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**Financial Markets, Judicial Costs and
Housing Tenure: An International Comparison**

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Abstract

This paper explores the determinants of international patterns of housing tenure choice. Up to now, no study has carried out an international comparison in housing tenure using household level data. The Luxembourg Income Study (LIS) provides microeconomic data on fourteen OECD countries. In most of these countries the cross-section is repeated over time. This allows us to construct a truly unique international dataset on over 400,000 households. The dataset also includes selected demographic variables (carefully matched between the different surveys). After controlling for fixed-country effects, cohort effects and calendar time effects, we find strong evidence that different downpayment ratios affect the age-profile of housing tenure, particularly for the young.

Keywords: homeownership, financial markets, judicial costs.

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1. Introduction

The purpose of this paper is to explore the determinants of international patterns of the decision to purchase homes. Previous literature shows that homeownership profiles are generally concave. However, the shape of this profile differs greatly between countries. In some countries, such as Australia, Canada, the United States or the United Kingdom, homes are purchased early in life and the age-profile increases sharply already at young ages. In other countries, such as Austria, Italy and Spain, homes are purchased more gradually over the life cycle and the average age of first purchase is reached only in the late thirties or forties. There are a variety of reasons why the profiles may differ, such as household composition, house prices and tax incentives. In this paper we try to control as much as possible for these factors, but focus primarily on the potential role of credit market imperfections and judicial costs.

Up to now, international comparisons have been carried out mainly using aggregate data or simulation studies. For instance, Maclennan et al. (1999) report a set of very useful statistics on European housing markets and speculate that asymmetries in market structure, institutions and tax policies affect not only the degree of competition in housing markets, but can also have far-reaching implications for macroeconomic policy. Lea and Diamond (1992) document wide differences in housing finance arrangements in four European countries and point out that these arrangements affect the housing tenure patterns. Hayashi, Ito and Slemrod (1988) show by means of simulations that differences in housing finance arrangements in the form of downpayment ratios can explain part of the international differences in saving rates.

The main contribution of this paper is that we exploit a large international dataset on households. The sample we use is a collection of 39 individual country surveys spanning almost 30 years of data and 14 countries, with a total of over 400,000 observations. Homeownership and age are observed in each of these surveys, as well as other appropriately matched demographic variables. Our dataset is then merged with country panel data on indicators of mortgage market imperfections. In future versions of this paper we plan to expand the panel to include also country-specific, time-varying indicators of judicial efficiency and of other institutional characteristics of the countries examined. Therefore, given the richness of our dataset, we can estimate the age profile of homeownership controlling for country-specific effects, cohort (or time) effects, demographic variables as well as institutional features of the housing markets.

Understanding the reasons for the difference in the age-tenure profiles has important policy implications. If the main reasons why the profiles differ can be traced to supply side factors, e.g., to mortgage market imperfections, then the unification of European financial markets will induce dramatic changes in the country mortgage markets and patterns of homeownership. On the other hand, if the main source of difference across profiles has to do with demand-side effects, or if the differences arise because intergenerational networks operate on a different scale across countries, then the effect of financial markets integration will be less important.

In Section 2 we present the microeconomic data set and the characteristics of the sample. Since we use basic demographic variables (such as homeownership, age, household composition and education), we are confident that the various surveys are broadly comparable, across years as well as across countries. In Section 3 we review various reasons why the age-profile of homeownership can vary and we describe the panel data with institutional features of housing financial markets. We also speculate about the source of the international differences in downpayment ratios and focus on judicial efficiency, asymmetric information and regulation.

The heart of the paper is in Section 4, where we present our econometric estimates and the predicted age-profile of homeownership for various levels of the downpayment rate. We find that the level of the downpayment is an important determinant of the homeownership profile, especially for the young. In Section 5 we present preliminary evidence about the interpretation of the estimated country fixed effects. Important determinants of homeownership are observed only at one point in time (or are averaged over many years), so their effect cannot be identified in our regressions. Descriptive evidence, however, suggests that the downpayment is sufficient statistics capturing the impact of judicial efficiency. However, country fixed effects are correlated with other characteristics of mortgage markets (such as mortgage maturity), suggesting that the estimated regressions might underestimate the impact of housing finance markets. Section 6 summarizes the evidence and its implications for housing markets and for the current debate about the link between saving and growth.

2. The international data set

The Luxembourg Income Study (LIS) is a research project run by CEPS-INSTEAD. Its main purpose is to enhance international comparability among twenty-five different household surveys. The main focus of the project is on income and taxation, and previous empirical literature has used LIS data mainly for international comparison of income inequality and poverty. Each survey contains information on demographic characteristics of the household and housing tenure, while in most cases data on wealth or consumption is absent or difficult to compare internationally. Since we use only basic variables we can refer mostly to the original variables without need of further corrections or imputation.

We selected data from fourteen countries (Australia, Austria, Belgium, Canada, Finland, France, Germany, Italy, Luxembourg, Netherlands, Spain, Sweden, United Kingdom and United States). We concentrate on a group of relatively homogeneous countries, and exclude, for instance, transition economies as Poland and Russia. These countries feature housing subsidies and mortgage markets that are fundamentally different from market economies. Other countries are excluded because we lack data on downpayment ratios.

