Tax incentives and the housing bubble: the Spanish case.

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Abstract

In this paper we analyse the effect of removing mortgage interest deductions in the Spanish real estate market. We start by estimating the housing price bubble as deviations of actual house prices, during 1997-2013, from their fundamental (theoretical) value. Expectations played a key role in the residential construction boom and, thus, by means of a rational intrinsic bubble model we are capable of estimating the behaviour of house prices more accurately. We then simulate what would have been the effects over the bubble had mortgage interest deductions been eliminated in 2004. For that purpose we estimate the effects both on the fundamental price and on the bubble component. The results suggest that even removing mortgage interest deductions in 2004 would have had significant effects on the actual increase in house prices and therefore on the bubble. Moreover, if the speculative bubble in the housing market had been dealt with sooner, in 2000, the effect would have been much greater and a substantial portion of the price bubble would have been avoided.

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1. Introduction

The housing market among other things is known to hold a worldwide favourable tax treatment. The market itself can be described as imperfect and inefficient relative to other financial markets. Some reasons for this are the characteristics of the own market, which include things such as the few number of participants and transactions (in comparison with the stock market for example) or supply rigidities. Other reasons come from outside of the market, and there's no doubt the tax treatment is one of them. The housing market plays an important role in many economies, and especially so in the Spanish economy. In our case, construction contributed for an average of approximately 10% of GDP and total employment in the last 20 years.

The evolution of house prices is of great importance. The long lasting profile of houses and its substantial weight in the portfolio of households alter resource allocation decisions made by consumers. House price increases are associated with a considerable wealth effect which alters the macroeconomic equilibrium (Hott, 2006). Similarly, falls in house prices distort the decisions of agents as the already mentioned characteristics of the real estate market do not allow them to modify their consumption decisions optimally, and in many cases, they will not adjust their consumption of housing stock, but instead reduce consumption of other assets. This makes consumers to stick to their homes even though prices are plummeting.

Houses are not only consumption goods, but also an investment decision which should therefore have positive returns similar to those of similar assets. This is why it is interesting to compare the evolution of house prices with the evolution of alternative assets. Real house price indexes (RHPI) in Spain grew by 120% between 1997 and 2007; this meant a compound annual growth rate (CAGR) of 7%. Figure 1.1 shows the annual returns of the real estate market, of the stock market (IBEX-35) and of the Spanish 10 year bond. The housing market outperformed the stock market for great part of the "boom years"; between 1999 and 2004. This information suggests that a bubble in the real estate market existed as house prices grew too much relative to the behaviour of alternative investments.

Figure 1 - Asset market profitability
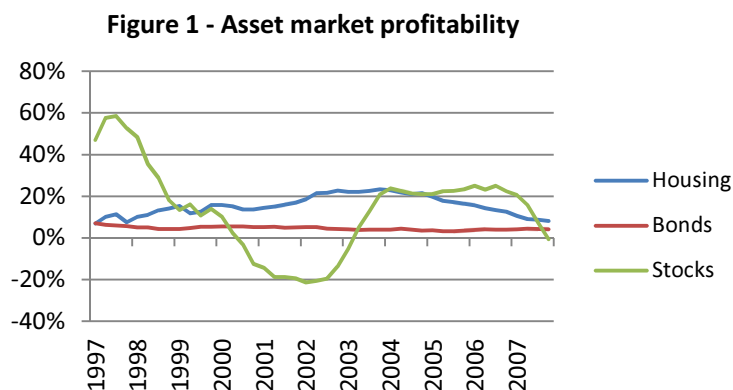
The concept of "bubble" defined as asset prices fluctuating more than fundamentally justified comes from the early works of Shiller (1981). In other words, increases in the value of an asset alone do not justify the existence of a bubble. There are two main approaches for detecting bubbles, the macroeconomic approach and the financial approach. The macroeconomic approach tries to explain the evolution of fundamentals and detect a bubble if there is a persistent deviation from them.

It has been mentioned that the Spanish tax system, as many other worldwide, favoured home-ownership. Through the concept of the user cost of home-ownership Poterba (1984) opened the way for the analysis of the housing market, both to analyse the determinants of prices and to measure the effect of policies over them. A favourable tax treatment decreases the user cost of ownership and, hence, makes owning more attractive than in a neutral tax system scenario. The non-taxation of imputed rents, the basically untaxed capital gains and the mortgage interest payments deduction (MID) are common features to many tax systems. In Spain, one step ahead was given and payments of the principal were also deductible from the Personal Income Tax (PIT). There is a question of up to what point these deductions and benefits have contributed in the past to the boom and the bubble. The importance of this has been noticed by governments (too late) as it was removed in 2011, brought back in 2012 by the incoming government with the hope of restarting the construction sector (and falling into the same mistakes made in the past) and removed again in 2013 by command of European decision makers.

There are several contributions in the recent literature which try to detect an over-valuation of the housing market. There exist some other contributions which measure the effect of tax subsidies on housing prices. However, I would say there is no other work which combines these two aspects. It is interesting to ask what would have been the effects over house price, and hence, over the bubble, if an implicit subsidy to home buying, such as MID, would have been removed on time. This is precisely what we will try to do in this paper. In order to do so, we define the housing bubble as the difference between the actual (observed) price and the fundamental (theoretical) price. Measuring the effect of the fiscal policy over the bubble is not a simple task as there are many factors which should be taken into consideration. On the one hand, we have the effects over fundamental house prices; here we include how consumers and constructors' would have behaved in an efficient market scenario. On the other hand, such a policy would have had an effect over the speculative component of house prices; this part catches the effect of the expectations of future capital gains, which are not backed by the evolution of fundamentals. In other words, demand increases because prices are expected to increase and this feedback mechanism is not sustainable.

The route map looks as follows: first we obtain the theoretical imputed rent as the equilibrium result in the market of housing services, we then use this rent to calculate the fundamental house price. The comparison between the fundamental house price and the actual one indicates that house prices fluctuate more than fundamentally justified. In the model we will assume rational investors with perfect foresight, two strong

assumptions which are not compatible with the existence of a bubble. In order to explain these excessive fluctuations we will consider alternative assumptions about expectations, more precisely, we will consider an speculative bubble model. This approach is based on Froot and Obstfeld (1991) "intrinsic bubble model". Typically, rational bubbles are viewed to be driven by extraneous variables; however, intrinsic bubbles are driven exclusively, though nonlinearly, by the exogenous fundamentals of the model. The price of an asset is hence given by the sum of the present-value of future dividends (or rents in the housing market) and a bubble term which depends on the evolution of fundamentals. Once we have the theoretical house price we estimate the effect of removing MID over it. If MID would have been eliminated in the past, not only would the fundamental price changed, but also the actual price would have evolved differently. In order to properly address the effect of removing MID on the bubble, we use the intrinsic bubble model where we can obtain a new bubble term with the different fundamentals. With all this information we are able to conclude that a third of the bubble could have been avoided if the tax reform had been implemented in 2000, and around a 10% if action was taken in 2004.

The rest of the paper will be organized as follows; section 2 explains the main features of the Spanish housing market, the role that fundamentals have on the evolution of prices, and a historical review of tax subsidies in Spain. Section 3 contains the model that determines the fundamental price of houses and analyses the effect of the MID removal on them. In section 4 we present the intrinsic bubble model. Finally, we sum up all the ideas and results of the paper in the conclusions.


2. Stylized Facts
2.1. Characteristics of the Spanish housing market

The Spanish housing market has been lately characterized by skyrocketing house prices (1997-2007); by a "boom", measured as the amount of houses built during the same period; and by an increasing weight in the whole of the economy. But there are also some underlying features which are not recent but have been like that for many years, especially those regarding the type of ownership and the use of the house.

It is important to state clearly the difference between "boom" and "bubble". As explained by Balmaseda, San Martín and Sebastián (2002) the "boom" is defined by the quantities, in other words, by the number of houses built. On the other hand, according to Case, Shiller (2004), a "bubble" is a situation in which prices are excessively elevated (relative to their fundamental justification) due to excessive public expectations of future price increases. Potential homebuyers think that a home which otherwise might appear to be too expensive for them is now attractive as they will be compensated by future price increases. Furthermore, first-time homebuyers might also think that in the future houses might become unaffordable and hence they must buy now. In addition to this, the housing market has the unique feature that people tend to think that prices are not likely to fall and hence it is a safe investment (relative to the stock market).

On the left-hand side graph of figure 2.1 we can see the evolution of house prices in real terms. Real house prices in Spain grew since the mid 80's until 1992. Back then, the probably first recorded housing bubble in Spain bursted after prices had doubled in real terms between 1985 and 1992. There was a fairly quick adjustment process as prices fell by 14% in 5 quarters, and since then, there was a period of "stability in house prices". For the next years (until 1998) prices were basically constant (between 1993 and 1998 RHPI grew by 1%), however since 1998 and the creation of the euro in 1999 prices have increased drastically. Balmaseda, San Martín and Sebastián (2002) estimate that up to 13% of the increase in prices between 2000 and 2002 can be attributed to the so called "euro effect". On the right-hand we have the interannual growth rates. House prices grew at an average of 7% during 1997-2007 reaching growth rates close to 20% in 2004.
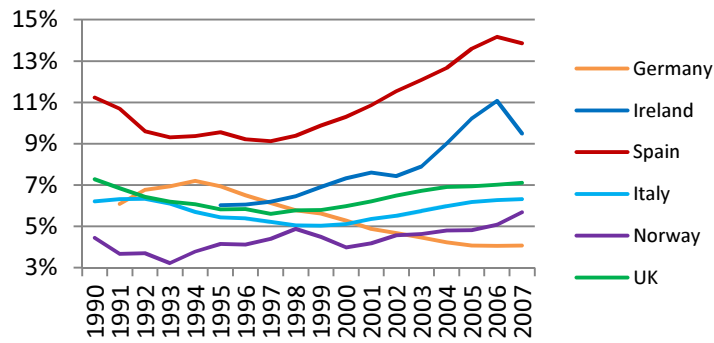
Figure 2.1
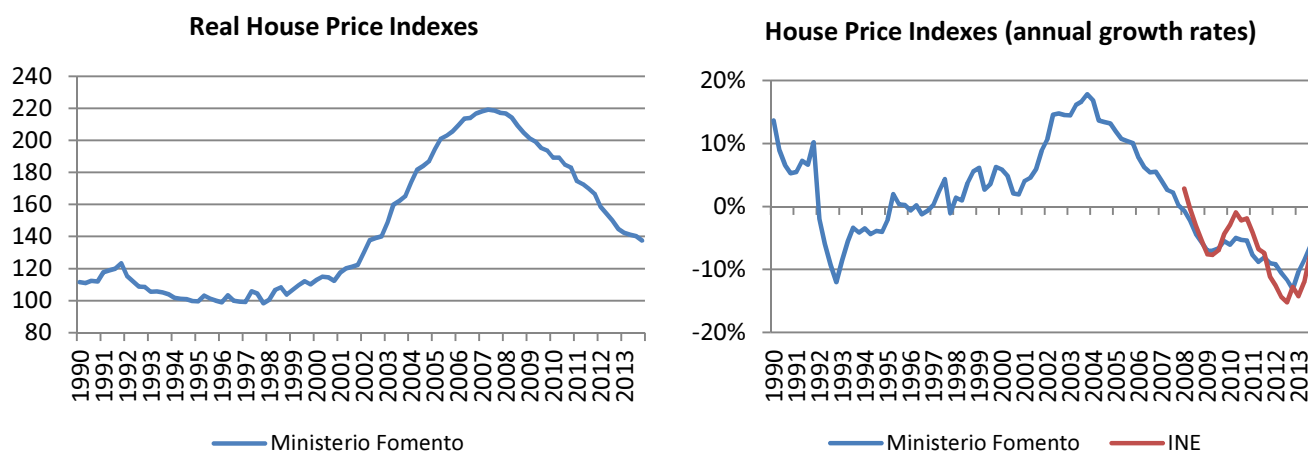
Source: *Instituto Nacional Estadística, Bank of Spain and Dallas FED*

The construction sector is a key variable of the Spanish economy and the main driver of the "boom". To measure the weight of this sector we look at the ratio of construction's GVA (Gross Value Added) over the total economy's GVA[1]. In figure 2.2 we have a European comparison of this ratio. Spain clearly rises above all other countries as the country where construction has been more important for the total economy during the whole period 1990-2007. Ireland, which also suffered a housing bubble, has a very similar evolution, though at lower levels. Regarding Spain, during the first part of the 90's, the trend was to reduce the ratio, however, since 1997 it boosted, reaching its maximum in 2006 point at which it had grown by 55%. The construction sector also has great importance regarding the employment of the Spanish economy. In 1997, the employed in construction accounted for 10% of all employees, number which grew with the boom reaching more than 13% in 2007.

