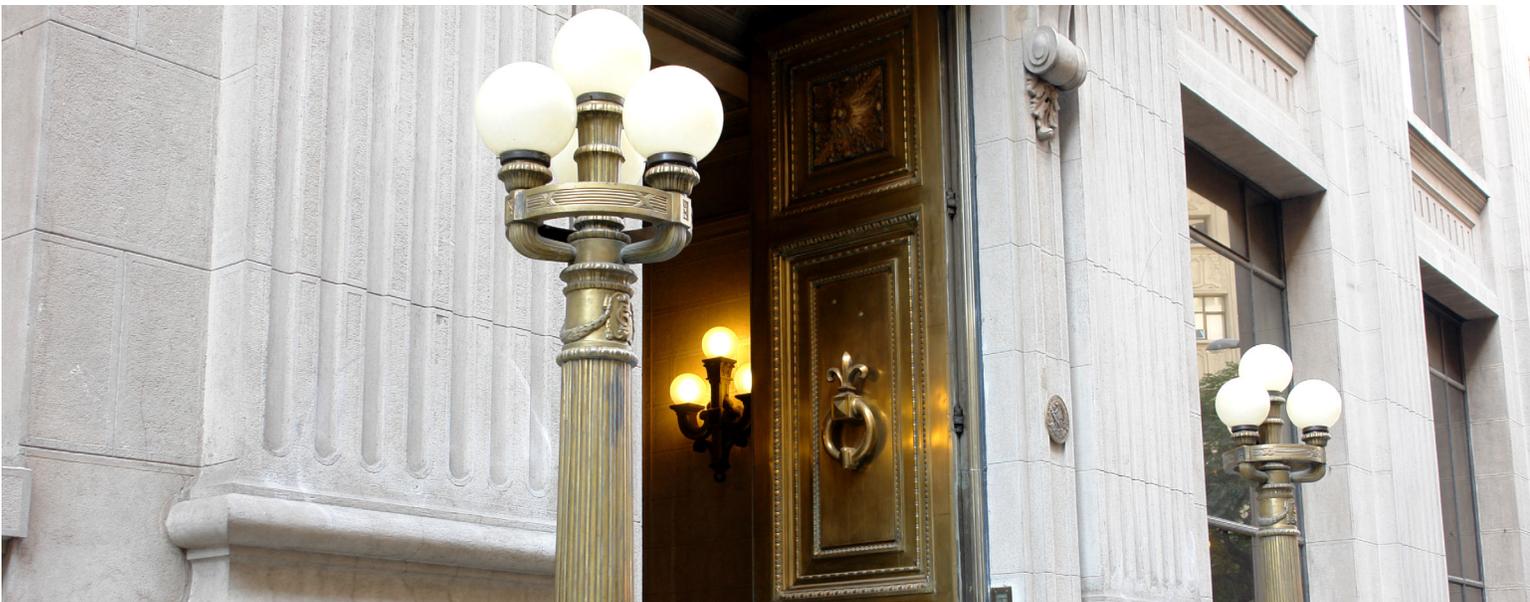# DOCUMENTOS DE TRABAJO

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ARE ALL CAPITAL INFLOWS ASSOCIATED WITH BOOMS IN HOUSE PRICES? AN EMPIRICAL EVALUATION[*]

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Abstract

Booms in house prices are leading indicators of financial crises. Therefore, understanding their causes is a key policy objective. Although theory suggests that large capital inflows are main factors behind these *booms*, empirical evidence about their association is still needed. This paper provides methodical evidence on the link between capital inflows and *booms* in real estate prices, with a specific focus on the composition of capital flows. We find that the positive association between large capital inflows and *booms* in real estate prices described in previous studies is explained mostly by bank and portfolio flows. In addition, we find evidence suggesting that this association is lower in countries with more flexible exchange rate regimes and with better quality of institutions. Finally, we found some evidence, although not robust, that support the idea that restricting financial development or introducing capital controls can help reduce the association between large capital inflows and *booms* in house prices.

Resumen

Dado que los *booms* en los precios de las viviendas anticipan -con una alta probabilidad- las crisis financieras, entender sus causas es muy relevante desde la perspectiva de política económica. Aunque la teoría sugiere que los grandes flujos de capital están entre los principales factores detrás de estos *booms*, la evidencia empírica sobre esta asociación es, por ahora, insuficiente. Este trabajo proporciona evidencia metódica sobre la relación entre las entradas de capitales y *booms* en precios de la vivienda, poniendo el foco específicamente en la composición de los flujos de capital. Los resultados muestran que la asociación positiva entre las entradas de capital y *booms* en precios de la vivienda descrita en estudios previos se explica principalmente por los préstamos bancarios y otros flujos de deuda. Además, encontramos evidencia que sugiere que esta asociación es menor en países con regímenes de tipo de cambio más flexibles y con mejor calidad de las instituciones. Por último, encontramos alguna evidencia, aunque no robusta, que apoya la idea de que un sistema financiero más restringido o la adopción de controles de capitales puedan ayudar a reducir la asociación entre las grandes entradas de capitales y los *booms* en el precio de la vivienda.

1 Introduction

Booms in real estate prices are leading indicators of financial crises;[1] therefore understanding their causes is highly relevant from the perspective of policy makers. Theory suggests that *booms* in real-estate prices can be associated with large capital inflows (Krugman (1998), Caballero and Krishnamurthy (2006)), Aoki et al. (2009), Korinek (2010), Korinek (2011), and Adam et al. (2011)). However, as pointed out by Reinhart and Reinhart (2008), the evidence provided by previous studies is mainly *"anecdotal"*. The goal of this paper is to help close this gap in the literature and provide methodical evidence on the association between large capital inflows and *booms* in real estate prices.[2] Specifically, we address three questions: (*i*) Is there a positive association between capital inflows and *booms* in real estate prices?; if so (*ii*) for what types of capital inflows is the association stronger?; and (*iii*) can some structural country's characteristics, such as financial development, regulatory quality, exchange rate regime and capital controls, affect this association?

To answer these questions, we build a panel of quarterly data for 35 countries that covers the period of $1990q1 - 2010q4$. First, we construct an index of *booms* in real estate prices, that measures both *the occurrence and the intensity* of an event, using a *threshold method* similar to the one used in Mendoza and Terrones (2008) for identifying credit *booms*. The method divides real estate prices in each country into its cyclical and trend components, and identifies a *boom* as an episode in which real estate prices exceed its long-run trend by more than a given threshold. According to this method, *booms* in real estate prices reflect country-specific unusually large price expansions. Second, we combine the measure of *booms* with a dataset of different types of net capital inflows (measured as percentage of GDP). The four types of capital flows are (1) *FDI*, (2) *portfolio equity*, (3) *portfolio debt*, and (4) *bank loans and other debt inflows* (hereafter *others inflows*). Then, we estimate the regression-based association between our measure of *booms* in house prices and the different types of capital inflows controlling for a set of variables that can also be associated with *booms*, such as growth in GDP and the inflation rate, and using instrumental variables and Tobit regressions to account for potential endogeneity bias and the fact that our dependent variable is censored by definition.

