Constraints on LTV as a Macroprudential Tool: A Precautionary tale

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Abstract

The introduction of limits or regulatory penalties on high LTV ratios for residential mortgages is one of the most frequently used tools of macroprudential policy. The available evidence seems to indicate that this instrument can reduce the feedback loop between credit and house prices. In this paper, we show that these constraints on LTV ratios, used by Spanish banking regulators before the onset of the housing crisis of 2008, did not prevent that feedback loop. In the Spanish case, the fact that appraisal companies were mostly owned by banks led to a situation in which the LTV limits were used to generate appraisal values adjusted to the needs of the clients, rather than trying to appropriately represent the value of the property. This tendency towards over-appraisals produced important externalities in terms of a higher than otherwise demand for housing, and intensification of the feedback loop between credit and house prices.

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1. Introduction

The financial crisis highlighted the need to go beyond a purely micro-based approach to financial regulation and supervision. There has similarly been a growing consensus among policymakers on the advantages of supplementing the traditional microprudential view with a macroprudential approach to regulation and supervision (Blanchard et al., 2010, Freixas, Laeven and Peydro, 2015).

There is extensive research on the effect of financial frictions (among them collateral constraints) on the transmission mechanism of shocks. For example, Kiyotaki and Moore (1997) show that credit restrictions and collateral requirements amplify the impact of shocks. Bernanke et al. (1999) show that financial frictions derive from information asymmetry between borrowers and lenders. These frictions could lead to small shocks having a persistent, amplified and extended impact. Iacoviello (2005) introduces the basic insights of Kiyotaki and Moore in a general equilibrium macroeconomic model where the collateralisable capital corresponds to real estate. Jermann and Quadrini (2012) and Mumtaz and Zanetti (2016) introduce financial frictions using the enforcement constraint to analyse the macroeconomic effects of credit constraints on financial flows and the labour market respectively.

Yet research on the effect of macroprudential policies remains relatively limited. In particular, empirical analyses of the effectiveness of historical macroprudential policies (MPPs) in avoiding financial instability are scarce, including quantifying the effect of macroprudential policy instruments on leverage, asset prices and asset price bubbles (Galati and Moessner, 2013).[4] Haldane (2013) has declared that 'macroprudential policy is roughly where monetary policy was in the 40's... If I were being charitable, that would be the 1940s, rather than the 1840s'.[5]

[4] Recently, Vandenbussche et al. (2015) have argued that macroprudential policies have the potential to change the demand for housing, and therefore mitigate housing prices and housing price bubbles.
[5] Cerutti et al. (2015) argue that 'taken altogether the empirical evidence on the effectiveness of macroprudential policies in managing credit flows and asset prices is still preliminary'.

Most studies have analysed the impact of macroprudential policies in a cross-section of countries[6]. However, Kok et al. (2014) notice that 'showing that macroprudential policy implementation has a significant effect in a sample of countries does not mean that the same is true for an individual country... Although many financial systems are highly interrelated, they can also differ significantly between countries. The policy impact should therefore also be analysed at the national level'. Some recent studies analyse the effect of LTV (loan to value) and DTI (debt to income) regulations in individual countries like Hong-Kong (He, 2014) and Korea (Kim, 2014), showing that these regulations have impact but with unintended consequences. In this paper we analyse a particular country (Spain) that suffered a sizeable housing bubble and, in contrast with other countries, had already some macroprudential policies in place. But instead of analising the unintended consequences of those policies, we study the reasons why some of those policies failed when financial institutions found a way to evade them. We argue that the efficacy of macroprudential policy depends on the institutional set-up of each country.[7] As the saying goes, 'the devil is in the details': even a well-intentioned macroprudential policy can become ineffective if the mortgage financing sector is plagued with perverse incentives that are unaffected by such policy.[8] Long before the crisis, Spanish banking regulation implemented many of the macroprudential policies included in the current toolbox of macroprudential recommendations, including countercyclical provisions, sectoral capital requirements and LTV regulations. Yet despite these preventive measures, the Spanish banking system experienced a substantial setback after 2008. We argue that one particularly important reason for this situation was that the ownership of appraisal companies by banks and savings and loans associations rendered most LTV policies ineffective. The Spanish experience is important because placing a limit on the LTV ratio is, around the world, the most common sectoral macroprudential tool (IMF, 2013a). In this sense, an analysis of the effectiveness of LTV ratios in Spain is particularly relevant.

The paper is structured as follows. Section 2 discusses the LTV ratio as a macroprudential tool and the importance of appraisals in its determination. This section also presents a discussion of the relationship

[6] For instance Lim et al. (2011), Kuttner and Shim (2013) or Vandenbussche et al. (2015).
[7] Cerutti et al. (2015) also find that 'the effectiveness of policies is both instrument and country specific'.
[8] Montalvo (2009a,b) presents a systemic view of the perverse incentives among the participants in the US mortgage finance system that led to the financial crisis. In the Spanish case, the role of rating agencies is mostly played by appraisal companies. Section 2.2 provides the details to interpret this analogy.

between market prices and appraisals. Section 3 describes intitucional detail of the the Spanish housing finance sector as well as the credit boom and bust of the financial sector during the first decade of the 21st Century. Section 4 explains the construction of the dataset and provides some descriptive statistics. Section 5 discusses the main results. Finally, we provide some conclusions and policy implications.

2. Literature Review

2.1 The macroprudential toolkit: appraisals and LTV ratios

There are basically three types of macroprudential tools: countercyclical capital buffers and provisions, sectoral tools and liquidity tools (IMF, 2013a).[9] While countercyclical buffers try to increase the resilience of the banking sector to shocks, sectoral tools attempt to control the excessive build-up of risk in a particular sector like, for instance, mortgage lending. Sectoral policies include high, and possibly countercyclical, risk weights for loans in the targeted sectors, constraints on LTV ratios and restrictions on DTI ratios. The IMF (2013a) shows that the most common sectoral macroprudential tool is a cap on LTV ratios. In the sample of 46 countries analysed by the IMF (2013a), 52% of the countries had a cap on the LTV ratio while 30% had a limit on the DTI ratio. Cerutti et al. (2017) extend the sample to 119 different countries and find that caps on LTV ratios are used in 21% of the sample while limits on DTI are employed in 15%. The reasons for these comparably lower percentages is that their sample contains more emerging economies than that of the original IMF study, and limits on LTV or DTI ratios are more frequently used in advanced economies.

In this paper we discuss the effect of caps on LTV ratios with particular application to the Spanish case.[10] In general, the literature concurs that restrictions on the LTV ratio are associated with reductions in housing transactions, credit volume and slower house price gains. From a theoretical perspective, Craig and Hua (2011), Igan and Kang (2011), and Allen and Carletti (2013), find that lowering loan-to-value ratios through regulation will lead to a reduction in real estate prices and a growth of transaction volumes

[9] Cerutti et al. (2015) also provide another very useful classification of macroprudential tools. It breaks down the tools into five groups: quantitative restrictions on borrowers, instruments or activities; capital and provisioning requirements; other quantitative restrictions on financial institutions' balance sheets; taxation/levies on activities or balance sheet composition; and other, more institutional-oriented measures.

[10] For the effect of countercyclical capital buffers, see Jiménez et al. (2016).

in a boom. Wong et al. (2011) offer evidence of LTV effectiveness in reducing delinquencies after property busts in a few Asian economies. Lim et al. (2011) find that several instruments such as LTV or DTI ratios reduce the procyclicality of credit and/or bank leverage in a panel of 49 countries during 2000-10. Finally, focusing on a panel of 59 countries, only Kuttner and Shim (2013) find that limits on LTV do less to slow credit growth than limits on the maximum DTI ratio. However, the IMF (2013b) claims that LTV ratios can have a relatively strong effect on house prices and aggregate demand. The Bank of Ireland (2014) also calculates that if loans had been capped at an LTV of 80%, credit losses on residential property of the banks would have been 17% lower than they turned out to be. Claessens et al. (2013) provide bank-level evidence that measures aimed at borrowers - DTI, LTV, and limits on credit growth and foreign currency lending - are effective in reducing leverage, asset and non-core to core liabilities growth during boom times.