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[1] The GVA as defined by Eurostat is the value of output less the value of intermediate consumption. It is a measure of the contribution to GDP made by an individual producer, industry or sector. The total GVA of the economy is calculated as GDP at market prices minus net taxes.

Figure 2.2 - Construction GVA/Total GVA

The graph shows Construction GVA/Total GVA percentages from 1990 to 2007 for Germany, Ireland, Spain, Italy, Norway, and UK.

It is important to define what is included in the construction sector. Constructions are usually differentiated between buildings; residential or non-residential, and civil engineering works. Up to now, we have referred to all kinds of construction, however, it must be stated that when we talk about the "boom" we refer to the boom in residential investment. In the case of Spain, the "Ministerio de Fomento" offers data since 2001 about the business volume divided between these three categories. Between 2001 and 2007 residential investment accounted for more than 50% of the construction sector on average, with non-residential investment fairly constant at 20% and civil engineering the rest.

Figure 2.3

Business volumes by types of constructions

Number of houses started each year
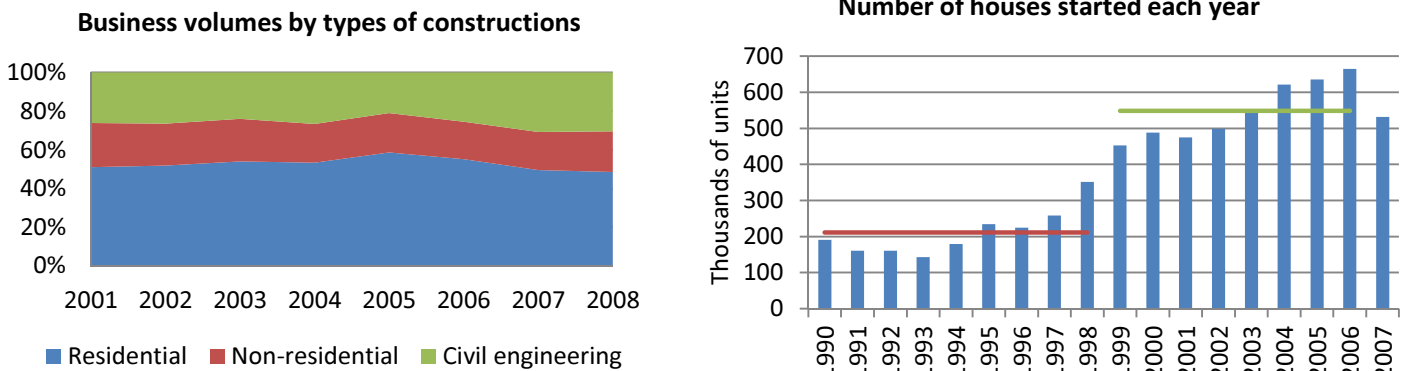
Source: Bank of Spain, Ministerio Fomento

The graph on the right shows the flow of houses started each year between 1990 and 2007. On average, between 1990 and 1998, 210,000 homes were initiated each year (represented by the red line in the graph). The "boom" in residential construction meant that each year more and more houses were built, reaching the maximum in 2006 of nearly 700 thousand homes. The average for the period 1999-2006 is 550,000 each year (this is represented by the green line), more than twice the number in the previous period. With increasing house prices, the demand could not sustain this level of new homes forever, this is why, since 2006, the construction of new homes has plummeted. In addition to this, another figure which gives us an idea of the magnitude of the boom, the stock, increased from 18.7 million homes in 1997 to 24 million in 2007.

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García-Montalvo (2003) characterizes the Spanish housing market by very low rental rates, by a high rate of vacant homes and a high proportion of secondary houses (the ratio of houses per household between 1990 and 2009 was on average 1.5, meaning that 50% of home-owners did not only own one house but two). The information gathered in INE's census has been appointed as the most convenient source to analyse the housing stock. Houses are classified according to 3 categories: the "principal" house is the usual residence of a family. "Secondary" houses are those which are occupied occasionally, during holidays or weekends for example. "Vacant" or "empty" houses are those not occupied, which could be sold, rented or might even be abandoned. From those principal houses we can distinguish 3 types of tenure: ownership, rent and cession.

Figure 2.4
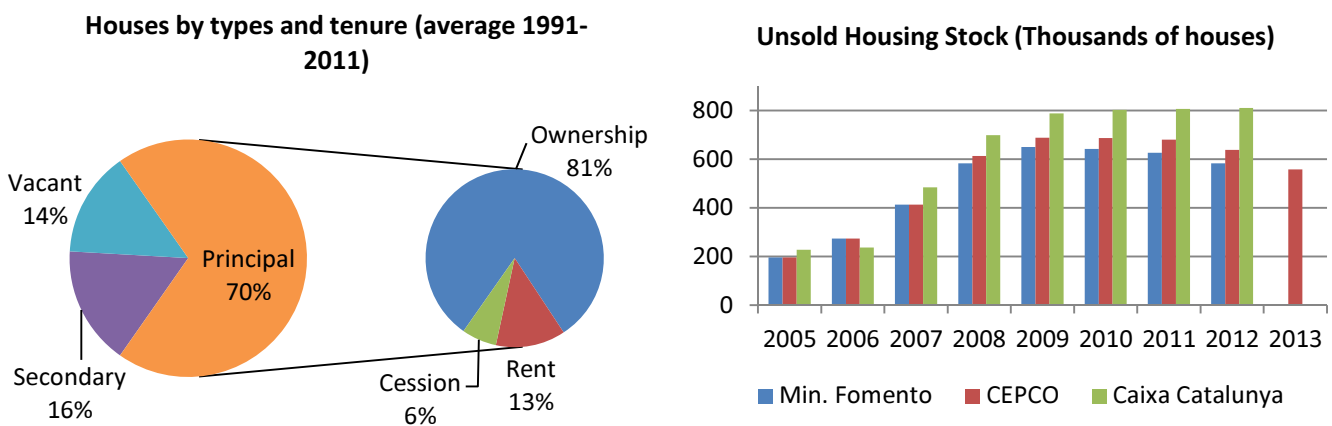
For a long time, it has been a characteristic of the housing market to have a high number of these "vacant" homes; on average, 14% of houses between 1991 and 2011 were vacant. However, the above mentioned boom together with the fall in demand in the last years has multiplied considerably the amount of unsold stock (this can be observed in the graph on the right of figure 2.4). Between 2005 and 2009/2010 this number tripled, passing from just over 200 thousand houses to 650-800 thousand depending on the source[2]. On average, over the last two decades 8 out of every 10 houses were owned and just 13% of them rented. Ortega et al. (2011) point out the low rental share of the Spanish housing market (11% in 2007) as one of the features not analysed in a general equilibrium context.

Bover (2005) quantified that housing assets accounted in the year 2002 for 79% of the households' wealth, while shares represented just 7.6% of it. If we look at the ratio of real estate wealth/total wealth of households, we can see how in 1998 this ratio was 68%, very close to reaching its minimum, and by 2007 it had increased to 85%.There's no doubt that changes o the price of an asset which is so important for households has

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many implications on their wealth and their consumption decisions and, hence, in the macroeconomic equilibrium.

Summing up, the housing market is one of the cores of the Spanish economy. Traditionally people in Spain tend to own their houses rather than to rent them, this has made houses to represent most of the household's wealth. Since the slowdown of the economy and the beginning of the crisis demand for housing has frozen and the stock of unsold houses has reached massive levels.

2.2. The role of fundamentals on the evolution of prices

The household's disposable income and the level of employment are two key variables determining the demand for houses which are depicted in figure 2.5. From the figure in the left we can see that since 1994 real disposable income grew at rates ranging between 2% and 6%. Between 1997 and 2007 real GDP grew by 49% at a CAGR of 4%. This increase in the income of families is one of the main explanations for the increase in housing demand and, hence, of the rise in the relative price of houses. The importance of the disposable income has been noticed many times. For the Spanish case, Bover (1993) attributed up to 70% of the increase in real house prices during the period 1985-1990 to the growth of real disposable income. A similar specification is used by García-Montalvo (2001) for the period 1987-1998, reaching the conclusion that 61% is explained by disposable income, while in García-Montalvo (2003) for a larger time horizon 1987-2000 this number is reduced to 41%. Finally, Balmaseda et al. (2002) find that for 1990-1999 income growth contributed to 45% of the house price increase.

Figure 2.5
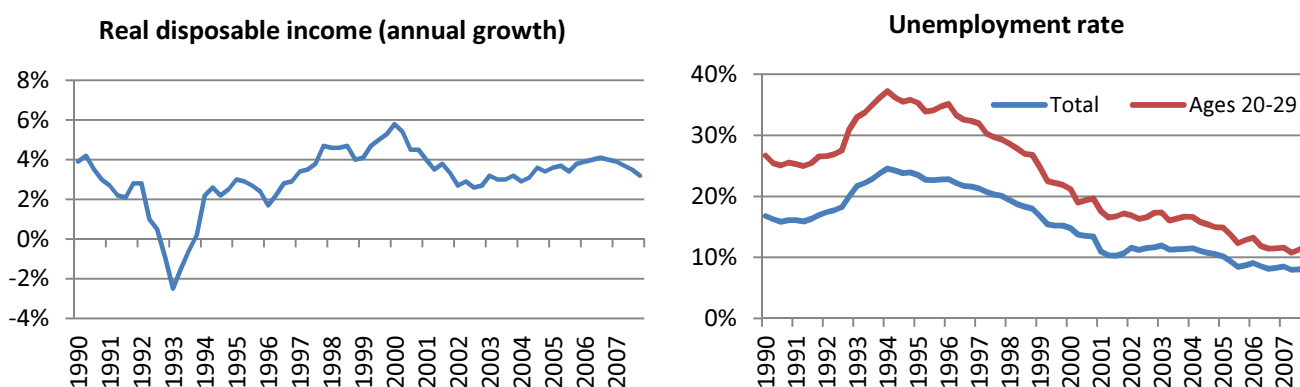
Source: Instituto Nacional Estadística

Furthermore, there was a continued decline in unemployment which reached its lowest value since the end of the 1970's of 7.95% in 2007-II. In the graph on the right we can see the evolution of the whole economy's unemployment rate and the youth unemployment rate. In his original estimation García-Montalvo (2001) attributed 21% of the increase in house prices to the decrease in youth unemployment, as it happened with the effect of disposable income, this number was reduced in his 2003 paper to

16%. Similarly, Balmaseda, San Martín and Sebastián (2002) quantify the effect of youth and women unemployment to explain 10% of the price increase.

