# The transmission of real estate shocks through multinational banks

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**Abstract:** This paper investigates the credit supply of banks in response to domestic and foreign real estate price changes. Using a large international dataset of multinational banks, we find evidence of a significant transmission of domestic real estate shocks into lending abroad. A 1% decrease in real estate prices in home country, in particular, leads to a 0.2-0.3% decrease in credit growth in the foreign subsidary. This response, however, is asymmetric: only negative house price changes are transmitted. Stricter regulation of activities of parent banks can reduce this effect, indicating a role for regulation in alleviating the transmission of real estate shocks. Further, the analysis of the impact of real estate shocks on foreign subsidiary funding indicates that shocks are transmitted through changes in long-term debt funding and equity.

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## 1. Introduction

In the early 2000s the U.S. enjoyed a credit boom and sizeable increases in housing prices. Unfortunately, the housing market turned in 2006, triggering a financial crisis, which proved to be systemic in 2007 and 2008. Indeed, the decline in house prices has been seen as one of the fundamental causes of the recent financial crisis (Acharya et al., 2009). However, the U.S. was not a unique case. Starting from 2007, the world economy quickly slid into a recession that emanated mainly from the banking systems of the developed economies. During this period many economies experienced collapses in real estate prices and many blamed the souring of real estate related assets such as mortgage-backed securities and real estate loans for the financial turmoil. Hence, a key question is the extent to which the banking system propagates shocks to the pricing of real estate related assets internationally.

As complex organizations that offer multiple services in various geographical markets, multinational banks are well suited to study the question at hand. Following financial liberalization, consolidation, and integration in many countries, cross-border banking activities have grown dramatically in recent decades.[2] In the pursuit of higher profitability and diversification, numerous banks extended their activities beyond their home countries, opening branches or subsidiaries abroad. Home countries of these banks exhibit diverse house price histories in both before and after the global financial crisis.

In this paper this variation in house prices are used to investigate whether real estate shocks are transmitted through multinational banks to local credit supply, as well as the implications of such shocks for the funding structure of foreign bank subsidiaries. The data cover the years 1999-2011, and is based on more than 600 foreign bank subsidiaries from an international

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[2] See Claessens and Van Horen (2013), and Bank of International Settlement (BIS) report (2010) for detailed discussions and recent trends.

sample of 53 countries. According to the results, price changes in real estate markets in home countries have economically and statistically significant effects on credit growth abroad through foreign bank subsidiaries. This finding is robust to various alternative specifications and subsamples. Additionally, this effect is asymmetric: negative parent country real estate price shocks have a significant impact, which is not the case for positive shocks. Moreover, stricter home country banking regulation regarding the real estate activities of parent banks reduces the effect of the transmission, indicating the importance of regulation.

The findings indicate that informational problems drive the transmission results. Specifically, in response to a negative change in home country real estate prices, foreign bank subsidiaries from neighboring countries or culturally related countries decrease their credit supply less compared to others. This is because informational asymmetries or political motivations play an important role in the transmission of real estate price shocks. Better information or closer relationships (proxied by contiguity and common language) seem to mitigate the cross-border transmission of house prices.

The results do not support the alternative channels, securitization and moral suasion by national authorities, possibly affecting the transmission of real estate shocks. Securitization enables banks to transfer risks such as mortgage portfolios to third parties, which in theory can handle them. This, in turn, should make banks less responsive to real estate prices, reducing the cross-border transmission. Nevertheless, we show that the aggregate securitization activity at the parent country not only fails to mitigate the transmission of real estate price changes, it may even decrease the host country's credit supply, which may be caused by collapses in secondary loan markets during the financial crisis.

Countries responded to the recent financial crisis in different ways; supporting their banking systems through recapitalizations, asset purchases, or nationalizations. Some policy responses are bank specific (like a bank nationalization), but there are indirect benefits for the banking system as a whole. How banking system uses this support by the governments is highly political, as the main motivation for governments is to stabilize the credit supply at home. Yet, banks can choose to use this support to increase lending abroad, where opportunities may be relatively better due to an event in real estate market. Alternatively they may use it to curb lending at home. Thus, national authorities may put pressure on the parent banks to decrease the credit supply in their foreign subsidiaries (Kamil and Rai, 2010). We use the policy responses of parent countries to recent financial crisis to proxy the incentives for national authorities. The more recapitalizations and asset purchases or nationalization occur in the home country, higher the probability of national authorities to use moral suasion for parent banks to decrease credit abroad. However, there is no evidence to support that. If anything, the transmission is weaker for the foreign bank subsidiaries, whose parent banks are from countries responding heavily to the recent financial crisis by recapitalizations, asset purchases, and nationalizations.

In addition, the transmission of real estate price changes comes mainly from the later part of the sample. The effect of the capital channel (or parent support), on the other hand, seems to be relevant for the earlier years but not after the recent financial crisis – confirming the results of De Haas and van Lelyveld (2013). Further, the examination of the in the funding structure of foreign subsidiaries reveals that the changes in credit supply are mainly due to the fluctuations in long-term debt funding and equity in response to home country house price changes.

There is a large literature on the impact of cross-border banking activities on financial stability, real economic activities, and other measures like efficiency and competitiveness of

national banking systems.[3] An essential feature in this literature is the importance of internal capital markets. Previous studies show that the loan supply in one geographical market depends not only on local banks' balance sheets, but also on the parent bank's cash flow and financing options in other geographical markets it operates. In their seminal paper, Houston, James and Marcus (1997) find that the operation of internal capital markets is important in explaining loan supply at the individual subsidiary level. They find that local loan supply is sensitive to holding-wide cash flow rather than merely to local cash flow.

For an international bank, internal capital markets are also of importance, given that global banks manage the capital requirement ratios of their local subsidiaries. The literature takes two approaches to illustrate the transmission of financial shocks through foreign banks. The first one focuses on macro-financial linkages using aggregate data to show the transmission through banking integration. Morgan, Rime and Strahan (2004) is an important example. Using the U.S. as a multi-market banking system, they show that interstate bank ownership has an effect on the volatility of real economic activity within states, making state business cycles smaller and more similar. In a recent paper, Kalemli-Ozcan et al. (2013) show how financial integration through global banks makes the international business cycles divergent in general, but less so during the financial turmoil periods. Cetorelli and Goldberg (2011) also use data on aggregate international lending activity and document the transmission of the recent financial crisis from developed countries to emerging markets through global banks.

The other approach concentrates on bank-level data and on specific countries as home and/or host countries. For example, in their influential article, Peek and Rosengren (1997) focus on the U.S. as the host country and Japan as the home country. They find that a negative shock in

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[3] Allen et al. (2011) provide a detailed discussion for Europe, whereas Claessens et al. (2001) compare foreign and domestic banks both in developed and developing countries.

Japanese stock prices affected the lending activities of Japanese banks in the U.S. In another paper, Peek and Rosengren (2000) illustrate how the Japanese banking crisis influenced real economic activity -specifically construction activity- in U.S. commercial real estate markets through Japanese banks in the U.S. More recently, Schnabl (2012) used the 1998 Russian default as a negative liquidity shock to international banks and analyzed its impact on Peru through these international banks. There are other papers, which use lender heterogeneity from loan-level data to illustrate the international transmission of the recent financial crisis or possible credit supply differences of foreign owned banks.[4] Cetorelli and Goldberg (2012) focus on intra-banking group flows during the financial crisis to open up the black box of internal capital markets of U.S. global banks, illustrating a locational pecking order for liquidity management. De Haas and Van Horen (2013), on the other hand, use an international loan-level panel with a similar focus on the recent financial crisis and confirm that banks reduce their credit supply selectively depending on their geographical and informational positions.

In recent years this literature started to employ more international bank-level data, increasing the number of countries in the sample rather than focusing on one country as host or home. De Haas and Van Lelyveld (2010) use an international sample of – mostly - developed countries, and provide evidence regarding the existence and functioning of internal capital markets. In another paper, De Haas and Van Lelyveld (2013) use a similar dataset, which includes the global crisis period (2007-2009), and show that parent support may not be effective if the parent itself is in trouble. Further evidence on the internal capital markets in emerging countries comes from Jeon et al. (2012), who confirm that internal capital markets contribute to the transmission of financial shocks through multinational bank subsidiaries. These papers emphasize the

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[4] See Beck et al. (2012) for a country study of Bolivia; Popov and Udell (2010) for Central and Eastern Europe; and Ongena et al. (2012) for Central Asia and Eastern Europe.

importance of the capital channel of the internal capital markets by showing the significant impact of parent's bank-level variables such as internal fund generation, liquidity, or capitalization on foreign subsidiary's credit supply.[5]

Introducing the real estate markets into the picture, Loutskina and Strahan (2012) show the positive causal effects of house prices on economic growth in the U.S. during the boom years before the recent financial crisis. They find that this effect gets bigger with financial integration, which in turn increases economic volatility through higher variation in house prices and through strengthened links between the collateral and the overall economy. Berrospide et al. (2011) relate the house prices and mortgage delinquencies in the U.S. during the 2007-2009 crisis to lending through multi-market banks, and document the cross-state transmission. They also consider securitization as a possible mitigating factor in this transmission. This study follows a similar approach given the use of regional variation in real estate markets to identify the transmission by Berrospide et al. (2011), and the results of both papers are largely consistent. Nevertheless, this paper is the first international bank-level study focusing on alternative asset prices, namely real estate and stock market prices, and documenting the transmission in response to changes in those prices. It is especially interesting to observe multi-market banks behaving along similar lines in an international environment with countries pursuing divergent national interests, and in the U.S. where the individual states are subject to a single regulator.

This study contributes to the literature in several ways. Most importantly, the focus is on a specific type of financial shock, namely real estate market shocks. This increases our knowledge of how different macroeconomic shocks -including growth in the real economy, - the changes in

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[5] An alternative is the so called collateral channel, which Chang and Dasgupta (2007) found relevant on multi-segment firms. They find that transmission to non-shock segments is not due to the lower availability of internal funds but to a decreased value of collateral assets and reducing availability of external finance.

stock markets, or real estate market prices are transmitted. Similar to De Haas and Van Lelyveld (2013), we use a large sample including both developed and developing countries. Unlike them, the paper focuses not only on huge banking conglomerates, but also on relatively smaller international as well as domestic players. The time coverage for the sample is better in the sense that it includes 2010 and 2011. During these years some recovery could be observed in the banking sector, while many countries were still experiencing a banking crisis.

The remainder of this paper is organized as follows. Section 2 discusses the model, data and the econometric methodology. Section 3 presents the empirical results and various robustness checks for those results. Section 4 concludes with a short discussion of policy implications.

## 2. The model, data and methodology

### 2.1. The model

To see the impact of foreign house price shocks on national economies, we employ a model similar to De Haas and Van Lelyveld (2013). In this model, the credit growth rate in foreign subsidiaries is explained by subsidiary level controls, parent level controls, and macroeconomic controls for both home and host countries.[6] This model is inspired by the Morgan et al (2004) paper, which modifies the Holmstrom and Tirole (1997) paper for a multi-market environment. The model is:

$$Gross\ credit\ growth_{i,j,m,t}$$

$$= \alpha_i + \gamma_t + \beta_1 Local\ real\ estate\ price_{m,t-1} + \beta_2 Parent\ real\ estate\ price_{n,t-1}$$

$$+ \delta_1 Bank_{i,j,m,t-1} + \theta_1 Country_{m,t} + \delta_2 Parent\ bank_{j,t-1} + \theta_2 Parent\ country_{n,t}$$

$$+ \varepsilon_{i,j,m,t}$$

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[6] Following De Haas and Van Lelyveld (2013) we use gross credit growth as the main dependent variable. Net credit growth and equity growth are also used in a robustness check. .

where the subscripts $i$, $j$, and $t$ denote the bank, the parent bank, and the year; $m$ and $n$ denote host and home countries. $\alpha_i$ and $\gamma_t$ are bank and year fixed effects. Further, $Bank_{i,j,m,t-1}$ and $Parent\ bank_{j,t}$ are sets of bank variables including size, capital and liquidity related controls for local and parent bank respectively. Controlling for size is crucial as the sample contains various banks with different sizes. In the basic set capital and liquidity of local and parent banks are also included to control for solvency and soundness of these banks. $Country_{m,t}$ and $Parent\ country_{n,t}$ are sets of macroeconomic variables, including GDP per capita, GDP per capita growth, inflation, and stock market indices growth in host and home countries respectively. The variable of interest is $Parent\ real\ estate\ price_{n,t-1}$, thus the focus will be on the coefficient $\beta_2$, which is the effect of real estate shocks in parent country on credit supply of a local bank -that is a foreign subsidiary. Although the emphasis will be on real estate market price changes, controlling for stock market changes is crucial as stock markets may be transmitted to foreign credit supply as well (Peek and Rosengren 1997).

To include domestic banks into the analysis, which will create extra variation in ownership, we also employ an alternative model, which includes interactions between foreign ownership dummies and parent controls:

$$Gross\ credit\ growth_{i,j,m,t}$$

$$= \alpha_i + \gamma_t + \mu_1 Foreign_{i,t} + \mu_2 Foreign\ bank_{i,t} + \beta_1 Local\ real\ estate\ price_{m,t-1}$$
$$+ \delta_1 Bank_{i,j,m,t-1} + \theta_1 Country_{m,t} + \beta_2 Parent\ real\ estate\ price_{n,t-1}$$
$$* Foreign\ bank_{i,t} + \delta_2 Parent\ bank_{j,t-1} * Foreign\ bank_{i,t} + \theta_2 Parent\ country_{n,t}$$
$$* Foreign\ bank_{i,t} + \varepsilon_{i,j,m,t}$$

where the variables are similar to the foreign subsidiary model explained above except the dummy variables $Foreign_{i,t}$ , $Foreign\ bank_{i,t}$ and relevant interaction terms. This specification allows the comparison of foreign bank subsidiaries with domestic banks as a control group. The impact of parent bank and parent country variables can be interpreted solely based on their interactions with the foreign ownership variable. In other words, parent bank and parent country variables are not featured in the model on their own. The number of domestic banks is much higher compared to foreign subsidiaries in the sample. Therefore, in a robustness check, a more comparable sample of domestic banks is generated using propensity matching at country-year level (with at least 30 observations by country-year). Foreign subsidiaries and domestic banks are matched according to their size, equity and liquidity measures.

## 2.2. Data

In this paper, we examine an international sample of more than 600 foreign bank subsidiaries located in 53 countries for the years from 1999 to 2011.[7] Income statement and balance sheet information on individual banks is taken from the Bankscope database.[8] The Bankscope Ownership Database is used to match parent banks with directly owned banks.[9] Only countries are included in the universe of owners, for which there is real estate market information for the

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[7] A similar analysis can employ Claessens and Van Horen (2013) foreign ownership data with a better coverage. Yet, the focus here is on foreign bank subsidiaries, thus knowing the parent banks and controlling for their characteristics are crucial.

