# Did housing taxation contribute to stabilize housing and credit boom?


## Abstract

This paper estimates, using a simultaneous equation model, the determinants of mortgage, including as a variable the tax saving due to the treatment of mortgage payments in Spanish income tax. The database presents the financial and individual characteristics of all the mortgage transactions handled by one financial intermediary in the years 2006-2008. Positive effects on mortgage amount (negative on term) are observed for the variables income, number of holders and educational level. However, negative effects on mortgage amount (positive on term) are observed for the variables interest rate and age. Finally, we observe that the income tax credit increased riskier borrowing during the housing boom years. In particular, if we increase by one percentage point the ratio of the present value of the stream of explicit tax savings to the price of the property, the mortgage amount granted increases by 1.6%, whereas it causes a 2% decrease in the term.


## 1. Introduction

From 1997 to 2007, in many countries, such as Spain, the combination of credit facilities, the steep rise in house prices and the resulting increase in mortgage debt contributed decisively to household indebtedness. Thus, it would be interesting to examine the behaviour and the key factors of this mortgage demand that has grown so greatly over the last decade in terms of its relative weight. Furthermore, it seems clear that housing taxation, and in particular the income tax credit for the acquisition of a primary residence, affects housing affordability and therefore mortgage demand (from the perspective of both the amount and the term of the mortgage).

The aim of this paper is to gain insight into the determinants of mortgage demand, including the tax saving due to the income tax credit for acquiring a primary residence. This paper uses data on mortgages for homes sold between 2006 and 2008 by a financial institution belonging to a real estate group with a strong presence throughout Spain. In this way, the paper seeks to provide answers to questions such as: What effects has the tax credit for acquiring a primary residence had on the mortgage amount granted? And on the repayment term of the loan? Has the credit for acquiring a primary residence had any impact on the yearly payments of mortgages granted in the last years of the property boom (2006-2008)?

The paper is structured as follows. The next section places the paper in the context of the housing taxation in Spain. Section 3 consists of a review of the economic literature, both theoretical and empirical, on mortgage demand and housing taxation. Section 4 presents the data used to perform the study, while in Section 5 we define the endogenous and explanatory variables of the model estimated. We then go on to detail the main results obtained and finish with some brief conclusions.

## 2. Economic framework

Home ownership has had a favorable tax treatment in Spain. One of the most distinctive factors of this favourable treatment is a tax credit of the mortgage amounts satisfied in house purchase in concept return of principal. This tax credit was introduced in 1979 (Law 44/1978 of income tax). Until 1999 a tax allowance were allowed to be deducted in the tax base for the amounts paid as interests of the mortgage loan. Besides, a tax credit of 15% of the mortgage amounts dedicate to principal repaid was also allowed. From 1999 (Law 40/1998 of income tax) the tax allowance was removed and the tax credit was expanded now incorporating not only the amounts satisfied in house purchase in concept return of principal but also in concept of interest. Furthermore, Law 40/1998 established an upper limit for the tax credit of €9,015.18 distributed as follows: during the first two years, the tax credit was of 25% up to 4,507.59 euros and a 15% applicable to the bracket between the first €4,507.59 and the upper limit for the tax credit of €9,015.18. From the third year on, percentages 20% and 15%, respectively, were applied. This rate of 15% was applied to all the amounts paid for mortgage loans that did not exceed the limit of 50% of the value of housing and to homes sold from 2007 (in accordance with the Law 35/2006).

This credit has been strongly criticised for discriminating against renting (García-Montalvo, 2007). In this respect, the credit favours home purchase regardless of household income. Moreover, it would seem that the amount of the credit has been shifted onto house prices. Consequently, there have been recommendations to abolish it, for example in FEDEA (2009). However, the effect of this relief on mortgage demand has never been among the criteria under discussion. Seen in this light, the entry into force of the abolition of this credit for 2013 (but without retroactive effects) provides an additional incentive for this paper.

## 3. Economic literature

In order to know the determinants of mortgage demand in Spain and the effects of taxation on this demand, it is of interest to gain a thorough knowledge of the economic literature on the subject. Specifically, we will divide the analysis of the economic literature into three parts. First we will review the economic literature that has analysed theoretical models of mortgage demand. We will then go on to examine the empirical models that analyse the determinants of mortgage demand. Lastly, we will conduct a detailed analysis of the economic literature that addresses the impact of taxation on housing decisions (paying special attention to the Spanish case). On this last point, we will focus on the empirical economic literature that studies the effects of taxation on mortgage demand.

### 3.1. Theoretical models

Jones (1993, 1994) created a theoretical framework based on the consumer problem to identify the mortgage demand in an environment of certainty for the returns and costs of financial assets. In this model, the optimal ratio of the mortgage to the value of the home is a function of the ratio of the cost of the mortgage debt to the return on investing in non-property assets (both magnitudes after tax credits), in many cases leading to corner solutions.

A second type of theoretical model is that of mean variance models of mortgage demand (Hendershott and Shilling, 1982; Alm and Follain, 1984 and 1987; Hendershott and Won, 1992; Brueckner, 1997). These models deal with mortgage demand within the general problem of portfolio decision optimisation. In these models the environment is one of uncertainty and therefore corner solutions are less likely.