In line with previous studies (*e.g.* Aizenman and Jinjarak (2008)), we find a robust, strong and positive association between large capital inflows and *booms* in real estate prices. However, we show that this association is largest (and more important) for *other inflows*. This result is very robust, it holds in almost all specifications and technics, and suggests that, compared with *FDI* and *portfolio flows*, *other inflows* are twice as likely to be associated with *booms* in house prices.

Then we assess if the association of capital inflows and *booms* in real estate prices is affected by some country characteristics. Specifically, we interact the different measures of capital inflows with quality of institutions (proxy by Rule of Law), the level of financial

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[1] Reinhart and Reinhart (2008) present evidence that real house prices boomed on the eve of the worst post-World War II banking crises in emerging market economies.

[2] Throughout the paper we use the terms house prices and real estate prices as synonymous.

development, financial openness, and the exchange rate regime. We find evidence suggesting that the association between capital inflows and *booms* in real estate prices is lower in countries with more flexible exchange rate regimes, and with better quality of institutions. However, this result is not robust to different empirical methodologies. Finally, we analyze if, as predicted by the recent theoretical model of Calvo (2011), the association between capital inflows and *booms* in house prices is higher in countries at the frontier of financial innovation -countries with more developed financial markets-, and if, as implied by Korinek (2010), capital controls can help reduce the probability of *booms* in house prices during periods of large capital inflows. The evidence we find is unsatisfactory: in most specifications, the effect of financial development and capital controls on the association between capital inflows and *booms* in house prices is not statistically significant.

These results have important policy implications. The results of this work suggest that countries should be extremely careful with the sudden influx of bank loans and other debt related flows, because they increase the likelihood of *booms* in house prices - which generally anticipate financial crises. In addition, our results provide evidence that can help policymakers choose the right policies to prevent *booms* in house price during periods of large capital inflows. Specifically, if the results of this paper are any guide, capital controls are not necessarily an efficient tool to reduce the probability of *booms* in real estate prices during periods of large capital inflows; other policies, with potentially fewer collateral effects, are much more likely to be successful in reaching this goal. In particular, adopting more flexible exchange rate regimes, improving the quality of institutions and managing financial innovation in a practical way, can be more effective tools than capital controls to reduce the association between large capital inflows and *booms* in house prices and avoid the risk of financial distress.

This paper is related both to previous empirical studies on the macroeconomic consequences of large capital inflows –e.g. Calvo et al. (1996); Reinhart and Reinhart (2008)- and to a more recent and rapidly growing literature on the relationship between capital inflows and asset prices - Aizenman and Jinjarak (2008); Jinjarak and Sheffrin (2011) and Jinjarak et al. (2011). Related to this literature, our first contribution is to show that the association between different categories of capital inflows and *booms* in real estate prices is different; specifically, that the association is more relevant for *bank loans and other debt related flows*. We believe this is an important distinction because it not only helps to account for some key features that characterize these inflows (maturity, currency composition, and sectorial relevance), but it also has important policy implications. Our second contribution is to show that some policies and institutions, such as more flexible exchange rate regimes and better quality of institutions, can help reduce this association and decrease, in turn, the risk of financial distress.

The rest of the paper is organized as follows. Section 2 presents a short conceptual framework to understand how capital inflows can be associated with *booms* real house prices. Then, section 3 presents the database and empirical methodology and discusses the main results. Finally, section 4 concludes.

2 How can large capital inflows be associated with *booms* in house prices?

Explaining how large capital inflows can be associated with increases in house prices is rather simple and straightforward. It is more complex however, to explain how the increase in house prices can end up in a *boom* and increase the risk of financial crisis. To explain this link, this section offers a simple explanation (or conceptual framework) that builds upon a variety of theoretical models. In particular, we illustrate how a sudden inflow of capital will give rise to an increase in house prices and how, under certain conditions, this initial increase can become a *boom*.

Consider an economy populated by a representative (and atomistic) agent that receives utility from the consumption of two types of goods: consumption goods and houses.[3] While consumption goods are tradable in international markets, houses are non-tradable. Thus, in every period the domestic supply of houses has to be equal to domestic demand. Furthermore, the supply of houses is fixed in the short run. For simplicity, assume that the economy is initially in a balanced trade deficit, where the domestic supply of consumption goods equals domestic demand. What will happen with house prices in this economy if there is a sudden inflow of capital? The answer is simple: independently of the cause of this sudden increase in inflows –they could be generated by domestic (*pull*) factors or external (*push*) factors- the consequence will be the same: real house prices will increase.

For the ease of exposition, let's assume that what creates the surge in capital inflows is a sudden decrease in world interest rates (i.e. the real interest rate is now lower). The decrease in interest rates makes current consumption relatively cheaper than future consumption, and increases the demand for consumption goods and houses. The increase in demand is financed by higher borrowings from abroad -the surge in capital inflows. But what happens to consumption goods and houses in the new equilibrium? In the new equilibrium consumption of tradable goods is higher than production of tradable goods: the economy runs a trade deficit. For houses, however, supply is fixed in the short run, which means that the surge in capital inflows creates an excess demand for houses. To clear the market the real price of houses (in terms of consumption goods) will increase.[4] In sum, in this very simple economy a sudden and exogenous increase in capital inflows leads to higher consumption, trade deficits, and *an initial increase in the real price of houses.*

Under certain conditions, *i.e.* the existence of market imperfections or externalities, that are present in most countries but at different degrees, the initial increase in house prices can be exacerbated and end up in a *boom*. In fact, in the presence of financial market imperfections, such as adverse selection and moral hazard, the agent's borrowing capability is limited by the value of her assets –*i.e.* the value of the house. The representative agent

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[3]See the Appendix for a summary description of a model like this.

[4]Note that the results would be identical if instead of a decrease in the international interest rate, the economy faces a demand shock. Although in this case the initial increase in house prices, and the surge in capital inflows, will be generated by pull factors, the amplification mechanism will be the same.

is atomistic, so she does not internalize the effect her decisions have on house prices and her borrowing capability. However, since all agents are equal, the aggregate economy's borrowing capability will be also limited by the value of houses. Therefore, the increase in house prices will increase the economy's credit limit, which in turn promotes more borrowing; more capital inflows that in turn increase the demand of consumption goods and houses even further. Put simply, the surge in capital inflows gets amplified: the initial sudden increase in capital inflows generates an incipient increase in house prices that is followed by new rounds of capital inflows. This process can evolve into a *boom* in housing prices through a sort of circular process, in which higher house prices make financial conditions of the economy seem sounder than they actually are, promoting more capital inflows that in turn push house prices even higher.

There are several models that include a mechanism like this. For example, Krugman (1998) develops a simple model where financial intermediaries are seen as having an implicit government guarantee and are not subject to strict regulation, creating a severe problem of moral hazard. Moral hazard encourages financial intermediaries to take excessive debts to get involved in too much risky lending. More risky lending push up house prices and starts the circular process. Similarly, Caballero and Krishnamurthy (2001) and Caballero and Krishnamurthy (2006) argue that a key ingredient in the creation of *booms* in asset prices in emerging economies are their poor banking systems and poor quality of institutions (the lack of Rule of Law). The lack of Rule of Law makes it difficult to enforce debtors to repay their debts unless they are secured by collateral. Hence, the borrower credit limit is affected by the price of its assets, and the price of assets is affected by the credit limit. In sum, theory predicts that surges in capital inflows are likely to be associated with *booms* in house prices, in particular when the quality of institutions (Rule of Law) is poor.