[8] Bankscope financial statements data is taken from WRDS. See Table A1 in the appendix for variable definitions.

[9] Bankscope provides only the most recent cross-section of ownership information; we generated the ownership data using yearly CD's for each year from 1999 to 2011. Only subsidiaries are included, as Bankscope does not provide information on branches. A caveat using solely direct ownership is the fact that part of the complex ownership structures of multinational banks is not captured. The ultimate ownership information could have been an alternative; however this would introduce too much complexity to the ownership information. Instead, basic ownership information is used to keep the sample as large as possible. This way the sample could contain not only huge multinational banks (there are only a few dozens of them) but also smaller banks. Note that these preferences may actually introduce a bias against the results of the paper, as the foreign subsidiaries may be affected by ultimate owners but not as much by direct owners.

relevant year. The sample includes only the banks for which more than 50% of ownership information was available in order to make sure that all the majority owners are identified. If a bank is majority owned by a foreign bank, it is counted as a foreign subsidiary. To avoid double entries and to better isolate shocks on specific entities we use unconsolidated statements -where available- for both subsidiaries and parent banks. To be able to use domestic banks as a control group these banks are retained.

The macroeconomic data come from World Bank's WDI, IMF IFS and OECD databases, and the banking regulation data come from The Bank Regulation and Supervision Survey, carried out by the World Bank. Geographical and cultural distance variables are taken from the CEPII database. The data on systemic crisis and policy responses are from Laeven and Valencia (2012). The aggregate securitization variables are generated from the ABS database and CMBS database.[10] Finally, real estate market data are collected from sources such as BIS, OECD and Dallas FED (Mack and Martínez-García 2011), and also from Global Properties Guide, a private company collecting data from alternative sources. We expand the Dallas FED International House Price Database by adding more countries but keeping the data as comparable as possible.[11] We predominantly use House price indices and calculate the changes in end-of-the-year indices and subtract consumer inflation to get the real change in real estate prices. Only changes in real estate prices are used, and not level information, for better comparability across different countries.

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[10] These two databases are provided by Asset-Backed Alert and Commercial Mortgage alert, both produced by a private company. They include all asset-backed issues, mortgage-backed issues (including CMBS), and collateralized debt obligations. Given these issues are under the control of a trustee, rated by at least one major rating agency, and collateralized by assets of some kind.

[11] We follow the Dallas FED database for the selection criteria in terms of geographic coverage (nationwide), vintage and type of dwellings (existing single-family) and priced unit (per dwelling).

Only around 7% of foreign bank subsidiaries are owned by banks from developing countries as defined by the World Bank, which is not surprising as most multinational banks are located in the developed world. Moreover, foreign bank subsidiary observations located in developing countries constitute around 21% of the whole sample.[12] Thus, the sample consists mostly of data from developed countries, suggesting that the bulk of multinational activity still happens among developed countries. This observation is consistent with the De Haas and Van Lelyveld (2010) paper.

Table 1 presents the summary statistics for the full sample –including domestic banks and foreign subsidiaries- and for the parent banks and home countries, which are just for foreign subsidiaries observations. Average real gross credit growth in the sample is 5.1% and net credit growth –net of loan loss provisions- is 4.9%, suggesting that loan loss provisions do not matter much. Mean equity growth rate is 5.5% and mean short-term funding and deposit growth is 5.2%, whereas the growth rate of long-term funding is very small at -0.5% with a large standard deviation. This may be due to the impact of global financial crisis of 2007-2009 on more fragile long-term funding. Growth rates larger than 100% are dropped as unreasonable, in order to avoid the impact of possible merger and acquisitions.

Table 2 displays the comparison of the foreign bank subsidiaries with parent banks. Parent banks have slightly –yet statistically significantly- lower capitalization -measured as equity over total assets- (10.4% vs. 13.2%) and lower liquidity –measured as liquid assets over total assets (26.4% vs. 29.8%). Regarding the size of the banks, parents are considerably larger than the foreign subsidiaries as expected. The relative size variable, which compares the size of subsidiary and parent bank in terms of total assets, indicates that the assets of foreign subsidiaries

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[12] If domestic banks are included, the number of banks in the developing countries constitutes 14% of the sample.

on average are as large as 14% of a parent's unconsolidated assets. When subsidiaries larger than their parent banks are excluded, which is likely caused by complex ownership structure, average relative size becomes around 7%.

In terms of macroeconomic variables, home countries experience lower real estate market price appreciation (1.2% vs. 2.0%) and stock market gains (2.9% vs. 6%) compared to host countries. This suggests that the parent banks seek better economic prospective and thus possibly higher profits. Yet the profits of subsidiaries –measured relative to total assets- and parent banks are almost the same at 1.1%.

In Table 3, pairwise correlations of selected variables are presented. Although host and home real estate market price changes are significantly correlated, the correlation coefficient is rather low at 0.234. Indeed, the countries displayed in Figure 1 are shown to have widely varying paths regarding real estate price changes. Yet, the mean values for the countries in the sample, as shown in Figure 2a, suggest a global boom (from 2001 to 2007) and bust (during 2008 and 2009) and later a slow recovery in 2010 and in 2011.[13] The stock market price changes follow a similar path in Figure 2, but the real estate markets are much smoother. The histogram of real estate market price changes (Figure 3) shows that there are more country-year observations with a positive price change and a fatter tail compared to the negative side –indicating possible real estate bubbles. Indeed, weighted mean of positive parent country real estate price changes are larger in absolute value compared to the negative ones (3.2% vs. -2%).

### 2.3. Econometric methodology

Three alternative econometric approaches are used in the paper, namely bank fixed effects regressions, pooled OLS regressions with country-fixed effects, and two-step dynamic panel

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[13] See Panel c in Figure 2 for average real estate price changes.

regressions, where both difference and system estimators are used. The benchmark regressions also include an IV regression, where local real estate prices are instrumented through population growth and bank regulation related to real estate activities, as local real estate prices respond to local credit supply. All regressions include one period lagged real estate price variables and bank-level variables to reduce endogeneity concerns. These concerns are further tackled by dynamic panel regressions –using differences and levels of explanatory variables as internal instruments (Arellano and Bond, 1991; Blundell and Bond, 1998).

The identification strategy pursued in the paper is based on the assumption that international real estate prices are not perfectly correlated. This is due to the immobile nature of real estate and the existence of national borders as an obstacle to population mobility. Although there seems to be synchronization in real estate markets in recent years (Hirata et al., 2013), the co-existence of boom and bust national housing markets together with rather flat housing markets suggests the co-movements are far from perfect. Therefore, the assumption is reasonable.[14] Using a global VAR analysis for 7 euro area countries,[15] Vansteenkiste and Hiebert (2011) show that spillovers from country-specific house price shocks exist but their magnitude is relatively low. Figure 1 displays the examples of countries experiencing booms and busts (e.g. Spain, United Kingdom and United States) together with rather stable ones (e.g. Germany, Japan and Switzerland). Indeed, the home and host country correlation for the foreign subsidiary sample the correlation coefficient is much higher for stock markets compared to real estate markets.[16]

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[14] Note that these countries are some of the most influential countries in the cross-border banking activities. Thanks to this fact, there is considerable variation in the variable of interest. See Table A2 in the appendix for a list of countries and their relative presence in the sample.

[15] These countries are Belgium, Germany, Ireland, Spain, France, Italy and the Netherlands.

[16] In Table 3, the correlation coefficient for equity indices of home and host countries is 0.712, whereas it is 0.234 for real estate prices.

### 3. Empirical evidence

In this section empirical evidence will be presented. First, we will set up the benchmark model and use alternative methodologies as discussed in the previous section. Second, alternative dependent variables, specifications, and robustness checks will be presented. This section concludes by investigating through which funding channel the real estate shock transmission may be operating –analyzing the changes in the funding structures of foreign subsidiaries.

#### 3.1. The impact of real estate markets

Table 4 includes the benchmark regressions with basic bank and country level controls. Alternative econometric approaches are presented by using foreign subsidiary only and full sample settings. In almost all regressions the coefficients of parent country real estate prices are positive and significant. In regressions 1 and 2, where bank fixed effects are used, a 1% decrease in parent country real estate prices leads to a decrease of 0.25-0.3% in the credit growth of foreign bank subsidiaries. Regressions include controls for local real estate prices to avoid a possible omitted variable bias. This is crucial as the price changes in the parent real estate market are at least partially correlated with local real estate price changes. The impact of local real estate prices is insignificant for the foreign subsidiary only sample, but in other regressions it becomes significant in the sample where domestic banks are included. This suggests that foreign banks are less sensitive to local real estate shocks, which can be explained by their ability to smooth the shocks thanks to their parents –an opportunity not shared by domestic banks. Another explanation may be that their assets are not as exposed to local real estate markets as those of domestic banks.

These results hold in regressions 3 and 4, where high credit growth banks are excluded (changes larger than 50%).[17] In pooled OLS regressions 5 and 6, the size as well as the significance of the coefficients decrease, underlining the importance of bank fixed effects regarding the impact of parent real estate shocks. The results of the two-step GMM models, estimated to alleviate endogeneity concerns, stay almost the same in regressions 7 and 8. In regressions 9 and 10, we use instrumental variable regressions with bank fixed effects, as explained in the methodology section. Instrumenting local house prices may be crucial as they may mechanically affect the credit growth through the value of mortgages. Interestingly, when local house prices are instrumented the size of the coefficient for the parent country, house price changes gets larger especially in regression 10, where the full sample is used. There, compared to domestic banks, a 1% decrease in housing prices in the parent country is associated with a 0.7% decrease credit growth in foreign bank subsidiary. Although instruments are rather weak in both regressions, instrumentation is relatively well in regression 10 compared to regression 9, which suffers from underidentification.

An important issue is whether this impact is economically significant. A one standard deviation decrease in real estate prices in the parent country (around a 7.5% decrease) leads to a decrease of around 2.5% in the credit growth of the foreign subsidiary. Although this is approximately 10% of the standard deviation of credit growth, it is almost 50% of its mean value. Especially given the persistence of some housing busts in certain countries (see Figure 1) the cumulative impact on growth rates can even be larger. Thus we argue that this is a considerably large impact, especially compared to the impact of local housing prices.

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[17] Dropping the dissolved or merged banks, or the banks whose ownership status change, does not affect the results (not reported).

Furthermore parent bank-level variables do not have a significant impact, except a marginally significant positive impact of parent liquidity in a few regressions. This observation is in line with the most recent findings from De Haas and Van Lelyveld (2013). They show that parent banks were not a source of stability for their subsidiaries during the last financial crisis, while a large number of them were suffering from a banking crisis at home.[18]

Looking at another important asset class, stock markets, there is a positive impact of parent equity markets, which is expected as they may have a similar impact on the parent-subsidiary relationship. Yet, the coefficients of parent equity markets are insignificant in most regressions, and the size of the impact is considerably smaller compared to real estate markets. More specifically, a one standard deviation decrease in stock market prices –around 34%- leads to a 1% to 1.5% decrease in credit growth in the fixed effects regressions with significant parent equity market coefficient. Compared to the transmission of real estate price shocks, the effects of a stock market price change at home country on the credit supply of the host country is lower. This difference in credit growth sensitivity to real estate and stock markets indicates that real estate prices are more important compared to stock markets regarding the cross-border transmissions. This may be explained by the role of real estate as collateral in the economy, as an extra channel influencing cross-border transmission. In Figure 2b, stock markets and real estate markets behave similarly, but stock markets move much more sharply compared to real estate markets. This result might reflect that the banks are aware of the volatility of stock markets and are thus better prepared not to transmit the fluctuations in stock markets, which are much more volatile compared to real estate markets.

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[18] The banking crisis at home is pervasive in the sample. With 41% of observations for foreign subsidiaries, home countries are in banking crisis.

### 3.2. Alternatives and robustness checks

This section starts by using alternative dependent variables, namely net credit growth (excluding loan loss reserves) and equity growth, which may be important as the parents are managing the capitalization of their subsidiaries. The results of the regressions 1 to 4 in Table 5, where net credit growth regressions are presented, are almost the same as in the benchmark regressions, indicating that the changes in credit growth do not have a large role due to loan loss provisions. Alternatively, parent banks may manage book capital of their foreign subsidiaries. In regressions 5 to 8, however, the coefficients of parent country real estate prices are positive. However, they are lower and less significant compared to the credit growth regressions, especially for bank fixed-effects regressions. This can be explained by internal capital markets being operated not only through book capital but also through risk capital, which is not observable in book capital, possibly weakening the transmission.[19] Still, some transmission of real estate price changes into equity growth rates of foreign bank subsidiaries exist, which will be relevant for the discussion of funding structures in the next subsection.

Table 6 displays the robustness checks with alternative specifications and a subsample using bank fixed effects regressions except regressions 11 and 12, where country-year fixed effects are used instead. Monetary policy transmission may be an important factor, leading to both higher real estate prices and higher credit supply. Regressions 1 and 2 include exchange rate and interest rate controls for both home and host countries, but the coefficients of parent real estate prices do not change much. Next, a lagged dependent variable is added in the baseline bank fixed effects regressions 3 and 4, which introduces a bias. Yet, the results do not change dramatically.

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[19] There are alternative approaches to capital management in foreign subsidiaries. For a more detailed explanation see De Haas and Naaborg (2006).

Developing countries experienced a series of crises in the late 90s and early 2000s. This paper investigates the effects of home country shocks, which are mainly developed countries, on the foreign subsidiaries, many of which are in developing countries. To be sure that this period is not driving the results in regression 5 and 6, we drop observations before 2002 and the results remain similar.

In the full sample specification, foreign subsidiaries are compared with domestic banks. But domestic bank universe is very large compared to foreign bank sample. To generate a more comparable control group of domestic banks in regressions 7 and 8, only domestic banks and foreign subsidiaries are included, which are matched by propensity scoring at country-year level. The coefficients of parent real estate prices are similar, which provides more confidence in the full sample specifications.[20] In regressions 9 and 10, the standard errors are clustered at the country level rather than the bank level as in the baseline regression, because error terms may be correlated within countries as well. Yet, the significance levels of parent real estate price changes are similar.

Most importantly, the demand side effects at the host country may drive the results, in the sense that the credit supply of foreign subsidiaries decrease not in response to home country house prices but to the local credit demand conditions. In regressions 11 and 12 we tackle this issue by adding country-year fixed effects next to the bank fixed effects, which take all country level variation at the host countries away (macro variables are dropped). Although the coefficients of parent real estate price changes are marginally significant, the size and the sign of the coefficient are similar. Finally, international comparability of house price data may be an

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[20] The foreign and domestic banks are matched 1 to 1 without replacement. When we include all domestic banks, which are matched with foreign banks at any time –ending up with a larger sample then in regression 8 but smaller than the full sample- the results stay similar (not reported).

important factor. In regressions 13 and 14 the banking universe is reduced to the Dallas FED International House Price Database sample only. This sample consists only of OECD countries and thus reduces the sample size by more than half but makes the house prices more comparable. The coefficient of parent real estate prices is marginally insignificant in the foreign subsidiaries only sample, but significant in the full sample. The sign of the coefficient is the same in both regressions.