Brueckner (1994) presents the most widespread theoretical model for explaining the mortgage size decision[1]. This decision is determined simultaneously with the value of the home and the level of savings in a two-period intertemporal framework. Its main distinctive feature is that, using a framework based on the consumer problem, it introduces uncertainty into the returns on financial assets, obtaining that the optimal volume of the mortgage

[1] Other theoretical models of mortgage demand include: Raney (1981), Jones (1983) and Alm and Follain (1987).

debt is a function of: the desired property size, household wealth, household income and the risk preferences of the household. In this environment, a non-corner solution using less than the maximum allowed amount of mortgage debt may be optimal.

### 3.2. Empirical models

On the basis of what has been discussed above in connection with theoretical models, demand for mortgage debt should be specified as an equation in a system of simultaneous equations that also includes a housing demand equation, an equation of alternative consumption to housing, a demand equation for non-property assets and an explanatory equation for consumer debt. For reasons of data availability and the intrinsic non-linearity of these equations, the literature has focused on partial estimates of this system. Thus we find side by side: individual estimates of mortgage demand considering the value of the property as exogenous (Ioannides, 1989); estimates of 'excess mortgage demand' on the minimum value necessary to buy the desired amount of housing (Jones, 1993 and 1994); and lastly, estimates of a system of simultaneous equations where the independent variables are mortgage debt and the value of the home, thus controlling for the simultaneity of the two decisions (Ling and McGill, 1998; Leece, 2000). Leece (2006) contrasts empirically, with data for the UK, Brueckner's model of mortgage demand corrected by the endogeneity of housing demand, using two-stage least squares.

To sum up, housing consumption, income for the period, wealth, expected mobility and the household's income tax status stand as important variables in empirical studies. We should also include the costs associated with the mortgage debt and other variables that approximate effects of the life cycle and risk preferences of households (age, marital status and number of children, for example).

### 3.3. Housing and taxation

The relationship between housing and taxation has been addressed in the economic literature from several perspectives. From a theoretical point of view, Henderson and Ioannides (1985) analyse the effects of tax treatment on tenure choice. In turn, the effects in terms of efficiency of favourable tax treatment for housing in various tax systems are examined by Nakagami and Pereira (1996) and Skinner (1996). López-García (2004) conducts a similar

study for the Spanish case, obtaining annual costs in GDP terms of 0.19% if land prices are considered exogenous, and 0.12% of the GDP if land prices are considered endogenous.

Working on the basis of the models proposed by Poterba (1984) and Meen (1990), several studies focus on the effect of taxation on price trends of housing assets and the stock of residential capital: Poterba (1991) and López-García (1996, 1999, 2004 and 2009). By way of illustration, López-García (1996) analyses the Spanish housing boom in the period 1985-1990 and the influence it had on incentives to save (such as identical income tax relief for the primary residence for both new and second-hand homes) and to invest (such as more favourable tax relief for new than for second-hand homes). In this context, he analyses the impact of Decree Law 2/1985.

Secondly, from an empirical point of view, the strategy usually consists in modelling housing tenure and demand for housing services together[2] (King, 1980). In this type of research it is usual to analyse the impact of public policies, and more specifically that of taxation, on tenure. In Spain, Jaén and Molina (1994), following King (1980), calculate the excess burden resulting from the tax system in force and conduct a simulation exercise on the potential changes in housing expenses in the event of changes in tax laws.

Sanromán (2006) performs a joint analysis of the determinants of tenure choice, the conditioning factors of the tax saving derived from home ownership, and the determinants of the probability of legal constraints on tax credits being binding for the agent. To this end she implements a two-stage estimation technique following the procedure proposed by Heckman, in which factors are included to correct for selection bias. She concludes that the structure of the tax does not affect the tenure decision, but that it does affect the magnitude of spending on primary housing. Lastly, García and Raya (2006) use a duration model to analyse the effects that the various taxation laws (Law 18/1991 and Law 40/1998) had on the tenure system for the primary residence through the 1990s.

In addition, many of these empirical studies employ the notion of the cost of using the home (Laidler, 1969; Rosen, 1979). Recently, Poterba and Sinai (2008) avail themselves of user cost to calculate the tax benefit obtained by the owner for both non-inclusion of imputed rent in income tax and the tax credit for acquiring a residence. For the Spanish case, user cost is applied by: Bover (1993) and López-García (1996) in the framework of housing price

[2] Without discussing either the demand for services or tax issues, Arévalo and Otero (2007) conduct a comparative study of the situation of the housing tenure system in Europe.

trends; Taltavull (2000) in the framework of the relationship between financial constraints and residential investment; Sanz (2000) to obtain the effects of tax allowances on property; Onrubia and Sanz (1999) to analyse the consequences of Law 40/1998 for primary home buyers; and Barrios and Rodríguez (2002) for an empirical analysis of the effects of personal income tax laws on housing tenure choice.

As we have seen, there is broad empirical coverage of the effects of housing taxation on the type of tenure, housing prices, and the housing stock of a country. However, few studies have focused on the effect of taxation on mortgage demand. In this regard, Jones (1995), investigating the determinants of demand for mortgage debt in Canada, finds evidence in favour of a positive impact of tax rates on mortgage demand. Follain and Dunsky (1997) study the effect of the cost (after tax) on mortgage demand. To do so, they estimate a simple mortgage demand equation both individually and within a system of equations (including an equation of the determinants of housing value). Lastly, Japelli and Pistaferri (2007) analyse the effect of the Italian government's tax reform in 1992[3]. The study analyses the effects of the reform on the probability of applying for a mortgage (probit model) and on the amount applied for (Tobit model). Their results indicate that the tax reform did not have a significant effect.