Even though the youth unemployment already catches some demographic effects over the demand of houses and some authors such as Bover (1993) have questioned the sensitiveness of house prices to them, it is worth mentioning two additional demographic factors. Firstly we have the growth of the population which are in a favourable position to purchase a house and/or start a household (these are people over 25 years). Between 1997 and 2007 this population grew from 27 million to 33.2 million, this is a 23% increase in 10 years. Secondly, the increased number of retired people in Europe, the creation of the euro and the reduction in transport costs, combined with the attractiveness of the Spanish coast for many Europeans, increased the housing investment by non-residents in Spain. This investment grew at an average growth rate of 20% between 1997 and 2003, point at which it represented 10% of total residential investment and 0.9% of GDP. Since 2004 the increase in house prices, the overcrowding of the coast and the competition from other countries such as Croatia could have contributed to the decrease in the non-residents investment (André, 2010).

There are a series of financial factors which affect the demand for housing. A decline in real interest rates and a deregulation of the mortgage market leading to lax lending standards are two of the main financial factors driving house prices up (André, 2010). There is a strong link between interest rates that are below Taylor-implied rates and housing bubbles. The impact of interest rates on housing bubbles is especially strong when they are "too low" for "too long" (Hott, 2012). The graph on the left of figure 2.6 shows the decline in real mortgage interest rate from over 11% in 1993 to around 0% in 2006. This cheaper access to credit made buying a house more attractive to many home-owners, especially those which had lower rents. The graph on the right shows the total mortgage credit as a percentage of GDP. Prior to the boom, the ratio credit-to-GDP grew at a CAGR of 7% between 1991 and 1996, this number doubled to 13% for the period 1997-2007, meaning a 270% absolute growth rate.

Figure 2.6

Real mortgage interest rate

Total mortgage credit (as a % of GDP)
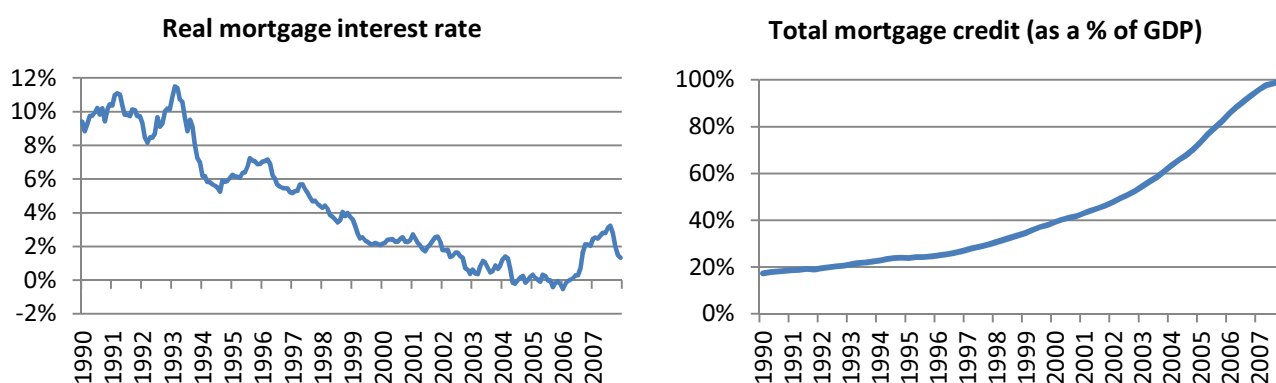
Source: Bank of Spain

Usually, the banking sector is highly exposed to the housing market and this is why the burst of a housing bubble usually leads to a banking crisis (Hott, 2006) and thus, the effects of crisis originated by a housing bubble are deeper than the effects of a crisis arising from a financial bubble. Helbling (2003) reviews the experience with asset price busts in industrial countries during the post-war period, comparing the effects after equity price busts and housing price busts. The conclusions were that housing price busts were less frequent, lasted nearly twice as long and were associated with output losses twice as large, reflecting greater effects on consumption and banking systems.

The banking sector played a key role in the Spanish real estate boom. Not only had the ratio credit-to-GDP risen since the 90's; the Loan-to-value (LTV) ratio, which is also a good measure of the involvement of banks in the housing market, was well over 64% until 2008. Since then, it has fallen to just over 50%. The increased role of the banking sector has many implications for the average household. The default (delinquency) rate was smaller than 2% in 1999; decreasing until it reached its minimum of 0.74% by the end of 2006. However, since then, it has skyrocketed, and in the first quarter of 2014 it was well above 13% and increasing. Decreasing house prices probably explain great part of the increasing default rate.

In conclusion, the continued growth in disposable income, the decline in unemployment rates, the easier and cheaper access to credit, the increase in the population over 25 years and the increase in demand by non-residents have all contributed to the increase in prices. We should now determine up to what point prices grew accordingly to these fundamentals, and to what point they grew exclusively due to expectations of future growth. It is interesting to point out that many of these fundamentals reached their maximum (or minimum in those cases for which it applies) in 2006. However, prices continued growing even though interest rates didn't fall any more or disposable income was not growing at the same pace.

2.3. Tax subsidies from a historical perspective

In previous sections we reviewed some reasons why the housing sector had so much importance in the economy. As pointed out by García-Montalvo (2001), the access to adequate housing appears in the Spanish constitution (Art. 47) as a "basic right of all Spaniards". It is widely agreed that home-ownership enjoys a favourable tax treatment in many countries, and Spain is one of them. This favourable treatment is one of the reasons why the rental share is so low[3].

We will now briefly explain the most common features of the tax treatment of the housing market, bearing in mind that not all of the taxes were applicable at the same time. Some of taxes appear during the construction process, like the Value Added Tax (VAT) of purchasing the land or the Corporate Income Tax (CIT) related to

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[3] In García-Montalvo, J. (2003). "Burbujas Inmobiliarias" the reader can find a set of "fallacies" very common in the Spanish society about price expectations which basically have lead many people to believe that "house prices cannot fall" or that "buying a house is the safest investment".

construction companies benefits. Other taxes are paid by the homebuyer. Regarding the consumer there are 3 stages were taxes appear: acquisition, tenure and selling. In the first stage, when the consumer buys a house, he/she has to pay indirect taxes depending on whether it is a new house (VAT) or second hand (ITP – "Impuesto Transmisiones Patrimoniales"). Usually, a part of the house entry payment could be deduced in the first year, and in subsequent years, deductions could be applied in concept of principal amortization. During the second stage (tenure stage) the home-owner will pay the property tax (IBI - "Impuesto Bienes Inmuebles"), a fraction of which could be at times deduced. Furthermore, deductions on mortgage interest payments could be applied in the Personal Income Tax (PIT). The final stage occurs when the agent sells the house. Houses are considered an investment with particular features, one of which is the fact that even if they are used over many years their value usually will increase. If this is the case, a capital gains tax is applied to the "investor". In real life however, capital gains from selling a house are basically untaxed.

In this paper we concentrate on the taxes supported by potential homebuyers, which affect the demand for housing through the user cost. Ever since the PIT was established in 1978, deductions of mortgage interest payments have been allowed. Many changes have occurred in the PIT law since 1988[4], out of which, the most important were the ones in 1992 and specially the 1999 one. The changes in these two years however went in completely opposite directions. In 1992, changes were meant towards a housing market where home-ownership did not benefit from so many privileges. Some of these measures were to introduce a 15% tax credit for rent payments, to eliminate principal and mortgage interest payments deductions of secondary homes or to reduce the maximum limit of MID in the usual residence (before 1992, MID limit was 4,800€ in the single declaration scenario and 9,600€ in the joint declaration scenario, after 1992, the latter limit was decreased to 6,000€).

The Spanish housing market before and after the 1998 reform is characterized by 6 main points according to many authors such as López García (2005), Sanz (2000) and J.M. Raya (2012). The table below summarizes this information:

	Element	Before 1999	After 1999
1.	Imputed rent	A percentage of the assessed value of property taxed	Imputed rents no longer taxed
2.	Property tax	A percentage of the assessed value of property taxed. Payments of this tax were deductible.	Property tax payments no longer deductible
3.	Mortgage interest deduction (MID)	Tax deductible with a limit of 800,000ptas (≈4,800€)	Mortgage interest payments and principal amortization jointly deductible (as a tax credit). The limits are increased to 1,500,000ptas (≈9,015€)
4.	Mortgage principal repayment	15% tax credit for principal repayments	
5.	Capital gains	Taxed at reduced rate with many exemptions	Still taxed at reduced rate but with more exemptions
6.	Rent payment if tenant was a renter	15% tax credit to rent payments	Removal of tax credit

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[4] See García-Vaquero (2005) for a detailed explanation of reforms in every year can be found

Some aspects of the reform must be mentioned. Firstly, the aim of taxing the imputed rents before 1999 was to tax the rent the home-owner saves or pays to himself. Secondly, regarding the changes in mortgage interest and principal repayment deductions, we must mention how the post-reform tax credit works. For the first two years, there was a tax credit of 25% for the first 4,500€ and 15% on the excess up to 9,015€, for subsequent years the former rate decreased to 20% while the latter stayed constant at 15%. Thirdly, one of the most important exemptions on capital gains occurs when the owner sells the usual residence with the purpose of buying a new one.

The elimination of the taxation of imputed rents and the elimination of the rent payment tax credit, together with the increase in the limits of interest and principal payments deductions are a clear tax advantage to home-ownership against its counterpart of renting a house. The importance of the non-taxation of imputed rents must be clearly stated: if that house was to be occupied by someone else, the rents received by the owner would be taxed; if the "investor" instead of buying a house in order to rent it, invested in an alternative asset, those dividends would also be taxed.

Two main arguments were used by the 1999 government to defend their reform. The first one is that the reform tried to increase the progressivity of the tax system. One feature of MID is that it is regressive as it is a tax deductibility and reduces taxable income; therefore, people with higher income enjoy greater benefits from it. The second argument they used was that the reform intended to increase access to home-ownership. Many people back then gratefully accepted this 1999 reform as the ex-ante price of a house was meant to decrease by means of promoting the favourable tax-treatment. What only few of them could imagine is that the huge increase in demand for houses would inevitably increase the ex-post price, and more so in the case of the bubble.