Table 7 displays alternative specifications. Internal fund creation and profitability at bank level may have an effect on real estate shock transmission, as they have been found significant in some earlier studies. Following Jeon et al. (2012), regressions 1 and 2 include internal funds (defined as net income over lagged loans) of both the subsidiary and parent as controls, but the results remain similar. When other bank level controls (profits and net interest margin) are included in regressions 3 and 4, as employed by De Haas and Van Lelyveld (2010), the coefficients of the variables of interest are still similar, but the coefficient is significant only in regression 4. An interesting question is whether parent banks differentiate their responses to real estate price shocks in favor of their more important subsidiaries. Regressions 5 and 6 include a relative size control, measuring the size of the subsidiary relative to the parent, and an interaction term with parent real estate prices. In the only foreign bank sample, this interaction term is negative, and in both regressions the coefficient of interest is similar to earlier findings. The negatively significant interaction term in the foreign subsidiary only sample implies that the larger the foreign subsidiary gets relative to the parent bank, the smaller is the impact of parent country real estate markets, thus the lower the transmission. For example, if the foreign subsidiary is as large as the parent bank itself, the marginal effect of the parent real estate market price changes becomes very close to 0 (0.270-0.281=-0.1%). This finding suggests that the

parent banks reduce lending in their core foreign subsidiaries less in response to a negative real estate shock at home confirming De Haas and Van Horen (2013) and Cetorelli and Goldberg (2012) for the case of real estate shock transmission. [21]

For the banks more exposed to real estate markets, the transmission might be larger compared to less exposed banks. For a smaller sample of banks, there is information about mortgages, which is used in regressions 7 and 8. When the ratio of mortgages in total loans for the parent and an interaction with parent house prices are included, the impact of parent real estate markets is significant and the coefficient is much larger - although the new controls are insignificant. A 1% decrease in parent country real estate prices seems to be associated with a 0.85% decrease in credit growth. One would expect a positive interaction term for parent mortgage exposure, as the parent banks –which are more involved in home country real estate markets- may transmit the real estate shocks more. The negative coefficient and insignificance may be caused by the much smaller sample. Finally, the transmission of parent real estate prices may mainly be driven by capitally constraint banks. To see whether this is the case, an interaction term of parent real estate prices and parent equity is added to the regressions 9 and 10, which turns up as insignificant. This suggests that the parent banks transmit the real estate price shocks at home regardless of their capitalization.

### 3.3. The effects of information, securitization and policy responses on transmission

In this section we focus first on the possible role of information between home and host countries as those may actually influence the cross-country transmission of real estate price shocks. Contiguity, geographical distance and a common language shared by home and host countries are used as proxies of information channels between home and host countries. In

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[21] Here, the core subsidiaries are defined by their asset size relative to the parent bank.

regressions 1 to 6 in Table 8, the interaction terms of those information variables and real estate prices are all negative. The interaction of contiguity and real estate prices is significantly negative in regression 1, with foreign sample, but not significant in the regression 2 with the full sample. This suggests that the transmission is weaker among countries, which are neighbors and countries sharing a common language. Yet, the plain distance variables in regressions 5 and 6 are insignificant.

Next, we turn to securitization opportunities for parent banks at home country. The use of securitization may mitigate transmission as –at least theoretically- banks can get rid of some real estate exposure smoothen their capital base, and this is partially observed in the U.S. setting (Berrospide et al., 2011). Yet Acharya et al. (2013) show that the risk is actually not transferred away from the banks, which provide explicit guarantees, and thus securitization may not be as effective. Furthermore, there is evidence linking the securitization activity with worse screening incentives, which may lead to lower loan quality (Keys et al., 2010), thus the impact of securitization on transmission is ambiguous. Indeed, when securitization variables (the amount and frequency of deals) are included in regressions 7 to 10 in Table 8, the interaction terms with the parent real estate prices are insignificant. In regressions with foreign subsidiaries only (7 and 9) the coefficients of securitization variables are negative and significant indicating more securitization activities at home decreases the credit growth of the foreign subsidiary. This may be caused by the freeze in the securitization markets during the financial crisis.

Parent countries' policy responses may provide important clues both about the severity of the financial crisis in those countries and also possible tendencies of moral suasion by national

authorities.[22] Obviously, government would not like to see their support to their national financial systems are going abroad through foreign subsidiaries, as this will be politically unpopular. Thus governments involved in bolder policy responses may use moral suasion with their multinational banks to decrease credit supply abroad. Regressions 1 and 2 in Table 9 include total direct fiscal outlays of the parent countries during 2007-2011, and regressions 3 and 4 include significant nationalizations at parent country in the previous year. The coefficients of those variables are negative, as expected, and significant for the full sample regressions. The interaction terms, however, are mostly insignificant and negative. Only in regression 2 with fiscal outlays it becomes marginally significant. Thus the results do not provide supporting evidence for moral suasion by parent governments.

Another important issue is that the transmission of real estate changes may be driven by financial crises. In regressions 5 and 6, we include domestic and foreign banking crises as control variables, as the occurrence of banking crises and real estate market busts are highly related especially during the recent crisis. The results are robust to the inclusion of local banking crisis controls.

Bank regulation and supervision may have an impact on the credit supply of foreign subsidiaries as illustrated by Ongena et al. (2013), who find stricter regulation at home associated with lower lending standards at host countries. As the focus is on real estate prices, banking regulation regarding the real estate activities of parent banks is of interest. We use the World

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[22] De Haas and Van Lelyveld (2013) discuss possible implications of parent country support to specific banks. Yet the impact of such support may be system wide not only bank-specific, as all the banks in the system indirectly benefits from such government support.

Bank's banking regulation survey,[23] more specifically a question from that survey, to show the possible impact of bank regulation on the transmission of the real estate shocks. The question is about the conditions under which banks can engage in real estate activities.[24] Table 10 includes this variable for parent countries and interact it with parent real estate prices. The results suggest that both real estate prices and the interaction term are significant in all regressions (except the difference GMM regression 5), with a positive and a negative coefficient respectively. This means that the stricter the parent bank is regulated in real estate activities (the higher the variable the stricter the regulation), the lower the marginal impact of parent country real estate price shocks on credit supply of foreign subsidiaries is. This is because strictly regulated banks less exposed to real estate markets and thus do not have to cut back credit abroad, where prospects are better compared to home country experiencing a decline in housing prices. In regression 1, for example, a bank, whose parent bank is unrestricted, decreases its credit supply by 0.6%, whereas if the parent bank is prohibited from real estate activities the bank decreases its credit growth only by 0.07% in response to 1% decrease in parent country real estate prices.

### 3.4. Asymmetric transmission in good or bad times

The impact of parent real estate shocks may be asymmetric, namely positive and negative shocks may have different impacts if substitution and spillover effects behave differently in response to real estate market price changes. From a theoretical perspective, the impact of both a

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[23] Although the direct engagement of banks to real estate activities might not be very important compared to their indirect involvement through credit provision, this question should proxy for the general approach by the regulator. See Barth et al. (2013) for the details of the banking regulation survey.

[24] The answers are categorized in 4 groups: Unrestricted (1 if a full range of these activities can be conducted directly in banks), Permitted (2 if a full range of these activities are offered but all or some of these activities must be conducted in subsidiaries or in another part of a common holding company), Restricted (3 if less than the full range of activities can be conducted in banks, or subsidiaries, or in another part of a common holding company or parent) and Prohibited (4 if none of these activities can be done in either banks or subsidiaries, or in another part of a common holding company or parent).

positive and a negative shock is ambiguous. A positive shock in the parent country not only leads to more funds to parent banks (a positive impact on foreign subsidiaries' credit supply), which can be used in profitable subsidiaries and for diversification purposes (as banks may be cautious of following housing busts), but also more investment opportunities in home country, which in turn may soak up scarce capital from foreign subsidiaries (a negative impact). Following the Berrospide et al. (2011) paper, we call the first channel the *spillover effect* and the latter one the *substitution effect*. Yet the magnitudes of the impact of alternative effects may be different in positive and negative shocks. In Table 11, we differentiate the positive and negative parent real estate price changes by including two variables instead of one. Although all the coefficients are positive, only negative shocks have a significant and economically large impact on credit growth of foreign subsidiaries. Indeed, a 1% decrease in parent real estate market prices is associated with a 0.35% to 0.6% decrease in credit growth, depending on the sample and econometric approach. It seems that the *spillover effect* dominates the *substitution effect* in adverse shocks, but the two effects are balanced in the case of favorable shocks. One explanation may be that in the case of adverse shocks the constrained banks (with lower asset value and higher loan losses) have to reduce credit to keep capitalization at reasonable levels, thus *spillover effect* is pervasive and lending in foreign markets are reduced. At the same time *substitution effect* is not as effective as the parent bank cannot decrease credit growth in parent country quickly in case of a negative shock. In a favorable shock, however, both effects can be equally relevant, as parent banks will not be bound. Parent banks will increase lending in foreign markets (*spillover effect*) and at the same time would like to bring funds home to use good economic environment caused by the favorable shock (*substitution effect*).

As discussed earlier, internal capital market mechanisms may have been changed with the recent global financial crisis. Thanks to the longer time period covered here, the sample can be split as before and after the financial crisis. In Table 12 the sample is split into two to see the difference in the transmission of real estate price shocks before and after the recent global financial crisis. There are two main observations from these regressions. First, the transmission of real estate price shocks is prevalent especially after 2006, as the coefficient is significant and positive in regression 1 and 2 and in this period parent equity is highly insignificant suggesting no role for parent capitalization. Yet when the earlier period is considered in regressions 3 and 4, parent equity is positive and significant, suggesting that the parent banks were providing stability before the recent crisis period. In regressions 5 to 8, we differentiate between negative and positive real estate price changes. Negative house price changes are transmitted, parallel to earlier results, after 2006 but there is no significant transmission before 2007. Interestingly, in regression 6 positive house price shocks are also significant and positive, though marginally. This suggests that the foreign subsidiaries of multinational banks from parent countries experiencing housing price increases enjoyed credit growth compared to their domestic counterparts.

### 3.5. Funding Channels

In this last section of the empirical analysis, the funding structure of foreign subsidiaries is examined to see the effects of cross-border shocks. Equity growth is already used as the dependent variable in section 3.2, resulting in suggestive evidence regarding equity growth in foreign subsidiaries is responsive to real estate market price changes in parent countries. Yet this finding was not consistent throughout the specifications. In this section the focus is on debt financing of foreign subsidiaries. Indeed the increase in credit supply may not only be funded by

equity, but also by debt, which is divided into two components: long-term funding, and short-term and deposit funding. The regressions in Table 13 feature these two variables as dependent variables with a specification similar to the baseline model.

The results suggest that the response of foreign subsidiaries' funding structure to the shocks in parent country real estate markets is mostly through their long-term funding. A one standard deviation decrease in parent country real estate prices (7.5%) leads to a decrease of 3.6% for the regression 2, where bank fixed-effects are employed for the whole sample. Indeed, in almost all specifications parent country real estate prices have a significantly positive impact on long-term funding growth of foreign subsidiary. On the other hand, short-term and deposit funding growth is responsive only in full sample regressions (8 and 10) and with a much smaller coefficient compared to long-term funding. In the sense that the deposit base is more stable compared to long-term funding, and thus, rather insensitive to the parent country real estate developments, the results are also consistent with the findings of De Haas and Van Lelyveld (2013), who also looked into the funding structure and found that funding structures mattered, especially during global crisis.[25] The long-term funding may to a large extent be from the parent bank; unfortunately data on internal loans are not available from Bankscope.

## 4. Conclusion

This paper investigates the credit supply of banks in response to national and foreign real estate price changes. The findings suggest real estate shocks are transmitted by multinational banks; more specifically a 1% decrease in real estate prices in home country leads to a 0.2-0.3% decrease in credit growth in the foreign subsidiary. This impact is significant and economically

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[25] They use the funding structure variables as control variables, whereas we try to explain the funding structure of foreign subsidiaries and thus use these variables as dependent variables.

large given the existence of sustained housing busts as seen during the recent financial crisis. A one standard deviation decrease in real estate prices in parent country (around a 7.5% decrease in the real house price index) leads to a decrease of around 2.5% credit growth in foreign bank subsidiary. The result is robust to alternative econometric methods and specifications -including the effects of banking crises, securitization, and policy responses of national government to recent financial crisis.

Moreover, there is evidence indicating an asymmetry in the response of foreign bank subsidiaries; the transmission is significant for negative real estate shocks but not for the positive ones. The findings further suggest that home country banking regulation regarding the real estate activities of banks has an effect on the transmission channel, as the impact is smaller if parent banks are more restricted in their real estate activities at home. Finally, we look into funding channels of foreign subsidiaries. Long-term debt funding and equity funding is responsive to foreign real estate shocks, whereas short-term and deposit funding is rather insensitive.

Our findings offer different policy implications for home and host country authorities. The transmission of real estate price changes in bad times such as the recent financial crisis may export the real estate shocks through foreign subsidiaries possibly deepening the ongoing crisis at host country. Yet, there is no evidence for the transmission of real estate shocks during boom period, meaning host countries should not worry about importing house price bubbles through increased credit supply of foreign subsidiaries.

Multinational banks from countries with less informational problems, generous governments preferring bold policy responses to financial crises, and restrictive regulators reduce the credit supply less in response to a negative house price shock. Hence, those countries are desirable as bank owners from the perspective of host countries. For home authorities, multinational banking

is less of a concern, as it seems to provide a reliable safety net for a crisis period characterized by severe house price declines. The foreign subsidiaries of those banks reduce lending abroad in response to negative house prices at home creating capital buffers if needed by parent bank.