In addition, Crowe et al. (2013) survey the literature on the effects of these types of MPPs in eliminating real estate booms. They find that a 10 percentage point decrease in the LTV ratio leads to a reduction in the real home price inflation between 8 and 13 percentage points. However, regulation seems to work only in the short term as people are able to fairly quickly find ways to circumvent the regulations[11]. Reinhardt and Sowerbutts (2015) find that banks can get involved in regulatory arbitrage. They find that foreign banks expand their lending into host countries when regulation that do not apply to them, for instance macroprudential capital requirements, are activated. However, they do not increase lending if the macroprudential action is no lending standards (for instance a limit on the loan to value ratio). Cizel et al. (2016) describe another mechanism to circumvent macroprudential regulations. Cizel et al (2016) show evidence of a substitution effect towards non bank credit as a consequence of macroprudential policies on bank credit. They find that quantity restrictions on bank credit are very potent but they also generate the strongest substitution effects.

[11] Hartmann (2015) notices that policy makers refer to the ability of agents to evade macroprudential policies as a challenge for using them. However, the exiting literature has not paid much attention to this possibility.

How were Spanish banks able to bypass tough regulation in terms of LTVs? How did banks contribute to the real estate bubble, both in terms of pricing and mortgage loan principals? In this paper we present some empirical evidence on how the Spanish banking system circumvented LTV regulation.

2.2 The mechanism for the circumvention of limits on LTV: over-appraisal

During the boom period, appraisers had incentives to inflate transaction prices in order to accommodate the financial needs of their clients (banks or financial brokers) and obtain future appraisal assignments. Nakamura (2010), suggests that valuations - in theory an independent assessment of the value of a home - have been subject to an upward bias driving excessively risky mortgage loans. The underlying mechanism was the belief that housing prices would continue to grow strongly, reducing the risk of default. In this scenario, appraisal prices lost validity as a risk assessment of the mortgage loan and gained validity as an element to be used for mortgage lending. As regards over-appraisal, Cho and Megbolugbe (1996) provide evidence using a sample of over 600,000 mortgage acquisitions in 1993, where only 5% of appraisals were below the selling price, while more than 65% were above. This data suggests that over-appraising has been a generalized practice. Loebs (2005), with a sample of homes priced between 1977 and 2004, observes that the appraised price is at or above the selling price in 97% of the cases. Calem et al. (2015) develop a model that replicates the distribution of the ratios of appraised values to transaction price observed in a rich dataset. Ben-David (2011) presents evidence of inflation in transaction prices in order to increase the debt capacity of the household. Finally, Freybote et al. (2014) use an experiment to test whether an upward bias in a new appraisal is produced when the appraiser has client feedback on a previous appraisal.

The mechanism of over-appraising in Spain was intensified by the fact that banks owned 25% of the appraisals companies (13 out of 56). Since these were the largest companies they accounted for 52% of the appraisals produced during those years. But control is not exercised exclusively with a majority equity stake. Sometimes banks had a significant stake even if they did not have the majority. There is also anecdotal evidence that appraisal companies that had only one or two banks as clients tended to inflate their valuation. We should notice that appraisal companies concentrated 76% of their turnover in just one or two clients, which were banks. An indirect effect of the influence of appraisals companies, owned or

participated by banks, on the rest of the sector is the fact that, given the technical conditions to calculate an appraisal, once a large part of the market tends to produce over-appraisals then other companies, that use those dwellings as comparables for new appraisals (a valuation needs of six comparables) will translate that over-appraisal to other real estate properties. In a period of rising home values, granting larger mortgages may not seem risky. By this logic, during the housing boom financial institutions were prone to opening the market to weak borrowers with financial constraints. To this end, appraisers were encouraged to introduce an upward bias in appraisal prices. As the appraisal was the value used by financial institutions to determine the loan to value ratio, even for new mortgages, this artificial increase in appraisal prices allowed to draw larger mortgages.[12]

From a purely theoretical perspective, it is reasonable to expect that appraisal companies owned by banks have a higher propensity to adjust appraisal values to help banks in the origination of mortgages by keeping low LTV ratios. Montalvo (2006) notes the pervasiveness of this institutional specificity of the Spanish housing finance system. In fact Montalvo (2009a) compares the perverse incentives of participants in the housing finance sector of the US and Spain (including consumers, bank, regulators and rating agencies). Many of the mechanisms at work in the US worked similarly in Spain, although for different reasons. For instance, consumers had a high propensity to buy houses independently of their financial situation. In the US the fact that mortgages were non-recourse in the largest states, and that house prices were growing very fast, generated a kind of put option: if prices continued to go up consumers could get capital gains, equity withdrawals and, if interest rates went further down, refinance. If prices were going down they could "jingle bell" (return the dwelling and cancel the debt). In Spain the mechanism was different since mortgages are recourse. Montalvo (2006) shows that the expectations of further increases in house prices were generalized: people expected that prices would go up 25% annually during the next 10 years[13]. An additional incentive to buy real estate was the fact that mortgage rates in Spain during the years of the fast expansion of the real estate sector (2002-2007) were very low. The spread over Euribor of mortgage rates in Spain, considering only variable rate mortgages (which in Spain

[12] Akin et al. (2014) provide evidence of this process in the Spanish case.
[13] US consumers were also optimistic about the future evolution of house prices (Case, Shiller and Thompson 2012), but much less so than Spanish consumers.

represented 90% of all the mortgages), was much lower than the corresponding spreads in all the other EU countries.

Regulators were also influenced by the political interest to expand the "ownership society". In the US this support came in the form of relaxation the conditions to get the mortgage guarantee of Freddie Mac and Fannie Mae. In Spain the government provided large subsidies and tax deductions for mortgages (not only for interest rate payments but also for capital) to buy houses.

In the banking industry the increase of the proportion of payment for performance produced intense incentives to sell banking products and, in particular, mortgages. In the US the securitization of mortgages move many mortgages out of banks' balance sheets, leading to lax screening[14]. The process of massive securitization of mortgages would have not worked without the perverse incentives of rating agencies: issuers of mortgage based securities paid for the rating, and there was the possibility of shopping for a good rating[15]. Many tranches of MBS got triple-A ratings even if the underline mortgages had plenty of NINJA (no income, no job, no assets) borrowers and high LTVs. The weakening of the screening standards was also very obvious in the case of the Spanish banking sector. However, the process was very different from the conditions of the US. Spanish banking regulation did not allowed to deconsolidate SPVs created with securitased mortgages and, therefore, banks could not improve their capital ratios by securitizing mortgages US-style. For this reason the kind of securitization observed in the US did not take place in Spain. However, Spanish banks needed to finance the increasing number of mortgages that they were originating. For this purpose traditionally they issue large amounts of covered bonds backed by their portfolio of mortgages. But only mortgages with a loan to value ratio of 80% or below can count for the backing portfolio. This is the point in which Spanish appraisal companies played a role similar to rating agencies: their valuations determined what mortgages could be included in the pool of mortgages that could back the issuance of covered bonds. In this case the perverse incentive was the fact that most of the appraisals were performed by companies owned by financial institutions.

[14] Keys et al. (2010)
[15] Montalvo (2009b) and Bolton, Freixas and Shapiro (2012)

This paper builds on this work and presents the first empirical evidence on the quantification of the over-appraisal process during the period leading up to the financial crisis[16] and its relationship to the financial health of banks after the onset of the crisis.