In all countries selected but Luxembourg and Austria the cross-section is repeated over time, providing an opportunity to exploit the time-variability of homeownership. Overall, the sample period spans three decades of data. The earlier survey is for Canada (the 1975 Survey of Consumer Finances), and the latest ones in Italy (the 1995 Survey of Household Income and Wealth), Sweden (the 1995 Income Distribution Survey) and the United Kingdom (the 1995 Family Expenditure Survey). In some case the sample design has changed during the sample period (as in Germany, before and after re-unification). In the Netherlands we rely on two different surveys (the 1983 and 1987 Additional Enquiry on the Use of Public Services and the 1991 and 1994 Socio-Economic Panel).

In short, the LIS survey allows us to construct a truly unique international dataset on over 400,000 households. Table 1 reports the data sources and the total number of observations available in each country. We matched variables in all the selected cross-sections and created an unbalanced cross-country panel. The number of surveys varies by country (e.g., only one survey in Luxembourg and Austria and four in the United States, Australia and the Netherlands). There is also a large variability in the number of observations in the individual

surveys. The four Canadian surveys, for instance, cover a total of 75,000 households, and the four Australian surveys almost 50,000 households. In most cases, however, the number of observations per country is between 15,000 and 30,000 (4 to 8 percent of the total sample size).

The demographic variables that we were able to match in the different surveys are family size indicators, number of earners in the household, a dummy for couples, age of the household head, education level of the head and housing tenure. The matching process is detailed in the Appendix. The main problem we encountered was to recode education in three levels: low, middle and high. In the original surveys the education variable sometimes appears as years of education, in some cases as the highest degree attained, in others still as age at completed education. The three constructed education levels are based on the 7 categories defined by the International Standard Classification of Education (ISCED, 1997). Full details are given in the Appendix.¹

One problem common to all studies that use microeconomic data is the definition of the household, of the head of the household and the potential endogeneity of headship over the life cycle. These problems are compounded when one uses repeated cross-section and especially when one wants to compare data in different countries. The definition that we use is mainly taken from the original surveys. The only exception is that if the head is a female and the spouse is a male, we define the head to be the male. The decision on who is the household head is sometimes left to the respondent, but in most cases it is income based (as detailed in the Appendix).

Table 2 reports the distribution of household heads in six age brackets as a fraction of the observations available in each country (surveys are thus aggregated over time). All statistics use sample weights. Each cell contains between 10 and 20 percent of the national sample, with two important exceptions. In Italy and Spain the incidence of young heads is much lower than elsewhere (4.70 and 6.92 percent, respectively), reflecting only in part differences in the age structure of the population. Rather, this shows that in Italy and Spain people tend to live with their parents well beyond their 20s (perhaps because of mortgage market imperfections). Independent households are, on average, richer. Therefore in these countries headship is correlated with wealth and homeownership.

¹ We thank Uwe Warner for useful suggestions on the topic.

Table 3 reports the proportion of homeowners in each bracket. The table points out large differences in the level and timing of homeownership across countries. As far as level concerns, notice that Austria, France, Germany and the Netherlands feature relatively low levels of homeownership. As far as timing, in Finland and in the United Kingdom homeownership is already widespread in the first age bracket. In these two countries and in Australia, Canada, Sweden and the United States homeownership the bulk of home acquisitions occurs in the early or mid-30s. In other countries (such as Austria and Germany) the increase is much more gradual. In Italy and Spain the proportion of homeowners in the youngest age bracket is only apparently high. We know from Table 2 that the cell size for the youngest age brackets is relatively small.

The age-profiles of homeownership are displayed graphically in Figure 1. Each profile is obtained by the fitted values of a probit regression of homeownership on a third-order age polynomial. Note the wide differences between countries. In Italy and Austria, for instance, the proportion of owner-occupation increases slowly with age, and reaches a peak before retirement. This pattern contrasts sharply with the experience of the other countries, such as the United States and the United Kingdom, Canada and Australia, where the profiles peak ten or fifteen years earlier. Note also the wide difference between Belgium and Netherlands. In Belgium homeownership is quite common even for the elderly, while in the Netherlands social renting is widespread. The lowest profile is in Germany, due to the overall level of low homeownership in that country (highlighted in Table 3 and in McCrone and Stephens, 1995). In the Scandinavian countries housing policies favor co-operative housing which we consider ownership. The profile is increasing up to age 40 in both Sweden and Finland, and exhibits a marked decline in Sweden after retirement age.

There are several possible explanations for the patterns shown in Figure 1. A first set of issues has to do with possible sample bias. As mentioned, Table 2 indicates that in Italy and Spain there are very few young household heads in the youngest age bracket, and Table 3 that in the same bracket the proportion of homeowners is relatively high. But in these samples we already noted that there is a likely correlation between wealth (and therefore homeownership) and headship. Young working adults with independent living arrangements tend to be wealthier than average, because many young working adults live with their parents. This implies that in these countries young households are under-represented by our sample. A related problem is

that in the empirical analysis we will use the age of the household head to describe the behavior of the household. In nuclear households this is not a bad assumption, but when many young adults co-reside with their parents, as in Italy and Spain, the age of the household is not a well-defined concept.

A second set of factors affecting homeownership depends on genuine differences in the composition of the population and in permanent income. The timing of household formation certainly interacts with homeownership. In particular, the average age at marriage and the arrival of children for many households coincides with plans to buy a house. Household resources are certainly correlated with the decision to buy a house. For this reason, in the regression analysis we will control for as many as possible demographic factors that are observed in the dataset and for education and year-of-birth to proxy for household resources.² The elements on which we are more interested, however, are credit market imperfections that limit mortgage lending and therefore the access to homeownership. These elements are discussed in the next section.