But quality of institutions is not the only factor that can exacerbate the association between large capital inflows and *booms* in house prices. First, there are studies that call attention to factors such as the exchange rate regime. Yellen (2011) argues that heavily managed exchange rate regimes may provide incentives for a circular process between capital inflows and higher real estate prices to arise. Consistently, Mendoza and Terrones (2008) find that credit *booms* in emerging economies are far more frequent in the presence of fixed or managed exchange rates, than under floating or dirty floating regimes. It should be easy to understand why. Fixed or managed exchange rate, make investors underestimate the volatility of the exchange rate, promoting excessive borrowing from abroad.

Second, theory implies that the degree of financial openness can potentially influence the association between capital inflows and *booms* in real estate prices. Diaz-Alejandro (1985) argued that when economies are more open to financial markets, they increase the probability of asset price bubbles and financial crisis. More recently Korinek (2010) presents a model where capital controls can help reduce the externalities generated by overborrowing, by making investors internalize the general equilibrium implications of their decisions.

Third, recent theoretical studies blame financial innovation for exacerbating the association between large capital inflows and *booms* in house prices. For example, Calvo (2011) develops a model where there is a direct relationship between capital flows and housing

prices. In Calvo's model capital inflows increase the liquidity of real estate assets, thereby increasing its value. In terms of Guillermo Calvo "*liquidity creates wealth*". Moreover, when capital inflows are intermediated by a local banking system with loose credit standards, this relationship gets strengthened.

Finally, most these theoretical contributions suggest that not all types of capital flows are the same; that some specific types of flows –e.g. debt flows- are more likely to be associated with *booms* in house prices. For example, Calvo's model implies that the association is relevant only for some types of flows. In particular, Krugman (1998) provides a conceptual framework for understanding the link between housing prices and specific types of capital inflow: *bank loans and other debt related flows*. Conceptually, it is easy to see why debt flows might have a stronger association with *booms* in house prices than FDI flows. Unlike FDI, they do not solve agency problems, can lead to inefficient capital allocation if domestic banks are poorly supervised, and generate moral hazard when debt is implicitly guaranteed by the government or international financial institutions. Korinek (2010) also provides support to the idea that the composition matters by showing the different magnitude of externalities created by different types of capital inflows. In particular, Korinek suggests that FDI does not impose an externality since it often stays in the country when a financial crisis hits, and do not need to be taxed.

In sum, the conceptual framework presented here offers a number of contrastable hypothesis: (1) large capital inflows are associated with *booms* in house prices; (2) this association is more relevant for some types of capital inflows, in particular debt related flows; and (3) the association will be higher in the presence of poor institutional quality, low capital controls, fixed exchange and financial innovation. In the following section we describe the empirical exercise we use to test these hypotheses, and discuss our results.

3   Empirical approach

3.1   Data issues

For the regression analysis, we construct a quarterly panel data for 35 advanced and emerging countries, from $1990q1 - 2010q4$. (See table 1 in the Appendix for the list of countries considered in the regression analysis. This panel data includes information on real housing prices, capital inflows, and a set of control variables.)

Real housing prices are constructed from the nominal housing prices dataset gathered by the Bank for International Settlements (BIS), which we then deflate by the consumer price index (CPI).[5] Capital inflows comes directly from the capital account information of

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[5]Each country included in the BIS dataset, might present more than one index of housing prices. The differences among them are given by their geographical coverage (e.g. national, regional), the characteristics of the property (e.g. residential, commercial, industrial), among other criterias. For purposes of this article, we selected those indexes with more information available and the higher possible coverage. See the data set description in the Appendix for details.

the Balance of Payments Statistics issued by the IMF (BoP).[6] In this sense our approach differs from Aizenman and Jinjarak (2008), where net capital inflows are approximated by the current account deficits. This distinction is important because, as emphasized previously, not all types of capital inflows are likely to be associated with *booms* in house prices. Thus using the current account deficits, which is the sum of all capital flows, may be misleading.

Regarding the set of control variables, annual real GDP growth and quarterly inflation rate comes from the *International Financial Statistics* (IFS) issued by the IMF. Financial depth is proxy by the stock of credit issued by the banking sector, as percentage of GDP. Capital account openness is proxy by the *de jure* index of Chinn and Ito (2008); while the degree of exchange rate flexibility comes from the "coarse" measure created by Reinhart and Rogoff (2004). Finally, we use Rule of Law from Kaufmann et al. (2010) as a proxy of quality of institutions. (See the Appendix B for more details about the sources and definitions of all the variables included in our empirical analysis.)

3.2   Estimation and results

This section estimates the regression-based association between *booms* of real estate prices and different types of capital inflows. In particular, we estimate *booms* in real estate prices as a function of international capital inflows and domestic conditions; and look if the composition of capital inflows matter for this association. In addition, we run a set of regressions to test whether the association between capital inflows and *booms* in real estate prices can be affected by the degree of financial openness, financial development, the exchange rate regime, and the quality of institutions. Methodologically we follow closely Olaberría (2012), which perform similar regression analysis, although its focus is on the relationship between capital inflows and stock prices.

Our variable *booms* in real house prices measures the *occurrence and the intensity* of a significant increase in real housing prices. In order to identify the occurrence of such increase, we follow Mendoza and Terrones (2008) definition of credit *booms*. First, we obtain the cyclical component of the real house price index as the difference between the index and its long-run trend using Hodrick-Prescott (HP) filter, with the standard smoothing parameter set at 1600 for quarterly data. Second, we compute the standard deviation of the cyclical component. Then, we define the event of a significant increase in real housing prices as the period when the cyclical component is above one standard deviation.[7]

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[6] As emphasizes by Alfaro et al. (2007), the IMF data is missing for many countries, in particular for the early nineties, which makes the data coverage to vary substantially from country to country. Additionaly, as Lane and Milesi-Ferretti (2001) suggests, there are a number of measurement problems with debt data related to different methodologies for recording non-payments, rescheduling, debt forgiveness, and reductions. We recognize these are important limitations of the database that may bias the estimates, but is the best we can do.

[7] As part of the robustness analysis, we construct a *boom* index using a rolling standard deviation resulting from a 5-years moving window, instead of a constant one. The events identified (*booms*) following this criterion do not differ significantly from those that use a constant standard deviation, as the correlation

Thus, our definition of *booms* is equal zero during normal times, and equal to the deviation from the trend during periods of extreme increase in the real housing prices. Figures 1a and 1b in the Appendix show the cyclical component of the real housing price index, its standard deviation, and the definition on *booms* used in the regression analysis for a selected number of advanced and emerging economies.

