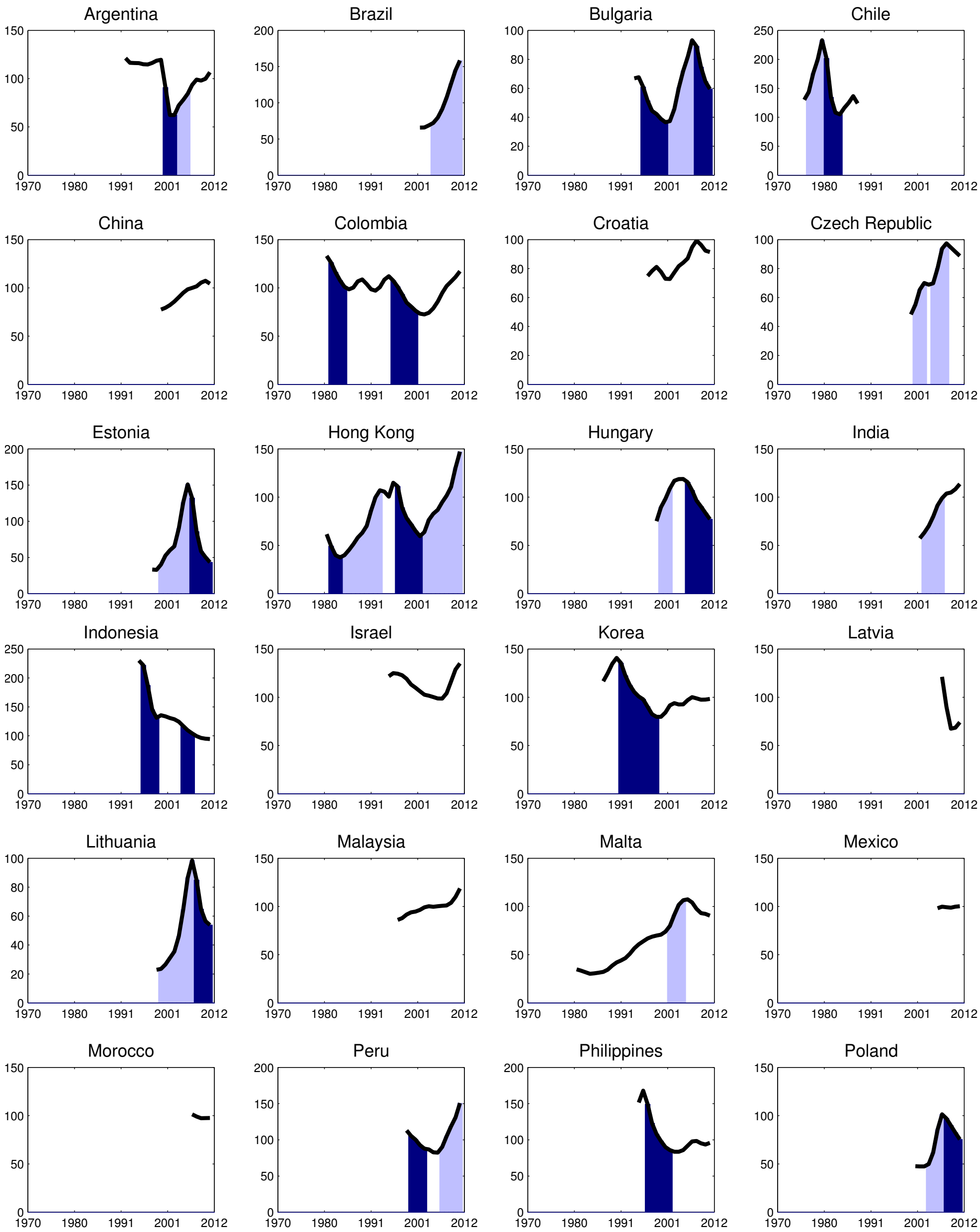

Figure A.4 Boom-bust in real house prices – Emerging economies (Cont'd)