3. Housing finance, downpayment ratios and judicial efficiency

Table 4 shows several indicators of housing financial markets for the 14 countries of our sample. Column (1) reports an indicator of the cost of borrowing, i.e. the spread between the mortgage rate and a long-term reference rate, column (2) outstanding mortgage loans as a percentage of GDP, column (3) the downpayment ratio and column (4) the typical mortgage maturity. It is clear that the characteristics of mortgage markets are widely different across countries. In some countries, such as the United States or the United Kingdom, the mortgage market is well developed, the downpayment is relatively low and mortgage maturity normally exceeds 20 years. In other, such as Belgium, Italy, Germany and Spain the mortgage market is relatively thin.³

² One should consider also the possibility that household formation depends on the availability of housing and the potential endogeneity of several demographic variables with respect to the decision to purchase a house. For instance, the average age of marriage might be delayed when couples cannot afford to buy a house. While potentially important, these effects are disregarded in this paper.

³ The average homeownership rate in Table 3 does not correlate with the size of the mortgage market, or with other indicators of housing finance. Thus, thin mortgage markets cannot be attributed to a low percentage of

Among the many possible indicators of mortgage market imperfections, the variable on which we focus in the econometric analysis is the downpayment ratio. In countries with relatively high downpayments households must accumulate funds prior to a purchase. Our working hypothesis is that households in these countries may desire a profile similar to that of the United States or the United Kingdom, but mortgage market imperfections prevent them to do so. For the availability of mortgages to have an impact on homeownership it must be the case that there is a preference for owning a house, as opposed to renting. In the theoretical literature, this is usually justified by assuming that a house yields higher utility when owned than when rented.⁴

Even though it is almost natural to think that high downpayment ratios affect the timing of housing tenure, this needs not to be the case. Intergenerational transfers can attenuate the effect of downpayment ratios. There are two ways in which these transfers interplay with the desire to acquire a home. If transfers help households to meet the downpayment, the relevant downpayment might be different than the one reported in Table 4, because family networks circumvent mortgage markets imperfections.⁵ Alternatively, if young households expect to receive a house as a bequest, they may choose to rent and wait to receive the bequest. This strategy avoids saving to meet the downpayment.⁶ Thus, the effect of the downpayment on the timing of purchase is not a priori obvious, making the empirical analysis more interesting and informative.

The downpayment ratio in Table 4 refers to conventional housing loans extended to first-time buyers. In constructing the downpayment series we have updated the dataset of Jappelli and Pagano (1994) to the 1990s using data from McLennan, Muellbauer and Stephens (1999), Lea and Diamond (1992), and Lea, Welter and Dubel (1997). We then merge data on downpayment ratios for the 1970s, the 1980s, and the 1990s with the microeconomic dataset.

owner-occupation. This implies that households acquire homes even where the downpayment is high, borrowing very little or not at all. We take this as indirect evidence that high downpayment ratios affect the timing of home purchases, but does not discourage people to become homeowners.

⁴ This can be justified in three ways: (1) owning eliminates the principal-agent relationship, i.e. the owner can alter the house as desired and is not subject to the risk of rent termination or rent increase in the future; (2) there may be tax incentives to owning; (3) there may be no alternative to owning because of imperfections and regulations in the rental market for housing.

⁵ Even if a network of informal markets may overcome housing finance imperfections, to be effective transfers have to be timed correctly. They have to occur when they are most needed, i.e. when credit constraints are binding. Bequests are very unlikely to serve these purposes. Gifts or loans have to occur *inter vivos*.

Since we do not have yearly data on downpayments for many countries, the implicit assumption is that the variable changes slowly over time. In Table 4 we report the average downpayment ratio used in the estimation for the 1975-1995 period (the years spanned by the microeconomic data). The Appendix reports further details on the construction and definition of this variable. Column (3) of Table 4 shows that Austria, Italy and Belgium and Spain are countries with relatively high downpayment ratios, while the United States, Canada, the United Kingdom and the Scandinavian countries features relatively low ratios.

There are several factors that can explain variations in the downpayment ratio across countries. As in Jappelli and Pagano (1994), prominent ones are: (1) *regulation* of minimum downpayment requirements; (2) the *cost of enforcing contracts* and the *willingness to repay* debt obligations; (3) the extent of *asymmetric information* between borrowers and lenders. Regulation has the most obvious impact on mortgage markets. Enforcement costs and asymmetric information can lead to either pure credit rationing, or to high downpayments and high interest rates to compensate for these problems (Jaffee and Stiglitz, 1990).

The recent law and finance literature emphasises the importance of different legal system and judicial efficiency for the performance of the credit market (La Porta et al., 1997, 1998). This literature suggests that the costs of enforcing contracts, the cost of disposing of collateral and the willingness to repay financial obligations can affect collateral requirements set by lenders and therefore the downpayment ratio.

Table 5 reports statistics to evaluate the efficiency of the judicial system and the willingness to repay debt obligations in the different countries. Column (1) reports an indicator of judicial efficiency (taken from La Porta et al, 1997). Columns (2) and (3) focus more directly on specific enforcement costs in mortgage market. They are proxied by the legal expenses as percentage of the mortgaged house price and the average duration of housing mortgage foreclosure. Finally, column (4) reports an indicator of “Rule of Law” (also taken from La Porta et al., 1997) which is meant to capture different degrees of willingness to repay in financial markets. Even though this indicator is rather crude, and does not exhibit a large cross-country variability, it could be taken as a proxy for moral hazard problems faced by lenders.

⁶ Guiso and Jappelli (1999) analyze the importance of this channel in the context of the Italian economy and find that transfers reduce only slightly saving time.