We start by estimating the following standard regression equation using a cross-country time-series unbalanced panel data of 35 developed and emerging countries over the period $1990q1 - 2010q4$:

$$boom_{it} = \beta_0 + \beta_1 CF_{it} + \beta_2 X_{it} + \mu_t + \eta_i + \epsilon_{it} \tag{1}$$

where the dependent variable ($boom_{it}$) is our measure of the *booms* in real housing price explained above, and the subscript i and t represent the country and time period respectively. CF_{it} represents the different categories of net capital inflows as percentage of GDP, including foreign direct investment (FDI), portfolio investment (equity and debt), and other inflows. X_{it} represents the set of control variables. Finally, μ_t and η_i denote unobserved time and country specific effects, respectively, and ϵ_{it} is the error term.

We first estimate a simple panel regression between *booms* in housing prices and different types of net capital inflows assuming fixed effect. Then, in order to avoid an omitted variable bias, we control for variables that can potentially be associated with housing prices. In particular, in order to control for the state of the economy we use the annualized real GDP growth rate, because if the economy is booming it is more likely that house prices are booming too. We also include the annualized inflation rate to control for the nominal and monetary conditions, because if the economy is facing an expansionary environment, it can create conditions for increasing housing prices.

Finally, we also use instrumental variables to deal with potential problems of endogeneity, as some variables that affect housing prices can also affect capital inflows. In particular, we use as instruments for capital inflows external factors (or push factors) like: (1) VIX, (2) GDP growth of the three main world economies (G3), (3) nominal short term interest rate of G3, and (4) the cyclical component of the non-energy commodity price index.[8] The advantage of using these external factors is that they are main determinants of capital inflows (see Forbes and Warnock (2012)) but are not directly associated with *booms* in house prices -if there is an association, the association is through capital inflows.

Table 2 reports our first set of results. Column 1 presents a simple panel regression between *booms* in housing prices and different types of net capital inflows including time (quarter/year) and country fixed effects. Column 2 follows a similar methodology as column 1, but adds the control variables. Finally, column 3 uses instrumental variables. The results in column 1 shows that the association between different types of net capital inflows and *booms* in housing prices is strong and significant at 1%. Moreover, "other inflows", which

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between these two indexes is close to 90%.

[8]We include the VIX because as Forbes and Warnock (2012) claims, this variable is one of the most important drivers of both, net and gross capital flows.

includes mainly cross-border bank flows, presents the stronger association with *booms* in house prices.

Nonetheless, the results in column 1 may be biased by the fact that we are not controlling for other factors that can affect housing prices. Column 2 presents the results after adding the annual GDP growth, and the quarterly inflation rate as controls. The results of the fixed effect estimations show that the association between GDP growth and *booms* in real estate prices is positive and statistically significant, similarly than with inflation, suggesting that *booms* in real estate prices are more likely to occur when the economy is growing fast and inflation is increasing. Column 2 also indicates that all net capital inflows are positively associated with *booms* in real estate prices. However, the magnitude of this association is not the same for all types of capital inflows. In particular, the coefficients is larger for "other inflows", suggesting that bank related inflows are the most likely to be associated with *booms* in house prices.

Finally, column 3 presents the results of endogenize net capital inflows through instrumental variables. Comparing with column 1 and 2, column 3 stresses the point that not all types of capital inflows can be associated with *booms* in real estate prices. In particular, we find that *other inflows* have by far the strongest association with *booms* in real estate prices.

To summarize, table 2 provides the first two statements of the paper: (1) net capital inflows can be associated with *booms* in housing prices, but (2) not all types of capital flows are created equal. Furthermore, the association is mostly relevant for bank related capital inflows. These results complement the findings of Aizenman and Jinjarak (2008) and Sá et al. (2011) who find that in OECD countries the current account balance (a close measure of total net capital inflows) is significantly associated with *booms* in real estate prices.

We turn now to the analysis of whether some factors, such as the flexibility of the exchange rate, the level of financial development, the degree of financial openness, and the quality of institutions can affect the association between capital inflows and housing prices. We assess these issues by allowing the association of each measure of capital inflows and *booms* in housing prices to vary with the level of financial development, financial openness, the exchange rate regime, and a proxy for the quality of institutions. We do this by interacting each capital inflows measure with linear measures of the variable of interest in each country and each period. Therefore, we estimate in this case the following regression:

$$boom_{it} = \beta_0 + \beta_1 CF_{it} + \beta_2 \left(CF_{it} * Interactions_{it} \right) + \beta_3 X_{it} + \mu_t + \eta_i + \epsilon_{it} \qquad (2)$$

In this regression the total association between capital inflows and *booms* in real estate prices is $\beta_1 + \beta_2 * Interaction_{it}$, where β_1 is the average effect across all countries, and β_2 is an effect specific on country i period t; an effect that depends on how different that country is with respect to the sample mean of that characteristic/interaction. The interactions are mean centered, thus if $\beta_1 > 0$ and $\beta_2 > 0$, capital inflows are, on average, positively associated with *booms* in real house prices, and the association is higher for countries that are above the average level for that characteristic/interaction; if $\beta_1 > 0$ and $\beta_2 < 0$, on average the association between capital flows and *booms* is positive, but

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the degree of association is lower for countries that are above average in terms of that characteristic/interaction.

Table 3 in the Appendix reports in column 1 to 4 the estimations including the individual interactions using a panel regression methodology assuming fixed effects; while column 5 reports the results considering all interactions together. Column 1 interacts net capital inflows with the log of financial depth. Column 2 interacts the different categories of net capital inflows with the measure of financial openness. Column 3 interact the different categories of net capital inflows with the degree of flexibility of the exchange rate regime. Finally, column 4 considers the interaction of net capital inflows with our proxy of the quality of institutions: Rule of Law. We also control for the growth rate of the economy, and the inflation rate, similarly than in previous estimations.[9]

By and large, the results presented in table 3 are in harmony with our expectations. First, we find that real GDP growth and inflation rate are significant in all regressions. We interpret this result as indicating that *booms* in housing prices are more likely to occur when the economy as a whole is booming. When we look at the different categories of capital inflows, the first insight is that *other inflows* and *portfolio flows* continue to be positively and significantly associated with *booms* in real estate prices in most regressions, reinforcing our findings of table 2. However, the coefficients are not always stable, showing that interactions play a significant role in understanding the association between capital inflows and *booms* in housing prices.

Column 1, for example, shows that the association between *booms* in real estate prices and net FDI inflows is stronger the more developed are financial markets, as reflected by the coefficient accompanying the measure of financial depth. This result is consistent with the conjecture described in Calvo (2011), which emphasizes that a more developed financial system can help to increase the liquidity of some fixed, and formerly not very liquid, assets, like houses; and that these liquidity considerations create a perfect environment for the creation of bubbles in housing prices. However, for other types of capital inflows, the effects are either not statistically significant or have the opposite sign than expected.

In the case of financial openness (column 2), the interaction is positive for *portfolio debt* and *other inflows,* and negative for *portfolio equity* and FDI, but none of them are significant, suggesting that stricter capital controls do not necessarily help reduce the association between capital inflows and *booms* in housing prices, a result at odds with Korinek (2010).