3. Types of Financial Institutions and Macroprudential Tools in Spain

Spanish financial institutions (up until 2012) can be divided into three groups according to their risk appetite and management practices (Salas and Saurina, 2002), as reflected by their relative ability to deal with the shock caused by the financial crisis. The first type of institution was commercial banks, which continued their activity without any regulator intervention. The second type was the savings banks (or *Cajas*). *Cajas* are an unusual part of the Spanish financial sector, characterized by heavy political involvement. Unlike commercial banks, they do not have tradable participations and are not quoted in the stock market. Therefore, takeovers and other control mechanisms relying on the share price do not act as automatic disciplining channels. When the crisis began, many savings banks suffered different types of interventions by the Bank of Spain and the public sector.[17] According to this fact, we can classify savings banks into[18]: those taken over by the Bank of Spain during the crisis ('rescued banks')[19] and those which ended up being owned by the Fund for the Orderly Restructuring of the Banking Sector (*Fondo de Reestructuración Ordenada Bancaria* - FROB)[20] because the government injected capital into them ('owned by FROB'). Finally, the third type of financial institution was non-bank financial companies.

With respect to the macroprudential policies, the LTV ratio played an important role in many aspects of Spanish financial sector regulation. First, the Bank of Spain recommended to not originate mortgages with an LTV over 80% and second, considered as low risk those mortgages with an LTV below 80%.[21] Third, the financial institutions subject to the standard method for the calculation of credit risk imputed a 50% weight to residential mortgages with an LTV below 80% and a 100% weight for any residential mortgage

[16] In response to this problem the Bank of Spain has, since 2011, been enacting new regulations to reduce the presence of financial institutions in the capital of appraisal companies.
[17] With one exception, the small bank Banco de Valencia owned by Bancaja, a savings bank.
[18] See Table A.1 of the Appendix for details.
[19] These financial institutions include CCM (Caja Castilla La Mancha, March 29, 2009), Caja Sur (April 22, 2010) CAM (Caja de Ahorros del Mediterráneo, July 22, 2011) and Banco de Valencia (November 21, 2011).
[20] The Fund for Orderly Restructuring of the Banking Sector (*Fondo de Reestructuración Ordenada Bancaria* - FROB) was the institution that injected public money into savings banks with financial issues and low levels of capitalization.
[21] Regulation CBE 4/2004, Annex IX.

with a higher LTV.[22] Fourth, a traditional securitization strategy used by Spanish financial institutions has been the issuance of covered bonds. The residential mortgages that are eligible for the pool of assets that supports the issuance of covered bonds need to have an LTV below 80%. Given these regulatory thresholds, we expect to see spikes at the thresholds in the distribution of the loan to appraisal value ratio, but there is no reason to believe that we will see any threshold in the loan to market price ratio.

In addition, during the third quarter of 2000, dynamic provisioning was introduced in Spain[23]. The calculation of the provision was also a function of LTV. Banks had to set aside, as a general provision, a higher percentage of the amount of debt for mortgages with a LTV above 80% than for mortgages with lower LTV ratios. Spain is particularly well-suited to test whether macroprudential instruments like LTV constrains have an impact on the lending cycle and on real activity. Even though many macroprudential policies were in place before the beginning of the crisis they did not prevent the considerable issues that Spanish banks faced in the wake of the housing market collapse. Finally, on 25 June 2012, the Spanish government requested external financial assistance to restructure and recapitalize the Spanish banking sector and signed a memorandum of understanding with the European Union. The latter amounted to a bailout of up to €100 billion from the European Financial Stability Facility (EFSF).

4. Data

Unfortunately, data availability is an important obstacle to analysing the Spanish real estate sector. One indication of this difficulty is the fact that until 2007 the official house price index, the only index available over a long period of time, was constructed using appraisal values and not market prices. In order to construct our dataset, we thus needed to combine information from a variety of different sources. First, we obtained market information from a residential real estate intermediary[24] with branches in most of the Spanish provinces. To gain a sense of the size of this company, we can compare its sales with the transactions of the market. For instance, the company made 6,528 sales in 2012, or around 4% of the total

[22] Regulation CBE 5/1993. Regulation CBE 3/2008 (section 16) reduced the risk weight of residential mortgages with LTV below 80% to 35%, and increased the weight of residential mortgages with LTV over 95% to 150%, keeping 100% for mortgages between 80% and 95% of the LTV.
[23] Jimenez et al. (2017) provide evidence of the effect of dynamic provisioning in the Spanish financial sector.
[24] For confidentiality reasons we cannot identify the company.

sales of home in the free market in Spain during that year.[25] We matched those residential units with information on the financial intermediary that provided the mortgage. The data, corresponding to residential mortgages originated between 2005 and 2010, include information on loan and borrower characteristics, including real estate appraisal value and lender identity. For a sample of 3,305 observations, we were able match this information with the information on the financial intermediary. For these houses we thus have the demographic characteristics of the family and financial information, as well as the characteristics of the dwelling, including the actual market price. In order to improve our ability to merge data from different sources of information, we matched each residential unit with their unique cadastral number (*numero catastral*) in the Cadastre Bureau database, the institution responsible for the geo-referenced cartography of all real estate assets in the Spanish territory. Using this identification number, we were able improve the matching of the information previously described with the information from the Property Registry,[26] which also includes the size of the loan, its characteristics and the price[27] declared to the Property Registry.[28] Our final dataset merges all the previous databases. It covers several thousand mortgages during the period 2005-2010, for which we have been able to obtain the actual market price of the collateral,[29] the appraisal value,[30] the price recorded in the Property Registry, and the mortgage amount.

As explained above, the data on transactions comes from a single large real estate intermediary, requiring a discussion of the representativeness of the sample. We cannot compare the market prices of these properties as the data on this intermediary is the only source of actual market prices available in the Spanish case. However, we can compare average appraisal price by square meter. The sample average of our sample, 2,072 euros/sqm is very similar to the average obtained from the official appraisals (2,140

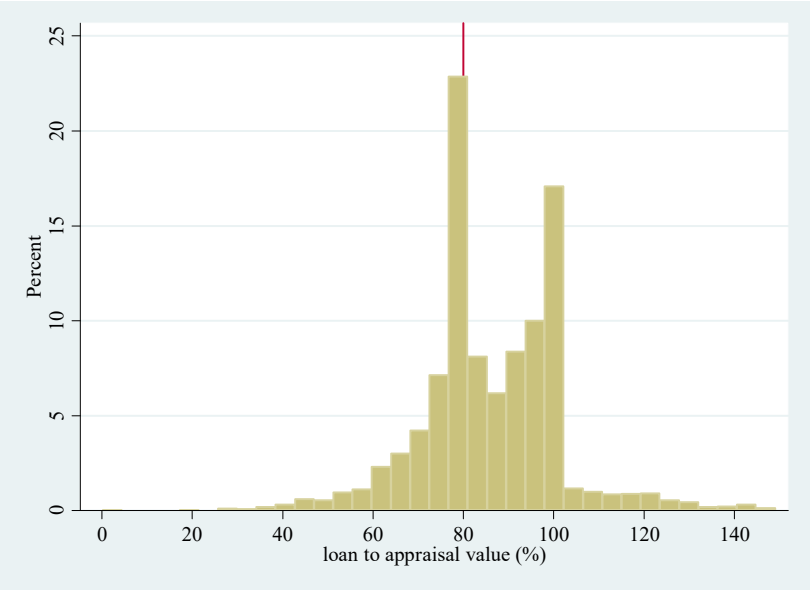
[25] This number excludes social housing and residential units that had some type of public subsidy.
[26] Property Registry refers to the Spanish *Registro de la Propiedad* which archives the property titles of all real estate assets.
[27] Note that prices declared to the Property Registry do not have to coincide with market prices, and there is an extended practice of using undeclared money to the tax authority as part of the payment in real estate transactions (Montalvo and Raya, 2012).
[28] To ensure that the matching was properly performed, we compared the common variables available in our constructed dataset with the information from the Property Registry (e.g. size of the loan, appraisal price). There was never any personal information (e.g. names of owners, location of the house, etc.) in our database as all the matching was performed by the institutions that collaborated in the study. We always received anonymized data after the successive processes of matching and merging datasets.
[29] This dataset is the only source of actual market prices available in Spain.
[30] We double-checked appraisal values using two of the databases.