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## Appendix. A1 Variable definitions and data sources

| Variable | Description | Sources |
|---|---|---|
| Gross credit growth | Growth rate of real gross loans (calculated in deflated US dollars) | Bankscope and WDI |
| Credit growth | Growth rate of real net loans (calculated in deflated US dollars)- excluding loan loss reserves | Bankscope and WDI |
| Asset growth | Growth rate of real total assets (calculated in deflated US dollars) | Bankscope and WDI |
| Equity growth | Growth rate of equity (calculated in deflated US dollars) | Bankscope and WDI |
| Long-term funding growth | Growth rate of long-term funding (Senior debt maturing after 1 year, subordinated borrowing and other funding -calculated in deflated US dollars) | Bankscope and WDI |
| Profit* | Lagged pretax profits over total assets | Bankscope |
| Net interest margin* | Net interest income over loans and other earning assets | Bankscope |
| Deposit growth | Growth rate of a bank's customer and short term funding (calculated in deflated US dollars) | Bankscope and WDI |
| Assets* | Lagged log of assets in millions of 2000 US dollars | Bankscope and WDI |
| Internal funds* | Internally generated funds (Net income/lagged loans) (Jeon et al. 2012) | Bankscope |
| Equity* | Lagged equity over total assets | Bankscope |
| Liquidity* | Lagged liquid assets over total assets | Bankscope |
| GDP growth* | Rate of real per capita GDP growth | WDI |
| Inflation* | Rate of change in consumer prices | WDI |
| GDP per capita* | GDP per capita in thousands of constant 2000 U.S. dollars | WDI |
| Real estate prices* | Lagged growth in real house price index (calculated by nominal HPI minus inflation) | GPG, BIS, OECD and Dallas FED |
| Parent real estate prices | Lagged growth in real house price index of parent bank's country (calculated by nominal HPI minus inflation) – 0 if a bank is domestic | GPG, BIS, OECD and Dallas FED |
| Equity index* | Change in S&P Global Equity indices | WDI |
| Interest rate* | Long-term government bond yields in percentages (in most cases 10 year) | IMF IFS and OECD |
| Exchange rate* | Growth rate of the real effective exchange rate, which measures the real value of a currency against a weighted average of several foreign currencies | WDI |
| Foreign | Dummy variable that equals 1 if a bank is foreign owned with a least 50% of shares | Bankscope |
| Foreign bank | Dummy variable that equals 1 if a bank is majority owned by a foreign bank | Bankscope |
| Banking crisis* | Dummy variable that equals 1 if a country is suffering a banking crisis | Laeven and Valencia (2012) |
| Mortgages* | Total mortgages over total net loans | Bankscope |
| Relative size | Size –measured by assets- of subsidiary relative to its parent | Bankscope |
| Positive parent real estate prices | Lagged growth in real house price index of parent bank's country (calculated by nominal HPI minus inflation) – 0 if HPI growth in parent country is negative | GPG, BIS and OECD |
| Negative parent real estate prices | Lagged growth in real house price index of parent bank's country (calculated by nominal HPI minus inflation) – 0 if HPI growth in parent country is positive | GPG, BIS and OECD |
| Contiguity | Dummy variable that equals 1 if the home and host countries are contiguous | CEPII (Mayer and Zignano, 2011) |
| Common language | Dummy variable that equals 1 if a language is spoken by at least 9% of the population in home and host countries | CEPII (Mayer and Zignano, 2011) |
| Distance | Geodesic distances (in '000 km) calculated following the great circle formula, which uses latitudes and | CEPII (Mayer and Zignano, |

| | | |
|---|---|---|
| | longitudes of the most important cities/agglomerations (in terms of population) | 2011) |
| Parent country securitization | Total amount of asset-backed issues, mortgage-backed (including commercial) issues and collateralized debt obligations collateralized by assets of some kind in the parent country over GDP of the parent country | Commercial Mortgage Alert and Asset-Backed Alert |
| Parent securitization number | Ln (1+ Total number of asset-backed issues, mortgage-backed (including commercial) issues and collateralized debt obligations collateralized by assets of some kind in the parent country) | Commercial Mortgage Alert and Asset-Backed Alert |
| Parent fiscal outlay | Fiscal cost of the recent financial crisis (2007-2011) (due to recapitalization, asset purchases and liquidity provision) for the parent country over GDP of the parent country | Laeven and Valencia (2012) |
| Significant nationalization | Dummy variable that equals 1 if state takes control over important institutions during the previous year in the parent country | Laeven and Valencia (2012) |
| Parent real estate activity | What are the conditions under which banks can engage in real estate activities? 1 if unrestricted, 2 if permitted, 3 if restricted, 4 if prohibited. | WB Bank Regulation and Supervision Surveys |

Notes: *These variable explanations are the same for the variables regarding parent banks –named as **Parent Variable Name**.

## A2. List of countries, number of banks and mean real HPI growth rates:

International Standards Organization (ISO) 3-digit alphabetic codes are used for countries. Real HPI growth values are mean values in percentages over the mentioned period and they are not shown if the country has less than 3 observations for the relevant period. Foreign subsidiaries and Parent banks shows the number of observations in the foreign subsidiaries only sample. * denotes the country is in the Dallas FED international house price database.

| Country | Foreign subsidiaries | Parent banks | Real HPI growth (98-11) | Real HPI growth (98-06) | Real HPI growth (07-11) | Country | Foreign subsidiaries | Parent banks | Real HPI growth (98-11) | Real HPI growth (98-06) | Real HPI growth (07-11) | Country | Foreign subsidiaries | Parent banks | Real HPI growth (98-11) | Real HPI growth (98-06) | Real HPI growth (07-11) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ARE | - | 2 | 2.5 | - | 2.5 | FRA* | 87 | 303 | 5.5 | 8.5 | 0.1 | MEX | 15 | 3 | 1.2 | - | 0.8 |
| ARG | 26 | 2 | -3.8 | -4.9 | -2.8 | GBR* | 201 | 52 | 5.6 | 10.0 | -2.1 | MYS | 41 | 7 | 2.1 | 1.4 | 3.2 |
| AUS* | 30 | 5 | 5.2 | 7.0 | 1.9 | GRC | 15 | 61 | 2.2 | 6.9 | -6.2 | NLD* | 66 | 68 | 3.1 | 6.3 | -2.5 |
| AUT | 30 | 98 | 0.5 | 0.0 | 1.1 | HKG | 25 | 29 | 2.4 | -3.0 | 12.2 | NOR* | 8 | 10 | 5.0 | 5.8 | 3.4 |
| BEL* | 40 | 78 | 4.2 | 5.7 | 1.5 | HRV | 42 | - | 0.4 | 1.5 | -2.2 | PHL | 4 | 12 | -3.8 | -6.6 | 1.2 |
| BGR | 26 | - | 2.8 | 6.8 | -4.4 | HUN | 71 | 24 | 3.9 | 10.9 | -7.3 | POL | 65 | 15 | 5.5 | 9.0 | 1.2 |
| BRA | 6 | - | 18.7 | - | 18.7 | IDN | 50 | 11 | -3.9 | -4.5 | -3.4 | PRT | 13 | 14 | 0.2 | 0.6 | -0.6 |
| CAN* | 74 | - | 4.6 | 5.3 | 3.2 | IND | - | 20 | 0.9 | - | 0.9 | RUS | 90 | 40 | 6.0 | 15.4 | -3.4 |
| CHE* | 306 | 131 | 1.7 | 0.9 | 3.2 | IRL* | 87 | 12 | 5.2 | 10.7 | -7.3 | SGP | 23 | 45 | 2.0 | -0.7 | 6.9 |
| CHN | 60 | 22 | 3.9 | - | 3.2 | ISR | - | 80 | 2.5 | 0.1 | 6.8 | SVK | 20 | 3 | 3.5 | - | 1.6 |
| COL | 9 | 6 | 0.4 | -3.1 | 6.8 | ITA* | 27 | 127 | 2.6 | 5.5 | -2.6 | SVN | 25 | 23 | 5.5 | 12.1 | 0.6 |
| CZE | 49 | 10 | 1.7 | - | 1.4 | JPN* | 3 | 199 | -3.4 | -3.8 | -2.5 | SWE* | - | 98 | 5.8 | 8.0 | 1.9 |
| DEU* | 130 | 422 | -1.3 | -1.6 | -0.7 | KAZ | 13 | 2 | -8.5 | - | -8.5 | THA | 18 | 4 | -1.8 | -1.6 | -2.4 |
| DNK* | 32 | 30 | 2.4 | 7.2 | -6.2 | KEN | 2 | - | 0.3 | 0.7 | -0.2 | TUR | 10 | 28 | -8.1 | - | -8.1 |
| EGY | 17 | - | -7.5 | -2.2 | - | KOR* | - | 2 | 0.5 | 0.5 | 0.3 | UKR | 57 | 4 | 10.2 | 34.7 | -19.2 |
| ESP* | 28 | 55 | 4.0 | 9.5 | -5.7 | LTU | 25 | 3 | 8.9 | 19.2 | -7.6 | USA* | 156 | 128 | 0.9 | 4.5 | -5.5 |
| EST | 12 | 4 | 5.2 | 33.4 | -11.7 | LUX | 174 | 40 | 5.5 | 7.6 | 0.7 | ZAF | 8 | 2 | 6.5 | 11.9 | -3.2 |
| FIN* | 8 | 5 | 4.4 | 6.8 | -0.1 | LVA | 21 | 6 | -6.1 | - | -6.1 | | | | | | |

## Table 1. Summary statistics

*Gross credit growth* is the growth rate of real gross loans, whereas *credit growth* the growth rate of real net loans. *Equity growth* is the growth rate of equity, *long-term funding growth is* the growth rate of long-term funding and *deposit growth* is the growth rate of a bank's customer and short term funding after dividing by the GDP deflator. *Net interest margin* is the net interest income over loans and other earning assets. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Internal funds* is the net income over lagged loans. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *Inflation* is the rate of change in consumer prices. *GDP growth* is the rate of real per capita GDP growth. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Real estate prices* is the lagged growth in real house price index. *Equity index* is the change in S&P Global Equity indices. *Interest rate* is the long-term government bond yields in percentages. *Exchange rate* is the growth rate of the real effective exchange rate. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank. *Banking crisis* is a dummy variable for countries experiencing a banking crisis. *Mortgages* is total mortgages over total net loans. *Profit* is the pretax profit over total assets. *Relative size* is the size –measured by assets- of subsidiary relative to its parent. *Net interest margin* is the net interest income over loans and other earning assets. *Contiguity* is a dummy variable for neighboring home and host countries, *Common language* is a dummy variable for home and host countries where a language is spoken by at least 9% of both countries' populations and *Distance* is geodesic distances (in '000 km) between the most important cities/agglomerations (in terms of population) of home and host countries. *Parent country securitization* is the total amount of asset-backed issues, mortgage-backed (including commercial) issues and collateralized debt obligations collateralized by assets of some kind in the parent country over GDP of the parent country.

 *Parent securitization number* is the number of those securitizations in the parent country plus 1 transformed in log. *Parent fiscal outlay* is the total fiscal cost of the recent financial crisis (2007-2011) (due to recapitalization, asset purchases and liquidity provision) for the parent country over GDP of the parent country. *Significant nationalization* is a dummy variable for parent countries where state takes control over important institutions during the previous year. *Real estate activity* is a categorical variable about under what the conditions banks can engage in real estate activities. It becomes 1 if unrestricted, 2 if permitted, 3 if restricted, 4 if prohibited. These variable explanations are the same for the variables regarding parent banks –named as **Parent *Variable Name***. Note that bank level variables are lagged one period.

| Variable | Obs | Mean | Std. | Dev. | Min |
|---|---|---|---|---|---|
| Gross credit growth | 24825 | 0.051 | 0.232 | -0.999 | 0.996 |
| Credit growth | 24834 | 0.049 | 0.237 | -0.999 | 0.999 |
| Equity growth | 24496 | 0.055 | 0.200 | -0.998 | 0.999 |
| Long-term funding growth | 14972 | -0.005 | 0.345 | -1.000 | 1.000 |
| Deposit growth | 24123 | 0.052 | 0.228 | -0.990 | 0.999 |
| Real estate prices | 24834 | 0.007 | 0.089 | -0.659 | 0.616 |
| Internal funds | 22741 | 0.026 | 0.089 | -0.985 | 1.000 |
| Profit | 24716 | 0.013 | 0.036 | -0.920 | 0.938 |
| Banking Crisis | 24834 | 0.488 | 0.500 | 0 | 1 |
| Assets | 24834 | 6.916 | 2.193 | -1.141 | 14.523 |
| Equity | 24834 | 0.121 | 0.120 | 0 | 1 |
| Liquidity | 24834 | 0.190 | 0.209 | 0 | 0.999 |
| GDP growth | 24834 | 1.117 | 3.028 | -17.545 | 14.040 |
| Inflation | 24834 | 2.935 | 2.696 | -4.480 | 26.240 |
| GDP per capita | 24834 | 27487.210 | 12600.160 | 402.629 | 56285.280 |
| Equity index | 24834 | 0.056 | 0.306 | -0.822 | 1.892 |
| Interest rate | 23953 | 4.378 | 1.760 | 1 | 15.75 |
| Exchange rate | 23605 | -0.005 | 0.043 | -0.161 | 0.296 |
| Foreign | 24834 | 0.116 | 0.320 | 0 | 1 |
| Foreign bank | 24834 | 0.109 | 0.312 | 0 | 1 |
| Parent real estate prices | 2718 | 0.012 | 0.075 | -0.479 | 0.576 |
| Parent Assets | 2718 | 11.010 | 2.263 | 1.609 | 14.753 |
| Parent Equity | 2718 | 0.104 | 0.162 | 0.002 | 1 |
| Parent Liquidity | 2718 | 0.265 | 0.168 | 0 | 0.998 |
| Parent lagged net interest margin | 2368 | 0.019 | 0.022 | -0.015 | 0.482 |
| Parent GDP growth | 2718 | 0.999 | 3.177 | -17.545 | 13.605 |
| Parent Inflation | 2718 | 2.222 | 2.218 | -4.480 | 25.232 |
| Parent GDP per capita | 2718 | 25240.350 | 10335.410 | 735.632 | 56285.280 |

| | | | | | |
|---|---|---|---|---|---|
| Parent banking crisis | 2718 | 0.418 | 0.493 | 0 | 1 |
| Parent profit | 2672 | 0.011 | 0.032 | -0.191 | 0.421 |
| Parent internal funds | 2310 | 0.024 | 0.079 | -0.324 | 0.925 |
| Parent Equity index | 2718 | 0.029 | 0.342 | -0.822 | 1.386 |
| Parent exchange rate | 2567 | 0.002 | 0.042 | -0.161 | 0.154 |
| Parent interest rate | 2654 | 4.132 | 1.847 | 1 | 15.75 |
| Relative size | 2672 | 0.144 | 0.467 | 0.000 | 4.926 |
| Parent Mortgages | 526 | 0.222 | 0.199 | 0 | 0.996 |
| Contiguity | 2723 | 0.288 | 0.453 | 0 | 1 |
| Common language | 2723 | 0.233 | 0.423 | 0 | 1 |
| Distance | 2723 | 3.284 | 3.714 | 0.060 | 18.550 |
| Parent country securitization | 2723 | 0.011 | 0.023 | 0 | 0.150 |
| Parent securitization number | 2723 | 2.301 | 1.826 | 0 | 8.006 |
| Parent fiscal outlay | 2723 | 1.675 | 4.451 | 0 | 40.7 |
| Significant nationalization | 2723 | 0.050 | 0.217 | 0 | 1 |
| Positive parent real estate prices | 2718 | 0.032 | 0.053 | 0 | 0.576 |
| Negative parent real estate prices | 2718 | -0.020 | 0.039 | -0.479 | 0 |
| Parent real estate activity | 2027 | 2.268 | 1.310 | 0 | 4 |