On the other hand, the negative coefficients for the interactions of capital inflows and the measure of exchange rate regime (column 3) indicates that in countries with more flexible exchange rate regime the association between capital inflows and *booms* in housing prices is lower, consistent with Mendoza and Terrones (2008).

Column 4 shows that, when considered by itself, our proxy for the quality of institutions is almost always negative and statistical significance. The positive coefficient accompanying *portfolio debt*, which is significant at 1% in column 4 but not in column 5, is rather puzzling. However, as expected, column 4 and 5 suggest that improving Rule of Law/quality of

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[9]Time (quarter/year) dummies are also included in the regressions, but their coefficients are not reported in the table.

institutions, helps to reduce the association between *other inflows* or *portfolio equity* and housing price *booms*. Column 5 reinforce the ideas describe above.

In table 4 we control for potential endogeneity problems using instrumental variables. To do this, we use the same set of instruments described above. Once again, we find that, in general, *booms* in real estate prices are positively and strongly associated with capital inflows, but composition matters. Moreover, this association seems to be affected by financial depth, financial openness, the flexibility of the exchange rate and the quality of institutions, in particular for "other inflows", as shown in column 5.

Most of our findings are consistent with theory. Specifically, our results confirm previous theoretical findings that an increase in net capital inflows can potentially be linked to *booms* in real property prices. The results are also consistent with the empirical literature. In particular, the finding that *banks loans and other debt flows* are the more dangerous type of capital. For example, Tong and Wei (2011) shows that the volume of total capital inflows has no significant effect on the severity of stock market declines, but that large pre-crisis exposure to debt related inflows tends to be associated with a more severe decline during the crisis. Or results complement the findings of Tong and Wei (2011) by showing that bank related flows are more likely to have been involved in the development of *booms* in the eve of the global financial crisis.

3.3   Robustness checks

As part of our robustness analysis, we assessed whether the results presented above differ significantly between emerging and advanced countries. To do so, we run two set of regressions, similar to the ones presented in table 2, and table 3, but now interacting the capital flows variables with an emerging market country dummy variable. We find that the relationship between capital flows and *boom* in housing prices is stronger for emerging market than advanced economies, in particular for other investment and equity flows. In addition, the role played by policy variables in this association is stronger for emerging market than for advanced countries.[10]

Finally, we assessed whether the estimation methods used in previous regressions bias our results somehow, as our explanatory variable ($booms_{it}$) is censored by definition. To do so, we estimate a Tobit panel model to analyze the association between capital flows and *boom* in housing prices, and another similar model to evaluate the role played by policy variables in this association. As table 5 shows, the relationship between capital flows and *boom* in housing prices remain strong, and is stronger for other investment and debt related flows. Regarding the role played by policy variables, table 6 shows the results of running a Tobit panel model with interactions, which also confirm most of our previous findings, as financial depth and capital account openness do not have a significant effect on the association of capital flows and *booms* in housing prices; while exchange rate flexibility and quality of institutions reduce the association, although the coefficients are less significant.

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[10] These results are available upon request.

4 Conclusions

This paper studied the association between capital inflows and *booms* in real estate prices. The goal was to understand if this association exists; if it was more relevant for specific types of capital flows; and if there were country characteristics that could affect the association. By seeking answers to these questions, this paper has tried to make a contribution for policy analysis and help improve our understanding of the role that institutions and policies can play in moderating the vulnerabilities associated with surges in capital inflows. A key lesson we learned from the recent global financial crisis is that wrong macroeconomic policies, weak regulation, and market failures pose a great risk to financial stability. In this sense, the paper's findings can potentially help policymakers choose the appropriate policy options to handle an increase in capital inflows.

A major implication of this paper is that capital inflows, in particular *bank loans and other debt related inflows*, are strongly associated with *booms* in real estate prices; and, therefore, can potentially increase the risk of financial crisis. Nonetheless, some policies can help reduce this association. The findings in this paper suggest that countries that adopt a more flexible exchange rate and improve the quality of their institutions (the Rule of Law) can reduce the probability of *booms* in real house prices during periods of large capital inflows. On the other hand, this paper did not find evidence in support of the idea that capital controls can help reduce the association between large capital inflows and *booms* in real house prices.

Finally, this paper found some evidence, although not robust, that countries at the frontier of financial innovation (with more developed financial markets) can face a higher association between some types of capital inflows and *booms* in real estate prices. This result provides empirical support for the model presented in Calvo (2011) where, in the presence of financial innovations such as mortgage-back-securities, a capital-inflow episode can enhances the liquidity of some of the receiving-economy's assets, which in turn fosters larger flows and higher asset prices. The big risk, as Calvo shows, is that this "liquidity" may suffer a major setback if capital flows collapse, and can, potentially, cause a severe impact on output and employment or crises.

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A   Appendix

A.1   A simple model to account for the association between capital inflows and real estate prices

Lets consider a simple two period real model of a small open economy where consumers derive utility from consuming both tradable goods (c^T) and house services or non-tradable goods (c^H). The economy is endowed with a constant stream of tradable (y^T) and houses (y^H). Therefore, consumer's preferences are given by:

$$\alpha \left[u \left(c_1^T \right) + v \left(c_1^H \right) \right] + \beta \left[u \left(c_2^T \right) + v \left(c_2^H \right) \right] \tag{3}$$

where α is a preference parameter that capture a demand shocks in period 1, $\beta > 0$ is the discount factor, $u(.)$ and $v(.)$ are strictly increasing and strictly concave functions.

Assuming that initial net foreign assets are zero, and combining the first-order conditions that arise from the consumer's problem, we get:

$$\frac{u' \left(c_1^T \right)}{u' \left(c_2^T \right)} = \beta \left(1 + r \right) \tag{4}$$

$$\frac{v' \left(c_1^H \right)}{v' \left(c_2^H \right)} = \beta \left(1 + r \right) \frac{p_1}{p_2} \tag{5}$$

where p_i denotes the relative price of houses in terms of the numeraire (tradable goods) for periods 1 and 2. Imposing the equilibrium condition in the non-tradable real estate market $(c_1^H = c_2^H = y^H)$,

$$\alpha = \beta \left(1 + r \right) \frac{p_1}{p_2} \tag{6}$$

Finally, note that in equilibrium:

$$\frac{2 + r}{1 + r} y^T = c_1^T + \frac{c_2^T}{1 + r} \tag{7}$$

Lets now assume a balanced trade deficit (i.e. $\alpha = 1$ and $\beta \left(1 + r \right) = 1$), and lets consider a decrease in world interest rates (i.e. $\beta \left(1 + r \right) < 1$) Note that from (4), the consumption of tradable goods in period 1 must be higher than in period 2 $(c_1^T > c_2^T)$. Hence, from (7), consumption of tradable goods is higher than production of tradable and the economy runs a trade deficit in period 1 $(c_1^T > y^T)$. Additionally, from (6), the relative price of non-tradable houses in terms of tradable goods increases in period one relative to period two $(p_1 > p_2)$, i.e. in period 1 the economy experiences high tradable consumption, high real price of houses, and a trade deficit, all relative to period 2. Intuitively, the higher

demand for consumption in period 1 relative to period 2 translates itself into a trade deficit and, given that the supply of houses is completely inelastic, to a higher real price of houses.[11]

In sum, an exogenous capital inflows leads to higher consumption, trade deficits, and an increase in the real price of houses. Note that in this model the association between housing prices and capital flows arises from the need to increase period 1 consumption, which in turn increases the current account deficit and capital inflows. Alternatively, we can stress the role played by the interest rate channel; as capital inflows help to sustain low levels of domestic interest rates, thereby strengthening domestic demand.