euros/sqm) reported in the statistics of the Department of Public Works (*Ministerio de Fomento*). The Department uses these appraisals, delivered directly from appraisal companies, to calculate their home price indicator. We would have liked to compare the distribution of LTV ratios for the population of mortgages between 2004 and 2010 (LTV calculated using appraisal values since there is no information on market prices). This information is not, however, available. We did find the distribution of loan to appraisal value for the stock of mortgages of 2009 (Trucharte, 2010). Unfortunately, this stock includes many mortgages that were originated long before the beginning of the fast expansion of the housing sector and, therefore, the LTV distribution is shifted to the left of the distribution of the LTV of new mortgages originated between 2004 and 2010. Therefore, reweighting our sample using the distribution of the LTV for the stock of mortgages of 2009 represents a lower bound for our estimators. We report the effect of this reweighting for several indicators below but we insist that this reweighting strategy does not lead to the actual distribution of the LTV for mortgages originated during the period of study, and is presented simply for setting a lower bound.

4.1. LTV calculations: loan to appraisal versus loan to market price

After merging the datasets, we can analyse the relationship between all the prices that characterize a real estate transaction. The first indicator is the loan to appraisal value ratio. This is the critical ratio from the perspective of banking regulation. The ownership of appraisal firms by banks led to perverse incentives that adjusted appraisal values to the financial needs of families, instead of reflecting the real value of the properties. This strategy was very risky since it is well known that delinquency rates increase rapidly once the mortgage reaches a loan to value over 80%.

Figure 1. Loan to Appraisal Value



Note: Loan to appraisal value (in percentage) for home acquisition mortgages in Spain from 2004 to 2010.

Source: own elaboration from our dataset.

Figure 1 shows that the loan to appraisal value ratio has a mode at 80% and very low frequencies above 100%. The distribution shows two peaks, at 80% and around 100%, consistent with the regulatory thresholds previously discussed. The average loan to appraisal value is 82.9%.[31] This number is also consistent with the result of dividing the average size of new mortgages by the appraisal value of an apartment of average size.

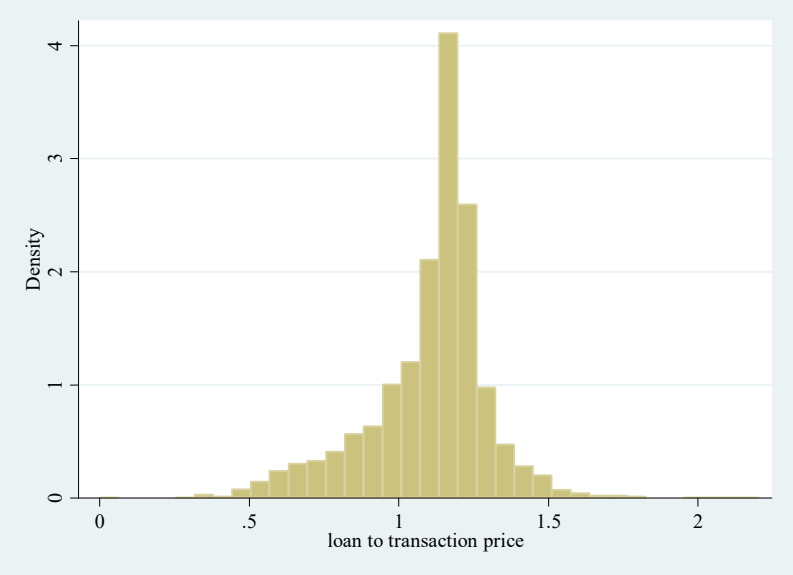
However, as we suggested above, the fact that banks and savings and loans associations owned a large proportion of the appraisal companies generated a perverse incentive that pushed appraisal values upwards and notably above the usual levels of over-appraising observed in other countries. To analyse this effect, Figure 2 presents the distribution of the ratio of loan over market price instead of the appraisal value. The figure is remarkable: most of the distribution of the loan to transaction price is over 100%. In fact, the average is 110%,[32] with a similar median. This is a clear reflection of over-appraising and challenges the traditional view that in Spain, contrary to in the United States, there was not an effect of mortgage equity withdrawal. In the United States, families frequently converted wealth into disposable

[31] The reweighted average, using the distribution of LTV of the stock of mortgages in 2009, is 70.4%.
[32] The reweighted average, using the distribution of LTV of the stock of mortgages in 2009, is 93.9%.

income by asking for a loan on the increase in the price of their house. In Spain this was not a common request. This led some analysts to claim, in the initial stages of the crisis, that the effect of a reduction in housing prices in Spain would not be as negative in terms of consumption as it was in the United States. Figure 2 shows the sort of equity withdrawal that was taking place in Spain: appraisal values were already capitalizing future increases in house prices and resulting in larger than otherwise loans. This kind of equity withdrawal is worse than that common in the US. In the Spanish case, the increase in house price did not have occurred, the expectation was enough.

The average of the over-appraisal reaches 29% of the market price.[33] Note that part of this difference was used by the bank to supposedly cover for the equity. Another part was used to pay for transaction costs, furniture, appliances, vacations or even the down payment on a car. There is also a trade-off between the loan to appraisal value ratio and the degree of over-appraisal. There are basically two situations: either the loan to appraisal value ratio is high, with a transaction price close to the appraisal price, or the loan to value is low with a high degree of over-appraisal. Savings and loans associations more frequently adopted the first strategy while banks had a high propensity to follow the second strategy.

Figure 2. Ratio of Loan to Market Price



[33] The ratio of the reweighted average of the two LTV (loan over market prices and loan over appraisal value) using the distribution of LTV of the stock of mortgages in 2009 leads to a higher over-appraisal level.

Note: Loan to market price (in percentage) for home acquisition mortgages in Spain from 2004 to 2010.
Source: own elaboration from our dataset.

4.2. Over-appraising across financial institutions

In Table 1 we examine several indicators of over-appraisal by different financial institution groups. Commercial banks have the lowest loan to market price among all the financial institutions. The reason for the high over-appraisal level is the low level of their loan to appraisal value ratios. This means that commercial banks hid their aggressive over-appraisal strategy using low regulatory LTVs. In column 2, we show the indicator for savings banks. In this case, their average loan to market value is higher than that of the commercial banks since their average loan to appraisal values was also clearly higher than those of commercial banks (around 8 percentage points). This is very important since the relevant ratio in the context of generalized overappraisal is the loan to market price.

In addition, the sample mean shows higher over-appraisals over market price for rescued banks[34]. There is also an important difference between rescued banks and institutions owned by the FROB. While the rescued banks had a low average loan to appraisal value ratio, the institutions that ended up being owned by the FROB report the highest levels of loan to appraisal value of all the institutions. This implies that the over-appraisal of the rescued banks is significantly higher (almost 6 percentage points) than the over-appraisal of the banks owned by the FROB, even though in both cases the level of loan to market price is the highest among banking institutions. The rest of savings banks had lower loan to market value than the savings banks rescued by the Bank of Spain or owned by the FROB. Finally, we have the other non-bank financial companies. In this case, the level of loan over market price is the highest, but the loan to appraisal ratio is also high, yielding a level of over-appraisal below that of both commercial and savings banks.

[34] All differences in mean discussed in this section are statistically significant at the 1% significance level.