The indicators in Table 5 are closely related to each other. Judicial efficiency correlates negatively with foreclosure duration. Legal expenses and duration are positively correlated. Rule of law correlates positively with judicial efficiency and negatively with duration. On the basis of these indicators, Belgium, Germany, Italy and Spain feature less efficient judicial systems and longer duration of mortgage foreclosure. In particular, the Italian case stands out. Due to the slowness of its judicial process, debt collection and repossession can be extremely expensive and time consuming: it takes an average of 4 years to repossess a house in case of mortgage foreclosure and legal expenses can be as high as 20 percent of the mortgaged house price. At the opposite extreme, the Netherlands, Canada, and the United States feature relatively high judicial efficiency and short duration of mortgage foreclosure. The descriptive evidence suggests that indeed enforcement problems might be at the root of the international differences in lending activity. The downpayment in Table 4 is negatively correlated with judicial efficiency, and positively correlated with duration and rule of law.

A further factor that can affect mortgage market performance is the extent of asymmetric information between borrowers and lenders. In the United States, Canada, and the United Kingdom loan applications are processed rapidly because specialized credit reference agencies provide information on the credit histories of all potential borrowers and creditors share information about their clients. In other countries, such as Finland, France, Italy, Belgium and Spain, these agencies are in their infancy or exchange limited data (mainly on defaults or arrears), so the extent of asymmetric information between lenders and borrowers is potentially more severe (Jappelli and Pagano, 1999).

Regulation often imposes minimum downpayment ratios for mortgage loans. These vary considerably between countries: until the eighties the limit was as high as 50 percent in Italy and 40 percent in Spain, and as low as 25 percent in Canada and 20 percent in France. In these countries, at least when regulation was in place, the downpayment ratio could have been regarded as truly exogenous.

Even though in this paper we focus primarily on differences in mortgage markets arising from downpayment ratios to explain the timing in homeownership, there are several other factors that one might want to consider. In almost all countries there is direct government involvement in the provision of mortgage loans, either directly or through tax incentives (EC Mortgage Federation, 1990). Subsidies for homeownership and direct

government intervention are also important, as well as the tax treatment of property and the regulation of rental markets. Finally, macroeconomic factors and business cycle indicators can also have an impact. We are unable to control for all these variables, and will assume that their impact is captured by country fixed effects and calendar time effects.

4. Empirical results

The econometric model posits that the probability of buying a house is a function of a polynomial in age common to all countries (indexed by c), a set of demographic variables X (education, household composition, number of earners and marital status) and the downpayment ratio D (which is a time-varying regressor).

$$\Pr(H = 1) = f(\text{age}) + b_1 X + b_2 b + d_1 D + d_2 D \times \text{age} + \sum_{c=1}^C g_c d_c \quad (1)$$

Equation (1) also includes country fixed effects and year-of-birth b . Given the collinearity between age, time and cohort we cannot estimate the effect of these variables independently. In our basic specification we assume that the data are explained by a combination of age and cohort effects, and disregard time effects. Note that the cohort effect is parameterized tightly, but that other functional forms (for instance, cohort dummies) do not affect the results.

The main hypothesis that we wish to test is that mortgage market imperfections affect the shape and/or the shape of the homeownership profile. We expect this effect to be greatest for the young, who don't have collateral and must save prior to purchase. In some specifications we interact the downpayment ratio with age in order to test for this effect. The main advantage of our approach with respect to previous comparative studies of housing markets is that we can test the hypothesis that mortgage market imperfections affect homeownership with microeconomic data. Furthermore, we can control for country fixed effects.

Equation (1) is first estimated by a minimum chi-square method. This amounts to estimating the probability of owning using weighted least squares on grouped data. Each group

corresponds to an age/year/country cell. The weights depend on the sample size of each individual cell. We then move to probit estimates of the model with the original 400,000 observations. Given the large sample size, the two sets of estimates are quite similar.

The minimum chi-square regressions are reported in Table 6. Column (1) excludes the downpayment ratio. Demographic variables have a large impact on the probability of purchasing a house: household size and the dummy for couple are positive and significantly different from zero. Education and number of earners shift the age-profile up by 5 to 7 percentage points. There is also a positive cohort effect, i.e. homeownership increases by 1 percentage point for each year of birth.

In the second column we add the downpayment ratio. The coefficient is negative, statistically different from zero at the 1 percent level and large in absolute value. Increasing the downpayment ratio by 10 percentage points reduces homeownership by 1.6 points. In column (3) of Table 2 we further add the interaction term with age. The two coefficients come with opposite signs, indicating that the derivative of the probability of owning with respect to the downpayment is large and negative at young ages, and becomes small in old age. The effect of the downpayment on the age-profile is shown most clearly in Figure 2 where we plot the estimated age effect for various levels of the downpayment ratio. Except for the downpayment ratio, which assumes values of 5, 20, and 50 percent, each profile is evaluated at sample means. The impact of the downpayment is largest in the youngest age group: lowering the downpayment from 50 percent (as in Italy) to 20 percent (as in France) or to 5 percent (as in the United Kingdom in the 1980s) increases the predicted probability by 10 and 15 percentage points, respectively. The downpayment effect tends to disappear at older ages. In column (4) we exclude Australia and Finland, because in these two countries age is reported in large bands and the age profiles are less reliable. We find similar patterns of coefficients.

We then estimated the model using household level data. The coefficients of the probit regressions are reported in Table 7 and confirm the previous set of results. Figure 3 plots again the estimated age-profile. Reducing the downpayment from 50 to 20 percent increases the probability for the young to become homeowners by nearly 10 percentage points.