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[11]Note that in this analysis it does not matter what generates the increase in capital inflow, because the effects on the model are the same. In other words, capital inflows can be the result of pull factors (e.g. an exogenous change in the demand for foreign assets) or push factors (e.g. a decrease in the internatinal real interest rate).
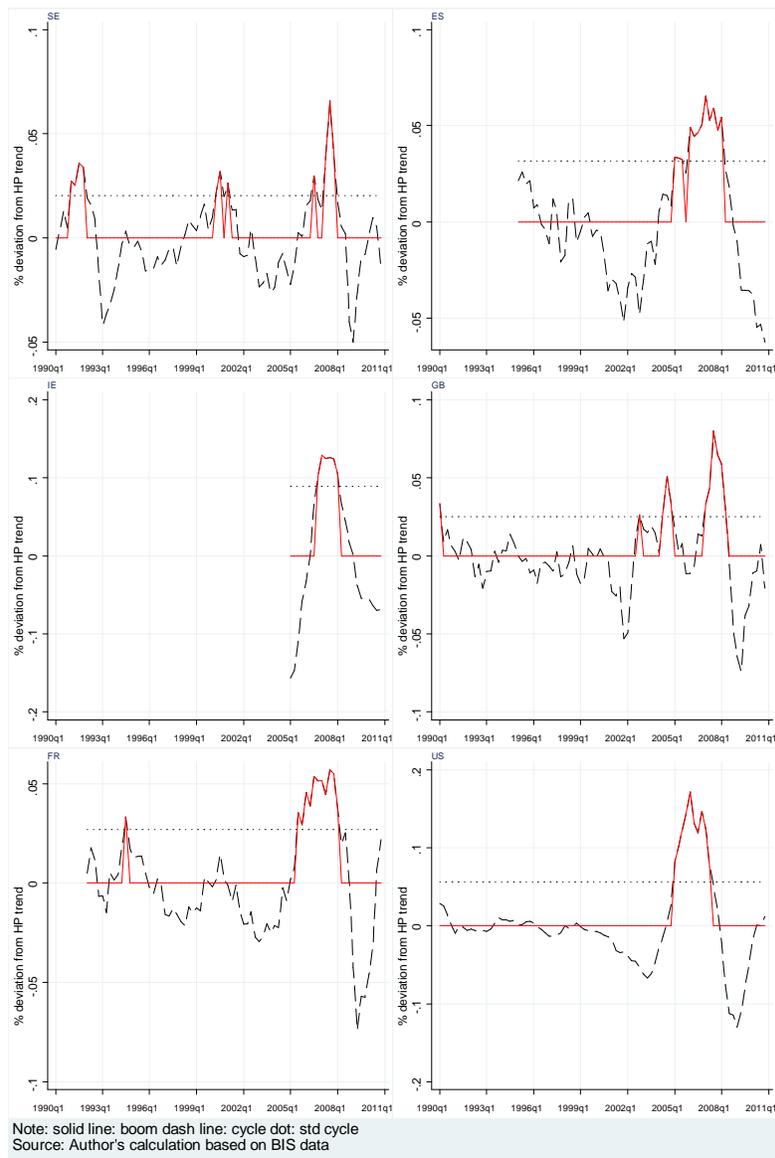
Note: solid line: boom dash line: cycle dot: std cycle
Source: Author's calculation based on BIS data

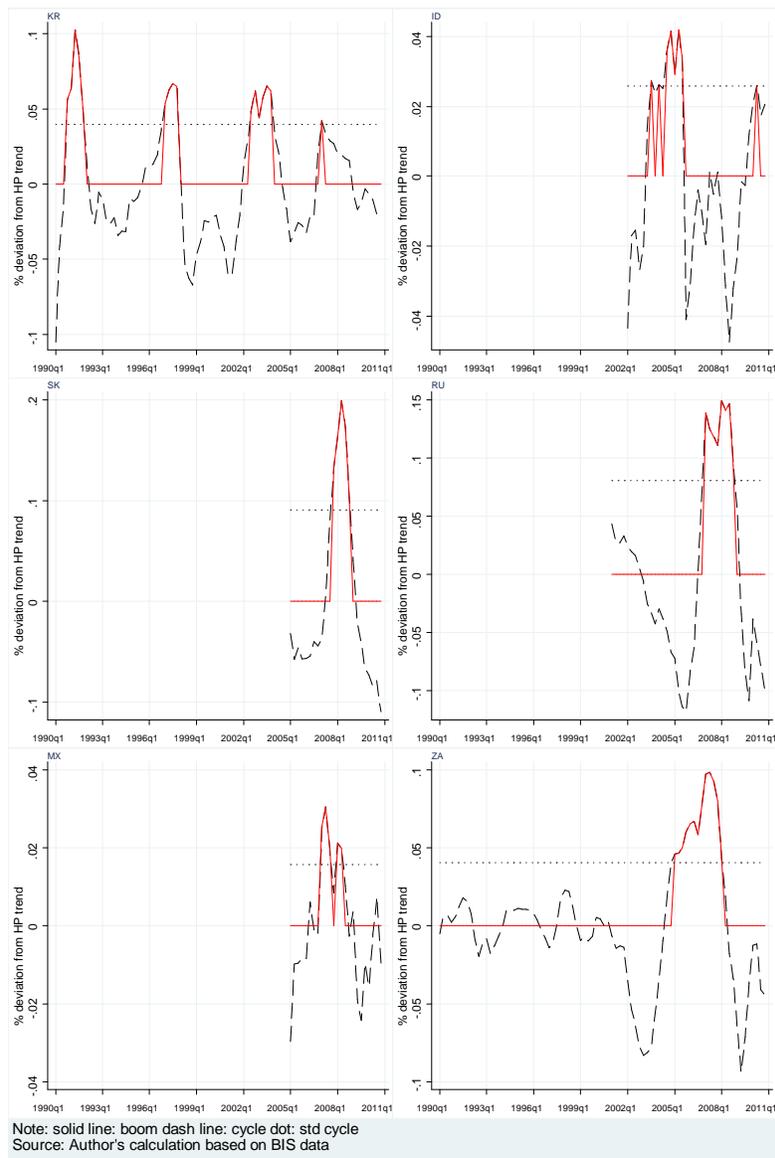Figure 1a: Booms in real estate prices (advanced economies)

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Figure 1b: Booms in real estate prices (emerging economies)

A.2   Dataset description

1. **Real estate prices.** A selection of housing price indexes used to construct the *boom* in housing prices, deflacted by the CPI. Sources: BIS and IMF.