**4. Data**

The database presents the financial characteristics of all the mortgage transactions handled by one financial intermediary in the years 2006-2008. Owing to the aim of the study, we have excluded from the analysis transactions relating to purchases of commercial premises, retirement homes, refinancing, debt consolidation and non-primary residences. The company, which belongs to a group that also contains an estate agency, operates in a specific segment of the housing market. Its clientele mostly comprises buyers of properties with medium or medium-low prices. In this respect, the buyers can be considered relatively homogeneous in terms of both their sociodemographic characteristics and the characteristics of the properties they buy. The data are collected on a half-yearly basis and entered into a single database. Those homes that form part of any given six-monthly set may have been registered on any day within that period. Thus, the database cannot be regarded as a panel database (as the homes registered in each six-monthly period are different, and therefore there is no underlying longitudinal structure).

[3] Before 1992, mortgage interests were deductible from Italian income tax.

In addition to the information on the financial transaction (date of registration, mortgage amount, appraisal value, interest rate applied, number of owners, etc.), data are also collected on the demographic characteristics of the home owner or owners in each case (educational level, age, marital status, nationality, type of contract, type of employment, etc.), together with internal information relating to the branch dealing with the sale. The sample contains more than 40,000 observations, of which a total of 18,505 observations present information for all the variables of importance for the analysis.[4]

Although the amount of sociodemographic information on individuals provided by this database is similar to that obtainable from other alternative microdatabases such as the Survey of Household Finances (*Encuesta Financiera de la Familias* or EFF), in fact, it presents richer information regarding the financial transaction. First, it provides exact information on the interest rate agreed upon (as opposed to an estimate made by the owner). Second, the appraisal value, as well as being the most relevant housing price for the financial transaction, can be understood as the perfect combination of the prices provided by the EFF: purchase price and valuation at time of purchase. It represents the present value, at the time of purchase, as set by an independent professional body (rather than the owner). Lastly, the database provides information on the number of mortgage holders, a variable that can be expected to be a determining factor for the financial conditions of the mortgage.

As far as the representativeness of the sample is concerned, the National Statistics Institute provides information on the mortgages granted each month. Between 2006 and 2008, a total of 3,417,480 new mortgages were taken out (in fact, there were only 2,743,469 mortgages for new acquisitions, with changes in the conditions of existing mortgages accounting for the difference). Considering that the average amount of the mortgages taken out in that period was €143,257 and using the sample data as standard deviation (see Table 2), the margin of error for a sample of 18,505 observations is 0.75%.

Furthermore, as we have seen, the official figure for the average mortgage amount is €143,257, while the sample average amount is €170,837. The difference between the two figures can be attributed to two factors. First, as explained above, the official statistic includes those mortgages which are not strictly new, but rather represent merely a change in conditions in relation to an already existing mortgage. It can reasonably be assumed that these

[4] The main reason for the difference is that, although the sample begins in 2004, the observations for 2004 and 2005 do not contain term as a variable.

previous mortgages will have been partly repaid, in which case the average amount of the official statistic would have a downward bias. Second, although, as mentioned earlier, the financial intermediary is specialised in the segment of medium and medium-low priced homes, it is also more strongly established in the larger cities (especially provincial capitals) than in smaller municipalities.

Table 1 presents an approximation to the territorial distribution of the database. Specifically, it lists the 15 towns that contribute most observations to the sample. These 15 towns (in 7 different autonomous communities) provide 9,419 observations, 50.90% of the total of the sample. They all have a population of over 100,000 inhabitants, and many of them are provincial capitals.

[TABLE 1]

**5. Definition of the variables and empirical model**

As regards the definition of the variables, let us first focus on the dependent variables. One of the novelties of this paper is that not only the amount of the mortgage but also its duration is a dependent variable. The reason for this is that these two aspects constitute the two key variables of mortgage demand and are determined simultaneously. To date, the economic literature has focused on studies in which mortgage demand was specified solely as the mortgage amount (or the loan to value), but not its duration. Thus, the dependent variables are finally defined as follows:

- Term (duration of the mortgage loan in logarithms)
- Mortgage (total amount of the mortgage loan in logarithms)[5]

[5] In most cases the dependent variable is taken to be the mortgage amount (Jones, 1995; Follain and Dunsky, 1997; Ling and McGill, 1998; Leece, 2000; Leece 2006), although in some studies the loan to value is also used as the dependent variable (Chao et al, 1995; Leece, 2006). A model has also been estimated using the loan to value ratio as a dependent variable. The results hardly differ and are available on request to the author.