## Table 2. Comparison of parent banks and foreign subsidiaries

*Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Internal funds* is the net income over lagged loans. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *Inflation* is the rate of change in consumer prices. *GDP growth* is the rate of real per capita GDP growth. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Real estate prices* is the lagged growth in real house price index. *Equity index* is the change in S&P Global Equity indices. *Banking crisis* is a dummy variable for countries experiencing a banking crisis. *Mortgages* is total mortgages over total net loans. *Profit* is the pretax profit over total assets. Positive t-test statistics mean that foreign bank subsidiaries have statistically larger mean values (and vice versa). *, ** and *** denote significance at 10%, 5% and 1%.

| Variable | Foreign bank subsidiaries | | Parent Banks | | |
| --- | --- | --- | --- | --- | --- |
| | Obs | Mean | Obs | Mean | ttest |
| Real estate prices | 2718 | 0.020 | 2718 | 0.012 | 1.678** |
| Assets | 2718 | 7.134 | 2718 | 11.010 | -85.456*** |
| Equity | 2718 | 0.132 | 2718 | 0.104 | 7.691*** |
| Liquidity | 2718 | 0.298 | 2718 | 0.265 | 5.559*** |
| GDP growth | 2718 | 1.519 | 2718 | 0.999 | 8.082*** |
| Inflation | 2718 | 3.257 | 2718 | 2.222 | 15.833*** |
| GDP per capita | 2718 | 23403.610 | 2718 | 25240.350 | -5.583*** |
| Banking crisis | 2718 | 0.355 | 2718 | 0.418 | -7.038*** |
| Profit | 2687 | 0.011 | 2672 | 0.011 | 0.989 |
| Internal funds | 2361 | 0.032 | 2310 | 0.024 | 5.56*** |
| Equity index | 2718 | 0.060 | 2718 | 0.029 | 6.3*** |
| Mortgages | 515 | 0.221 | 526 | 0.222 | -0.031 |

# Table 3. Correlations for credit growth, house and stock market prices, banking crisis and funding variables

*Gross credit growth* is the growth rate of real gross loans. *Equity growth* is the growth rate of real equity, *long-term funding growth* is the growth rate of long-term funding and *Deposit growth* is Growth rate of a bank's customer and short term funding after dividing by the GDP deflator. *Net interest margin* is the net interest income over loans and other earning assets. *Real estate prices* is the lagged growth in real house price index. *Equity index* is the change in S&P Global Equity indices. *Real estate activity* is a categorical variable about under what the conditions banks can engage in real estate activities. It becomes 1 if unrestricted, 2 if permitted, 3 if restricted , 4 if prohibited. *Banking crisis* is a dummy variable for countries experiencing a banking crisis. Only foreign bank subsidiaries are included. *, ** and *** denote significance at 10%, 5% and 1%.

| | Gross credit growth | Parent real estate prices | Real estate prices | Equity index | Parent Equity index | Real estate activity | Parent real estate activity | Banking Crisis | Parent banking crisis |
|---|---|---|---|---|---|---|---|---|---|
| Gross credit growth | 1 | | | | | | | | |
| Parent real estate prices | 0.089*** | 1 | | | | | | | |
| Real estate prices | 0.130*** | 0.234*** | 1 | | | | | | |
| Equity index | 0.095*** | 0.222*** | 0.186*** | 1 | | | | | |
| Parent Equity index | 0.077*** | 0.239*** | 0.147*** | 0.712*** | 1 | | | | |
| Real estate activity | 0.064*** | -0.003 | -0.083*** | 0.038*** | -0.022 | 1 | | | |
| Parent real estate activity | 0.041** | -0.133*** | -0.036** | 0.011 | 0.037** | -0.050*** | 1 | | |
| Banking Crisis | -0.121*** | -0.244*** | -0.385*** | -0.154*** | -0.147*** | -0.056*** | 0.079*** | 1 | |
| Parent banking crisis | -0.144*** | -0.382*** | -0.334*** | -0.192*** | -0.246*** | 0.087*** | -0.042*** | 0.462*** | 1 |

| | Gross credit growth | Equity growth | Long-term funding | Deposit growth | NIM | Parent real estate prices | Real estate prices |
|---|---|---|---|---|---|---|---|
| Gross credit growth | 1 | | | | | | |
| Equity growth | 0.302*** | 1 | | | | | |
| Long-term funding | 0.285*** | 0.166*** | 1 | | | | |
| Deposit growth | 0.499*** | 0.263*** | 0.150*** | 1 | | | |
| Net interest margin | 0.003 | 0.015 | -0.015 | -0.042*** | 1 | | |
| Parent real estate prices | 0.089*** | 0.092*** | 0.057** | 0.098*** | -0.023 | 1 | |
| Real estate prices | 0.130*** | 0.141*** | 0.102*** | 0.159*** | -0.182*** | 0.234*** | 1 |

## Table 4. Benchmark regressions with House prices and other parent controls

The dependent variable is *Gross credit growth*, which is the growth rate of real gross loans. *Real estate prices* is the lagged growth in real house price index. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. Same variables are included for parent banks and in full sample regressions parent bank variables are interactions with foreign bank dummy. Bank-level variables are lagged one period. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank. We estimate all regressions using year fixed effects. In regressions 1, 2, 3, 4, 9 and 10, bank fixed effects and robust standard errors are used, whereas in regressions 5 and 6 country fixed effects and bank-level clustered standard errors are used. In regressions 9 and 10, domestic real estate prices are instrumented by domestic population growth and bank regulation regarding real estate activity. In regression 7, two-step GMM difference estimator, and in regression 8, two-step GMM system estimator are used. Regarding the validity of instrumentation Hansen's J test for overidentifying restrictions and Arellano and Bond test for autocorrelation of order 2 are provided for the dynamic panel regressions, where only foreign bank subsidiaries are included.   *, ** and *** denote significance at 10%, 5% and 1%.

| | Bank FE | | |Credit growth|<0.5 | | POLS | | Dynamic Panel | | Domestic Real estate prices IV | |
| | Foreign | Full sample | Foreign | Full sample | Foreign | Full sample | Difference | System | Foreign | Full sample |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| | | | | | Dependent variable: Gross credit growth | | | | | |
| Real estate prices | 0.066 | 0.075*** | 0.038 | 0.021 | 0.118 | 0.080*** | 0.011 | -0.030 | -0.228 | -3.485 |
| | (0.076) | (0.029) | (0.059) | (0.022) | (0.074) | (0.028) | (0.090) | (0.077) | (1.503) | (2.370) |
| Parent real estate prices | 0.257** | 0.300*** | 0.205** | 0.232*** | 0.149 | 0.170* | 0.315** | 0.253** | 0.282* | 0.691** |
| | (0.112) | (0.103) | (0.085) | (0.079) | (0.099) | (0.092) | (0.140) | (0.117) | (0.162) | (0.338) |
| Assets | -0.123*** | -0.115*** | -0.050** | -0.070*** | -0.005 | -0.001 | -0.134** | -0.003 | -0.125*** | -0.126*** |
| | (0.026) | (0.009) | (0.020) | (0.006) | (0.005) | (0.001) | (0.056) | (0.009) | (0.027) | (0.016) |
| Equity | -0.031 | -0.047 | 0.013 | 0.009 | 0.031 | -0.083*** | 0.216 | 0.017 | -0.083 | -0.301 |
| | (0.183) | (0.071) | (0.136) | (0.051) | (0.078) | (0.022) | (0.289) | (0.119) | (0.304) | (0.212) |
| Liquidity | 0.356*** | 0.265*** | 0.283*** | 0.152*** | 0.064* | 0.031** | 0.277* | -0.026 | 0.363*** | 0.337*** |
| | (0.082) | (0.031) | (0.058) | (0.021) | (0.035) | (0.013) | (0.147) | (0.057) | (0.092) | (0.066) |
| GDP growth | 0.011*** | 0.012*** | 0.008*** | 0.010*** | 0.012*** | 0.012*** | 0.009** | 0.016*** | 0.015 | 0.050* |
| | (0.003) | (0.001) | (0.002) | (0.001) | (0.003) | (0.001) | (0.004) | (0.003) | (0.023) | (0.026) |
| Inflation | 0.010** | -0.001 | 0.008*** | -0.000 | 0.007* | -0.005*** | 0.009* | 0.002 | 0.013 | 0.043 |
| | (0.004) | (0.002) | (0.003) | (0.001) | (0.004) | (0.002) | (0.005) | (0.003) | (0.016) | (0.029) |
| GDP per capita | -0.000 | 0.000*** | 0.000 | 0.000*** | -0.000 | 0.000*** | -0.000 | -0.000 | -0.000 | 0.000* |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Equity index | -0.034 | 0.043*** | -0.015 | 0.046*** | -0.016 | 0.060*** | -0.072* | -0.015 | -0.041 | -0.009 |
| | (0.036) | (0.010) | (0.026) | (0.008) | (0.032) | (0.010) | (0.039) | (0.033) | (0.048) | (0.041) |
| Parent Assets | 0.002 | -0.004 | -0.003 | -0.003 | -0.003 | -0.006* | -0.003 | -0.002 | 0.003 | 0.009 |
| | (0.009) | (0.006) | (0.008) | (0.005) | (0.003) | (0.003) | (0.008) | (0.004) | (0.011) | (0.013) |
| Parent equity | 0.025 | 0.017 | -0.107 | -0.126** | 0.040 | 0.034 | -0.044 | 0.009 | 0.028 | 0.052 |
| | (0.090) | (0.077) | (0.071) | (0.054) | (0.047) | (0.048) | (0.122) | (0.062) | (0.095) | (0.133) |
| Parent Liquidity | 0.079 | 0.110* | 0.046 | 0.064 | 0.029 | 0.041 | 0.321** | -0.031 | 0.070 | 0.100 |
| | (0.070) | (0.061) | (0.060) | (0.049) | (0.036) | (0.035) | (0.128) | (0.070) | (0.071) | (0.103) |
| Parent  GDP growth | -0.000 | 0.008*** | -0.001 | 0.004** | 0.002 | 0.006*** | -0.004 | 0.001 | 0.000 | 0.006 |
| | (0.004) | (0.002) | (0.003) | (0.002) | (0.003) | (0.002) | (0.005) | (0.004) | (0.004) | (0.004) |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Parent Inflation | -0.005 | -0.000 | 0.001 | 0.004 | 0.006 | 0.007** | -0.005 | 0.004 | -0.005 | 0.003 |
| | (0.007) | (0.005) | (0.005) | (0.004) | (0.004) | (0.004) | (0.008) | (0.005) | (0.007) | (0.010) |
| Parent GDP per capita | -0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.000 | -0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Parent Equity index | 0.032 | 0.042** | 0.025 | 0.045*** | 0.011 | 0.022 | 0.078** | 0.047 | 0.024 | -0.033 |
| | (0.037) | (0.019) | (0.028) | (0.015) | (0.036) | (0.018) | (0.039) | (0.037) | (0.052) | (0.058) |
| Foreign | | -0.066 | | -0.012 | | -0.052** | | | | 0.033 |
| | | (0.059) | | (0.032) | | (0.022) | | | | (0.119) |
| Foreign bank | | 0.084 | | 0.053 | | 0.071 | | | | -0.129 |
| | | (0.097) | | (0.069) | | (0.051) | | | | (0.229) |
| Lagged gross credit growth | | | | | | | -0.081** | 0.166*** | | |
| | | | | | | | (0.035) | (0.031) | | |
| N | 2345 | 23290 | 2005 | 21680 | 2723 | 24862 | 1372 | 2338 | 2328 | 23238 |
| R-sq | 0.181 | 0.127 | 0.187 | 0.153 | 0.147 | 0.104 | | | 0.172 | -1.049 |
| Number of banks | 603 | 4874 | 544 | 4618 | | | 502 | 880 | | |
| Number of instruments | | | | | | | 551 | 758 | | |
| AB test AR2 | | | | | | | 0.752 | 0.222 | | |
| Hansen p-value | | | | | | | 1.000 | 1.000 | | |
| First stage F stat | | | | | | | | | 0.685 | 3.486 |
| OIR test | | | | | | | | | 0.748 | 0.167 |
| Underidentification test | | | | | | | | | 0.519 | 0.032 |

# Table 5. Alternative dependent variables: Net credit growth and equity growth

The dependent variable is *net credit growth*, which is the growth rate of real net loans in regressions 1-6 and equity growth in regressions 7-12. *Real estate prices* is the lagged growth in real house price index. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. Same variables are included for parent banks. Bank-level variables are lagged one period. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank. We estimate all regressions using year fixed effects. In Bank FE regressions, bank fixed effects are used together with robust standard errors whereas in POLS regressions country fixed effects and bank-level clustered standard errors are used. In regressions 5 and 11, two-step GMM difference estimator and in regression 6 and 12 two-step GMM system estimator are used. Regarding the validity of instrumentation Hansen's J test for overidentifying restrictions and Arellano and Bond test for autocorrelation of order 2 are provided for the dynamic panel regressions, where only foreign bank subsidiaries are included. *, ** and *** denote significance at 10%, 5% and 1%.