2. **Capital inflows as percentage of GDP**. Net capital inflows as percentage of GDP separated by FDI, debt portfolio, equity portfolio, and other investment flows. Source: IFS, IMF.

3. **GDP growth rate**. Annual percentage variation of the GDP at constant prices. Source: IFS, IMF.

4. **Inflation rate.** Annualized percentage change of the Consumer Price Index (CPI). Source: IFS, IMF.

5. **Financial depth**. Stock of bank domestic credit as percentage of GDP. Source: IFS, IMF.

6. **Capital account openness**. Financial openness as defined by Chinn and Ito (2008).

7. **Exchange rate regime**. "Coarse" definition of exchange rate regime defined by Reinhart and Rogoff (2004).

8. **Rule of Law.** It captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts. Source: Kaufmann et al. (2010).

9. **Volatility Index.** The Chicago Board Options Exchange Volatility Index (VIX). Source: Bloomberg.

10. **Short term interest rate.** Policy nominal interest rate. Source: Bloomberg.

11. **Commodity price index**. Non-energy price index. Source: Word Bank.

Tabla 1: List of countries

Emerging economies							
Emerging Asia		Emerging Europe		Latin America		Middle East and Africa	
MY	Malaysia	EE	Estonia	MX	Mexico	IL	Israel
ID	Indonesia	SK	Slovak Rep			ZA	South Africa
KR	Korea	LT	Lithuania				
		RU	Russia				
		CZ	Czech Rep				
		BG	Bulgaria				
		HU	Hungary				
		LV	Latvia				
		PL	Poland				

Advanced economies					
Europe		Other developed		Off-shore	
SE	Sweden	NZ	New Zealand	HK	Hong Kong
CH	Switzerland	CA	Canada		
BE	Belgium	AU	Australia		
ES	Spain	US	US		
AT	Austria	JP	Japan		
IE	Ireland				
GR	Greece				
GB	UK				
NL	Netherlands				
FR	France				
SI	Slovenia				
DK	Denmark				
PT	Portugal				
NO	Norway				

Tabla 2: Determinants of booms in real property prices

All countries			
	(1)	(2)	(3)
VARIABLES	Fixed effect	Fixed effect	IV
Net FDI % GDP	0.1346***	0.1060***	0.2796***
	(0.0331)	(0.0341)	(0.0848)
Net Equity & GDP	0.1778***	0.1629***	0.0399
	(0.0295)	(0.0296)	(0.0726)
Net Debt % GDP	0.1430***	0.1247***	0.0678
	(0.0285)	(0.0288)	(0.0798)
Net OI % GDP	0.2295***	0.2083***	0.4187***
	(0.0218)	(0.0225)	(0.0896)
GDP growth		0.1948***	0.0726
		(0.0448)	(0.0529)
Inflation		0.0035*	0.0047**
		(0.0018)	(0.0019)
Constant	0.0086	0.0025	-0.0004
	(0.0129)	(0.0129)	(0.0141)
Observations	1,866	1,866	1,866
R-squared	0.234	0.243	
Number of IFS code	35	35	35

Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

All countries

Tabla 3: Determinants of booms in real property prices with interactions (Panel)

VARIABLES	(1) Fin depth		(2) Openness		(3) ER regime		(4) Rule of Law		(5) All	
Net FDI % GDP	-0.0921	(0.0707)	0.0969*	(0.0528)	0.0492	(0.0586)	0.0534	(0.0628)	-0.0592	(0.0801)
Net Equity & GDP	0.3500***	(0.0745)	0.2443***	(0.0505)	0.1331**	(0.0579)	0.4130***	(0.0629)	0.4704***	(0.0845)
Net Debt % GDP	0.1832***	(0.0485)	0.1096**	(0.0465)	0.1679***	(0.0466)	-0.0029	(0.0485)	0.0914	(0.0644)
Net OI % GDP	0.3025***	(0.0389)	0.2580***	(0.0345)	0.1869***	(0.0441)	0.2754***	(0.0334)	0.2331***	(0.0476)
GDP growth	0.3000***	(0.0576)	0.2697***	(0.0566)	0.2865***	(0.0563)	0.2733***	(0.0568)	0.3056***	(0.0584)
Inflation	0.2033***	(0.0589)	0.1823***	(0.0598)	0.1795***	(0.0599)	0.1857***	(0.0599)	0.2218***	(0.0621)
INTERACTIONS										
Net FDI % GDP*Fin depth	0.3131***	(0.0861)							0.2082*	(0.1104)
Net Equity & GDP*Fin depth	-0.2052***	(0.0736)							-0.1652*	(0.0940)
Net Debt % GDP*Fin depth	-0.0728	(0.0627)							-0.1501**	(0.0746)
Net OI % GDP*Fin depth	-0.1145**	(0.0489)							-0.1728***	(0.0639)
Net FDI % GDP*Openness			-0.0074	(0.0475)					-0.0954	(0.0871)
Net Equity & GDP*Openness			-0.0480	(0.0496)					0.1771**	(0.0885)
Net Debt % GDP*Openness			0.0578	(0.0442)					0.0254	(0.0615)
Net OI % GDP*Openness			0.0068	(0.0297)					0.1244***	(0.0474)
Net FDI % GDP*ER Regime					-0.0368	(0.0396)			-0.0551	(0.0445)
Net Equity & GDP*ER Regime					-0.0618*	(0.0355)			-0.0520	(0.0451)
Net Debt % GDP*ER Regime					-0.0140	(0.0319)			-0.0328	(0.0356)
Net OI % GDP*ER Regime					-0.0721**	(0.0296)			-0.0735**	(0.0309)
Net FDI % GDP*Rule of Law							0.0028	(0.0038)	0.0027	(0.0075)
Net Equity & GDP*Rule of Law							-0.0154***	(0.0039)	-0.0247***	(0.0071)
Net Debt % GDP*Rule of Law							0.0097***	(0.0029)	0.0084*	(0.0043)
Net OI % GDP*Rule of Law							-0.0034**	(0.0017)	-0.0047*	(0.0028)
Constant	-0.0128	(0.0128)	-0.0125	(0.0129)	-0.0120	(0.0129)	-0.0107	(0.0128)	-0.0145	(0.0127)
Observations	1,324		1,324		1,324		1,324		1,324	
R-squared	0.261		0.239		0.244		0.261		0.292	
Number of IFS code	31		31		31		31		31	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Tabla 4: Determinants of booms in real property prices with interactions (IV)