We will now go on to define the explanatory variables of the model. We will also provide a brief justification of the variables used and the sign we expect to obtain (the analysis will only deal with the effect of each variable on the mortgage amount, as the expected sign of each variable in the term equation is precisely the opposite):

- Appraisal value (in logarithms). In fact, as we have seen in the literature review, this is also an endogenous variable of the model. As a consequence of this, the system of simultaneous equations is estimated by instrumental variables (Brueckner, 1994; Leece, 2006). Table A.1 presents the instrumental estimate, in which the appraisal value is determined on the basis of several sociodemographic variables (number of holders, income, educational level, type of employment, type of contract and nationality). The prediction of this estimate is the variable 'appraisal value' in the simultaneous equation model (standard errors have been adjusted). As the appraisal value increases – i.e., as the loan to value ratio decreases – the incentive to increase the mortgage amount applied for and granted is expected to increase (Brueckner, 1994).
- Income (in logarithms). Likewise, as income increases, the incentive to increase the mortgage amount applied for and granted is expected to increase (Brueckner, 1994).
- Age (in levels and squared). As age increases, the need to apply for a larger mortgage amount is expected to decrease. The quadratic term is included to capture a possible non-linearity of the effect.
- Interest rate. This is the value of the Euribor index, the reference rate for 99% of mortgages in Spain. An increase in the interest rate is expected to have a negative effect on the mortgage amount applied for (and a positive one on the term), as it is more costly to repay the debt.
- Marital status: married (the reference category), in an unmarried couple, separated, single, or widowed. In this case there are two effects of opposite sign. First, being married reduces the risk of the mortgage amount applied for, thus increasing the likelihood of a larger amount being applied for and granted. On the other hand, it is also true that being married increases the capacity to save, thus reducing the need for a larger mortgage amount.
- Number of holders. This can be interpreted in similar terms to the previous variable. The larger the number of mortgage holders, the lower the risk (and the greater the capacity to save).
- Educational level: primary (the reference category), secondary, or university. Having university studies reduces the risk of an increase in the mortgage amount, and therefore the amount applied for and granted will increase. This effect should be reinforced by the supposedly greater bargaining power of individuals with a higher educational level.

- Type of contract: permanent (the reference category), permanent seasonal, uncontracted, temporary, and works and services contract. Having a permanent contract also reduces the risk of an increase in the mortgage amount.
- Type of employment: clerical assistant (the reference category), manager, skilled worker, unskilled worker, and other. Being a manager reduces the risk of an increase in the mortgage amount.
- Nationality: Spain (the reference category), Latin America, Africa, Asia and Oceania, EU-15 and other rich countries, and Eastern Europe. Being Spanish is expected to increase the mortgage bargaining power, and should therefore result in a larger amount being granted.
- Tax saving. The tax saving is that specified in Law 40/1998[6], in accordance with Onrubia et al (2004). That is to say, this variable is specified as the explicit marginal saving obtained according to (1):[7]

$$AF = (1-\theta)*\{t_{ds}(K+I)\} + \theta\{t_{ds}*\frac{B}{2} + t_d[(K+I) - \frac{B}{2}] \qquad (1)$$

where:

$\theta$ is a dummy variable (0,1) that takes the value 0 if the amounts for which a tax credit is payable are less than €4,507.59 per annum and 1 otherwise.

$t_{ds}$ is the increased tax credit rate for amounts paid towards the purchase of a property by means of an indebtedness of at least 50% of the price, applicable to the first €4,507.59 of the tax base, consisting of both capital and interest (25% in the first two years of purchase and 20% from the third year on).

*K* is the part of the tax credit corresponding to amounts paid towards the purchase of a property in the form of mortgage repayment.

*I* is the part of the tax credit corresponding to amounts paid towards the purchase of a property in the form of mortgage interests.

*B/2* represents amounts paid towards the purchase of a property in the form of mortgage repayment and interests, with an upper limit of €4,507.59.

[6] Following Onrubia and Sanz (1999) and Sanromán (2006), the annual mortgage amount payable was calculated using the information on the total mortgage amount, the term and the interest rate granted, applying the finance law corresponding to a fixed instalment mortgage. This same finance law was subsequently applied to obtain the discounted value of the stream of tax savings.

[7] Domínguez and López-Laborda (2001) present another alternative to evaluate the incentive effect of personal income tax with regard to housing decisions, using the net present value of the tax saving.

$t_d$ is the tax credit rate for amounts paid towards the purchase of a property applicable to the bracket between the first €4,507.59 and the upper limit for the tax credit of €9,015.18 (15%). This rate will be applicable to all amounts paid, both for mortgages that do not exceed the threshold of 50% of the value of the property and for homes sold from 2007 on (in accordance with Law 35/2006)[8].

Finally, two further clarifications. First, in order to avoid the instantaneous nature inherent in the definition of explicit tax saving, i.e., the fact that it refers strictly to one income tax year, the variable 'tax saving' is specified in terms of present value (discounted at a rate of 5%) of the stream of explicit tax savings over the life of the mortgage. The mortgage repayment period is considered as the period of this stream. This specification makes it possible to capture the relationship between the term of the mortgage and the 'subsidised' amount. Second, this tax saving in present value terms is defined with respect to the value of the financed property. These two features help us to obtain a more accurate effect in the estimates.