Table 1: Appraisal to Market Price Ratio by Type of Financial Institution

Scenario	Commercial Banks	Savings banks	*Rescued banks*	*FROB owned*	*Rest of savings banks*	Other Financial companies
% of whole sample	39.61%	51.62%	8.56%	30.65%	12.41%	8.77%
Appraisal over market price ratio	34.77%	25.96%	30.49%	23,42%	29.60%	24.94%
Loan to appraisal value	82.70%	90.95%	88.06%	93.69%	87.05	93,55%
Loan to market price	109.96%	113.17%	113.70%	114.36%	111.40%	114.57%

4.3. Descriptive statistics

Tables A.2 and A.3 in the appendix show the descriptive statistics of the variables used in our analysis. We use the aforementioned matched sample which contains 3,305 observations. The average transaction price (€156,005) is considerably lower than the appraisal value (€195,214). As a result, the appraisal to transaction price ratio is, for the whole period, 1.29. This figure confirms the extent of the valuation bias in the Spanish housing finance process.

The average LTV is 87.5%. In terms of the price of the loan we have two sources of information: the type of benchmark rate and the spread. Lenders use as benchmark interest rates either the Reference Interest for Mortgage Loans (RIML) or the Euribor. In our sample, 84% of the loans were priced using the Euribor. The spread is defined as the difference between the gross loan rate and the reference rate. The average spread, which is extremely low, is 0.85. Using the same data source, the average spread in 2016 was 1.51 (and reached 2.57 in 2013). This figure is the result of extreme competition in the financial market to obtain new mortgages. In fact, with these low spreads, the only way to increase benefits was to increase the number of loans. The combination of high LTVs and very favourable pricing contributed to both the housing boom and lax credit standards (Akin et al., 2014)

We also include several borrower characteristics that enable us to infer the risk profile of the borrower, and their likelihood of being credit constrained if credit markets were functioning under traditional credit standards. The first variable is monthly household income, with an average just above €1,550. Second, our dataset provides information on the borrower's labour status and type of contract, if employed. From the labour status information, we know whether the borrower is working in the private sector, the public sector, is self-employed, or not working. Moreover, for those who are employed, the type of labour contract enables us to identify borrowers working with a permanent contract and those with a temporary contract. Our sample mainly consists of active workers, and the share of the borrowers employed with a temporary contract is 35%.

The loans in the sample period were originated by 86 lenders. As we know the identities of the lenders, we are able to classify them broadly into three groups: commercial banks (21), savings banks (51), and non-bank financial institutions (14). We further divide these institutions using proxies for their risk appetite and management practices, as reflected by their relative ex post ability to deal with the shock caused by the financial crisis. As mentioned, we divide the savings banks into three categories: rescued banks, banks owned at some point by the FROB, and the remaining savings banks.

In terms of the characteristics of the house, in addition to the mortgage amount, the market price and the appraisal value, we also have information on its location. We distinguish between coastal and interior provinces. Almost half of the houses purchased are located in coastal provinces.

5. Empirical results

In the descriptive section, we found evidence of a strong tendency for over-appraisal. This mechanism has important consequences for macroprudential policies: from the regulator perspective, most of the LTVs were below 80%. However, the loan to market price was much higher, indicating that delinquency rates were bound to increase rapidly if the economy slowed.[35] Moreover, the upward bias in appraisal was not simply the result of adding a constant percentage to every market price. Since

[35] Agarwal et al. (2015) show that the likelihood of default is higher for transactions in which there is a high valuation bias. In this sense we can say that mortgages with a high valuation bias are riskier than mortgages with low or no bias.

appraisers use a version of the hedonic procedure to set the appraisal value of the dwellings, based on the price and characteristics of six other dwellings sold in the same area, it is interesting to check if the pricing of the characteristics is similar to the one offered by the market price. For this purpose we have ran two hedonic regressions: one for the appraisal price and a second one for the market price. The estimation uses OLS with robust standard errors[36]. It is well known since Rosen (1974), that the implicit (adjusted) price is endogenous in the estimation of housing bid functions because unobserved demand factors may correlate with implicit prices of amenities and the level of amenities (the endogenous variable). However, the first stage hedonic price specification is free of this problem if the specification does not include characteristics of buyers or sellers. Our specification (Equation 1) only includes characteristics of the dwellings, and it does not include demand related characteristics that could lead to misspecification and bias.

$$Price_{ij} = \alpha + \beta_1 Rooms_i + \beta_2 Size_i + \beta_3 Age_i + \beta_4 Lift_i + \beta_5 State_i + \beta_6 Outside_i + \beta_7 Floor_i + \beta_8 Parking_i + \beta_9 Coastal_i + \beta_{10} Location_i + u_i \quad (1)$$

where j refers, alternatively, to appraisal price or market price. Table 2 shows the results of estimating the two hedonic equations. In the first column, we show coefficients for the equation in which the dependent variable is appraisal value while in the second column, the dependent variable is the market price. Significant coefficients are larger for the market price equation than for the appraisal price specification. The effect of size, lift, parking, state of conservation, location in a coastal area (and location dummies) are, in absolute values, higher for market prices. This means that market prices are more sensible to dwelling and location characteristics than appraisal prices. In this sense, appraisals do not reflect market price behaviour. This fact can be interpreted as first evidence that appraisal prices are more affected by other features, such as financial conditions. Furthermore, over-appraisal depends on individual and loan characteristics.

[36] Using clustered standard errors at the provincial level does not alter the conclusions.

Table 2: Hedonic Models

VARIABLES	Appraisal price	Market price
Rooms	0.00791	0.00491
	(0.00681)	(0.00731)
Size	0.00704***	0.00712***
	(0.000393)	(0.000315)
Age of the dwelling	-0.000996	-0.00117
	(0.000819)	(0.000676)
Lift	0.0960***	0.114***
	(0.0159)	(0.0126)
State of conservation	0.0233**	0.0620***
	(0.00884)	(0.00974)
Outside condition	-0.00618	0.00510
	(0.0151)	(0.00925)
Floor	0.00211	2.29e-05
	(0.00201)	(0.00214)
Parking	0.0423**	0.0821***
	(0.0150)	(0.0156)
Coastal	-0.619***	-1.052***
	(0.0831)	(0.0704)
Constant	11.70***	11.58***
	(0.0257)	(0.0297)
Time and location dummies	yes	yes
Observations	3,706	3,706
Adjusted R-squared	0.640	0.720

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Once we have shown that the importance of the hedonic determinants of appraisal values and market prices are different, we analyze the determinants of the ratio of appraisal over market prices and its two components: the loan to appraisal ratio and the loan to market price ratio. The explanatory variables include characteristics of the client likely to determine their score (risk punctuation) and her likelihood of being credit constrained under usual credit standards, financial conditions of the mortgage and risk appetite of the different groups of institutions as indicated by their financial situation after the beginning of the crisis. Institutions with high risk appetite ended up originating loans with lower scores (higher probability of default) and higher actual delinquency rates than financial institutions with lower risk appetite. We expect credit constrained applicants (e.g. low income, temporary contracts, etc.) to be more likely to need an overappraised estimate of the value of the dwelling because for these borrowers the likelihood of getting the mortgage approved with a very high LTV is low. In this sense, we expect that the mortgages of those clients with lower income or educational level, and those with temporary contracts or unemployed, will have with a higher upward appraisal value for their dwellings than other clients. Scoring

models tend to penalize clients with low income or temporary contracts and, therefore, to compensate, and reach a score that could lead to the approval of the mortgage, you need to have a lower loan to appraisal value than clients with high income or permanent contracts.

However, the previous hypothesis is conditional on the weight that scoring models give to the different characteristics of the borrowers. It is well know that Spanish mortgages are recourse meaning that if money is still owed after the collateral is seized and sold, the lender can go after the borrower's other assets or sue to have his or her wages garnished. This implies that in cases of joint and several liability, the conditions can be soften given the possibility of claiming the entire amount of the debt from any of the joint debtors[37]. If the scoring model weights heavily the number of debtors then the individual characteristics of the main debtor ("titular") may not be relevant.