All countries

VARIABLES	(1) Fin depth	(2) Openness	(3) ER regime	(4) Rule of Law	(5) All
Net FDI % GDP	0.0260 (0.0485)	0.1097*** (0.0423)	-0.0037 (0.0453)	0.1144** (0.0455)	-0.0039 (0.0557)
Net Equity & GDP	0.2354*** (0.0664)	0.1851*** (0.0453)	0.0965* (0.0519)	0.3061*** (0.0573)	0.3640*** (0.0766)
Net Debt % GDP	0.1114*** (0.0382)	0.0424 (0.0400)	0.1133*** (0.0332)	-0.0675 (0.0412)	0.0041 (0.0508)
Net OI % GDP	0.3182*** (0.0310)	0.2379*** (0.0270)	0.1383*** (0.0383)	0.2749*** (0.0253)	0.2189*** (0.0401)
GDP growth	0.2208*** (0.0501)	0.2312*** (0.0487)	0.2360*** (0.0484)	0.2297*** (0.0489)	0.2205*** (0.0494)
Inflation	0.0980*** (0.0367)	0.0788** (0.0374)	0.0928** (0.0365)	0.0756** (0.0376)	0.0879** (0.0377)
INTERACTIONS					
Net FDI % GDP*Fin depth	0.1236** (0.0617)				0.1377 (0.0930)
Net Equity & GDP*Fin depth	-0.1375** (0.0661)				-0.0641 (0.0839)
Net Debt % GDP*Fin depth	-0.0610 (0.0494)				-0.1699*** (0.0593)
Net OI % GDP*Fin depth	-0.1535*** (0.0411)				-0.2031*** (0.0540)
Net FDI % GDP*Openness		0.0011 (0.0410)			-0.0171 (0.0670)
Net Equity & GDP*Openness		-0.0697 (0.0452)			0.1368 (0.0862)
Net Debt % GDP*Openness		0.0763* (0.0420)			-0.0190 (0.0555)
Net OI % GDP*Openness		-0.0011 (0.0259)			0.1304*** (0.0385)
Net FDI % GDP*ER Regime			-0.1015*** (0.0300)		-0.0856** (0.0333)
Net Equity & GDP*ER Regime			-0.0310 (0.0304)		-0.0257 (0.0414)
Net Debt % GDP*ER Regime			-0.0169 (0.0220)		-0.0376 (0.0261)
Net OI % GDP*ER Regime			-0.0783*** (0.0230)		-0.0867*** (0.0247)
Net FDI % GDP*Rule of Law				-0.0011 (0.0056)	-0.0065 (0.0056)
Net Equity & GDP*Rule of Law				-0.0129*** (0.0066)	-0.0233*** (0.0066)
Net Debt % GDP*Rule of Law				0.0105*** (0.0038)	0.0133*** (0.0038)
Net OI % GDP*Rule of Law				-0.0052*** (0.0026)	-0.0061** (0.0026)
Constant	-0.0059 (0.0125)	-0.0043 (0.0126)	-0.0037 (0.0125)	-0.0032 (0.0124)	-0.0036 (0.0122)
Observations	1,324	1,324	1,324	1,324	1,324
Number of ifs_code	31	31	31	31	31

Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Tabla 5: Determinants of booms in real property prices (Tobit)

All countries

VARIABLES	(1) Tobit	(2) Tobit
Net FDI % GDP	0.2032*	0.0980
	(0.1121)	(0.1098)
Net Equity & GDP	0.4430***	0.4060***
	(0.1122)	(0.1030)
Net Debt % GDP	0.6207***	0.5819***
	(0.1160)	(0.1081)
Net OI % GDP	0.9164***	0.8624***
	(0.0995)	(0.0958)
GDP growth		0.6767***
		(0.2098)
Inflation		0.0136*
		(0.0081)
sigma u	0.0112	0.0000
	(0.0110)	(0.0014)
sigma e	0.1287***	0.1273***
	(0.0062)	(0.0059)
Constant	-0.1461***	-0.1615***
	(0.0562)	(0.0548)
Observations	1,866	1,866
Number of IFS code	35	35

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Tabla 6: Determinants of booms in real property prices with interactions (Tobit Panel)

All countries

VARIABLES	(1) Fin depth		(2) Openness		(3) ER regime		(4) Rule of Law		(5) All	
Net FDI % GDP	-0.2409	(0.2930)	0.4624	(0.2866)	0.1339	(0.2842)	0.3335	(0.2802)	-0.2531	(0.3492)
Net Equity & GDP	1.3443***	(0.3663)	1.3557***	(0.3028)	0.8284***	(0.2973)	2.1816***	(0.3784)	1.7938***	(0.4437)
Net Debt % GDP	1.1110***	(0.2455)	0.7410***	(0.2491)	1.0016***	(0.2542)	0.6308**	(0.2474)	0.9888***	(0.3137)
Net OI % GDP	1.2364***	(0.1830)	1.1381***	(0.1781)	0.9795***	(0.2506)	1.1422***	(0.1610)	1.1366***	(0.2498)
GDP growth	1.4432***	(0.3054)	1.0050***	(0.2883)	1.0593***	(0.2773)	1.2065***	(0.2924)	1.3201***	(0.3007)
Inflation	0.6196**	(0.2486)	0.5708**	(0.2591)	0.5205**	(0.2358)	0.6469**	(0.2612)	0.6087**	(0.2649)
INTERACTIONS										
Net FDI % GDP*Fin depth	1.4696***	(0.3590)							1.1725**	(0.5034)
Net Equity & GDP*Fin depth	-0.4021	(0.3291)							0.2306	(0.4427)
Net Debt % GDP*Fin depth	-0.1134	(0.2757)							-0.2836	(0.3567)
Net OI % GDP*Fin depth	-0.0539	(0.2188)							-0.4096	(0.3121)
Net FDI % GDP*Openness			0.0626	(0.2377)					-0.4145	(0.3440)
Net Equity & GDP*Openness			-0.7222***	(0.2366)					0.1381	(0.4138)
Net Debt % GDP*Openness			0.1175	(0.2210)					0.2185	(0.2765)
Net OI % GDP*Openness			-0.0367	(0.1321)					-0.0269	(0.2046)
Net FDI % GDP*ER Regime					-0.2347	(0.1702)			-0.2893	(0.1972)
Net Equity & GDP*ER Regime					0.0891	(0.1800)			-0.1633	(0.2261)
Net Debt % GDP*ER Regime					0.1131	(0.1213)			0.0978	(0.1494)
Net OI % GDP*ER Regime					-0.0623	(0.1269)			-0.1306	(0.1481)
Net FDI % GDP*Rule of Law							0.0267	(0.0167)	-0.0015	(0.0279)
Net Equity & GDP*Rule of Law							-0.0864***	(0.0199)	-0.1039***	(0.0350)
Net Debt % GDP*Rule of Law							0.0238*	(0.0136)	0.0195	(0.0201)
Net OI % GDP*Rule of Law							0.0035	(0.0074)	0.0141	(0.0130)
sigma u	0.0448***	(0.0113)	0.0359***	(0.0127)	0.0324**	(0.0126)	0.0427***	(0.0115)	0.0449***	(0.0118)
sigma e	0.0879***	(0.0049)	0.0919***	(0.0051)	0.0924***	(0.0052)	0.0879***	(0.0049)	0.0853***	(0.0047)
Constant	-0.1514***	(0.0474)	-0.1545***	(0.0496)	-0.1412***	(0.0477)	-0.1571***	(0.0483)	-0.1493***	(0.0470)
Observations	1,324		1,324		1,324		1,324		1,324	
Number of IFS code	31		31		31		31		31	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

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