| | Bank FE | | POLS | | Dynamic Panel | | Bank FE | | POLS | | Dynamic Panel | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Foreign | Full sample | Foreign | Full sample | Difference | System | Foreign | Full sample | Foreign | Full sample | Difference | System |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| | Dependent Variable: Net credit growth | | | | | | Dependent variable: Equity growth | | | | | |
| Real estate prices | 0.072 | 0.090*** | 0.115 | 0.096*** | 0.015 | -0.015 | 0.113* | 0.071*** | 0.136*** | 0.083*** | 0.169** | 0.148*** |
| | (0.079) | (0.030) | (0.078) | (0.029) | (0.099) | (0.081) | (0.058) | (0.024) | (0.046) | (0.022) | (0.079) | (0.053) |
| Parent real estate prices | 0.241** | 0.292*** | 0.134 | 0.152 | 0.279** | 0.233* | 0.099 | 0.093 | 0.104* | 0.109* | 0.236** | 0.194** |
| | (0.113) | (0.104) | (0.101) | (0.094) | (0.137) | (0.123) | (0.082) | (0.075) | (0.061) | (0.056) | (0.110) | (0.088) |
| Assets | -0.120*** | -0.114*** | -0.005 | -0.001 | -0.139** | -0.006 | -0.092*** | -0.113*** | -0.004 | 0.001* | -0.191*** | -0.012** |
| | (0.026) | (0.009) | (0.005) | (0.001) | (0.056) | (0.009) | (0.015) | (0.007) | (0.003) | (0.001) | (0.043) | (0.006) |
| Equity | 0.044 | -0.026 | 0.043 | -0.084*** | 0.347 | 0.041 | -0.699*** | -0.770*** | -0.146*** | -0.099*** | -1.159*** | -0.250*** |
| | (0.186) | (0.072) | (0.080) | (0.022) | (0.299) | (0.118) | (0.089) | (0.039) | (0.032) | (0.009) | (0.229) | (0.063) |
| Liquidity | 0.361*** | 0.294*** | 0.071** | 0.039*** | 0.321** | -0.039 | 0.015 | 0.003 | -0.011 | -0.000 | 0.088 | 0.010 |
| | (0.083) | (0.031) | (0.036) | (0.013) | (0.143) | (0.058) | (0.042) | (0.018) | (0.018) | (0.007) | (0.096) | (0.034) |
| GDP growth | 0.014*** | 0.013*** | 0.015*** | 0.013*** | 0.014*** | 0.019*** | 0.010*** | 0.011*** | 0.009*** | 0.011*** | 0.008** | 0.008*** |
| | (0.003) | (0.001) | (0.003) | (0.001) | (0.005) | (0.003) | (0.003) | (0.001) | (0.003) | (0.001) | (0.004) | (0.002) |
| Inflation | 0.008* | -0.003 | 0.005 | -0.007*** | 0.008 | 0.000 | 0.005 | 0.003 | 0.005 | 0.001 | 0.002 | 0.000 |
| | (0.004) | (0.002) | (0.004) | (0.002) | (0.005) | (0.003) | (0.004) | (0.002) | (0.003) | (0.001) | (0.005) | (0.003) |
| GDP per capita | -0.000 | 0.000*** | -0.000 | 0.000*** | -0.000 | -0.000 | -0.000*** | 0.000* | -0.000*** | -0.000 | -0.000** | -0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Equity index | -0.044 | 0.040*** | -0.025 | 0.058*** | -0.075* | -0.023 | 0.125*** | 0.138*** | 0.140*** | 0.150*** | 0.067** | 0.105*** |
| | (0.036) | (0.011) | (0.033) | (0.010) | (0.041) | (0.034) | (0.026) | (0.009) | (0.025) | (0.009) | (0.030) | (0.026) |
| Parent Assets | 0.002 | -0.003 | -0.003 | -0.006* | -0.000 | -0.002 | 0.006 | 0.007 | 0.000 | -0.001 | -0.003 | 0.004 |
| | (0.009) | (0.006) | (0.003) | (0.003) | (0.008) | (0.004) | (0.007) | (0.005) | (0.002) | (0.002) | (0.006) | (0.003) |
| Parent equity | 0.029 | 0.015 | 0.041 | 0.034 | -0.046 | 0.017 | 0.029 | 0.056 | 0.094*** | 0.084*** | 0.071 | 0.084 |
| | (0.092) | (0.078) | (0.048) | (0.049) | (0.108) | (0.065) | (0.069) | (0.057) | (0.031) | (0.030) | (0.100) | (0.056) |
| Parent Liquidity | 0.084 | 0.114* | 0.035 | 0.045 | 0.325** | -0.043 | 0.110* | 0.128** | 0.061** | 0.060*** | 0.138 | 0.047 |
| | (0.071) | (0.062) | (0.037) | (0.036) | (0.142) | (0.070) | (0.059) | (0.051) | (0.024) | (0.023) | (0.115) | (0.050) |
| Parent GDP growth | -0.000 | 0.008*** | 0.003 | 0.006*** | -0.003 | 0.001 | 0.004 | 0.001 | 0.002 | 0.000 | 0.006* | 0.005* |
| | (0.004) | (0.002) | (0.003) | (0.002) | (0.005) | (0.004) | (0.003) | (0.002) | (0.002) | (0.002) | (0.003) | (0.003) |
| Parent Inflation | -0.004 | -0.000 | 0.006 | 0.007* | -0.005 | 0.004 | 0.007 | 0.006 | 0.004 | 0.003 | 0.006 | 0.007** |
| | (0.007) | (0.005) | (0.004) | (0.004) | (0.008) | (0.005) | (0.005) | (0.004) | (0.003) | (0.003) | (0.007) | (0.003) |

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parent GDP per capita | -0.000 | 0.000 | 0.000 | 0.000 | -0.000 | 0.000 | -0.000 | 0.000 | -0.000 | -0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Parent Equity index | 0.014 | 0.035* | 0.004 | 0.021 | 0.058 | 0.043 | 0.003 | 0.009 | -0.032 | -0.008 | -0.028 | -0.072** |
| | (0.039) | (0.020) | (0.038) | (0.019) | (0.041) | (0.039) | (0.028) | (0.014) | (0.026) | (0.013) | (0.034) | (0.032) |
| Foreign | | -0.071 | | -0.052** | | | | -0.011 | | 0.001 | | |
| | | (0.059) | | (0.023) | | | | (0.042) | | (0.019) | | |
| Foreign bank | | 0.083 | | 0.077 | | | | -0.105 | | -0.010 | | |
| | | (0.097) | | (0.051) | | | | (0.076) | | (0.036) | | |
| Lagged credit growth | | | | | -0.067* | 0.159*** | | | | | | |
| | | | | | (0.037) | (0.031) | | | | | | |
| Lagged equity growth | | | | | | | | | | | -0.132*** | 0.064** |
| | | | | | | | | | | | (0.031) | (0.028) |
| N | 2340 | 23264 | 2718 | 24834 | 1366 | 2331 | 2699 | 25337 | 3108 | 26953 | 1626 | 2718 |
| R-sq | 0.187 | 0.130 | 0.151 | 0.105 | | | 0.189 | 0.157 | 0.171 | 0.120 | | |
| Number of banks | 602 | 4871 | | | 500 | 878 | 677 | 5266 | | | 579 | 982 |
| Number of instruments | | | | | 551 | 758 | | | | | 557 | 761 |
| AB test AR2 | | | | | 0.607 | 0.317 | | | | | 0.013 | 0.683 |
| Hansen p-value | | | | | 1.000 | 1.000 | | | | | 0.995 | 0.999 |

## Table 6. Robustness checks

The dependent variable is *Gross credit growth*, which is the growth rate of real gross loans. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank –these dummies are only included in full sample regressions. *Interest rate* is the long-term government bond yields in percentages. *Exchange rate* is the growth rate of the real effective exchange rate. Same variables are included for parent banks, the benchmark controls are not reported in the table. *Real estate prices* is the lagged growth in real house price index. Bank-level variables are lagged one period. We estimate all regressions using bank and year fixed effects –except regressions 11 and 12 where country-year fixed effects are used- and robust standard errors. In regressions 5 and 6 only observations after 2001 are included. In regressions 7 and 8, foreign bank subsidiaries are matched with domestic banks at country-year level using propensity scoring based on size, equity and liquidity. In regressions 13 and 14 only observations from Dallas FED sample are included. Odd numbered regressions are only with foreign subsidiaries and even numbered regressions are with full sample. *, ** and *** denote significance at 10%, 5% and 1%.

| | Macro | | Lagged Dependent | | After 2001 | | PS matching (1to1) | | Country Level SE clustering | | Country-Year FE | | Dallas FED sample | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Foreign | Full sample | Foreign | Full sample | Foreign | Full sample | Foreign | Full sample | Foreign | Full sample | Foreign | Full sample | Foreign | Full sample |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| | | | | | | | Dependent variable: Gross credit growth | | | | | | | |
| Real estate prices | -0.096 | 0.001 | 0.073 | 0.072** | 0.098 | 0.070** | -0.207 | -0.129 | 0.066 | 0.075 | | | -0.201 | -0.049 |
| | (0.113) | (0.062) | (0.082) | (0.030) | (0.079) | (0.030) | (0.183) | (0.122) | (0.093) | (0.050) | | | (0.260) | (0.105) |
| Parent real estate prices | 0.292* | 0.345** | 0.368*** | 0.405*** | 0.246** | 0.284*** | 0.283* | 0.323** | 0.257*** | 0.300*** | 0.211* | 0.200* | 0.397 | 0.538** |
| | (0.161) | (0.147) | (0.110) | (0.102) | (0.111) | (0.104) | (0.146) | (0.144) | (0.093) | (0.083) | (0.128) | (0.113) | (0.285) | (0.243) |
| Foreign | | -0.084 | | -0.088 | | -0.097 | | -0.356* | | -0.066 | | -0.075 | | -0.130 |
| | | (0.200) | | (0.061) | | (0.068) | | (0.212) | | (0.072) | | (0.065) | | (0.232) |
| Foreign bank | | -0.071 | | 0.169* | | 0.102 | | 0.280 | | 0.084 | | 0.074 | | 0.115 |
| | | (0.209) | | (0.099) | | (0.110) | | (0.214) | | (0.112) | | (0.104) | | (0.258) |
| Lagged credit growth | | | -0.026 | -0.024* | | | | | | | | | | |
| | | | (0.035) | (0.013) | | | | | | | | | | |
| Exchange Rate | 0.196 | 0.359*** | | | | | | | | | | | | |
| | (0.166) | (0.075) | | | | | | | | | | | | |
| Parent exchange rate | 0.157 | 0.080 | | | | | | | | | | | | |
| | (0.184) | (0.171) | | | | | | | | | | | | |
| Interest rate | -0.029*** | -0.021*** | | | | | | | | | | | | |
| | (0.009) | (0.006) | | | | | | | | | | | | |
| Parent interest rate | -0.006 | -0.002 | | | | | | | | | | | | |
| | (0.009) | (0.006) | | | | | | | | | | | | |
| N | 1705 | 9899 | 1971 | 21153 | 2071 | 21267 | 1261 | 2839 | 2345 | 23290 | 2723 | 24862 | 991 | 8619 |
| R-sq | 0.162 | 0.155 | 0.183 | 0.136 | 0.210 | 0.139 | 0.176 | 0.131 | 0.181 | 0.127 | 0.378 | 0.220 | 0.112 | 0.144 |
| Number of banks | 438 | 2199 | 513 | 4497 | 542 | 4592 | 322 | 819 | 603 | 4874 | 981 | 6446 | 243 | 1859 |

## Table 7. Alternative specifications

The dependent variable is *Gross credit growth*, which is the growth rate of real gross loans. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank –these dummies are only included in full sample regressions. Same variables are included for parent banks, these benchmark controls are not reported in the table. *Real estate prices* is the lagged growth in real house price index. *Internal funds* is the net income over lagged loans. *Profit* is the pretax profit over total assets. *Net interest margin* is the net interest income over loans and other earning assets. *Parent mortgages* is total mortgages over total net loans of the parent. *Relative size* is the size –measured by assets- of subsidiary relative to its parent. Bank-level variables are lagged one period. We estimate all regressions using bank and year fixed effects and robust standard errors. Odd numbered regressions are only with foreign subsidiaries and even numbered regressions are with full sample. *, ** and *** denote significance at 10%, 5% and 1%.

| | Foreign (1) | Full sample (2) | Foreign (3) | Full sample (4) | Foreign (5) | Full sample (6) | Foreign (7) | Full sample (8) | Foreign (9) | Full sample (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dependent variable: Gross credit growth | | | | | | | | | |
| Real estate prices | 0.133 | 0.077** | 0.079 | 0.058* | 0.065 | 0.056 | 0.126 | 0.076** | 0.060 | 0.075*** |
| | (0.088) | (0.030) | (0.086) | (0.030) | (0.076) | (0.055) | (0.216) | (0.031) | (0.076) | (0.029) |
| Parent real estate prices | 0.248** | 0.336*** | 0.169 | 0.261** | 0.270** | 0.240** | 0.858* | 0.843** | 0.183 | 0.272** |
| | (0.122) | (0.110) | (0.139) | (0.123) | (0.117) | (0.110) | (0.455) | (0.419) | (0.130) | (0.123) |
| Internal funds X Parent internal funds | -0.825 | -0.842 | | | | | | | | |
| | (0.769) | (0.744) | | | | | | | | |
| Internal funds | 0.015 | 0.098** | | | | | | | | |
| | (0.140) | (0.047) | | | | | | | | |
| Parent internal funds | -0.068 | -0.021 | | | | | | | | |
| | (0.120) | (0.104) | | | | | | | | |
| Profit | | | 0.602** | 0.401*** | | | | | | |
| | | | (0.294) | (0.140) | | | | | | |
| Net interest margin | | | -1.325* | -0.928*** | | | | | | |
| | | | (0.747) | (0.185) | | | | | | |
| Parent profit | | | 0.334 | 0.697 | | | | | | |
| | | | (0.593) | (0.554) | | | | | | |
| Parent net interest margin | | | -0.925 | -0.148 | | | | | | |
| | | | (0.720) | (0.635) | | | | | | |
| Relative size | | | | | 0.017 | -0.005 | | | | |
| | | | | | (0.039) | (0.034) | | | | |
| Relative size X Parent real estate prices | | | | | -0.281* | -0.041 | | | | |
| | | | | | (0.147) | (0.073) | | | | |
| Parent mortgages | | | | | | | -0.554 | 0.078 | | |
| | | | | | | | (0.344) | (0.136) | | |
| Parent mortgages X Parent real estate prices | | | | | | | -2.537 | -1.805 | | |
| | | | | | | | (1.905) | (1.447) | | |

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Parent equity X Parent real estate prices | | | | | | | | | 0.677 | 0.243 |
| | | | | | | | | | (0.672) | (0.636) |
| Foreign | | -0.055 | | -0.005 | | -0.084 | | 0.062 | | -0.067 |
| | | (0.056) | | (0.068) | | (0.152) | | (0.068) | | (0.059) |
| Foreign bank | | 0.085 | | -0.142 | | 0.092 | | -0.074 | | 0.085 |
| | | (0.108) | | (0.129) | | (0.170) | | (0.267) | | (0.097) |
| N | 1775 | 20974 | 1595 | 20701 | 2300 | 9767 | 413 | 21267 | 2345 | 23290 |
| R-sq | 0.200 | 0.141 | 0.192 | 0.146 | 0.183 | 0.159 | 0.242 | 0.123 | 0.181 | 0.127 |
| Number of banks | 463 | 4444 | 411 | 4278 | 590 | 2247 | 122 | 4421 | 603 | 4874 |