Several reforms were made since 1999 worth mentioning. Some measures have been taken to deal with institutional factors which also tilt the owning-renting decision towards the former. The "Sociedad pública de alquiler", created in 2005, promotes home rental with maximum guarantee for landlords and better conditions for tenants. In 2009 a set of reforms were made with the aim of increasing the protection of the landlord and facilitating the ejection of the tenant if necessary (Ortega, Rubio, 2011). Regarding the favourable tax treatment to home-ownership, in 2006, the tax credit on rent payments was reintroduced; it consisted in a 10% deduction for rents smaller than 24,000€, aimed at making rental more available and cheaper to lower rents. In January 2011, MID on the usual residence were eliminated for rents greater than 24,000€; however, it was reinstated in 2012 by the incoming government and once again removed in 2013 by command of European decision makers.

Capozza et al. (1996) consider the positive externalities attributed to home-ownership as the main rationalization for the favourable tax treatment. Green and White (1997) showed that children of home-owners are more likely to finish high school, less likely to become young parents and less likely to be arrested; holding parent's income, education, race, age and marital status constant. García-Montalvo (2003) gives 4

common arguments. First, the real estate market generates essential housing services to which families dedicate great part of their budget. Secondly, the asymmetry created by an inelastic supply (in the short run) and a very sensitive demand in the case that there was an economic downturn. Thirdly, the long lasting profile of houses implies that any decision has considerable long-term effects. Finally, houses are an important real asset in people's portfolio considered an alternative to financial assets.

We should now have at least a brief look at literature contributions. Poterba (1984) opened the way with the asset-market model, which by means of the user cost approach, is able of measuring the effects of fundamentals on prices and also allows measuring the effect of policy changes on them. In his 1984 paper he concluded that for an economy with a 25% marginal tax rate, the effect of eliminating MID was an increase in the user cost from 4% to 7%, leading to an immediate fall of 26% in real house prices and a long-run effect of -29% over the stock of housing capital. Capozza et al. (1996) estimated the effect of eliminating property tax and mortgage interest deductions, and concluded that changes in taxation affected prices but not so much quantities. For an economy with a 22% marginal tax rate they estimated a 13% decrease in house prices. They also pointed out that removing these deductions removes the preference for debt financing a house and, therefore, it would reduce the level of borrowing. Other studies make international comparisons of tax systems. Crowe et al. (2011) stated that the evidence about the relationship between business cycles and housing's tax treatment is inconclusive from country-to-country experience; there are countries with relatively unfavourable tax treatments where prices increased a lot in the past years and countries with relatively favourable treatments where prices did not increase much.

For the Spanish economy, López García (2000, 2008) studied what would be the effects over the real estate market if PIT deductions (principal and interest payments deductions) were permanently eliminated. A 26% decrease in house prices in the short-run and a 16% decrease in the long-run were the main results. In López García (2005) the scenario before and after the 1998 reform were compared, reaching the conclusion that, in the long-run, the reform would barely have any effect over the price of houses or the stock, but that there will be a distributional effect as the most regressive elements were eliminated. Sanz (2000) focused the analysis on the user cost rather than on house prices. The uniqueness of this paper lies on how it includes all the features of the tax-treatment such as the limits of the different deductions, the different kinds of PIT declarations or the level of debt financing of the house. The main findings were again that the reform made tax subsidies more progressive, that for low income levels debt financing became more profitable and finally that there was an overall decrease in the user cost after the reform. García-Vaquero (2005) used the concept of "tax wedge" as the difference between the user cost after taxes and the user cost without taxes and concluded that the joint effect of taxes and subsidies lead to a decrease in the user cost and hence there was an effective tax subsidy.

Ortega et al, (2011) use a different approach: they built a small open economy DSGE model. Their main findings are that removing MID has small effects on the overall

economy (0.1% decrease in GDP and 0.6% decrease in employment), but reallocates resources from the construction sector to the consumption goods sector. Additionally, its removal implies a decline of 8% in real house prices, an increase of 5.6% in the rental share and a reduction in fiscal expenditure equal to 0.9% of GDP. We should bear in mind that according to the data provided by the Spanish tax authorities, MID implied a cost greater than 4,000 million € annually to the government since 2000 (Raya, 2012).

3. The Fundamental Value of Houses
3.1. The model

In this section we develop the model which allows us to calculate the theoretical house value determined by its fundamentals. The following model combines the asset and the market view of house prices. Starting with the asset view, the house price is defined as the present value of future imputed rents; the theoretical framework proposed by Poterba (1984) is the basis on which such works are based. In equilibrium, home-owners equalize the benefits obtained from housing services with the costs of owning a house. On the one hand, the imputed rent, defined as what it would have cost to rent an equivalent property for a period (Himmelberg et al, 2005), is the benefit. On the other hand, the cost of owning a house during one period is the user cost of home-ownership (γ) multiplied by the real price of the house $(P)_t$. This equilibrium is expressed by (1.1):

$$R_t = \gamma P_t \tag{1.1}$$

There are several factors commonly used in literature to define the user cost. First of all, the owner has to pay a mortgage interest rate (r_t). Secondly, the house is subject to depreciation (at a rate δ). Thirdly, the owner has to pay maintenance expenses (m) and will bear the risk of house price fluctuations for which the owner must be compensated by a risk premium (ρ). Finally, the owner can profit from potential capital gains (π^e). For our analysis we need to account for the effect of tax subsidies. There exists a proportional personal income tax at rate (τ) from which a fraction (φ) is allowed to be deduced in concept of principal and interest payments of the mortgage. According to García-Montalvo (2003), after the 1998 reform the user cost for the Spanish housing market can be written in a simplified form as in equation (1.2)[5]:

$$R_t = \left[(1-\varphi)\left[(1-\tau)r_t + \delta + m + \rho - \pi^e \right] \right] P_t \tag{1.2}$$

Regarding capital gains, quite restrictive assumptions are usually made. Himmelberg et al. (2005) for example use the average real growth rate of house prices to predict the

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[5] For a more detailed analysis of the expression of the user cost before and after the tax reform of 1998 there are many working papers. Especially those written by MA López-García (2000, 2005 and 2008), JF Sanz (2000) and of course the already mentioned García-Montalvo (2003).

future growth rate. In order to relax this assumption, we follow Hott and Monnin (2006) and derive expected capital gains from the expected future fundamentals. According to the rational expectations hypothesis, the expected housing revalorization is equal to the expected value in period t of the price in $t+1$. Defining $\kappa = \delta + m + \rho$ we get the expression:

$$R_t = \left[(1-\varphi) \left[(1-\tau)r_t + \kappa - \left(\frac{E[P_{t+1}]}{P_t} - 1 \right) \right] \right] P_t \tag{1.3}$$

Rearranging (1.3) for P_t it will now look as follows:

$$P_t = \frac{\dfrac{R_t}{(1-\varphi)} + E[P_{t+1}]}{\left[(1-\tau)r_t + \kappa + 1 \right]} \tag{1.4}$$

We define $\omega_t = (1-\tau)r_t + \kappa + 1$. By forward iteration of the value P_{t+1} we obtain what we will call the "price equation (1.5)". This equation tells us that the fundamental price of a house is determined by the present and future values of the imputed rents (R_t) and the mortgage interest rate.

$$P_t = \frac{1}{1-\varphi} E \left[\frac{R_t}{\omega_t} + \frac{R_{t+1}}{\omega_t \omega_{t+1}} + \frac{R_{t+2}}{\omega_t \omega_{t+1} \omega_{t+2}} + ... \right] = \frac{1}{1-\varphi} E \left[\sum_{i=0}^{\infty} \frac{R_{t+i}}{\prod_{j=0}^{i} \left[(1-\tau)r_t + \kappa \right]_{t+j}} \right] \tag{1.5}$$

There are two main approaches to interpret the evolution of imputed rents (Hott, 2006). The first approach assumes a no-arbitrage condition by which in equilibrium, agents will be indifferent between buying and renting a house and hence imputed rents will be equal to actual real rents (R_t^a). The problem with assuming rents as a determining factor for fundamental prices is that rents do not have to be fundamental themselves. The Spanish rent market is strongly influenced by government intervention (in the form of regulation) and subject to imperfect information. Additionally, the low rental share makes the actual rent not to be an appropriate proxy for the imputed rent. The alternative approach includes the market view on house prices. This consists on calculating the fundamental rents by assuming that they are the outcome of market equilibrium between demand and supply of housing services[6]. The main advantage of this method is that the interaction between demand and supply allows the GPD and the stock of houses to affect the fundamental house price (P_t) via the fundamental rents (R_t). In Hott (2006), both approaches were compared for a set of countries and the market approached yielded better results. Due to this, it is the approach we will follow.

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[6] This is not the demand and supply of houses but of housing services, the right to occupy a house by buying or renting it.

We will now look at the demand and supply sides of the housing services market. The demand side is influenced by the utility an individual derives from occupying a house and the budget restraint he faces. A representative consumer faces the following maximization problem:

$$\max_{\{d_t, c_t\}} U(d_t, c_t) = d_t^\alpha c_t^{1-\alpha}$$

$$s.t. \quad \tilde{y}_t = d_t R_t + c_t$$

Where c_t is goods' consumption, d_t the occupation of housing units, α is the marginal rate of substitution and $\tilde{y}_t$ the disposable income. The disposable income of agents depends on the gross income and the effect of taxes and subsidies on it. The unit price of consumption goods is normalized to 1 and the cost of occupying a house for one period is equal to the real imputed rent (R_t). The utility maximizing demand of housing per capita is:

$$d_t = \frac{\alpha \tilde{y}_t}{R_t} \tag{1.6}$$

Multiplying the per capita terms $(d_t, \tilde{y}_t)$ by the population (N_t) of identical individuals will give us the aggregate demand for housing in the economy:

$$D_t = N_t d_t = \frac{\alpha N_t \tilde{y}_t}{R_t} = \frac{\alpha \tilde{Y}_t}{R_t} \tag{1.7}$$

The housing market is in equilibrium when the supply of housing equals the demand:

$$D_t = \frac{\alpha \tilde{Y}_t}{R_t} = S_t \tag{1.8}$$

By rearranging for the imputed rent we get the expression which relates the imputed rent to the disposable income and the housing stock; this is the fundamental value of imputed rents:

$$R_t = \frac{\alpha \tilde{Y}_t}{S_t} \tag{1.9}$$

In expression (1.9), the imputed rent is a function of $\tilde{Y}_t$, which we said depended on taxes. The income available for agents depends on the fraction of the price of the house which can be deduced from the personal income tax, hence, an increase in the proportion which is allowed to be deduced will increase disposable income and vice versa. We define $\tilde{Y}_t$ as follows:

$$\tilde{Y}_t = Y(1 + q\varphi) \tag{1.10}$$

Where, q is the percentage of periods where deductions are allowed. For the time being, we consider two extreme cases for the disposable income and, thus, two extreme cases for the imputed rent (the real value of which will lie between those limits). First, the case were MID had never existed and, hence, $\tilde{Y}_t = Y$; this is the "exogenous Y case". Second, a fraction φ has always been deduced and will be like that in the future, therefore, $\tilde{Y}_t = Y(1+\varphi)$; "full deduction case".