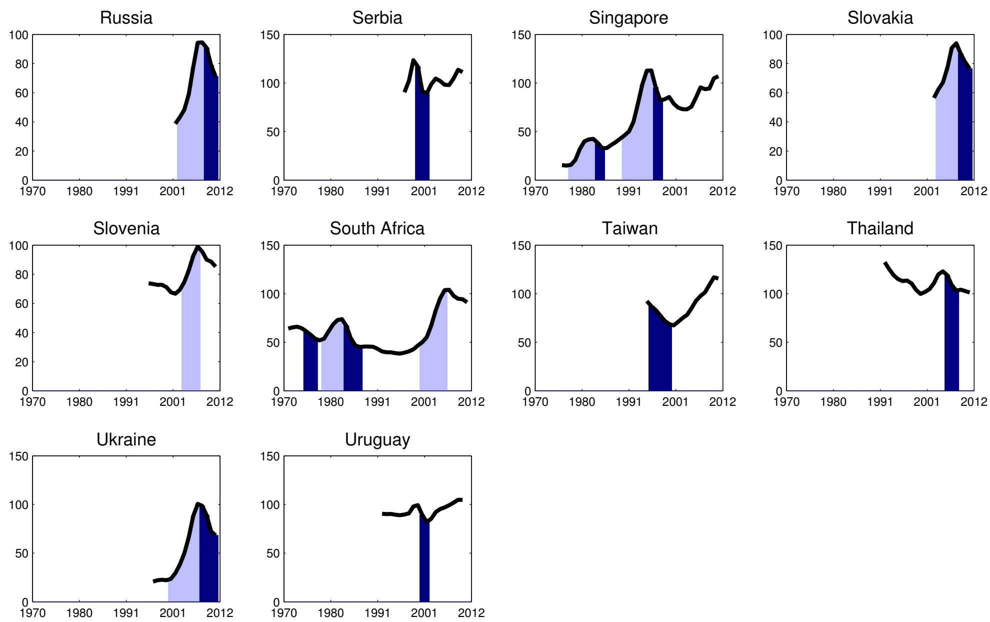

Table A.1 House prices description

Country	*Descr.*	*Source*
Argentina	Apartments in Buenos Aires City - average price	ARKLEMS
Australia	Residential property prices, new and existing dwellings	OECD
Austria	Residential property prices, new and existing dwellings	OECD
Belgium	Residential property prices, new and existing dwellings	OECD
Brazil	21340 - Residential Real Estate Collateral Value Index	CBB
Bulgaria	RESIDENTIAL PROPERTY PR., EXIST.FLATS (BIG CITIES),PER SQ..M,Q-ALL NSA	BIS
Canada	Residential property prices, new and existing dwellings	OECD
Chile	Morande and Soto, 1992	Paper
China	RESID. PROPERTY PRICES, (BEIJING), PER SQ.M, M-ALL NSA (Average existing and new)	BIS
Colombia	HPI - For three major colombian cities - Quarterly data	NCB
Croatia	AVERAGE PRICES OF NEW DWELLINGS SOLD PER 1 m2	CBS
Czech Republic	Residential property prices, new and existing dwellings	OECD
Denmark	Residential property prices, new and existing dwellings	OECD
Estonia	RESID. PROPERTY PRICES, ALL DWELLINGS, PER SQ.M.,Q-ALL	BIS
Finland	Residential property prices, new and existing dwellings	OECD
France	Residential property prices, new and existing dwellings	OECD
Germany	Residential property prices, new and existing dwellings	OECD
Greece	Residential property prices, new and existing dwellings	OECD
Hong Kong	RESIDENTIAL PROPERTY PR.,ALL DWELLINGS, PER SQUARE M., M-ALL NSA	BIS
Hungary	RESID. PROPERTY PRICES, ALL DWELLINGS, PER SQ.M.,Q-ALL NSA	BIS
Iceland	RESIDENTIAL PROP.PR.,ALL DWELLINGS(GR. REYKJAVK),PER SQ.M,M-ALL NSA	BIS
India	RESIDEX - Median residential property price across 20 cities	NHB
Indonesia	RESIDENTIAL PROPERTY PRICES, NEW HOUSES (BIG CITIES), PER DWELLING,NSA	BIS
Ireland	Residential property prices, new and existing dwellings	OECD
Israel	Residential property prices, new and existing dwellings	OECD
Italy	Residential property prices, new and existing dwellings	OECD
Japan	Residential property prices, new and existing dwellings	OECD
Korea	Residential property prices, new and existing dwellings	OECD
Latvia	RESIDENTIAL PROPERTY PRICES, EXISTING FLATS, PER SQUARE M., Q-ALL, NSA	BIS

Note. Note here.

Table A.1 House prices description (Cont'd)

Country	*Descr.*	*Source*
Lithuania	RESIDENTIAL PROPERTY PR., ALL DWELLINGS, PER SQUARE M., Q-ALL, NSA	BIS
Luxembourg	RESIDENTIAL PROPERTY PRICES, ALL DWELLINGS, Y-ALL & Res. Prop. Prices	OECD
Malaysia	RESIDENTIAL PROP. PRICES, ALL DWELLINGS, PER SQ. M., Q-ALL Y-ALL NSA	BIS
Malta	PROPERTY PRICES INDEX (BASED ON ADVERTISED PRICES)	NCB
Mexico	RESIDENTIAL PROPERTY PRICES, ALL DWELLINGS, PER DWELLING, Q-ALL NSA	BIS
Morocco	RESIDENTIAL PROPERTY PRICES, EXIST.DWELLINGS, PER SQUARE M., Q-ALL NSA	BIS
Netherlands	Residential property prices, new and existing dwellings	OECD
New Zealand	Residential property prices, new and existing dwellings	OECD
Norway	Residential property prices, new and existing dwellings	OECD
Peru	La Molina, Miraflores, San Borja, San Isidro y Surco	NCB
Philippines	Prime 3BR Condominium Price - Makati CBD	Colliers
Poland	RESIDENTIAL PROPERTY PRICES,(BIG CITIES), PER SQ.M.,Q-ALL NSA	BIS
Portugal	Residential property prices, new and existing dwellings	OECD
Russia	RESIDENTIAL PROPERTY PRICES,EXISTING DWELLINGS,PER SQUARE M,Q-ALL NSA	BIS
Serbia	Prices of dwellings of new construction	NSO
Singapore	price index, private residential, Singapore	NSO
Slovakia	Residential property prices, new and existing dwellings	OECD
Slovenia	Residential property prices, new and existing dwellings	OECD
South Africa	RESIDENTIAL PROPERTY PR.,ALL MIDDLE-SEGMENT HOUSES,PER DWELL.,M-ALL SA	BIS
Spain	Residential property prices, new and existing dwellings	OECD
Sweden	Residential property prices, new and existing dwellings	OECD
Switzerland	Residential property prices, new and existing dwellings	OECD
Taiwan	Sinyi House Price Index, National	Synyi
Thailand	RESID. PROPERTY PR., ALL DETACHED HOUSES(GR.BANGKOK),PER SQ.M,M-ALL SA	BIS
Ukraine	Average Price of Apartments, Kiev (US $ per sq. m.)	Blagovest
United Kingdom	Residential property prices, new and existing dwellings	OECD
United States	Residential property prices, new and existing dwellings	OECD
Uruguay	Indice Gral. de Precios m2 de Laspeyres	INE

Note. Note here.