## Table 8. Information channel and securitization

The dependent variable is *Gross credit growth*, which is the growth rate of real gross loans. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank –these dummies are only included in full sample regressions. Same variables are included for parent banks, these benchmark controls are not reported in the table. *Real estate prices* is the lagged growth in real house price index. *Contiguity* is a dummy variable for neighboring home and host countries, *Common language* is a dummy variable for home and host countries where a language is spoken by at least 9% of both countries' populations and *Distance* is geodesic distances (in '000 km) between the most important cities/agglomerations (in terms of population) of home and host countries. *Parent country securitization* is the total amount of asset-backed issues, mortgage-backed (including commercial) issues and collateralized debt obligations collateralized by assets of some kind in the parent country over GDP of the parent country. *Parent securitization number* is the number of those securitizations in the parent country plus 1 transformed in log. Bank-level variables are lagged one period. We estimate all regressions using bank and year fixed effects and robust standard errors. Odd numbered regressions are only with foreign subsidiaries and even numbered regressions are with full sample. *, ** and *** denote significance at 10%, 5% and 1%.

| | Foreign (1) | Full sample (2) | Foreign (3) | Full sample (4) | Foreign (5) | Full sample (6) | Foreign (7) | Full sample (8) | Foreign (9) | Full sample (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dependent variable: Gross credit growth | | | | | |
| Real estate prices | 0.070 | 0.075*** | 0.058 | 0.073** | 0.066 | 0.071 | 0.068 | 0.075*** | 0.061 | 0.075*** |
| | (0.075) | (0.029) | (0.076) | (0.029) | (0.076) | (0.050) | (0.075) | (0.029) | (0.075) | (0.029) |
| Parent real estate prices | 0.360*** | 0.356*** | 0.358*** | 0.409*** | 0.293** | 0.314** | 0.227** | 0.321*** | 0.308** | 0.350*** |
| | (0.120) | (0.113) | (0.132) | (0.122) | (0.140) | (0.133) | (0.115) | (0.107) | (0.121) | (0.116) |
| Contiguity X Parent real estate prices | -0.319** | -0.167 | | | | | | | | |
| | (0.158) | (0.167) | | | | | | | | |
| Common language X Parent real estate prices | | | -0.307* | -0.351** | | | | | | |
| | | | (0.174) | (0.162) | | | | | | |
| Distance X Parent real estate prices | | | | | -0.013 | -0.011 | | | | |
| | | | | | (0.028) | (0.027) | | | | |
| Parent country securitization | | | | | | | -2.182*** | -0.708 | | |
| | | | | | | | (0.597) | (0.526) | | |
| Parent country securitization X Parent real estate prices | | | | | | | 11.714 | -0.522 | | |
| | | | | | | | (7.466) | (7.084) | | |
| Parent securitization number | | | | | | | | | -0.031*** | -0.002 |
| | | | | | | | | | (0.011) | (0.008) |
| Parent securitization number X Parent real estate prices | | | | | | | | | -0.008 | -0.037 |
| | | | | | | | | | (0.065) | (0.060) |
| Foreign | | -0.067 | | -0.066 | | -0.090 | | -0.065 | | -0.066 |
| | | (0.059) | | (0.059) | | (0.141) | | (0.059) | | (0.059) |
| Foreign bank | | 0.082 | | 0.080 | | 0.070 | | 0.084 | | 0.091 |
| | | (0.097) | | (0.097) | | (0.144) | | (0.097) | | (0.098) |
| N | 2345 | 23290 | 2345 | 23290 | 2345 | 10818 | 2345 | 23290 | 2345 | 23290 |
| R-sq | 0.182 | 0.127 | 0.182 | 0.127 | 0.181 | 0.154 | 0.186 | 0.127 | 0.184 | 0.127 |
| Number of banks | 603 | 4874 | 603 | 4874 | 603 | 2434 | 603 | 4874 | 603 | 4874 |

## Table 9. Financial crisis regressions: Nationalizations, banking crises and recent global crisis

The dependent variable is *Gross credit growth*, which is the growth rate of real gross loans. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank –these dummies are only included in full sample regressions. Same variables are included for parent banks, the benchmark controls are not reported in the table. *Real estate prices* is the lagged growth in real house price index. *Parent fiscal outlay* is the total fiscal cost of the recent financial crisis (2007-2011) (due to recapitalization, asset purchases and liquidity provision) for the parent country over GDP of the parent country. *Significant nationalization* is a dummy variable for parent countries where state takes control over important institutions during the previous year. *(Parent) Banking crisis* is a dummy variable for (parent) countries experiencing a banking crisis. Bank-level variables are lagged one period. We estimate all regressions using bank and year fixed effects and robust standard errors. Odd numbered regressions are only with foreign subsidiaries and even numbered regressions are with full sample. *, ** and *** denote significance at 10%, 5% and 1%.

| | Foreign (1) | Full sample (2) | Foreign (3) | Full sample (4) | Foreign (5) | Full sample (6) |
|---|---|---|---|---|---|---|
| | | | Dependent variable: Gross credit growth | | | |
| Real estate prices | 0.063 | 0.073** | 0.064 | 0.072** | 0.063 | 0.034 |
| | (0.076) | (0.029) | (0.076) | (0.029) | (0.076) | (0.028) |
| Parent real estate prices | 0.249** | 0.286*** | 0.277** | 0.313*** | 0.236** | 0.220** |
| | (0.113) | (0.105) | (0.114) | (0.105) | (0.113) | (0.107) |
| Parent fiscal outlay | -0.007 | -0.022* | | | | |
| | (0.013) | (0.012) | | | | |
| Parent fiscal outlay X Parent real estate prices | -0.003 | -0.006** | | | | |
| | (0.003) | (0.002) | | | | |
| Significant Nationalization | | | -0.032 | -0.023*** | | |
| | | | (0.032) | (0.008) | | |
| Significant Nationalization X Parent real estate prices | | | -0.233 | -0.238 | | |
| | | | (0.283) | (0.297) | | |
| Banking Crisis | | | | | -0.033 | -0.070*** |
| | | | | | (0.030) | (0.008) |
| Parent Banking Crisis | | | | | -0.040 | -0.077*** |
| | | | | | (0.030) | (0.019) |
| Foreign | | -0.069 | | -0.068 | | -0.081 |
| | | (0.059) | | (0.059) | | (0.059) |
| Foreign bank | | 0.078 | | 0.083 | | 0.082 |
| | | (0.097) | | (0.097) | | (0.095) |
| N | 2345 | 23290 | 2345 | 23290 | 2345 | 23290 |
| R-sq | 0.181 | 0.127 | 0.181 | 0.127 | 0.182 | 0.133 |
| Number of banks | 603 | 4874 | 603 | 4874 | 603 | 4874 |

**Table 10. Bank regulation on real estate activities and house price transmission**

The dependent variable is *Gross credit growth*, which is the growth rate of real gross loans. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank –these dummies are only included in full sample regressions. Same variables are included for parent banks, these benchmark controls are not reported in the table. *Real estate prices* is the lagged growth in real house price index. *Real estate activity* is a categorical variable about under what the conditions banks can engage in real estate activities. It becomes 1 if unrestricted, 2 if permitted, 3 if restricted, 4 if prohibited. Bank-level variables are lagged one period. We estimate all regressions using bank and year fixed effects and robust standard errors. Odd numbered regressions are only with foreign subsidiaries and even numbered regressions are with full sample. Regarding the validity of instrumentation Hansen's J test for overidentifying restrictions and Arellano and Bond test for autocorrelation of order 2 are provided for the dynamic panel regressions.   *, ** and *** denote significance at 10%, 5% and 1%.

| | Bank FE | | POLS | | Dynamic Panel | |
|---|---|---|---|---|---|---|
| | Foreign | Full sample | Foreign | Full sample | Difference | System |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Dependent variable: Gross credit growth | | | | | |
| Real estate prices | 0.091 | 0.036 | 0.123 | 0.040 | 0.020 | -0.079 |
| | (0.085) | (0.036) | (0.083) | (0.034) | (0.114) | (0.091) |
| Parent real estate prices | 0.769*** | 0.982*** | 0.584*** | 0.633*** | 0.494 | 0.657*** |
| | (0.235) | (0.234) | (0.202) | (0.198) | (0.382) | (0.234) |
| Parent real estate activity X | -0.175** | -0.231*** | -0.183*** | -0.192*** | -0.083 | -0.206*** |
| Parent real estate prices | (0.077) | (0.076) | (0.071) | (0.071) | (0.129) | (0.078) |
| Parent real estate activity | 0.000 | 0.010 | 0.004 | 0.007 | 0.001 | 0.004 |
| | (0.012) | (0.010) | (0.006) | (0.005) | (0.014) | (0.008) |
| Lagged gross credit growth | | | | | -0.092** | 0.139*** |
| | | | | | (0.039) | (0.035) |
| N | 1786 | 17536 | 2032 | 18770 | 1112 | 1811 |
| R-sq | 0.174 | 0.133 | 0.149 | 0.109 | | |
| Number of banks | 477 | 3880 | | | 420 | 659 |
| Number of instruments | | | | | 414 | 762 |
| AB test AR2 | | | | | 0.776 | 0.176 |
| Hansen p-value | | | | | 1.000 | 1.000 |

# Table 11. Asymmetric effects of parent country house price shocks

The dependent variable is *Gross credit growth*, which is the growth rate of real gross loans. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank –these dummies are only included in full sample regressions. Same variables are included for parent banks, these benchmark controls are not reported in the table. *Positive real estate prices* is the lagged growth in real house price index if positive and zero otherwise. *Negative real estate prices* is the lagged growth in real house price index if negative and zero otherwise. Bank-level variables are lagged one period. We estimate all regressions using year fixed effects. In regression 1 (foreign subsidiaries only) and 2 (full sample), bank fixed effects and robust standard errors are used. In regression 3, two-step GMM difference estimator, and in regression 4, two-step GMM system estimator are used. Regarding the validity of instrumentation Hansen's J test for overidentifying restrictions and Arellano and Bond test for autocorrelation of order 2 are provided for the dynamic panel regressions, where only foreign bank subsidiaries are included. *, ** and *** denote significance at 10%, 5% and 1%.

|  | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
|  |  | Dependent variable: Gross credit growth | | |
| Real estate prices | 0.069 | 0.075*** | 0.011 | -0.035 |
|  | (0.076) | (0.029) | (0.091) | (0.077) |
| Positive parent real estate prices | 0.131 | 0.153 | 0.061 | 0.165 |
|  | (0.150) | (0.141) | (0.187) | (0.147) |
| Negative parent real estate prices | 0.465** | 0.547*** | 0.621*** | 0.368* |
|  | (0.207) | (0.202) | (0.238) | (0.208) |
| Lagged gross credit growth |  |  | -0.073** | 0.173*** |
|  |  |  | (0.037) | (0.031) |
| N | 2345 | 23290 | 1372 | 2338 |
| R-sq | 0.181 | 0.127 |  |  |
| Number of banks | 603 | 4874 | 502 | 880 |
| Number of instruments |  |  | 577 | 796 |
| AB test AR2 |  |  | 0.759 | 0.213 |
| Hansen p-value |  |  | 1.000 | 1.000 |

**Table 12. Sample split regressions: Transmission before and after the financial crisis**

The dependent variable is *Gross credit growth*, which is the growth rate of real gross loans. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank –these dummies are only included in full sample regressions. Same variables are included for parent banks, the benchmark controls –except *Parent equity*- are not reported in the table. *Positive real estate prices* is the lagged growth in real house price index if positive and zero otherwise. *Negative real estate prices* is the lagged growth in real house price index if negative and zero otherwise. Bank-level variables are lagged one period. In regressions 1, 2, 5 and 6 observations after 2006 are included, whereas in regressions 3, 4, 7 and 8 only observations before 2007 are used. We estimate all regressions using year fixed effects. In regression 1 (foreign subsidiaries only) and 2 (full sample), bank fixed effects and robust standard errors are used. In regression 3, two-step GMM difference estimator, and in regression 4, two-step GMM system estimator are used. Regarding the validity of instrumentation Hansen's J test for overidentifying restrictions and Arellano and Bond test for autocorrelation of order 2 are provided for the dynamic panel regressions, where only foreign bank subsidiaries are included.   *, ** and *** denote significance at 10%,  5% and 1%.

| | Year>=2007 | | Year<2007 | | Year>=2007 | | Year<2007 | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Foreign | Full sample | Foreign | Full sample | Foreign | Full sample | Foreign | Full sample |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | Dependent variable: Gross credit growth | | | | | | | |
| Real estate prices | 0.107 | 0.084** | 0.012 | 0.136** | 0.110 | 0.084** | 0.014 | 0.135** |
| | (0.093) | (0.034) | (0.187) | (0.065) | (0.093) | (0.034) | (0.188) | (0.066) |
| Parent real estate prices | 0.212* | 0.360*** | -0.101 | -0.171 | | | | |
| | (0.123) | (0.119) | (0.345) | (0.318) | | | | |
| Positive parent real estate prices | | | | | 0.105 | 0.312* | -0.262 | -0.266 |
| | | | | | (0.175) | (0.173) | (0.355) | (0.352) |
| Negative parent real estate prices | | | | | 0.365* | 0.429* | 0.728 | 0.365 |
| | | | | | (0.219) | (0.220) | (1.145) | (1.090) |
| Parent equity | -0.243 | -0.254 | 0.357** | 0.315** | -0.243 | -0.255 | 0.353** | 0.316** |
| | (0.149) | (0.162) | (0.150) | (0.123) | (0.149) | (0.162) | (0.150) | (0.124) |
| Foreign | | -0.131 | | -0.123 | | -0.129 | | -0.125 |
| | | (0.087) | | (0.109) | | (0.087) | | (0.109) |
| Foreign bank | | 0.346** | | -0.190 | | 0.352** | | -0.189 |
| | | (0.144) | | (0.207) | | (0.144) | | (0.207) |
| N | 1471 | 14043 | 698 | 8355 | 1471 | 14043 | 698 | 8355 |
| R-sq | 0.249 | 0.145 | 0.085 | 0.111 | 0.250 | 0.145 | 0.086 | 0.111 |
| Number of banks | 454 | 3874 | 211 | 2565 | 454 | 3874 | 211 | 2565 |

## Table 13. Funding structure regressions: What can be the transmission channel?

The dependent variable is *long-term funding growth* in regressions 1-6 and *Deposit growth* in regressions 7-12. *Real estate prices* is the lagged growth in real house price index. *Assets* is the natural logarithm of total assets in constant 2000 US dollars. *Equity* is equity over total assets and *liquidity* is liquid assets over total assets. *GDP growth* is the rate of real per capita GDP growth. *Inflation* is the rate of change in consumer prices. *GDP per capita* is GDP per capita in thousands of constant 2000 dollars. *Equity index* is the change in S&P Global Equity indices. Same variables are included for parent banks. Bank-level variables are lagged one period. *Foreign* is a dummy variable for foreign owned banks and *Foreign bank* is a dummy variables banks with are majority owned by a foreign bank. We estimate all regressions using year fixed effects. In Bank FE regressions, bank fixed effects are used together with robust standard errors whereas in POLS regressions country fixed effects and bank-level clustered standard errors are used. In regressions 5 and 11, two-step GMM difference estimator and in regression 6 and 12 two-step GMM system estimator are used. Regarding the validity of instrumentation Hansen's J test for overidentifying restrictions and Arellano and Bond test for autocorrelation of order 2 are provided for the dynamic panel regressions. *, ** and *** denote significance at 10%, 5% and 1%.