Obviously the financial conditions of the mortgage are also important. The bank can try to compensate the higher risk of high loan to value mortgages by charging higher spreads, or using as a reference rate an indicator that lead to higher interest rates as the RIML. Finally, institutions with a high risk appetite, indicated by their lower standards in the origination of mortgages, should present higher levels of over-appraisal and loan to value. If the risk appetite is very high then the individual characteristics of the debtors may not be relevant, indicating that most of the mortgages were approved independently of the risk profile of the applicants[38]. Our hypothesis is that if over-appraisal was used to improve the score of credit constrained borrowers, then, the financial institutions with high risk appetite[39] should be the ones that ended up with an intervention of the Bank of Spain, or an injection of public capital.

In order to analyse whether the over-appraising mechanism is related to some characteristics of either the borrower or the loan, we estimate a reduced form equation of the determinants of the upward bias in appraisal prices (Equation 3). We define this indicator as the ratio of the appraisal price and the

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[37] Normally there is a main debtor ("titular") and one or several guarantors. It is frequent that the main debtor is the son, or the daughter, of the guarantors.

[38] Montalvo (2017) shows, using more than one million mortgages, that during the years of the rapid expansion of mortgages in Spain (2002-2007) most of the mortgages were approved (around 95%). Loan officers routinely overruled the automatic decisions of the scoring system in cases of high or very high risk. In particular, in 80% of the cases of high or very high risk the mortgage was approved even though internal circular letters advise loan officers to use the overruling ability "exceptionally".

[39] In general non-bank financial institutions have a higher risk appetite than banks.

market price of the dwelling. Results for the over-appraisal equation, and the two loan to value equations (both in terms of appraisal and market price) are displayed in Table 3. We use OLS with robust standard errors[40], including the variables described in section 4: proxy for the risk profile of the borrower (labour status, marital status, education, age, type of contract, number of holders, nationality and income);[41] proxy for the risk appetite of financial institutions, the benchmark reference interest rate and the spread. The remaining variables in both equations are mainly controls and include time and location dummies. The results are robust to adding controls for dwelling characteristics to the regression.[42]

$$
\begin{aligned}
Overappraisal_{ij} &= \alpha + \beta_{11} Private\ employment_i + \beta_{12} Public\ employment_i + \beta_2 Maried_i \\
&+ \beta_{31} Secondary_i + \beta_{32} University_i + \beta_{41} Age_i + \beta_{42} {Age^2}_i \\
&+ \beta_5 Permanent\ contract_i + \beta_{61} Number\ of\ holders2_i \\
&+ \beta_{62} Number\ of\ holders3_i + \beta_7 Spanish_i + \beta_8 Income_i \\
&+ \sum \beta_{9k}\, Type\ of\ financial\ institution_{ik} + \beta_{10} Benchmark\ interest\ rate_i \\
&+ \beta_{11} Spread_i + \sum \beta_{12,t} \quad Time_t + \beta_{13} Coastal_i + \varepsilon_i
\end{aligned}
$$

where j refers, alternatively, to appraisal to market price (overappraisal), loan to appraisal value and loan to market price. Focusing on the determinants of over-appraisal, the ratio of appraisal value over market prices (Column 1), we find that the upward bias is negatively correlated with having a university degree, working in the public sector, or being Spanish. In all these cases, it is reasonable to assume that these individuals have fewer financial constraints. In the boom period, being a university graduate reduces the upward bias by 4.06 percentage points with respect to having a primary education. Being Spanish reduces

[40] The results are robust if we used clustered standard errors at provincial level. All the regressions include time and location dummies. Since the dependent variable is a ratio of appraisal value and market price for each specific operation it is unlikely that we find endogeneity problems. Nevertheless, we check the robustness of the results to potential unobservable effects correlated with explanatory variables using additional controls for dwelling characteristics without finding major differences with the results of Table 3.

[41] In Spain these variables are used as a predictors of the probability of default rather than the borrower's credit history (Diaz-Serrano and Raya, 2014)

[42] Results are available by request.

over-appraisal by 2.17 percentage points. This evidence of discrimination in the Spanish mortgage market is in line with Diaz-Serrano and Raya (2014).

As expected, the spread over the reference interest rate has a positive effect on the ratio of appraisal value over market price.[43] This is evidence that higher interest rates are set to try to compensate for the high risk assumed for a loan with higher over-appraising (i.e. for either increasing the mortgage total amount or accommodating the actual risk associated with the loan to market value ratio). In particular, an increase of one percentage point in differential is associated with an increase of 4.2 percentage points in the ratio between appraisal values and transaction prices. In addition, when the Euribor is the benchmark interest rate, the ratio between appraisal and transaction prices decreases 6.8 percentage points. This result provides evidence that lenders tend to use the RIML for riskier mortgages. By construction, the RIML is not only higher but also less volatile and reacts less intensively to changes in market interest rates compared to the Euribor. This makes the RIML more advantageous for lenders, especially when considering riskier borrowers.

Finally, another relevant variable is the type of financial institution in terms of their risk appetite and management practices, as reflected by their financial position at the onset of the crisis. As expected for this specification, we find evidence for a higher upward bias (3.8 percentage points) for savings banks that were taken over by the Bank of Spain. Thus, the more problematic financial institutions (those finally rescued) over-appraised more, which was likely the main cause of their subsequent financial situations. In addition, we observe a smaller bias for non-bank financial companies (10.4 percentage points), the FROB owned institutions (7.8 percentage points), and the remaining savings banks (6.8 percentage points), compared to commercial banks.

In the next two columns of Table 3, we break down over-appraisal into two ratios: loan to appraisal value and loan to market price. The impact of the spread is particularly intense in the loan to market price ratio. Being Spanish implies a reduction on both ratios, although more important on the loan to market price ratio than on the loan to appraisal value ratio. This is reasonable since given the extended practice of

[43] Akin et al. (2014) and Agarwar et al. (2015) also find that lenders charge higher interest rates to compensate for the higher risk of default in cases of large valuation bias.

over-appraisal the loan to market price contained more information about the likelihood of future delinquency of the mortgage. The use of the Euribor as the reference interest rate also reduces the loan to market price more than on the loan to appraisal value. The number of guarantors of the mortgages has an increasing effect on both ratios, while it does not have any effect on the ratio of appraisal value over market price. Finally, working as a civil servant has a negative effect on the loan to market price ratio but no effect on the loan to appraisal value ratio. In general, the sign of the parameters is the same in both specifications, with the exception of the coefficients of the type of financial institution, an indication of the different strategies adopted by various financial institutions. Thus, in a competitive market, some financial institutions decided to increase mortgage amounts without over-appraising (and imposing higher spreads). This strategy was mainly adopted by the non-bank financial institutions which did not have to follow Bank of Spain regulations. Other financial institutions opted for the over-appraisal strategy. This pattern is clearly observed among commercial banks and rescued savings banks.

Table 4 shows the loan to appraisal value and loan to market price equation split into two subsamples: the loan to appraisal value above 80% or at/below this threshold. We should notice that while this threshold is relevant for the loan to appraisal value, because of banking regulation, it is not that relevant for the loan to market value since this is not a ratio considered by banking regulation. Interestingly, there is a change in sign for the coefficient on the coastal variable in both specifications when the loan to appraisal value surpasses 80%. Many of these coastal properties were second residencies thus it was reasonable to reduce the upward valuation bias for this type of property when the loan to value was already quite high. Educational level, age and type of contract are only relevant for the loan to market value specification if the loan to appraisal value is below 80%. More importantly, income is positive and statistically significant for loan to appraisal values at/below 80% but not for LTVs above this level. This is true for both specifications (loan to appraisal value and loan to market price). The coefficient on the Spanish nationality variable is negative for low LTVs, positive for high loan to appraisal value and not statistically significant for the loan to market value specification for loan to appraisal value over 80%. Having more mortgage holders increases the loan to value no matter whether we are above or below the 80% threshold in both specifications. Finally, the type of financial institution does not have any statistically

relevant effect on the loan to appraisal value for LTVs at/below 80% of the loan to appraisal value. However, it is very relevant to explaining the loan to appraisal values above 80%. In the loan to market value specification there are significant differences across commercial banks, saving banks and non-bank financial institutions, but there are no differences across savings banks. It is very interesting to notice that, for the sample of loan to appraisal value at or below 80%, the type of financial institution is not statistically relevant in any case while the spread is very relevant while for the sample of mortgages with a loan to appraisal value above 80% the spread is not statistically significant and all the dummies for the type of financial institution are statistically significant.