Thus, finally the simultaneous equation model to estimate is:

$$\begin{aligned} P_i &= \alpha + \beta_0 * M_i + \beta_2 * X_i + \beta_3 * AF_i + u_i \\ M_i &= \alpha' + \beta_0' * P_i + \beta_1' * PV_i + \beta_2' * Z_i + \beta_3' * AF_i + u'_i \end{aligned} \qquad (3)$$

where $P_i$ and $M_i$ are the dependent variables 'term' and 'mortgage' respectively, $PV_i$ is the variable 'appraisal value' (corresponding to the instrumental estimate described above), $X_i$ and $Z_i$ are the remaining explanatory variables of each equation (income, age, interest rate, etc.) and $AF_i$ is the variable referring to the tax saving. In addition, $u_i$ and $u'_i$ are the error terms of the two equations and $\alpha$, $\alpha'$, $\beta_i$ and $\beta'_i$ are the parameters to estimate.

Lastly, the models estimated include controls for geographical area and six-month period. In order to avoid identification problems, three have been included. First of all, bank identifiers have been included in the term equation (is more likely that institution rules affect term than mortgage amount[9]). Secondly, different controls for

[8] It is assumed in the calculation of the variable 'tax saving' that individuals take advantage of the provisional arrangements in compensation for income tax reform as stipulated in Law 35/2006 (in the sample there is no property eligible for the provisional arrangements as stipulated in Law 40/1998).

[9] In the sample years some institutions offer mortgages of up to 50 years while others fixed a maximum term of 35 years.

geographical area have been used: province in the term equation and postcode in the mortgage equation. Finally, appraisal price was only an explanatory variable in the mortgage equation.

Table 2 below presents information on the descriptive statistic of each of the variables. We observe that the average mortgage amount of the sample is €170,837, with a 35-year term, for a property with an appraisal value of €198,517 (which makes a loan to value ratio of over 86%, slightly higher than the sample average). The average value of the interest rate on this mortgage is 4.23% and it will enjoy a tax saving of €1,377 for amounts paid towards the purchase of a property in the form of mortgage repayment and interests. The average discounted value of the stream of tax savings is €26,584, which means that this amount 'subsidises' 13.27% of the value of the property.

[TABLE 2]

**6. Results**

With a view to estimating the effect of each variable on mortgage demand, a simultaneous equation model is estimated in which the two dependent variables that are simultaneously determined are: the mortgage amount granted and the term in which it is to be repaid (Table 3)[10].

Discussing first of all the coefficients corresponding to the equation of the mortgage amount, we find that an increase in the term, the appraisal value, the number of mortgage holders and the household income increases the mortgage amount granted. Specifically, a 1% increase in the term, the appraisal value and the income will increase the mortgage amount by 0.71%, 0.73% and 0.05% respectively. We observe, therefore, that the elasticity of the appraisal value in relation to the mortgage amount does not reach unity. This means that when the appraisal value increases, the proportion that the mortgage amount represents in relation to the appraisal value tends to diminish. That is, the mortgage amount increases less than proportionally to the appraisal value, the risk of the loan thus decreasing.

[10] Although the correlation between some explanatory variables exceeds 0.5, the model does not present multicollinearity problems, as the maximum value of the variance inflation factor is 2.77 (obtained for the variable 'mortgage' in the equation whose dependent variable is the term).

Level of income is therefore shown to be an indicator that conditions not only the decision as to whether or not to grant a mortgage, but also what amount to grant. This effect is notable, as the model includes variables relating to educational level, which also has a positive effect on the mortgage amount (in relation to having only primary studies, having university studies increases the mortgage amount by 2.5%); the type of employment in which the holder is engaged (in relation to being a clerical assistant, being a manager increases the mortgage amount by 5.70%) and the type of employment contract he or she has. With regard to the last of these variables, mortgage holders with a permanent contract (or with a works and services contract) are granted larger loans than those with a permanent seasonal one or, of course, without any sort of contract.

As regards the number of mortgage holders, assuming the rest of the characteristics remain equal, the presence of an additional holder increases the mortgage amount by 4.91%. This variable also provides a certain approximation to the level of income that stands surety for the mortgage, not only the income of the first signatory. However, a 1% increase in the interest rate reduces the mortgage amount by 0.10%. Likewise, the age of the first mortgage holder has a negative affect (albeit a decreasing one, given the sign of age squared) on the mortgage amount. In turn, the variables included in order to capture the effect that the nationality of the mortgage applicant might have on the mortgage amount show us that, other characteristics being equal, the largest amounts are granted to Latin American applicants and the smallest to African ones. In this case, the result seems to indicate greater bargaining skills, probably as a result of the formers' fluency in Spanish. Lastly, being separated or single, in relation to being married, reduces the mortgage amount granted by 1.5% and 2.2% respectively.

Thus all the variables have the expected signs, the mortgage amount increasing whenever an increase in the variable (income, assessment value, being a manager, having a permanent contract, being married, having university studies, etc.) reduces the risk of default. For both marital status and number of mortgage holders, we observe that the risk reduction effect is stronger than the saving capacity effect.

As far as the effect of taxation is concerned, if we increase by one percentage point the ratio of the present value of the stream of explicit tax savings to the price of the property, the mortgage amount granted increases by 1.6%.

If we now go on to examine the term equation, we find that a 1% increase in the mortgage amount increases the length of the repayment period by 1.27%, while a 1% increase in the interest rate lengthens the term by 0.06%. In other words, increases in the interest rate affect the mortgage amount negatively, but the term positively (smaller mortgages are granted with longer terms). This pattern of behaviour between equations, whereby the explanatory variables (and, practically always, the categories) continue to be significant but change sign, is repeated for the rest of the explanatory variables. For example, when household income increases by 1%, the term decreases by 0.18%, and an additional mortgage holder reduces the term by 1.82%. Educational level, type of contract, type of employment and marital status behave similarly. In the case of nationality, being Eastern European or African entails facing a longer term to repay the mortgage loan. Again, all the variables have the expected signs.