The final step in the theoretical framework is to replace the fundamental imputed rents given by (1.9) in price equation (1.5) and get the Fundamental House Price Equation:

$$P_t = \frac{1}{1-\varphi} E\left[\sum_{i=0}^{\infty} \frac{\alpha \tilde{Y}_{t+i}}{S_{t+i} \prod_{j=0}^{i} \left[(1-\tau)r_t + \kappa + 1 \right]_{t+j}} \right] \qquad (1.11)$$

From (1.11) it follows that house prices depend on present and future aggregate income, mortgage rates and construction activities. The two fiscal parameters ($\varphi \ and \ \tau$) also affect house prices. Furthermore, φ not only affects the determination of prices but also the imputed rent via $\tilde{Y}_t$. Both fiscal parameters are assumed to be constant forever unless the policymaker decides to change them; once they are changed to a new rate they will stay constant forever again. In this paper we will deal with φ, the fraction of PIT which is allowed to be deduced as principal and interest payments of the mortgage. We will consider a government which eliminates this deduction but leaves the marginal PIT rate (τ) unchanged, and thus, the new policy will set $\varphi_1 = 0$. We should ask: "Who will be affected by this policy change?" We assume that there is no "retroactivity". If this policy change was implemented in the year 2000, everybody who bought a house before then will still be able to deduce $\varphi_0 = 15\%$ from PIT until they settle their debt, however, every new home-owner who debt-finances the new house will not be able to do so. For our purposes, the number of people owning a house and enjoying mortgage interest deductions does not affect house prices. In this model we have obtained theoretical house prices which are determined by fundamental imputed rents. These rents are the equilibrium result of the interaction between demand and supply of housing services. Therefore, it is the marginal home-buyer that determines the demand for housing and, thus, the one who sets house prices.

3.2. Calibration process

In this section we present the steps used to estimate the fundamental house price. First we estimate the fundamental imputed rents which we then use to obtain P_t. As the fundamental price equation depends on all the future values of imputed rents and mortgage interest rates, we have to make some assumptions and calibrate the model in order to obtain a consistent house price. For the time being, we will assume that agents

are rational and have perfect foresight. These assumptions allow us to substitute the expected future fundamentals by their actual values:

$$E\left[P_{t+1}\right] = P_{t+1}$$
$$E\left[r_{t+1}\right] = r_{t+1}$$

We still have three main problems with which we will have to deal. First we need to find adequate values for different parameters. We also have to make some assumptions on how fundamentals evolve out-of-sample. Finally, if we have a look at equations (1.9) and (1.11), we see that some variables are expressed as index numbers (R_t, Y_t) and others at their levels (S_t). Hence, in order to be able to compare both sides of the equation, we need appropriate conversion factors.

Calibration of fundamental rents: We follow Hott's (2009) proposition, which says that even if in the short-run actual rents deviate from their theoretical values, in the long-run the actual values do not oscillate much from their fundamental ones. In expression (1.9) we see that α affects the level of imputed rents (R_t). We choose a parameter α_0 which minimises the Mean Square Difference (MSE) between actual and imputed rents. This α_0 includes the preference parameter α and the conversion factor. Overall, we have to solve the following minimization problem:

$$\min_{\{\alpha_0 > 0\}} \sum_{t=0}^{T} \left[R_t^a - \frac{\alpha_0 \tilde{Y}_t}{S_t} \right]^2 \tag{1.12}$$

Future values of fundamentals: In order to calculate the fundamental price of housing, it is required to have all future fundamentals up to infinity. As we do not have such data we make assumptions about how fundamentals evolve after the end of the sample (time T). P_t depends on the future theoretical rent (R_t) and future mortgage interest rate (r_t). We will assume that imputed rents evolve at a constant growth rate (g), equal to the average growth rate of the last 5 years.

$$R_{T+i} = (1+g)^i R_T = (1+g)^i \frac{\alpha_0 \tilde{Y}_t}{S_t}, \ \forall i > 0$$

Similarly, the mortgage interest rate will be assumed constant and equal to the average rate of the last 5 years $(\bar{r})$ from period T+1 onwards.

$$r_{T+i} = \bar{r}, \ \forall i > 0$$

How to choose the period in which we compute the average growth rate of rents and average interest rate is quite arbitrary. For this reason, it is convenient at this point to make a robustness test of this fundamental model. To do so, we consider two other

periods, the last 10 years and the whole sample. The fundamental price proofs not to be sensitive to which period is chosen.

Calibration of fundamental house prices: Once we have the fundamental imputed rents and the mortgage interest rates up to infinity, our remaining parameters in order to calibrate the fundamental house price are $m, \rho, \delta, \varphi, \tau$ and the conversion factor α_1. We assume $\kappa = \delta + m + \rho = 0.08$ [7]. Regarding the fiscal parameters, we initially set $\tau = 20\%$ and $\varphi_0 = 15\%$. Whether the value chosen for τ is increased to 25% or not does not alter our results very much, giving some additional sense of robustness. Finally, regarding the conversion factor, we choose α_1 so that the deviation of the fundamental house price (P_t) from the actual house price (P_t^a) is minimal in a randomly chosen time period. We assume that in this point prices are in their long-run equilibrium and so variations in the fundamental prices explain actual prices.

First we have to determine in which period prices are in equilibrium. We take two scenarios. The first one, following the research of Balmaseda, San Martín and Sebastián (2002) and García-Montalvo (2003) among others would assume prices in the period 1997-1999 to be in equilibrium. The second option is to take the price in 2000-2001 to be in equilibrium. The results differ a bit as in the second approach prices appear to be slightly undervalued from their fundamentals in the period 1997-1999. This result lies in accordance with Ayuso and Restoy (2006) .The authors attribute the overvaluation in 2004 to be the consequence of an adjustment process deriving from the undervaluation of prices in the late 1990's after the "bubble" bursted in 1992. They reject the hypothesis of a bubble in the early 2000's.

We follow the first scenario taking the prices in 1997-1999 as reference. The reason for this is that prices were stable for 6 years between 1993 and 1998 with a real appreciation of just 1%. But also, it is interesting for us to assume prices to be in equilibrium in 1999, so that when we check the effect of removing the MID in 2000 and in 2004 we start from a long-run price equilibrium. Overall, we have to solve the following minimization problem:

$$
\min_{\{\alpha_1 > 0\}} \sum_{1997-I}^{1999-IV} \left[P_t^a - \alpha_1 \frac{\left(\dfrac{R_t}{1-\varphi} + P_{t+1} \right)}{(1-\tau)r_t + \kappa + 1} \right]^2
\tag{1.13}
$$

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[7] In the literature, κ as such is not defined. However, the set of values taken by $\delta + m + \rho$ usually ranges between 4-12%. Poterba (1992) for example uses 8%, and the average value in Hott (2009) for 6 different countries is 8% too. We take this approximation, however, we also allowed for some changes in order to test the robustness of the model and results did not change significantly.

3.3. Data

In this section the data used for the calibration and estimation of the fundamental house value is presented. All data must be quarterly and the time horizon taken into account includes from 1997-I to 2013-III. Data is deseasonalized and nominal values deflated by the domestic Consumer Price Index (CPI).

The lack of data and the doubtful quality regarding house prices has been repeatedly commented. Many troubles come from the heterogeneity of houses both in time and in space. Bover (1993), who was the first analyst to face this problem, pointed out that no data is available before 1976 nor complete series at a national level before 1986. Since then, data is provided by the different appraisal agencies, and all of them aggregated by the "Ministerio de Vivienda". In 1995, the "Ministerio de Fomento" took over using the same methodology[8]. García-Montalvo (2012) argued that financial entities' involvement in appraisal agencies' capital lead the latter to overestimate the value of houses during the "boom" period. According to him, house price data is subject to a possible over-valuation close to 30% during this period. Since 2007, INE offers a hedonic price index. The hedonic price model consists on explaining the price of a good in terms of its characteristics, which for the housing market could be nº of bedrooms, nº of bathrooms, square feet, whether or not the house has a garage, etc. However, due to its short time span we have to choose another source. In this paper we consider house prices since 1997, we follow data provided by the "Ministerio de Fomento".

The housing stock; measured as the number of houses, and the mortgage interest rate; approximated by the "Tipo de los préstamos libres para adquisición de vivienda de hogares" are obtained from the "Boletín Estadístico" from the Bank of Spain. Disposable income, inflation and actual rents are all obtained from INE. The GDP is obtained from the "Contabilidad Nacional Trimestral" and R_i^a are approximated by the "Vivienda en alquiler" component in the CPI.

3.4. Removing mortgage interest deductions: the fundamental price

In this section we analyse the effect on the fundamental house price of removing MID. On a nutshell, its elimination would have meant an increase in the user cost of owning a house and, hence, a decrease in the demand for housing, followed by a decrease in the fundamental house price. We are also interested in comparing the effects of the policy had it been taken in the year 2000 or in 2004, this is; at the beginning of each legislation period prior to the crisis. Before discussing the effects of removing MID we shall review the overvaluation of house prices. There are two main approaches for detecting bubbles: the macroeconomic one and the financial one.

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[8] See Bover (1993) and García-Montalvo (2001) for a more detailed analysis of the different sources of data and how they are gathered.

The financial approach uses the "price-to-earnings" and "price-to-income" ratios, as in the financial asset pricing literature. Many authors, such as Case, Shiller (1989, 2004), have extended those ratios to the real estate market. The first ratio is equivalent to the housing price-to-rent ratio and reflects the relative cost of owning versus renting; if house prices are high, potential home buyers would tend to rent and, thus, the demand for houses would decrease and prices would fall. The second one, the price-to-income ratio, describes the affordability of a house. Commonly, it is agreed that if the price-to-rent ratio is high, prices are sustained by unrealistic expectations of capital gains rather than by fundamentals and, hence, a bubble may exist. The financial approach, which is more straightforward than the macroeconomic one as it does not require the calculation of the fundamental price, has been criticized as inadequate in order to explain house price bubbles (Himmelberg et al, 2005). These indicators only consider one fundamental factor at a time, but even if they considered several of them, they only consider the current fundamental and not their future development (Hott, 2006).

Ayuso et al. (2006) present a summary of the research on housing bubble detection for the Spanish case. The following table summarizes the findings in the recent literature:

Work	Approach	Overvaluation in 2002-2003 (%)[9]
Balmaseda, San Martín and Sebastián (2002)	Macro	28
Ayuso and Restoy (2003)	Financial	20
Martínez-Pagés and Maza (2003)	Macro	43
García-Montalvo (2003)	Financial	28
Abad (2013)	Macro	25-32

As described in sections 3.1 and 3.2, in this paper we follow the "macro" approach for the fundamental price and the overvaluation. There are two reasons for choosing this approach. The first one is the inadequacy of the price-to-rent ratio mentioned above. The second reason is that the macroeconomic approach as described in section 3.1 allows us to introduce fiscal policy changes and measure their impact over the fundamental price.

The fundamental price is represented in figure 3.1. This graph shows the two extreme cases: the "exogenous Y case" fundamental price, and the "full deductions case" price. These are the upper and lower limits to the fundamental price. We assume prices to be in "equilibrium" during the period 1997-1999. Fundamentals are able to explain the actual price for two additional years (until 2001), and from then onwards, the theoretical price continued to grow slowly while the actual price boosted. According to our estimates, house prices were overvalued by 30-34% in the year 2003. This figure is a bit higher than the results obtained by García-Montalvo (2003), Ayuso (2003) and Balmaseda et al. (2002) but lower than the one obtained by Martínez-Pagés (2003). This paper basically follows the same approach as in Abad (2013),[10] however, including

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[9] Difference between actual price and long-run equilibrium (%)
[10] I wish to thank J. Abad for helpful discussion and advice in the elaboration of this paper. Furthermore, his estimation of the imputed rent is used in this paper as the "exogenous Y case rent", where income is not affected by taxes.

fiscal policy parameters; this may be the reason for the discrepancy between the two figures.