There is no strong theoretical justification for considering cohort effects in housing tenure choices. An alternative identification assumption is to estimate the regressions dropping year-of-birth and introducing unrestricted time effects. Time effects might capture house price

effects and other macroeconomic variables, but also changes in sample designs over time. The estimated coefficients are similar to the ones reported in Tables 6 and 7, so for brevity we report only the predicted age-profiles for different levels of the downpayment ratios. We still find that downpayment affects homeownership at young ages: the downpayment coefficient is -0.286 and the coefficient on the interaction term is 0.0055 , and both are statistically different from zero at the 1 percent level. However, controlling for time effects, we see in Figure 4 that the downpayment increases the predicted probabilities for the old but does not affect its average level (the profiles cross each other at age 50).

Given the potential endogeneity of headship in Italy and Spain, we repeat the estimation excluding these two countries from the analysis. We find again a significant impact of the downpayment. In the regression with cohort effect but no time dummies the downpayment coefficients have again opposite signs but the standard errors are larger than in the full sample estimates. In the regressions with fixed effects the results are essentially unaffected.

5. Explaining country fixed effects [preliminary]

Our regressions do not take into account explicitly other important determinants of homeownership. Housing policies (tax incentives to homeownership, subsidies, rent control and social housing programs), labor market effects (migration and other determinants of the demand for housing) and genuine differences in the preference for owning rather than renting certainly affect the housing market and the timing of home purchase. In our econometric specification, the effects of these omitted variables are captured by country fixed effects.

In our context, these fixed effects are no more than an admission of ignorance, because the macroeconomic variables that affect the demand for housing are difficult to measure and to compare across countries. Furthermore, one needs time variability to identify their effect. As an exploratory and descriptive analysis we consider the correlation coefficients of the estimated fixed effects with other determinants of the age-profile of homeownership. Our focus here is limited. We wish to check if the downpayment ratio is a sufficient statistic for measuring the effect of mortgage market imperfections, or if instead we are missing important dimensions through which these markets affect homeownership.

In Table 8 we report the correlation matrix between the fixed effects and mortgage maturity (reported in Table 4) and our indicators of judicial efficiency (described in Table 5). We find a negative and significant correlation between fixed effects and the average length of mortgage maturity (-0.71), implying that countries with relatively low maturities exhibit higher levels of homeownership. Since mortgage maturity is one further dimension by which lenders can limit the supply of mortgage loans to households, this negative correlation indicates that the impact of mortgage market imperfections on homeownership might even be larger than what we estimate in Table 7.

On the other hand, we find no significant correlation between the fixed effects and judicial costs or efficiency. The correlation coefficients in the first column in Table 8 are small and not significantly different from zero. We speculate that the downpayment ratio (for which we control in the regression) captures well the effect of judicial efficiency. In future work we plan to collect time-varying data on mortgage duration and at least one indicator of judicial efficiency. Hopefully, at that stage our preliminary evidence will be corroborated by the econometric results.

5. Conclusions

We explore the determinants of homeownership using an international dataset on over 400,000 households in 14 countries. The dataset also includes selected demographic variables, carefully matched between the different surveys. The econometric estimates are consistent with the hypothesis that mortgage market imperfections distort the age-tenure profile, inducing people to save when young and to postpone home purchase later in life. Using a unique international dataset, we find that the effect of lowering the downpayment ratio from 50 to 20 percent would increase the homeownership of the young by about 10 percentage points. This effect is then attenuated in older ages. Our findings are also useful to analyze the impact of financial deregulation in countries that have lowered the downpayment ratio in the last three decades (such as Spain and the United Kingdom). The results are robust with respect to the particular estimator used, and to the presence of country fixed effects. When we consider time

effects or we exclude Italy and Spain from the sample we still find a significant distortion of the age-profile of homeownership in the direction predicted by the theory.

This study carries implications for the evolution of European housing markets. Many changes in European mortgage markets have taken place during the past decade: minimum downpayments have been lowered in many countries, restrictions on maturities abolished, legal costs reduced and second mortgages introduced. Credit reference agencies are now operating on large scale at the European level, collecting and disseminating households' credit records. These changes are undoubtedly sharpening lenders' competition; credit terms for prospective homebuyers will improve accordingly. The econometric estimates suggest that convergence of European mortgage markets will shift the tenure profile towards the youngest cohorts and stimulate, at least temporarily, higher demand for housing and mortgages.

Our findings have far-reaching implications also within the saving literature. In the presence of a downpayment constraint, the young must save prior to home purchase. Deaton (1999) points out that this effect raises the aggregate wealth-income ratio and reinforces the link between saving and growth in finite horizon models. The econometric estimates show that the downpayment ratio is an important determinant of the timing of home purchase. Most likely, the distortionary effect on the age profile translates also into a distortion of the age-consumption profile. Thus credit market imperfections provide one route to explain international differences in the aggregate saving rate.

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Data Appendix

1. The household head

The definition of the head of the household is the same as in the original surveys with one important exception. If the head is a female, and the spouse is a male, we define the household head to be the male. In each country the definition of the head varies somewhat, according to the definitions given below:

Australia: The head is the primary income unit of the family. If the income unit is a couple, the head is the husband.

Austria: The respondent designates the head of the household.

Belgium: The head is the male in the case of married or unmarried couples, the male or the female in the case of a single person living with children. In all other cases the respondent designates the head of household

Canada: The head of household is always the head of the primary economic family.

Finland: The head of the household is the person with the highest income.

France:

Germany: The survey unit head is the person with the best knowledge of household living conditions.