In turn, the effect of taxation in the term equation also has the opposite sign to that of the mortgage amount equation. Specifically, increasing by one percentage point the ratio of the present value of the stream of explicit tax savings to the price of the property causes a 2% decrease in the mortgage term.

[TABLE 3]

Thus, the tax saving generated by the income tax credit resulting from Laws 40/1998 and 35/2006 is conducive to a mortgage with a greater risk of default, insofar as it is a mortgage for a larger total amount to be repaid in a shorter term. Table 4 presents a simple simulation exercise in which the new mortgage amounts and terms are calculated for several 'typical' mortgages, after discounting for the effect of taxation, namely an increase of one percentage point in the ratio of the present value of the stream of explicit tax savings to the price of the property. To gain an idea of the quantitative dimension of this effect, if we recall that the average of the taxation variable is 0.133, an increase of one percentage point (to 0.143) yields an increase of 7.52% in the taxation variable with respect to its average value[11].

[11] It is a complex task to translate this percentage into a quantity in absolute values of annual explicit tax saving, as it depends on both the price of the property and the mortgage amount and term. For an individual whose mortgage has an amount, term and appraisal value exactly equal to the average sample values, the increase in annual explicit tax saving would be approximately €180.

With these new conditions, we calculate the difference between the annual amounts payable by the individual and those payable with the initial mortgage. In all cases, the increase in the annual amounts is greater than the annual explicit tax saving, all new mortgages therefore being riskier. Specifically, we see that for a mortgage of €230,000 (corresponding to the 75$^{th}$ percentile of the sample distribution) the increase in the annual amount stands between €298 and €376, far more than the increase in the annual explicit tax saving (which would be €0, given the financial structure of the loan). This is also the case for the median mortgage amount (€200,000). In this case the increase in the annual amount would stand between €259 and €320. Lastly, for a mortgage of €150,000 (corresponding to the 25$^{th}$ percentile of the sample distribution), the increase in the annual amount would stand between €195 and €246. In all cases, this increase is much larger than the increase in the explicit tax saving, which in the best case (when the term is 40 years) would be €30.

[TABLE 4]

**7. Conclusions**

This paper provides empirical evidence of the effect that the tax saving generated by the income tax credit for the acquisition of a primary residence has on the total amount and the term of the mortgage granted. This evidence complements prior evidence with regard to the impact of the credit on other variables relating to the housing market. Previously, López-García (1996, 1999 and 2004) had shown that as this credit is identical for new and used properties, it can be considered as an incentive to save. Incentives to save give rise to an increase in the pre-existing housing stock and an increase in the price of this housing. The result is therefore an income transfer to the detriment of younger individuals, who are forced to buy their first home at a higher price. García and Raya (2006) had also obtained empirical evidence of the effect of the income tax credit on the probability of making a tenure switch from renting to owning. Specifically, this probability increased by between 3% and 9% (depending on the level of income), revealing that this credit was somewhat more regressive than the credit given in the previous law (Law 18/1991).

Using information on the mortgage transactions handled over the years 2006-2008 by a financial institution, we have estimated a simultaneous equation model on the determinants of mortgage demand (in terms of its two fundamental characteristics: the amount of the mortgage and the repayment term). The results show effects of the

explanatory variables of opposite sign depending on whether they are on the mortgage amount or the term. Thus, positive effects on mortgage amount (negative on term) are observed for income, number of holders and educational level. However, negative effects on mortgage amount (positive on term) are observed for interest rate and age. Thus all the variables have the expected signs, the mortgage amount increasing whenever an increase in the variable reduces the risk of default.

We observe that the tax saving has the effect of increasing the risk of the mortgage. In this respect, if we increase by one percentage point the ratio of the present value of the stream of explicit tax savings to the price of the property, the mortgage amount granted increases by 1.6%, whereas it causes a 2% decrease in the term. This effect of the tax saving on mortgage demand gives rise to an increase in the annual payments that is far greater than the increase in the tax saving. Thus, for example, for the median mortgage (€200,000 repayable over 30 years at an interest rate of 5%), the increase in the annual amounts would stand between €259 and €320. That is, the tax saving resulting from Laws 40/1998 and 35/2006 made affordable more expensive housing through greater risk taking.

Even if we ignore the 'inflationary' effect that the credit has on housing prices, the totality of the saving generated by this credit for the acquisition of a primary residence is used up in the process of gaining access to a larger mortgage payment (as a result of buying a more expensive home) and contracting it at a shorter term than we would have done in the absence of the credit. Therefore, the empirical evidence provides a new reason for the abolition of the credit, insofar as this credit would appear to have contributed positively to the 'financial illusion' created in Spain in the housing boom years[12]. This illusion is clearly visible in the results of the estimated model and the simulation exercise, since individuals with the same financial profile (income, educational level, type of contract, type of employment, etc.) took out riskier mortgages (a larger amount to be repaid over a shorter term).