Table 3: Determinants of Over-Appraisal and its Components

VARIABLES	Appraisal value to market price (ATP)	Loan to appraisal (LTA)	Loan to market price (LTP)
Coastal	0.763	0.149	1.627***
	(0.603)	(0.245)	(0.261)
Spread	4.206***	2.058*	6.570***
	(0.783)	(0.955)	(0.886)
Education (ref:compulsory)			
Secondary	-3.255	0.964	-0.951
	(2.076)	(0.865)	(0.697)
University degree	-4.059*	0.911	-2.137
	(1.888)	(1.216)	(2.418)
Age	-0.401	0.0592	-0.148
	(0.512)	(0.184)	(0.204)
Age^2	0.00266	-0.00260	-0.00249
	(0.00579)	(0.00227)	(0.00254)
Joint and several liability (ref:1)			
2	0.169	3.827***	4.492***
	(1.310)	(1.078)	(0.736)
3	-0.299	7.385***	7.938***
	(1.754)	(1.773)	(0.980)
Spanish national	-2.174**	-1.538**	-4.286***
	(0.805)	(0.543)	(0.226)
Marital status (ref: separate, single or widow)			
Married	-0.732	1.400	1.647
	(0.994)	(1.907)	(1.955)
Labour status (ref: non occupied)			
Private or self-employed	-0.972	-2.158	-2.589**
	(1.591)	(1.823)	(1.042)
Public sector	-3.921*	-0.0227	-2.226*
	(1.875)	(2.087)	(1.060)
Type of contract (ref: temporary)			
Permanent	0.791	0.478	1.304*
	(0.485)	(0.660)	(0.710)
Income (€ thousand)	1.459	0.368	1.830*
	(1.414)	(0.614)	(0.806)
Reference interest rate (ref: RIML)			
Euribor	-6.776***	-2.762***	-9.347***
	(1.216)	(0.822)	(0.835)
Financial Institution (ref: Commercial banks)			
Non-bank financial institution	-10.42***	10.91***	3.541**
	(1.915)	(0.948)	(1.212)
Rescued Banks	3.821*	-0.824	2.763*
	(2.001)	(1.022)	(1.516)
FROB owned	-7.786***	6.798***	1.792*
	(0.507)	(0.841)	(0.992)
Rest of savings banks	-6.847***	2.373***	-2.916**
	(1.274)	(0.703)	(0.905)
Constant	155.2***	79.79***	119.7***
	(10.57)	(5.040)	(3.027)
Time dummies	yes	yes	yes
Observations	3,305	3,305	3,305
Adjusted R-squared	0.174	0.130	0.114

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Determinants of Over-Appraisal by LTV level

	Loan to appraisal value (LTA)		Loan to market price (LTP)	
VARIABLES	LTA≤80	LTA>80	LTP≤80	LTP>80
Coastal	1.497***	-2.835***	2.840***	-1.370***
	(0.216)	(0.269)	(0.325)	(0.391)
Spread	2.255***	-2.687	7.108***	2.967**
	(0.631)	(1.610)	(1.530)	(1.089)
Education (ref:compulsory)				
Secondary	-0.549	-0.0899	-4.188**	0.137
	(0.601)	(0.495)	(1.603)	(0.616)
University degree	-0.584	0.775	-6.565***	0.0387
	(1.178)	(1.190)	(1.816)	(1.980)
Age	-0.0155	-0.173	-0.522*	0.0464
	(0.146)	(0.191)	(0.264)	(0.294)
Age^2	-0.00156	0.00266	0.000732	-0.00192
	(0.00181)	(0.00325)	(0.00318)	(0.00420)
Joint and several liability (ref:1)				
2	1.376***	2.400**	3.882***	2.849***
	(0.405)	(0.935)	(0.823)	(0.512)
3	2.930***	3.580*	11.11***	3.447**
	(0.549)	(1.798)	(1.874)	(1.045)
Spanish national	-2.990***	3.091***	-10.14***	0.991
	(0.679)	(0.906)	(1.036)	(0.977)
Marital status (ref: separate, single or widow)				
Married	2.219***	-2.012	4.583*	-1.914
	(0.427)	(2.032)	(2.086)	(1.560)
Labour status (ref: non occupied)				
Private or self-employed	-1.253	-0.569	-6.422***	1.610**
	(0.679)	(1.841)	(0.958)	(0.611)
Public sector	-1.722	3.120	-9.781***	5.560
	(1.981)	(3.553)	(2.406)	(3.108)
Type of contract (ref: temporary)				
Permanent	-0.496	0.657	0.574	1.142
	(0.379)	(0.891)	(1.192)	(0.752)
Income (€ thousand)	0.873***	0.484	2.549**	1.842
	(0.212)	(0.737)	(0.969)	(1.597)
Reference interest rate (ref: RIML)				
Euribor	-1.262	1.894**	-9.634**	-4.794***
	(0.931)	(0.735)	(3.036)	(1.334)
Financial Institution (ref: Commercial banks)				
Non-bank financial institution	-1.923	11.99***	-6.156***	5.069***
	(1.373)	(1.634)	(1.108)	(0.853)
Rescued Banks	-0.814	-4.655***	-0.267	0.521
	(2.127)	(1.289)	(3.213)	(0.668)
FROB owned	-0.594	5.033***	-4.119*	0.977
	(0.487)	(1.025)	(2.047)	(0.989)
Rest of saving banks	-0.0275	3.834***	-3.625*	-1.520**
	(0.843)	(0.945)	(1.783)	(0.551)
Constant	75.83***	78.86***	86.98***	121.2***
	(2.264)	(5.305)	(4.911)	(3.750)
Time dummies	yes	yes	yes	yes
Observations	1,306	1,999	1,306	1,999
Adjusted R-squared	0.060	0.072	0.220	0.072

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6. Conclusions and Policy Implications

Macroprudential policies with impact on the mortgage market have the potential to change the demand for housing and, therefore, mitigate real estate booms. In this paper we discuss empirical evidence on the effectiveness of constraints on LTV ratios in the Spanish financial sector during the credit boom of the first decade of the 21st century. In particular, we show that despite having several MPPs in place, the Spanish financial system was unable to avoid the formation of a large housing bubble financed by a credit bubble. At the onset of the crisis, the narrative was that Spain could not suffer a banking shock as intense as the one in the United States because of the conservative practices in the origination of mortgages and the avoidance of securitization US-style. It turned out, however, that the Spanish banking crisis has been very severe despite claims of Spanish mortgage industry conservatism. We argue that the manipulation of loan to appraisal values, due to the ownership of appraisal companies by financial institutions, has been a determinant cause of the challenges the Spanish banking system has faced in recent years.

Using a unique combination of datasets from different sources, we have been able to match appraisal values, market prices and official registration prices for several thousand residential properties. We find evidence of a large degree of over-appraisal. We show that appraisal values were quite different from market values. In fact, the upward bias is around 25%. This is considerably larger than the valuation bias usually found in other countries. Agarwal et al. (2015) document a valuation bias of around 5% in refinanced mortgages. The bias is two percentage points larger for third party originators (e.g., mortgage brokers), but remains much smaller than the over-appraisal found in the Spanish case. In the United States, over-appraisal was a mechanism to expand the scope of the transaction by adding items such as appliances, transaction costs, cars, coupons, and often cash (Ben-David, 2011). An observed 6.6% was easy for appraisers to justify.