Italy: The survey unit head is usually the husband or father. If he is abroad or lives outside the household the head is the person who is economically responsible for the family.

Luxembourg: The survey unit head is the male in the case of couples. Otherwise, it is the owners of the housing unit.

Netherlands: The respondent designates the head (he or she must be over 18 years old). Otherwise, the interviewer suggests the rent payer, the homeowner, the person with the highest income, or the oldest person.

Spain:

Sweden:

United Kingdom: The survey unit head is the head of household. The head of household must be a member of that household. He or she is the person, or the husband of the person, who: (1) owns the household accommodation, or (2) is legally responsible for the rent of the accommodation, or (3) has the household accommodation as an emolument or perquisite, or (4) has the household accommodation by virtue of some relationship to the owner who is not a member of the household. When two members of different gender have equal claim, the male is taken as head of household. When two members of the same gender have equal claim, the elder is taken as head of household.

United States:

2. Variables used in the estimation

AGE OF THE HOUSEHOLD HEAD. The variable is measured in years. In Australia and Finland the original survey only reports selected age categories. In these cases, the age variable is recoded according to the midpoint of the interval.

NUMBER OF CHILDREN UNDER AGE 18 This variable excludes the head and the spouse if they are under 18 and includes adopted, foster children or other young relatives.

NUMBER OF ADULTS defined as the difference between the number of persons in the household and number of children under age 18.

NUMBER OF EARNERS As a general rule, we define a person with positive salary or income from self-employment.

EDUCATIONAL LEVEL OF THE HEAD The level of detail of this variable varies across the different surveys. In some cases the respondent reports years of education, in others the level of attainment in (approximate) years of education. In few cases, the variable is reported as “age at completed education.” We code the original variables in three levels of education. They are based on the 7 categories defined by the International Standard Classification of Education (ISCED, 1997). The dummy **LOW LEVEL** refers to ISCED 0 (pre-primary), ISCED 1 (primary, between ages of four and seven, lasts five or six years and is always compulsory) and ISCED 2 level (junior high school, corresponding often to the end of full-time compulsory schooling). The dummy **MIDDLE LEVEL** contains various types of secondary education corresponding to ISCED 3 (upper secondary education, which starts around the age of 14 or 15 and refers to either general, technical or vocational education). The dummy **HIGH LEVEL** corresponds to ISCED 5, 6 and 7 levels. It includes college degree or equivalent, postgraduate university degree, and programs which do not lead to a university degree, but to higher vocational education and training, following the successful completion of the upper secondary level. We use the country tables in OECD (1990), describing number of years and age for each school level in each country to recode education levels in each survey into the three dummy indicators.

COUPLE The dummy equals one if the head has a spouse or a cohabiting /steady partner.

TENURE-OWNED OR RENTED HOUSING Details available for homeownership vary by country. Most distinguish between owned and rented living quarters. We define the household as owner when the survey gives sufficient information concerning the actual purchase of the house (privately or through co-operatives, as in Sweden) or the occupation with a redemption agreement. It takes value zero in the remaining cases of rented house, social or free housing.

SAMPLE WEIGHTS We use the original sample weights for each survey. Usually sample weights handle sampling errors and blow N up to the national figure.

DOWNPAYMENT RATIO In constructing this series we updated the dataset of Jappelli and Pagano (1994) to the 1990s using data from McLennan, Muellbauer and Stephens (1999), Lea and Diamond (1992), and Lea, Welter and Dubel (1997). The downpayment ratio is difficult to measure for a variety of reasons: even though during a decade it might have changed, where possible, we took the average of the minimum downpayment ratio during that decade; regulatory ceilings differ across classes of mortgages (we usually refer to conventional loans without mortgage insurance, government guarantees or subsidies); in some countries there is no statutory minimum downpayment ratio and payment arrangements are at the discretion of the individual lender (in that case we assumed that the minimum downpayment ratio equals the minimum observed average downpayment ratio in the decade). An Appendix available upon request reports sources and definitions for the downpayment ratio in each country.

Table 1
The international dataset

Country	Data sources and years available	Number of observations (percent)
Australia	Australian Income and Housing Survey: 1981, 1985, 1989, 1994	48,783 (12.00)
Austria	Austrian Microcensus: 1987	10,510 (2.58)
Belgium	Panel survey of the Centre for Social Policy: 1985, 1988, 1992	13,541 (3.33)
Canada	Survey of Consumer Finances: 1975, 1981, 1987, 1991	75,312 (18.52)
Finland	Income Distribution Survey: 1987, 1991	23,114 (5.68)
France	Family Budget Survey: 1984, 1989, 1994	31,019 (7.63)
Germany	German Socio Economic Panel Study: 1984, 1989, 1994	14,931 (3.67)
Italy	The Bank of Italy Survey of Household Income and Wealth: 1986, 1991, 1995	23,493 (5.78)
Luxembourg	The Luxembourg Social Economic Panel Study: 1985	2,002 (0.49)
Netherlands	Additional Enquiry on the Use of Public Services: 1983, 1987. Socio-Economic Panel: 1991, 1994	17,631 (4.34)
Spain	Expenditure and Income Survey: 1980, 1990	43,952 (10.81)
Sweden	Income Distribution Survey: 1992, 1995	27,255 (6.70)
UK	The Family Expenditure Survey: 1986, 1991, 1995	20,067 (4.93)
US	March Current Population Survey: 1974, 1979, 1986, 1991	55,036 (13.53)
All countries	39 surveys	406,646

Table 2**Sample composition**

The table reports the proportion of household heads in each age bracket. The statistics are computed using sample weights. Country values are aggregated over different years. The Appendix reports the definition of the household head in each survey.