After receiving considerable pressure from international organizations, the Spanish government has removed the tax credit for mortgages taken out as of 2013. López-García (2009) is critical of this measure, and supports maintaining it for new homes (thus creating an investment incentive). An investment incentive keeps the housing stock topped up and lowers the price of pre-existing properties, thus generating an income redistribution to the benefit of younger and future generations. From the financial point of view, this measure can be considered

[12] The bank default rate in Spain grew from 0.5% in 2007 to 5.56% in 2010.

positive, as it reduces the incentive to apply for and obtain riskier mortgages. Indeed, from a financial perspective, the optimum would have been to abolish the credit retroactively. In this sense, housing taxation has contributed to reinforce credit facilities and the steep rise in house prices in increasing household indebtedness. Besides, this tax credit has created a riskier household indebtedness. Thus, this paper provides additional evidence that housing taxation, in general, was not used to calm housing an credit boom, but on the contrary.

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**Table 1: Geographical distribution of the sample: largest towns**

| Town | Observations |
|---|---|
| ALGECIRAS | 189 |
| ALICANTE | 275 |
| BARCELONA | 2571 |
| BILBAO | 130 |
| CORDOBA | 122 |
| GETAFE | 128 |
| HUELVA | 181 |
| L'HOSPITALET DE LLOBREGAT | 258 |
| MADRID | 3690 |
| MALAGA | 352 |
| SEVILLA | 416 |
| TERRASSA | 107 |
| VALENCIA | 531 |
| VALLADOLID | 95 |
| ZARAGOZA | 374 |
| **Total** | 9419 |

**Table 2: Descriptive statistics**

| **Variable** | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| Income tax credit | 1377.408 | 298.751 | 172.78 | 1800 |
| Income tax credit (present value of the stream) | 26584.61 | 5957.14 | 1714.28 | 35273.63 |
| Tax saving | 0.133 | 0.036 | 0.004 | 0.67 |
| Interest rate | 4.231 | 0.954 | 2.832 | 5.393 |
| Assessed value | 198517.7 | 83541.88 | 40000 | 867968 |
| Loan to value (%) | 83.646 | 14.054 | 40.40 | 149 |
| Age | 34.684 | 8.429 | 18 | 70 |
| Income | 1466.267 | 656.555 | 416 | 7650 |
| Mortgage | 170837.2 | 75.712 | 11400 | 647000 |
| Number of holders | 1.814 | 0.708 | 1 | 4 |
| Term | 35.109 | 5.165 | 1 | 50 |
| *Type of employment* | | | | |
| Clerical assistant | 0.010 | 0.102 | 0 | 1 |
| Manager | 0.015 | 0.121 | 0 | 1 |
| Skilled worker | 0.356 | 0.479 | 0 | 1 |
| Unskilled worker | 0.427 | 0.495 | 0 | 1 |
| Other | 0.193 | 0.394 | 0 | 1 |
| *Educational level* | | | | |
| Primary | 0.640 | 0.479 | 0 | 1 |
| Secondary | 0.319 | 0.466 | 0 | 1 |
| University | 0.040 | 0.197 | 0 | 1 |
| *Type of contract* | | | | |
| Permanent | 0.555 | 0.496 | 0 | 1 |
| Permanent seasonal | 0.019 | 0.135 | 0 | 1 |
| Uncontracted | 0.409 | 0.491 | 0 | 1 |
| Temporary | 0.001 | 0.030 | 0 | 1 |
| Works and services | 0.015 | 0.125 | 0 | 1 |
| *Marital status* | | | | |
| Married | 0.307 | 0.461 | 0 | 1 |
| Unmarried couple | 0.002 | 0.053 | 0 | 1 |
| Separated | 0.020 | 0.141 | 0 | 1 |
| Single | 0.665 | 0.471 | 0 | 1 |
| Widowed | 0.003 | 0.060 | 0 | 1 |
| *Nationality* | | | | |
| Spain | 0.696 | 0.459 | 0 | 1 |
| Latin America | 0.170 | 0.376 | 0 | 1 |
| Africa | 0.060 | 0.238 | 0 | 1 |
| Asia & Oceania | 0.021 | 0.144 | 0 | 1 |
| EU-15 and rich countries | 0.013 | 0.113 | 0 | 1 |
| Eastern Europe | 0.038 | 0.192 | 0 | 1 |
| N | 18505 | | | |