In Spain, however, over-appraisal was an important driver of the housing bubble, as it was used to open the market for borrowers with financial constraints. Appraisal values were already capitalizing future increases in house prices and resulting in loans to high risk borrowers (using over-appraisal to avoid

MPPs). Thus, although in both cases lax standards and excessive credit were the ultimate causes of the house price inflation, the underlying mechanism was different. While in the United States, lax standards for mortgage granting were the result of perverse incentives in the housing finance sector related to the securitisation process, and the possibility of taking securitised mortgages out of the banks' balance sheets, in Spain the mechanism was over-appraisal to increase the pool of mortgages that allowed the issuance of covered bonds.

The extent of this over-appraisal process had significant externalities in terms of the demand for housing and the increase in prices. From 1986 until 2007 the only official housing price available[44] in Spain was based on appraisals. This fact together with technical details concerning the calculation of appraisals fed a vicious circle that led to a large housing price bubble. The bias towards producing high appraisal values to accommodate the financial needs of banks' clients led to an aggregated price index that had also a bias toward a rapid growth rate, giving the impression that house prices were growing faster than they actually were. In addition, the inflated appraisal value of a house had external effects on the appraisal value of nearby units, even if the buyer did not need additional financing, since the standard protocol of Spanish appraisal companies was to take the average appraisal value of six houses near to the unit being valued to calculate the baseline appraisal. Rapid growth rates in official house prices signalled by the mass media also attracted various large, and many small, private investors. Moreover, many families were led to believe that if they did not buy quickly, house prices would be unattainable in the future (Montalvo and Raya, 2012).

The second important result of the paper is that the determinants of loan to value ratios are different whether we use appraisal values or market prices. In general, the effect of the determinants of the loan to value ratio are underestimated if we use appraisals rather than real transaction prices. This result is relevant since the appraisal value was the indicator used to calculate the loan to value and, therefore, had a significant influence on the decision to originate a mortgage and its size. As a result, MPPs that impose

[44] The price index of the Ministry of Public Works and Urban Development (*Ministerio de Obras Públicas y Urbanismo*), later called the Ministry of Housing (*Ministerio de Vivienda*).

limits on LTV may be ineffective in preventing house price inflation and financial crises fuelled by credit bubbles.

The upward bias of appraisal values depended on the characteristics of applicants and the financial institutions originating the mortgages. Over-appraising is negatively correlated with a university degree, a permanent contract and Spanish nationals. In all these cases, it is reasonable to assume that there are less financial constraints. The determinants are also different when we use the 80% LTV threshold. In the case of Spain, level of education, labour situation and Euribor are relevant determinants for the loan to market price in the subsample of mortgages with loan to appraisal at/below 80% LTV. Real income is statistically significant for both specifications (loan to appraisal value and loan to market value), but only for LTVs at/below 80%.

With respect to different groups of financial institutions, the savings banks that ended up being rescued by the Bank of Spain present higher valuation bias than the other institutions. Mortgages originated by commercial banks also have a high level of over-appraisal but mostly because their appraisal values were lower relative to market values than those of the other financial institutions, particularly savings loans. The fact that commercial banks, contrary to savings banks, distribute dividends to shareholders and try to reduce the cost of capital, may have been a factor in the valuation bias of commercial banks and the comparatively low loan to appraisal value.

Macroprudential policies that encourage a cap on LTV ratios can potentially break the feedback loop between credit and house prices. However, as the expression goes, 'the devil is in the details', and the effectiveness of these tools depends on the institutional set-up of each country. In the Spanish case, the fact that most of the appraisals were done by companies owned by financial institutions generated a clear conflict of interest that produced a strong tendency, together with penalties for high LTVs, towards over-appraisals.

One possible solution to this problem was to limit the ownership of appraisal companies by banks and other mortgage originators. This was the solution adopted by the Bank of Spain after 2010. Prior to 2008, 52% of the appraisals (weighted by value) were carried out by appraisal firms owned by banks. In

2010, 44% of all appraisals in Spain were still done by a company owned by a bank or a savings bank but by 2011, that proportion had dropped to 21% and has since steadily declined.

An alternative solution to recover the effectiveness of the LTV is to link the value used for the LTV ratio to the price as reflected on the title kept at the Property Registry. This price is that on the official record of the transaction registered at the recorder's office. This solution would also solve the issue of undeclared money in the transaction of residential properties. In Spain, it is customary to declare a price for a residential property at the recorder's office below the price paid by the buyer. In this way the seller reduces the burden of the capital gains tax and the buyer decreases the payment for the sales tax. Since we obtained every possible price/value for all the properties in our database, we can quantify this effect for the first time. In close to 55% of all transactions, there was some undeclared money[45]. The average amount was 8% of the market price. If mortgages were capped at 80% of the registered price, many of the perverse incentives described above would disappear. Buyers would not have an incentive to accept the overvaluation of their houses to obtain a larger mortgage since they would have to pay more sales taxes. Sellers might still have incentives to declare lower values for the transaction, but that incentive would not be aligned with the incentives of buyers who may need a mortgage as large as possible to finance their purchase. This mechanism would avoid the multiplicity of prices for the same real estate asset and would increase tax revenues, largely avoiding undeclared money. Finally, it would eliminate the external effects on public opinion of price indices based on appraisals.

[45] See Montalvo and Raya (2012).

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APPENDIX

Table A.1 Classification of S&L according to the type of public sector intervention

Classification	
Rescued banks	**Date**
CCM (Caja Castilla La Mancha)	March 29, 2009
Caja Sur	April 22, 2010
CAM (Caja de Ahorros del Mediterráneo)	July 22, 2011
Banco de Valencia	November 21, 2011
Capital injection by FROB	**Composition (previous S&L merged)**
BFA-Bankia	Caja Madrid, Bancaja, Caja Insular Canarias, Caixa Laietana, Caja Ávila, Caja Segovia and Caja Rioja
Catalunya Banc	Caixa Catalunya, Caixa Tarragona and Caixa Manresa
Nova Caixa Galicia Banco	Caixa Galicia and Caixanova

Table A.2: Mortgage Characteristics*

	Sample Mean (standard deviation)
Amount of the Loan (€)[1]	171,211
	(70,513)
Appraisal value (€)[1]	195,214
	(69,813)
Loan to Value (%)	87.56
	(18.64)

Spread (%)	0.85
	(0.43)
Appraisal to market price (%)	128.93
	(22.25)
Market price (€)[1]	156,005
	(60,073)
Reference Interest Rate (% of total)	
RIML (ref)	15.16
Euribor	84.84
Financial Institution (% of total)	
Commercial bank	39.61
Savings Bank	51.62
Individually rescued[2]	8.56
FROB owned	30.65
Rest	12.41
Non-bank financial institutions	8.77
Years (% of total)	
2005	52.95
2006	31.29
2007	4.57
2008	2.51
2009	4.6
2010	4.08
Number of Observations	3,305

[1] Variables are in real terms.

Table A.3: Borrower Characteristics

	Sample mean (standard deviation)
Labour status	
Public sector employee	10.32
Private sector employee or self-employed	86.63
Non-employed	3.06
Type of contract	
Permanent	62.17
Temporary	34.77
Marital status	
Married	31.04
Separate	
Single	68.96
Widow	
Education	
Compulsory	54.52
Secondary (non compulsory)	33.4
University degree	12.07
Joint and several liability (number of debtors under the same contract)	
One	31.71
Two	57
Three	11.01
Location	
Interior	57.7
Coastal	42.93

Region	
Community of Madrid	27.62
Income in real terms (€ thousand)	1,563
	(0.65)
Age	33.77
	(9.18)
Number of Observations	3,305

In percentage for categorical variables.