| | Bank FE | | POLS | | Dynamic Panel | | Bank FE | | POLS | | Dynamic Panel | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Foreign | Full sample | Foreign | Full sample | Difference | System | Foreign | Full sample | Foreign | Full sample | Difference | System |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| | Dependent variables: Long-term funding growth | | | | | | Dependent variables: Deposit growth | | | | | |
| Real estate prices | 0.114 | -0.084 | 0.038 | -0.069 | 0.074 | 0.178 | 0.068 | 0.030 | 0.100 | 0.034 | 0.153 | 0.085 |
| | (0.163) | (0.052) | (0.138) | (0.048) | (0.201) | (0.160) | (0.077) | (0.030) | (0.074) | (0.029) | (0.225) | (0.249) |
| Parent real estate prices | 0.481** | 0.457** | 0.246 | 0.359** | 0.522* | 0.467** | 0.109 | 0.194* | 0.096 | 0.174** | 0.034 | 0.092 |
| | (0.225) | (0.199) | (0.168) | (0.148) | (0.299) | (0.214) | (0.109) | (0.102) | (0.091) | (0.086) | (0.490) | (0.766) |
| Assets | -0.018 | -0.085*** | -0.004 | 0.006*** | -0.059 | -0.010 | -0.158*** | -0.128*** | -0.010** | -0.000 | -0.333** | 0.005 |
| | (0.027) | (0.012) | (0.007) | (0.001) | (0.060) | (0.010) | (0.033) | (0.010) | (0.004) | (0.001) | (0.154) | (0.086) |
| Equity | -0.013 | 0.128 | 0.072 | 0.051 | 0.045 | 0.333 | 0.748*** | 0.535*** | 0.133* | 0.057*** | 1.859*** | 0.355 |
| | (0.284) | (0.121) | (0.130) | (0.033) | (0.459) | (0.211) | (0.227) | (0.082) | (0.075) | (0.022) | (0.394) | (0.437) |
| Liquidity | -0.110 | -0.122*** | -0.021 | -0.019 | 0.159 | -0.039 | -0.243*** | -0.218*** | -0.022 | -0.026** | -0.153 | -0.150 |
| | (0.101) | (0.040) | (0.043) | (0.017) | (0.214) | (0.062) | (0.079) | (0.030) | (0.028) | (0.010) | (0.542) | (0.531) |
| GDP growth | 0.007 | 0.005** | 0.008 | 0.004* | 0.001 | -0.001 | 0.011*** | 0.013*** | 0.013*** | 0.014*** | 0.005 | 0.016* |
| | (0.007) | (0.002) | (0.006) | (0.002) | (0.010) | (0.006) | (0.003) | (0.001) | (0.003) | (0.001) | (0.014) | (0.008) |
| Inflation | 0.002 | -0.009*** | 0.008 | -0.008*** | 0.008 | 0.003 | 0.008* | -0.002 | 0.004 | -0.006*** | 0.002 | 0.003 |
| | (0.008) | (0.003) | (0.006) | (0.003) | (0.012) | (0.004) | (0.004) | (0.002) | (0.004) | (0.002) | (0.019) | (0.058) |
| GDP per capita | -0.000 | 0.000*** | -0.000 | 0.000*** | 0.000 | -0.000 | 0.000* | 0.000** | 0.000 | 0.000* | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Equity index | 0.006 | 0.145*** | 0.061 | 0.124*** | -0.002 | 0.040 | -0.004 | 0.077*** | 0.005 | 0.098*** | -0.033 | -0.010 |
| | (0.060) | (0.020) | (0.056) | (0.018) | (0.081) | (0.059) | (0.034) | (0.012) | (0.035) | (0.012) | (0.115) | (0.183) |
| Parent Assets | -0.018 | -0.010 | -0.003 | -0.004 | 0.013 | 0.001 | 0.003 | -0.002 | -0.000 | -0.003 | -0.006 | -0.007 |
| | (0.015) | (0.012) | (0.006) | (0.005) | (0.018) | (0.006) | (0.012) | (0.008) | (0.003) | (0.003) | (0.033) | (0.033) |
| Parent equity | -0.005 | -0.006 | -0.009 | 0.015 | -0.106 | 0.064 | -0.102 | -0.044 | 0.080 | 0.061 | -0.187 | -0.002 |
| | (0.151) | (0.109) | (0.082) | (0.077) | (0.209) | (0.095) | (0.105) | (0.090) | (0.053) | (0.050) | (0.261) | (0.257) |
| Parent Liquidity | -0.035 | 0.079 | -0.027 | -0.046 | -0.270 | -0.091 | 0.088 | 0.134* | 0.077** | 0.077** | 0.247 | 0.175 |
| | (0.141) | (0.118) | (0.065) | (0.060) | (0.308) | (0.088) | (0.085) | (0.074) | (0.035) | (0.034) | (0.404) | (0.563) |
| Parent GDP growth | -0.027*** | -0.009** | -0.011** | -0.005 | -0.018 | -0.013** | 0.004 | 0.011*** | 0.002 | 0.009*** | 0.006 | 0.001 |
| | (0.008) | (0.004) | (0.005) | (0.003) | (0.011) | (0.006) | (0.004) | (0.002) | (0.003) | (0.002) | (0.015) | (0.035) |
| Parent Inflation | -0.022* | -0.001 | -0.008 | -0.008 | -0.017 | -0.005 | -0.000 | 0.011** | 0.005 | 0.006* | 0.002 | 0.002 |
| | (0.013) | (0.010) | (0.007) | (0.006) | (0.015) | (0.010) | (0.006) | (0.005) | (0.004) | (0.004) | (0.028) | (0.021) |

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parent GDP per capita | -0.000 | -0.000 | -0.000 | -0.000* | -0.000 | -0.000* | -0.000 | -0.000 | -0.000 | 0.000 | -0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Parent Equity index | 0.244*** | 0.059 | 0.176*** | 0.050* | 0.171** | 0.216*** | 0.033 | 0.042** | 0.023 | 0.015 | 0.030 | 0.039 |
| | (0.074) | (0.037) | (0.067) | (0.030) | (0.076) | (0.081) | (0.037) | (0.019) | (0.037) | (0.018) | (0.126) | (0.285) |
| Foreign | | 0.028 | | -0.025 | | | | -0.002 | | -0.053** | | |
| | | (0.111) | | (0.030) | | | | (0.046) | | (0.022) | | |
| Foreign bank | | 0.203 | | 0.153* | | | | -0.022 | | 0.022 | | |
| | | (0.171) | | (0.082) | | | | (0.108) | | (0.048) | | |
| Lagged long-term funding growth | | | | | -0.163*** | 0.044 | | | | | | |
| | | | | | (0.047) | (0.042) | | | | | | |
| Lagged deposit growth | | | | | | | | | | | -0.067 | 0.073 |
| | | | | | | | | | | | (0.058) | (0.062) |
| N | 1215 | 14582 | 1442 | 15864 | 650 | 1146 | 2458 | 23873 | 2855 | 25497 | 1444 | 2455 |
| R-sq | 0.113 | 0.075 | 0.118 | 0.095 | | | 0.192 | 0.120 | 0.128 | 0.072 | | |
| Number of banks | 332 | 3395 | | | 257 | 459 | 630 | 4987 | | | 530 | 921 |
| Number of instruments | | | | | 329 | 539 | | | | | 554 | 760 |
| AB test AR2 | | | | | 0.036 | 0.401 | | | | | 0.199 | 0.502 |
| Hansen p-value | | | | | 1.000 | 1.000 | | | | | 0.999 | 1.000 |

**Figure 1. Real House Price Index Growth rates of countries in the sample**
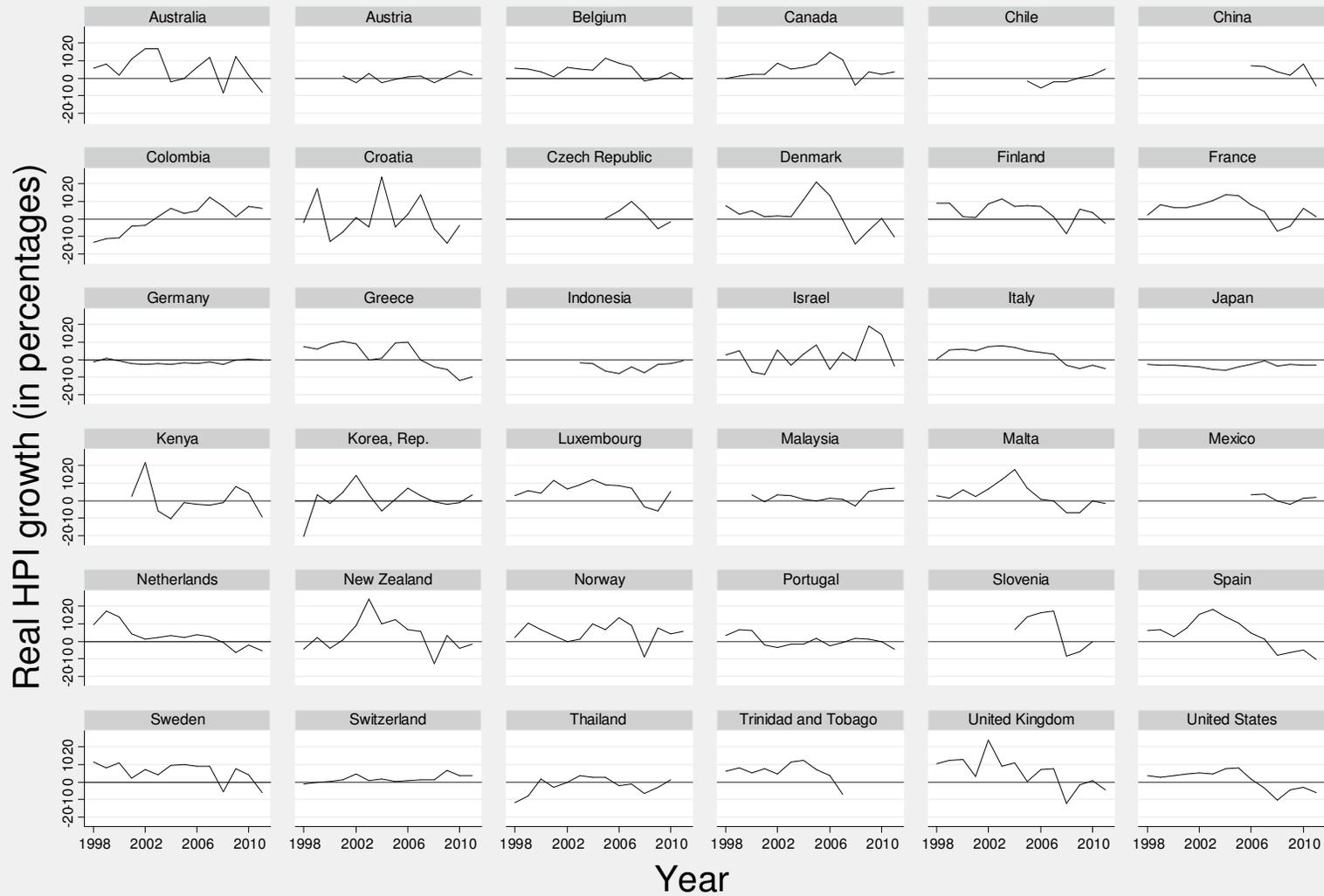


Countries with more than 5 years of data. HPI growth is bounded by +-25%.

**Figure 2. Stock markets, real estate markets and summary statistics**



**Panel a**



Mean Real HPI (annual change %)
Mean S&P Global Equity Indices* (annual change %)

*Stock market observations with larger than 50% or lower than -50% are dropped from mean calculation.
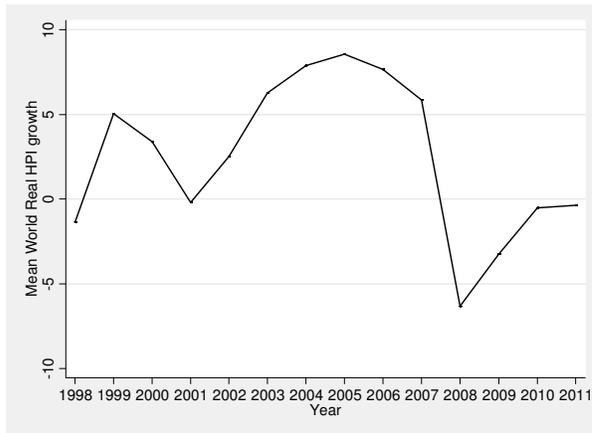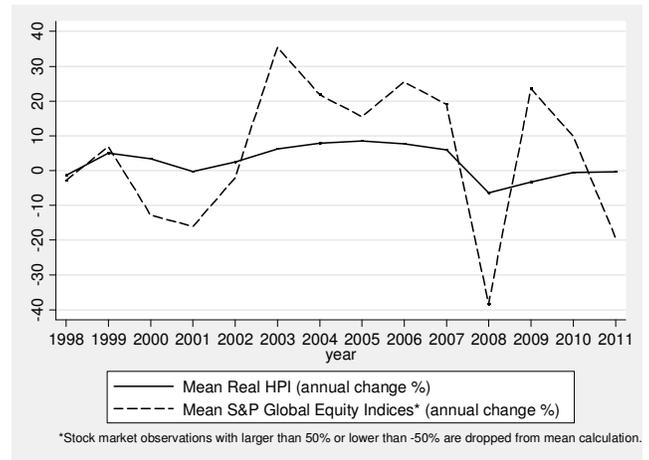
**Panel b**

| Variable: Real HPI growth | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| *Full sample* | | | | | |
| 2007-2011 | 287 | -0.972 | 12.035 | -47.923 | 57.678 |
| 2002-2006 | 245 | 6.685 | 12.726 | -65.869 | 61.609 |
| 1998-2001 | 148 | 1.686 | 12.801 | -83.505 | 40.979 |
| *|Real HPI growth|<25%* | | | | | |
| 2007-2011 | 268 | -0.505 | 8.051 | -22.913 | 23.733 |
| 2002-2006 | 224 | 4.931 | 7.269 | -19.358 | 23.904 |
| 1998-2001 | 138 | 1.678 | 7.299 | -20.342 | 19.141 |

**Panel c**

**Figure 3. Histogram of real house price growth**