Country	< 30	30-39	40-49	50-59	60-69	>70
Australia	18.44	22.70	18.00	14.12	13.13	13.61
Austria	10.18	17.16	16.83	15.71	20.66	19.47
Belgium	11.27	22.69	19.31	17.72	17.45	11.56
Canada	16.99	21.86	18.91	15.00	13.14	14.10
Finland	12.40	21.66	26.03	19.21	13.79	6.90
France	12.89	23.12	19.81	16.81	15.55	11.82
Germany	13.35	22.21	21.63	19.83	13.37	9.61
Italy	4.70	17.81	22.30	22.39	19.91	12.88
Luxembourg	10.19	18.23	22.28	23.08	13.79	12.44
Netherlands	16.41	25.82	19.47	13.51	13.81	10.98
Spain	6.92	18.93	21.33	22.00	18.50	12.32
Sweden	15.83	18.48	21.45	17.25	13.47	13.51
United Kingdom	13.83	20.97	18.88	15.07	16.40	14.86
United States	16.72	23.37	20.62	15.17	12.48	11.64

Table 3**Homeownership by the age of the household head**

The table reports the proportion of homeowners in each age brackets. Statistics are computed using sample weights. Country values are aggregated over different years.

Countries	< 30	30-39	40-49	50-59	60-69	>70	Average
Australia	29.90	65.00	76.97	80.67	81.25	64.13	65.06
Austria	20.93	48.70	55.51	60.69	58.18	44.04	49.95
Belgium	28.62	62.12	74.35	76.23	75.36	70.99	66.52
Canada	31.85	64.68	76.25	77.65	75.03	60.49	64.00
Finland	43.41	75.85	86.31	87.86	86.36	78.20	78.47
France	16.63	48.82	64.66	68.31	69.83	62.75	56.00
Germany	9.43	28.99	41.16	43.33	47.97	41.11	35.56
Italy	32.88	48.22	63.38	69.71	69.31	63.50	61.87
Luxembourg	38.24	54.52	72.42	78.57	83.33	68.27	68.08
Netherlands	26.18	56.01	62.30	52.81	38.93	24.74	46.11
Spain	43.29	66.16	76.33	78.54	79.87	76.41	73.27
Sweden	28.02	60.25	69.11	71.31	67.59	45.61	57.97
United Kingdom	51.60	70.92	75.69	72.95	63.04	53.17	65.53
United States	28.32	57.65	71.00	77.68	79.46	73.25	63.07

Table 4**Housing finance: an international comparison**

The interest rate spread is the average interest rate on mortgage loans minus the reference long-term rate. Interest rates on mortgage loans are drawn from Hypostat 1986-96, Table 21. Long term interest rates are drawn from OECD (1996). Data refer to 1986-96, except for Finland and Sweden (1990-96), Luxembourg (1986-87) and Spain (1993-96). Outstanding mortgage loans over GDP are 1986-96 averages. Annual outstanding loans against mortgage in residential property is based on Table 14 in Hypostat 1986-96 and annual GDP from IMF Financial Statistics. The downpayment ratio is the 1970-1995 average of downpayment ratios. The source is Jappelli and Pagano (1994), EC Mortgage Federation (1996) and MacLennan et al (1998). Mortgage maturity is based on 1995 EC Mortgage Federation data and is drawn from Lea et al. (1997).

Country	Interest rate spread	Outstanding mortgage loans / GDP	Downpayment ratio	Mortgage maturity
Australia	.-	.-	23.33	.-
Austria	1.52	.-	33.33	20-30
Belgium	1.02	20.08	26.67	15-20
Canada	.-	44.00	23.33	.-
Finland	1.23	32.35	18.33	10-15
France	0.95	22.05	20	15-20
Germany	1.10	45.11	30	25-30
Italy	1.47	5.30	44.67	15
Luxembourg	-1.02	.-	40	15-20
Netherlands	0.41	43.29	25	30
Spain	-2.30	15.01	26.67	15-20
Sweden	0.20	45.00	13.33	20-30
United Kingdom	1.08	51.87	12.33	25
United States	1.60	45.00	17	.-

Table 5**Efficiency of the judicial system and costs and duration of housing mortgage foreclosure: an international comparison**

The table reports indicators of the efficiency of the judicial system, measurement of enforcement costs and an indicator of law-and-order tradition. Efficiency of the judicial system is an assessment of the integrity of the legal environment as it affects business taken from the country-risk agency Business International Corporation. It is an average of 1980-83 and the scale goes from 0 to 10, with lower scores indicating lower efficiency levels. Source: La Porta et al. (1997). Legal expenses as percent of the price of the mortgaged house and duration of housing mortgage foreclosure refer to 1990 and are drawn from European Mortgage Federation (1996). Data for duration in Austria, Canada, Luxembourg, and United States have been obtained directly by country experts. Rule of law is an index assessing the law-and-order tradition in the country. It is an average of the 1982-95 period. The scale is from 0 to 10 with lower scores for less tradition of law and order. Source: La Porta et al. (1997).