The fundamental price reached its maximum by 2006. The imputed rents continued growing during 2006 and 2007, however, recall from section 2.2 that, mortgage interest rates were close to 0% in 2006 and grew to 3% by the third quarter of 2007. The increase in the interest rate raised the user cost and offset the growth of imputed rents. For this reason, the fundamental price stayed fairly constant during 2006-2007; however, the actual price kept rising. The 2008 recession translated into an increase in the unemployment rate and a fall in disposable income, these, together with an accumulated housing stock which had tripled following the boom in residential construction, lead to an excess supply and the bursting of the bubble in the second quarter of 2007, period in which the house price overvaluation peaked, exceeding 80%. The fundamental price experienced the greatest fall in 2008. Between the end of 2009 and the beginning of 2011 disposable's income growth rate seemed to recover, and this, together with the stagnation of the housing supply, is why the fundamental price recovered too. However, since 2011 disposable income again was decreasing and, thus, the fundamental price has been falling until the last data is available (third quarter of 2013). The fundamental price has fallen by 12% between the end of 2007 and the end of 2013. The actual price has plummeted without stop ever since the adjustment process began in mid-2007. By 2013, real house prices had fallen by 36% but they were still 29% overvalued. Presumably, with data from the beginning of 2014 we would see an increasing fundamental price.

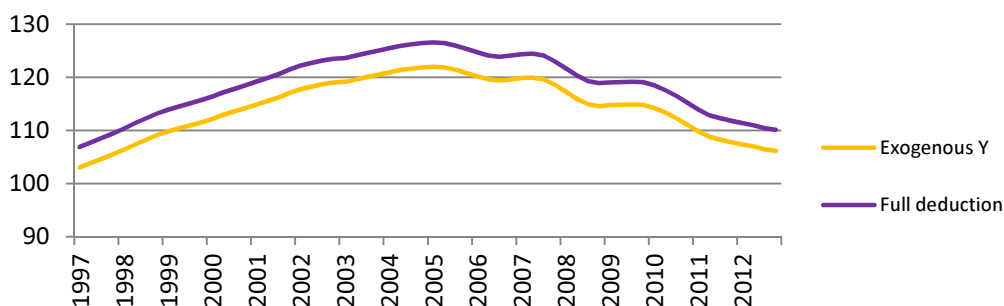**Figure 3.1 - Fundamental house price**

Figure 3.2 shows how the fundamental price would have behaved in case MID had been eliminated at different points in time. This fiscal policy change has two effects over the fundamental price. The first effect occurs via disposable income and imputed rents. In equation (1.10) we defined disposable income as a function of aggregate income and the number of periods in which deductions were allowed $\tilde{Y} = f(Y, q, \varphi)$. Removing MID will reduce disposable income, reducing the imputed rent and, hence, reducing also the fundamental price. The sooner the policy change occurs, the greater the effect will be over income. The following table summarizes the different expressions for $\tilde{Y}$.

Case	Nº years 1997-2008	q	$\widetilde{Y} = f(Y, q, \varphi)$
Exogenous Y	11	0	$\tilde{Y} = Y$
Full deduction	11	100%	$\tilde{Y} = Y(1 + \varphi)$
Removing MID in 2000	11	7/11 = 64%	$\tilde{Y} = Y(1 + 64\%\varphi)$
Removing MID in 2004	11	3/11 = 27%	$\tilde{Y} = Y(1 + 27\%\varphi)$

The second way by which this policy affects the fundamental price is the direct effect of removing φ on the fundamental price equation (1.11). This is a 16% decrease in the fundamental price. This result matches those studies reviewed in section 2.3; Poterba (1984), Capozza (1996) and MA López García (2000, 2008). It might strike the reader that this second effect on the fundamental price is independent of whether the reform takes place in 2000 or in 2004. We should take two things into account. First, fundamental house prices are defined as the present value of all future imputed rents, they are the steady state equilibrium towards which actual prices should move and therefore, this equilibrium is not sensitive to whether the policy is taken with just 4 years of difference.

Secondly, most papers which evaluate the effects of such a fiscal policy change only measure the effects on the fundamental price or the steady state equilibrium. What they do not take into consideration is the speculative component of house prices. The complete removal of MID has been criticized to be a policy which has a limited effect as it can only be done once. Furthermore, the effects of this policy change are said to be a one-time decrease in prices which leaves no room for future action (Crowe et al, 2011). In this paper however, we want to measure the effect of the policy change not only on the fundamental price but on the bubble as well. To do so, we cannot only focus on the effect portrayed in figure 3.2 but we also have to model how the actual price would have behaved given the expectations bubble.

Our result will show that carrying the reform in 2000 or in 2004 will not significantly matter for the fundamental price in the long-run, but will be crucial for the bubble component and, hence, the "actual price". In the next section we will see the role played by expectations and how they have contributed to explain the evolution of prices.

Figure 3.2 - Fundamental house price and fiscal policy
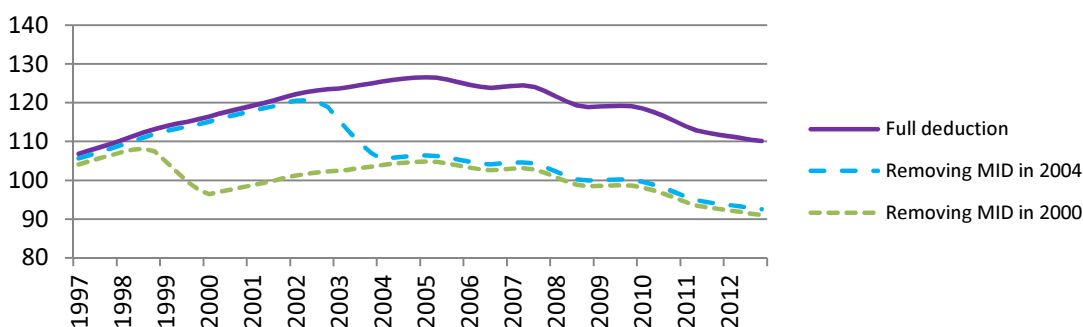
4. The intrinsic bubble in the real estate market
4.1. Calibration process

In the fundamental model it is not only assumed that agents are rational, but also that they have perfect foresight. These indeed are two very strong assumptions' regarding investor's forecasting abilities. We accept that, in the long-run, prices will reflect their fundamentals and they will revert to them. However, in the short-run bubbles may exist. In this section we try to explain the deviation of actual and fundamental prices by means of a speculative bubble model. Shiller (1981) attributes excessive fluctuations in the stock market to the irrational behaviour of investors. Rational bubbles, however, rely on the self-fulfilling expectations of investors and, thus, prices could increase only because investors believe that the price will increase in the next period.

The "intrinsic bubble model" proposed by Froot and Obstfeld (1991)[11] for the stock market can be easily applied to the real estate market. In order to do so, we simply consider the imputed rents (R_t) calculated in section 3 as the dividends paid in the stock market model. Bearing this in mind, the real price of a house according to the intrinsic bubble model (P_t^b) will be the sum of the present-value term and a bubble term $P_t^b = P_t^{pv} + B_t$ as in (2.1):

$$P_t^b = aR_t + cR_{t+1}^\lambda \qquad (2.1)$$

where a and c are arbitrary constants and $\lambda > 1$ gives the bubble term its explosive character. It should be stated that the bubble term in this paper is a function of periods' $t+1$ rent which is a modification of the original proposition, see appendix A for a further discussion of this matter. First we calculate the present-value term in (2.1). The constant a can be calibrated in the same way as in section 3.2; we set a so that P_t^{pv} is equal to the actual price (P_t^a) in 1997.

The second part of (2.1) corresponds to the bubble term. The exponent $\lambda = \log_{1+\tilde{g}}(1 + \kappa + \tilde{r})$ is the key element for the model; it is what allows prices to overreact to changes in fundamentals. We assume $\tilde{g}$ to be the average growth rate of imputed rents and $\tilde{r}$ to be the average real mortgage interest rate, both of them for the 5 first periods of the sample (1997-2001). Just as in the fundamental model, choosing this period is quite arbitrary. Similarly, in order to test the robustness of the model we allow for another period, in this case, the first 10 years (1997-2007). The model is again robust to these changes in parameters. The arbitrary constant c is calibrated so that it reduces the Mean Square Error (MSE) during the whole sample. Therefore, c solves the following minimization problem:

$$\min_{\{c\}} \sum_{t=0}^{T} \left[P_t^a - \left(aR_t + cR_{t+1}^\lambda \right) \right]^2$$

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[11] See Appendix A for a review of the intrinsic bubble model as developed by Froot and Obstfeld (1991).

In figure 4.1 we display the results obtained both for the fundamental and the estimated price, and we compare them to the actual price. The bubble term explains most of the actual house price fluctuations and the model fits best in the upward trend of house prices but not so well when prices start to decline. Once the bubble bursts, the model predicts a much more pronounced fall in prices. However, this should not be thought as a drawback of this model. The model is derived from a financial asset valuation framework and hence, it ignores some characteristics of the real estate market. In particular, as mentioned in section 2.2, the banking sector is highly exposed to the housing market. Hence, house prices are not allowed to decline as fast as the model predicts since it would have a substantial impact on the financial sector's soundness. Moreover, there are supply rigidities since owners may not want to sell their houses even though prices might be plummeting if they expect this fall to be transitory.

Figure 4.1 - House Prices
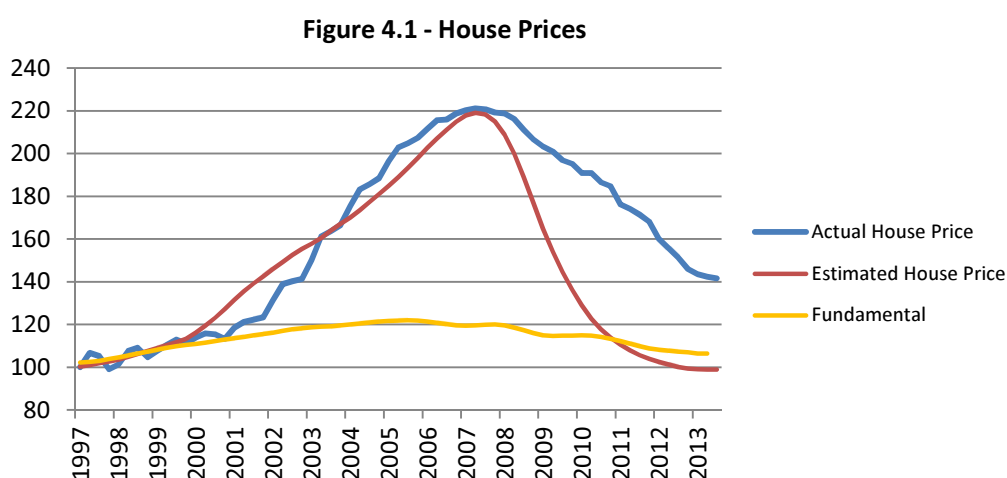
In any case, main purpose of this paper is to simulate how the housing price bubble would have evolved had tax subsidies, such as MID, been removed in the early 2000's. Thus, for our purposes, we are just interested in the upward trend of house prices rather than on the adjustment process which took place following the bubble burst. For this reason, even though this model might present several drawbacks and deficiencies, it is very useful for what we want to analyse. We use the estimated house price as a proxy of the actual house price in the upward cycle of prices.