**Table 3: Simultaneous equation model of mortgage demand**

| | Dependent variable: mortgage (log) | | Dependent variable: term (log) | |
|---|---|---|---|---|
| | *Coeff.* | *Z* | *Coeff.* | *Z* |
| Tax saving | 1.603** | 36.21 | -2.004** | -47.30 |
| Interest rate | -0.102** | -8.89 | 0.055** | 9.18 |
| Appraisal value | 0.728** | 12.63 | | |
| Age | -0.014** | -9.43 | 0.007 | 9.88 |
| $Age^2$ | 0.000** | 16.45 | -0.000** | -10.34 |
| Income | 0.053** | 8.94 | -0.177** | -5.57 |
| Mortgage (log) | | | 1.270** | 69.55 |
| Number of holders | 0.049** | 14.87 | -0.018** | -10.01 |
| Term (log) | 0.706** | 6.34 | | |
| *Type of employment (ref.: cler.)* | | | | |
| Manager | 0.057** | 2.67 | -0.033** | -2.91 |
| Skilled worker | 0.002 | 0.27 | -0.102 | -0.80 |
| Unskilled worker | -0.000 | -0.82 | -0.004 | -0.78 |
| Other | 0.041 | 1.32 | -0.023 | -1.43 |
| *Educational level (ref.: primary)* | | | | |
| Secondary | 0.006* | 1.88 | -0.010** | -3.95 |
| University | 0.025** | 4.62 | -0.028** | -5.85 |
| *Type of contract (ref.: perm.)* | | | | |
| Permanent seasonal | -0.011* | -1.92 | 0.020 | 1.27 |
| Uncontracted | -0.007** | -2.32 | 0.011** | 4.66 |
| Temporary | -0.019 | -0.47 | 0.025 | 0.68 |
| Works and services | 0.066** | 5.83 | -0.044** | -10.01 |
| *Marital status (ref.: married)* | | | | |
| Unmarried couple | 0.005 | 0.97 | -0.045 | -0.54 |
| Separated | -0.015** | -2.16 | 0.041** | 3.62 |
| Single | -0.022** | -4.55 | 0.037** | 6.65 |
| Widowed | -0.063 | -2.34 | -0.025 | -1.34 |
| *Nationality (ref.: Spain)* | | | | |
| Latin America | 0.057** | 10.78 | 0.002 | 1.46 |
| Africa | -0.011** | -2.75 | 0.010** | 2.63 |
| Asia & Oceania | 0.013 | 1.34 | 0.035 | 1.05 |
| EU-15 and rich countries | -0.014 | -1.23 | 0.014* | 2.20 |
| Eastern Europe | 0.059 | 1.09 | 0.029** | 3.09 |
| Bank identifier control | NO | | YES | |
| Area control | Postcode | | Province | |
| N | 18505 | | 18505 | |
| RMSE | 0.187 | | 0.261 | |

** Significance level of 5%.
* Significance level of 10%.

**Table 4: Simulation of the impact of a tax saving of €100 on annual payments**

| Amount without tax saving | Amount with tax saving | Term without tax saving | Term with tax saving | Interest rate | Difference in annual amounts |
|---|---|---|---|---|---|
| 200,000 | 203,200 | 35 | 34.31 | 5.00% | 285.03 |
| 150,000 | 152,400 | 30 | 29.41 | 4.25% | 230.99 |
| 230,000 | 233,680 | 40 | 39.22 | 5.50% | 307.91 |
| 200,000 | 203,200 | 30 | 29.41 | 5.00% | 319.55 |
| 200,000 | 203,200 | 40 | 39.22 | 5.00% | 259.43 |
| 200,000 | 203,200 | 30 | 29.41 | 4.25% | 307.99 |
| 200,000 | 203,200 | 30 | 29.41 | 5.50% | 327.35 |
| 150,000 | 152,400 | 30 | 29.41 | 5.00% | 239.66 |
| 150,000 | 152,400 | 40 | 39.22 | 5.00% | 194.57 |
| 150,000 | 152,400 | 30 | 29.41 | 4.25% | 230.99 |
| 150,000 | 152,400 | 30 | 29.41 | 5.50% | 245.52 |
| 230,000 | 233,680 | 30 | 29.41 | 5.00% | 367.48 |
| 230,000 | 233,680 | 40 | 39.22 | 5.00% | 298.35 |
| 230,000 | 233,680 | 30 | 29.41 | 4.25% | 354.19 |
| 230,000 | 233,680 | 30 | 29.41 | 5.50% | 376.46 |

**Table A.1: Regression of the appraisal value**

| | Dependent variable: assessed value (log) | |
|---|---|---|
| | *Coeff.* | *Z* |
| Surface area registered | 0.001 | -0.91 |
| Number of holders | 0.099** | 23.36 |
| Income | 0.161** | 19.54 |
| *Type of employment (ref.: clerical)* | | |
| Manager | 0.044 | 1.55 |
| Skilled worker | 0.001 | 0.06 |
| Unskilled worker | -0.060** | -2.77 |
| Other | 0.042* | 1.86 |
| *Educational level (ref.: primary)* | | |
| Secondary | -0.053** | -7.90 |
| University | 0.068** | 5.43 |
| *Type of contract (ref.: permanent)* | | |
| Permanent seasonal | -0.013 | -0.71 |
| Uncontracted | -0.090** | -14.59 |
| Temporary | 0.008 | 0.14 |
| Works and services | 0.010 | 0.69 |
| *Marital status (ref.: married)* | | |
| Unmarried couple | -0.031 | -0.82 |
| Separated | -0.017 | -1.03 |
| Single | -0.062** | -9.68 |
| Widowed | -0.027 | -0.74 |
| *Nationality (ref.: Spain)* | | |
| Latin America | 0.035** | 4.99 |
| Africa | -0.091** | -9.66 |
| Asia & Oceania | 0.000 | 0.01 |
| EU-15 and rich countries | 0.002 | 0.12 |
| Eastern Europe | -0.022* | -1.94 |
| Constant | 3.808 | 58.68 |
| N | 18505 | |
| RMSE | 0.23 | |
| $R^2$ | 0.50 | |

** Significance level of 5%.
* Significance level of 10%.