4.2. Removing mortgage interest deductions: the bubble

Just as we did in the fundamental model case, we now consider the effects of a complete removal of MID. That is, changing φ from $\varphi_0 = 15\%$ to $\varphi_1 = 0$. We use the calibrated model presented in section 4.1 to measure the effects of such a removal of MID on the bubble. We set parameters a and c from the real economy data. However, in this simulation exercise, we will no longer have real data with which to calibrate it. For this reason, we keep the same parameters a and c and we approximate how the actual price

would have evolved by changing the bubble component of house prices R_t^{λ}. We will consider three scenarios; the base case is the actual situation, in which MID were not eliminated prior to the bursting of the bubble. The second scenario is the case that MID would have been removed in 2004. The third scenario is removing MID in the 2000. Each scenario will have an associated estimated house price.

Figure 4.2 shows the bubble term according to the model in section 4.1, and how this component would have changed once MID were been removed. Contrary to the fundamental price case, here there is a clear difference in the bubble component depending on whether MID were removed in 2000 or 2004. Removing MID in 2004 would have meant that the peak of the bubble term would have been 26% below that the one with no fiscal policy change at all. Had this policy action been taken in 2000, the effect would have been as twice as big and the bubble term would have been 51% smaller than the actual one. Consumers' expectations on house prices play a key role in the evolution of these prices. As MID are removed, and hence, home-ownership become less attractive, the demand for houses falls and thus, prices would not have risen so much. The sooner this policy was implemented, the slower (and smaller) the upward expectations would have evolved.

Figure 4.2 - The bubble component and fiscal policy
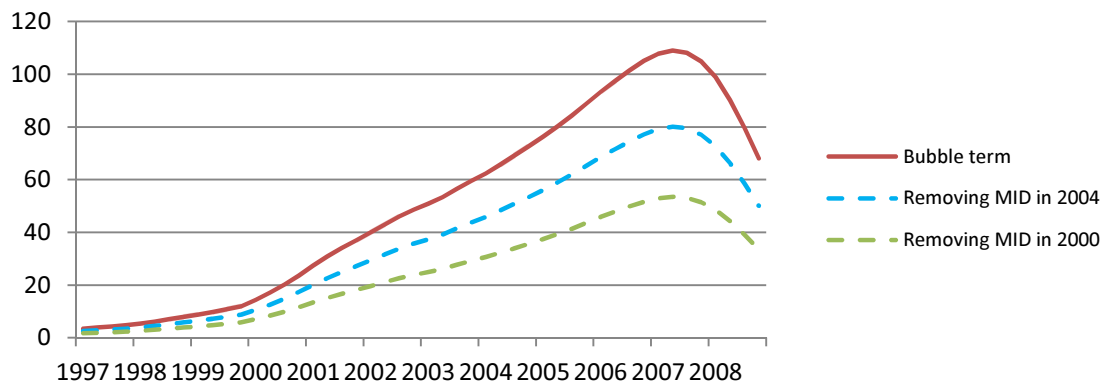
In figure 4.3 we present the actual house price and the estimated effects of those fiscal policy actions. In this graph we do not only focus on the bubble term (B_t), as in the previous graph, but we look at the estimated house price (P_t^b). The green and light blue lines represent how the actual house price would have evolved if MID had been removed in the 2000 and 2004, respectively. We start from a situation where estimated prices are higher than the actual price. This initial overestimation could be attributed to the "euro effect" mentioned in section 2.1. If MID had been removed in 2004, prices would have been 14% smaller than the actual prices reached at the peak, just before the bubble burst. In the scenario where MID were removed in 2000, prices behave more smoothly and at their maximum would have been 27% smaller than actual prices.

Figure 4. 3 - Actual price and estimated price
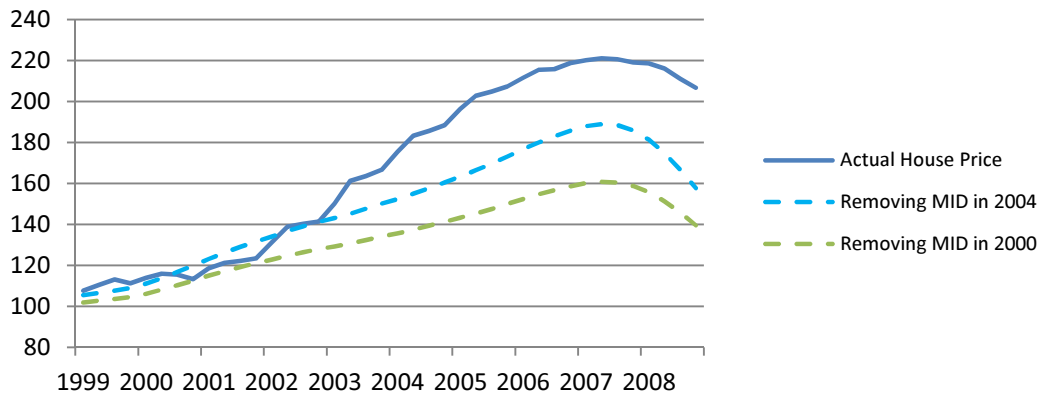
Measuring how prices would have peaked is of great importance; however, they do not reflect the whole effect of the policy change on the housing bubble. Recall we defined the bubble as the difference between actual and fundamental prices. We have already obtained the estimated effect of removing MID both on the fundamental price and the actual price. In order to measure the overvaluation in each scenario, we have to compute the difference between the estimated house price in each of the three cases (depicted by figure 4.3) and the fundamental house price in each scenario (as shown in figure 3.2).

Figure 4.4 shows the overvaluation in each scenario. There are several ways to assess the effect of the tax policy over the bubble. The first one is to measure the overvaluation at the maximum point. The actual overvaluation was around 80% at the 2007 peak. We can compare the overvaluation in the two alternative scenarios with this one. Our results indicate that, in 2007, had MID been removed in 2004; the maximum overvaluation would have been 5 percent smaller, but still close to 80%. In this case, the decrease in the estimated price is mostly offset by the decrease in the fundamental price. However, if MID would have been removed in 2000, the fall in the estimated price would have been greater, as there were 4 more years in which expectations would have curbed, and thus, the overvaluation in 2007 would have been 30% smaller in this case.

Figure 4.4 - Overvaluations
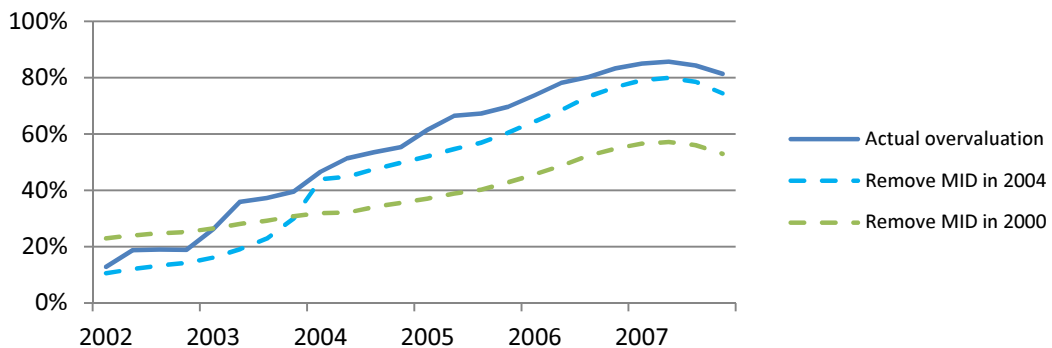
The second way to assess the effect over the bubble is to measure the accumulated overvaluation which would have been avoided. When the bubble is at its early stages, the relative impact of removing MID on the bubble component is small compared to the

impact on fundamentals. Therefore, in those cases we can find some periods in which the net impact of removing tax incentives on overvaluation is even positive. We ignore those periods in calculating the accumulated impact of the tax reform. Our results indicate that removing MID in 2004 would have meant that the housing bubble would have been just 15% smaller during this period. But if MID had been removed in 2000, the bubble would have been 36% smaller.

The following table summarizes the results. The first row corresponds to figure 4.2. It just reflects the impact on the bubble term. The second row gathers the information from figure 4.3: how (smaller) would have the estimated house price been with the tax reform. The third row measures how smaller the overvaluation would have been at the peak (2007), as shown in figure 4.4. The fourth row shows the amount of accumulated overvaluation that would have been avoided with the policy change.

Element	Removing MID in 2000 (%)	Removing MID in 2004 (%)
Effect on the bubble term	-51	-26
Effect on the house price peak	-27	-14
Effect on peak overvaluation	-30	-5
Accumulated overvaluation avoided	36	15

Overall, we can conclude that removing the implicit tax subsidy to home-ownership would have had a substantial but not complete effect on the housing bubble. By removing MID, buying a house would have become less attractive and the demand for houses would have decreased, hence, curbing prices. This effect is particularly strong if we take into consideration the speculative component of house prices. A bubble occurs when house prices increase uniquely due to expectations of future capital gains. Therefore, should prices have initially been lower; expectations would have built up to a lower extent. The fundamental house value seems not to be very sensitive to the date in which MID are removed. On the contrary, the estimated house price according to the intrinsic bubble model changes considerably depending on the policy timing; the sooner the fiscal reform would have been taken, the smaller the house price increase.

5. Conclusions

In the description of the Spanish 2008-2013 recession it is common to find an appeal to the housing bubble as one of the main drivers of the economic disaster. Moreover, most analysts and political actors claim that policy inaction on the bubble is highly responsible for the severity of our recession. However, nobody has estimated so far to what extent tax deductions are really responsible for the bubble build-up. In this paper we try to quantify it. All in, we could have avoided a third of the bubble if the tax reform had been implemented in 2000 and around a 10% if actions were taken in 2004, a date that was too close to the end of the boom period.

We assess the effect of a fiscal policy change –eliminating mortgage interest deductions (MID) - on the Spanish housing bubble. The first step is to calculate the fundamental (or theoretical) house value. Following the asset-market approach originally proposed by Poterba (1984), we develop a model based on the user cost of home-ownership. Once this model is calibrated, we obtain a fundamental house value, and define deviations of actual prices from this fundamental price as bubbles. As the fundamental model cannot explain the house price fluctuations, we follow the intrinsic bubble model proposed by Froot and Obstfeld (1991) to justify excessive price fluctuations. In a rational bubble model, prices deviate from fundamentals as the consequence of the self-fulfilling expectations of agents, however, in the intrinsic bubble model, agents overreact to changes in the fundamentals of the model, though in a nonlinear fashion.

The price of a house according to this model is the addition of a present-value term and a bubble term. This model is capable of explaining house price fluctuations accurately until the bursting of the bubble. However, it has two main drawbacks. The first one is that the model does not consider a very important actor of the housing market: banks. Banks play a key role in the price adjustment process, given its implications on their financial soundness. The second one is that the model is derived from a financial asset pricing model and, thus, it ignores some characteristics of the housing market such as supply rigidities. But, for the purpose of this paper, which is to simulate how the housing bubble would have evolved if tax subsidies had been eliminated in the early 2000's, the model does not suffer from these drawbacks.

We quantify the effect on the estimated 80% built-up bubble if MID had been removed in 2000 or in 2004, that is, at the beginning of each legislation period prior to the crisis. The main result of the paper is that removing MID in 2004 would have meant a bubble reduction of just 5-15% smaller. That year is too close to the end of the boom and the following burst, and thus, the effects are limited. However, had MID been removed in 2000, we could have avoided between 27-36% of the price bubble.

In the model we define disposable income as a function of aggregate income and tax incentives; the longer an individual can make deductions from the personal tax income, and the greater the amount that can be deduced is, the higher the disposable income of

this individual will be. Thus, we obtain two extreme cases for the disposable income in the economy; "the exogenous income" case is the one with no deductions. The "full deduction income" case is the one where deductions could be applied in every period. These two extreme cases for disposable income yield two extreme cases for imputed rents and, therefore, two extreme cases for the fundamental price. Removing MID at some point will lead to an intermediate scenario where individuals will experience a decrease in their disposable income as they have to pay more taxes. These two extreme cases define the boundaries of the effect of such a fiscal policy change.

Furthermore, as mentioned above, in this model we take the housing supply as exogenous. This is a quite strong assumption in the simulation exercise. It is true that removing MID would shift the demand for houses curve to the left, while leaving the supply curve unchanged (Lopéz-García, 2000 and 2008). However, even if the supply curve remains constant, a shift in the demand curve would have decreased the quantity supplied. By considering the housing stock as exogenous we do not take into account this effect. Therefore, the results are again an upper band on the fiscal policy change impact.

Given the political implications of the results, we asked ourselves how dependant results are to changes in the parameters of the model. Several robustness tests have been made throughout the paper. Results proved to be consistent with different parameters. In sections 3.2 and 4.2 we chose time periods in which to measure the average growth rate of imputed rets and the average imputed rents. Which period to choose could be quite an arbitrary decision. Again, the model proved to be robust whether we chose 5 years, 10 years or even the whole sample.

In summary, as far as we know this paper is the first to quantify the effect of fiscal policy decision on the housing bubble. Previous works had dealt with the effect on the steady state equilibrium house price. However, none of them considered the overall effect on the bubble. From here, several extensions could be done. One of them is the impact on the bubble had a different monetary policy been implemented. Another extension is related to loan supply under different tax incentives schemes.

6. Bibliography

Abad, J. (2013). "Precios de la vivienda: sobrevaloración y burbuja", *Universidad Complutense de Madrid*

André, C. (2010). "A Bird's Eye View of OECD Housing Markets", *OECD Economics Department Working Papers*, No. 746, OECD Publishing.

Ayuso, J and Restoy, F. (2006). "El precio de la vivienda en España: ¿Es robusta la evidencia de la sobrevaloración?", *Boletín Económico Banco de España, Junio 2006,* pp. 59-65

Ayuso, J., and Restoy, F. (2003). "House prices and rents: an equilibrium asset pricing approach", *Documentos de Trabajo*, Nº0304, Banco de España

Balmaseda, M., San Martín, I. and Sebastián, M. (2002). "Una aproximación cuantitativa a la burbuja inmobiliaria", *Situación Inmobiliaria BBVA,* diciembre 2002, pp. 22-28

Bover, O. (1993). "Un modelo empírico de la evolución de los precios de la vivienda en España (1976-1991)," *Investigaciones Económicas,* Vol. XVIII, Nº1, pp. 65-86

Bover, O. (2005). "Wealth effects on consumption: microeconometric estimates from the Spanish survey of household finances", *Documentos de trabajo - Banco de España,* Nº0522

Capozza, D., Green, R. and Hendershott, P. (1996). "Taxes, Mortgage Borrowing,and House Prices", *Wisconsin-Madison CULER working papers 97-05,* University of Winsconsin Center for Urban Land Economic Research

Case, K. and Shiller, R. (1989). "The Efficiency of the Market for Single-Family Homes", *American Economic Review,* Nº 79(1), pp. 125-137

Case, K. and Shiller, R. (2004). "Is there a bubble in the housing market?", *Cowles foundation paper,* Nº 1089, pp. 299-362

Crowe, C., Dell'Ariccia, G., Igan, D. and Rabanal, P. (2011). "*How to Deal with Real Estate Booms: Lessons from Country Experiences*", IMF working paper, WP/11/91

Froot, K., and Obstfeld, M. (1991). "Intrinsic Bubbles: The Case of Stock Prices", *American Economic Review*, Vol. 81, Nº5, pp.189-214

García-Montalvo, J. (2001). "Un análisis empírico del crecimiento del precio de la vivienda en las Comunidades Autónomas Españolas," *Revista Valencia de Economía y Hacienda,* Nº 2, pp. 117-136

García-Montalvo, J. (2003). "La Vivienda en España: desgravaciones, burbujas y otras historias", *Perspectivas del Sistema Financiero*, Nº78, pp.1-43

García-Montalvo, J. (2012). "Perspectivas del precio de la vivienda en España", *Cuadernos de Información Económica*, Nº227, pp.49-57

García-Vaquero, V. and Martínez-Pagés, J. (2005). "Fiscalidad de la vivienda en España", *Documentos Ocasionales – Banco de España*, Nº0506

Green, R. and White, M. (1997). "Measuring the Benefits of Homeowning: Effects on Children", *Journal of Urban Economics,* Nº41, pp. 441-461

Helbling, T., and Terrones, M. (2003). "When Bubbles Burst-Chapter II", *World Economic Outlook - International Monetary Fund*, April 2003, pp.61-76

Himmelberg, C., Mayer, C. and Sinai, T. (2005). "Assessing High House Prices: Bubbles, Fundamentals and Misperceptions", *NBER working papers,* WP11643

Hott, C. (2009). "Explaining House Price Fluctuations," *Swiss National Bank Working Papers,* 2009-05

Hott, C. and Jokipii, T. (2012). "Housing Bubbles and Interest Rates," *Swiss National Bank Working Papers,* 2012-07

Hott, C. and Monnin, P. (2006). "Fundamental Real Estate Prices: An Empirical Estimation with International Data," *National Centre of Competence in Research Financial Valuation and Risk Management,* Nº356

López García, MA. (2000). "Un marco para la discusión de los efectos de la política impositiva sobre los precios y el stock de vivienda", *Papeles de trabajo del Instituto de Estudios fiscales,* Nº 8, pp.1-36

López García, MA. (2005). "La vivienda y la reforma fiscal de 1998: un ejercicio de simulación", *Hacienda Pública Española,* IEF, Vol. 175 (4), pp. 123-147

López García, MA. (2008). "Política impositiva y política de vivienda", *Clm. Economía,* Nº 11, pp. 201-243

Martínez-Pagés, J. and Maza, L. (2003). "Análisis del precio de la vivienda en España", *Documentos de trabajo*, Nº0307, Banco de España

Ortega, E., Rubio, M. and Thomas, C. (2011). "House purchase versus rental in Spain", *Documentos de trabajo-Banco de España,* Nº1108

Poterba, J. (1984). "Tax Subsidies to Owner-Occupied Housing: An Asset-Market Approach," *The Quarterly Journal of Economics,* Vol. 99, Nº4, pp.729-752

Poterba, J. (1992). "Taxation and Housing: Old Questions, New answers", *The American Economic Review*, Vol. 82, Nº2, pp.237-242

Raya, JM. (2012). "Una aproximación al impacto económico de la recuperación de la deducción por la compra de vivienda habitual en el IRPF", *Observatorio de Divulgación Financiera*, Documento de Trabajo Nº6

Sanz, J.F. (2000). "Las ayudas fiscales a la adquisición de inmuebles residenciales en la nueva Ley del IRPF: un análisis comparado a través del concepto de coste de uso", *Hacienda Pública Española,* Nº 155, pp. 149-176

Shiller, R. (1981). "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?", *The American Economic Review,* Vol. 71, Nº 3, pp. 421-436

7. Appendix A

7.1. Intrinsic bubbles in a present-value model

The financial assets valuation model proposed by Froot and Obstfeld (1991) starts from the standard no arbitrage condition where real stock prices in period t (P_t) are equal to the expected dividends paid in period t (D_t) plus the expected real price of the stock in the next period (P_{t+1}) discounted at rate r :

$$P_t = (1+r)^{-1} E_t \left[D_t + P_{t+1} \right] \tag{3.1}$$

By successive forward substitution of the expected price in t+1 we obtain that the stock price is equal to the present discounted value of expected dividend payments:

$$P_t^{pv} = \sum_{s=t}^{\infty} (1+r)^{-(s-t+1)} E_t(D_s) \tag{3.2}$$

Equation (3.2) is a particular solution to the difference equation (3.1), however, it is not the only possible solution. Let $\{B_t\}_{t=0}^{\infty}$ be any sequence of random numbers such that:

$$B_t = (1+r)^{-1} E_t(B_{t+1}) \tag{3.3}$$

Then, $P_t = P_t^{pv} + B_t$ is a solution to (3.1) which can be thought of as the sum of the present-value solution and a bubble term. Assuming that the dividends of period t are known when setting P_t, we have that the present-value stock price is directly proportional to dividends:

$$P_t^{pv} = \kappa D_t \tag{3.4}$$

We now define $B_t(D_{t+1})$ [12] as:

$$B_t(D_{t+1}) = c D_{t+1}^{\lambda} \tag{3.5}$$

where λ and c are constants. In this case, the bubble term in period t depends on the expected dividend in t+1.

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[12] This is a modification of the original proposition. According to the author's model the bubble term is a function of current dividends and not of expected dividends. We consider that this slight modification suits better the Spanish real estate market while leaving the model practically unaltered. Furthermore, in (3.6) we proof that (3.5) satisfies (3.3).

Defining g as the growth rate of dividends we can verify that (3.5) satisfies (3.3):

$$
\begin{aligned}
B_t = (1+r)^{-1} E_t\left(B_{t+1}\right) &= (1+r)^{-1} B(D_{t+2}) \\
&= (1+r)^{-1} B\left[(1+g)D_{t+1}\right] \\
&= (1+r)^{-1}(1+g)cD_{t+1}^{\lambda} \\
&= B_t(D_{t+1})
\end{aligned}
\tag{3.6}
$$

as long as $\lambda = \log_{1+g}(1+r)$. By summing the present-value term and the bubble in (3.5) we obtain the model's basic stock-price equation:

$$
P_t = P_t^{pv} + cD_{t+1}^{\lambda}
\tag{3.7}
$$

Whenever $c \neq 0$, equation (3.7) will contain a bubble. It might be the case that $c < 0$ and therefore, there is the possibility of a negative bubble. However, the expected positive path of the present-value term could overcompensate the negative development of the bubble term and we could have a situation of a negative bubble where prices are not expected to get negative (Hott, 2006).

Like all rational bubbles, intrinsic bubbles rely on self-fulfilling expectations. However, instead of being driven by extraneous variables, these expectations are driven by the nonlinear form of the price solution. $\lambda > 1$ is the explosive nonlinearity which allows us to expect that agents will overreact to changes in fundamentals.