Country	Efficiency of the judicial system	Legal expenses as percentage of the mortgaged house price	Duration of housing mortgage foreclosure (in months)	Rule of law
Australia	10	.-	.-	10
Austria	9.5	.-	13	10
Belgium	9.5	16-23	24	10
Canada	9.25	.-	4.75	10
Finland	10	.-	.-	10
France	8	12-18	10-12	8.98
Germany	9	6	12-18	9.23
Italy	6.75	18-20	36-60	8.33
Luxembourg	.-	2	12	--
Netherlands	10	11	2-3	10
Spain	6.25	5-15	36	7.80
Sweden	10	.-	.-	10
United Kingdom	10	4.75	12	8.57
United States	10	.-	9	10

Table 6
Regressions with grouped data

The table reports minimum chi-square estimates for the probability of owning the house of residence. Cells are constructed for each age, year and country of the international dataset. The weights in the regressions are $w_i = \sqrt{\left(\frac{n_i}{\hat{p}_i(1-\hat{p}_i)}\right)}$, where n_i is the number of observations in each age-country-year cell and $\hat{p}_i$ the estimated probability of homeownership in each cell. Each regression includes a full set of fixed country effects. The regression in column (4) excludes Australia and Finland.

Variables	(1)	(2)	(3)	(4)
Age	.0780 (.0073)*	.0768 (.0073)*	.0813 (.0073)*	.0841 (.0077)*
Age ²	-.0011 (.0001)*	-.0011 (.0001)*	-.0012 (.0001)*	-.0013 (.0002)*
Age ³ /100	.0005 (.0001)*	.0005 (.0001)*	.0006 (.0001)*	.0006 (.0001)*
Year of birth	.0032 (.0004)*	.0025 (.0004)*	.0026 (.0004)*	.0027 (.0005)*
No. of adults	.0272 (.0099)*	.0231 (.0010)*	.0189 (.0100)	.0222 (.0104)*
No. of children <18 years	.0233 (.0080)*	.0244 (.0080)*	.0197 (.0080)*	.0162 (.0085)
Two earners	-.0588 (.0231)*	-.0466 (.0233) *	-.0660 (.0237)*	-.0821 (.0252)*
More than two earners	-.0821 (.0283)*	-.0711 (.0284)*	-.0760 (.0284)*	-.0794 (.0318)*
Couple	.2337 (.0216)*	.2262 (.0217)*	.2400 (.0219)*	.2206 (.0227)*
Education (middle)	.0589 (.0175)*	.0571 (.0174)*	.0666 (.0175)*	.0604 (.0194)*
Education (high)	.0478 (.0303)	.0357 (.0305)	.0099 (.0310)	.0164 (.0340)
Downpayment ratio		-.1612 (.0483)*	-.3966 (.0754)*	-.4229 (.0783)*
Downpaym. Ratio×Age			.0048 (.0012)*	.0058 (.0013)*
No. of observations	2117	2117	2117	1984
R ²	.881	.882	.883	.870

Table 7
Probit regressions

The table reports probit regressions for the probability of owning the house of residence using household level data. Rather than the original coefficients, we report the probability change due to a partial change in each independent variable dF/dx (standard error). For dummy variables dF/dx is for a discrete change from 0 to 1. The regression in column (4) excludes Australia and Finland. Each regression includes a full set of fixed country effects. Excluded attributes are one-earner and low education.

Variables	(1)	(2)	(3)	(4)
Age	.0770 (.0016)	.0757 (.0016)	.0756 (.0016)	.0718 (.0018)
Age ²	-.0011 (.0000)	-.0011 (.0000)	-.0011 (.0000)	-.0010 (.0000)
Age ³ /100	.0005 (.0000)	.0005 (.0000)	.0005 (.0000)	.0005 (.0000)
Year of birth	.0029 (.0002)	.0014 (.0002)	.0014 (.0002)	.0018 (.0002)
No of adults	.0287 (.0014)	.0281 (.0014)	.0280 (.0014)	.0270 (.0015)
No of children <18 years	.0190 (.0009)	.01924 (.0009)	.0193 (.0009)	.0194 (.0010)
Two earners	.0702 (.0020)	.0714 (.0020)	.0712 (.0020)	.0693 (.0022)
More than two earners	.0740 (.0036)	.0763 (.0036)	.0761 (.0036)	.0753 (.0041)
Couple	.2248 (.0023)	.2241 (.0023)	.2244 (.0023)	.2288 (.0025)
Education (middle)	.0600 (.0021)	.0596 (.0021)	.0597 (.0021)	.0615 (.0023)
Education (high)	.0770 (.0022)	.0763 (.0022)	.0762 (.0022)	.0740 (.0026)
Downpayment ratio		-.3410 (.0231)	-.4156 (.0379)	-.4910 (.0399)
Downpaym. ratio×Age			.0015 (.0006)	.0035 (.0006)
No. of observations	400,442	400,442	400,442	329,713

Table 8**Correlation matrix between indicators of housing finance and of judicial efficiency.**

The table reports the correlation coefficients between the country fixed effects estimated in the probit regression in column (3) of Table 7, mortgage maturity and indicators of judicial efficiency and enforcement costs. The definition of the variables is reported in Tables 4 and 5. One star indicates correlation significant at the 5 percent level.

	Country fixed effects	Mortgage maturity	Judicial efficiency	Legal expenses	Duration	Rule of law
Country fixed effects	1					
Mortgage maturity	-0.705*	1				
Judicial efficiency	-0.029	0.439	1			
Legal expenses	0.066	-0.375	0.371	1		
Duration	0.214	-.680*	-.811*	0.512	1	
Rule of law	0.053	0.371	.825*	0.202	-.692*	1

Figure 1

Individual countries homeownership profiles

This descriptive figure reports age-profiles of homeownership in the 14 countries of the international dataset. Each profile is obtained by the fitted values of a probit regression of homeownership on a third-order age polynomial. The country datasets are aggregated over all years. The observations used to fit the probit regressions are reported in Table 1.

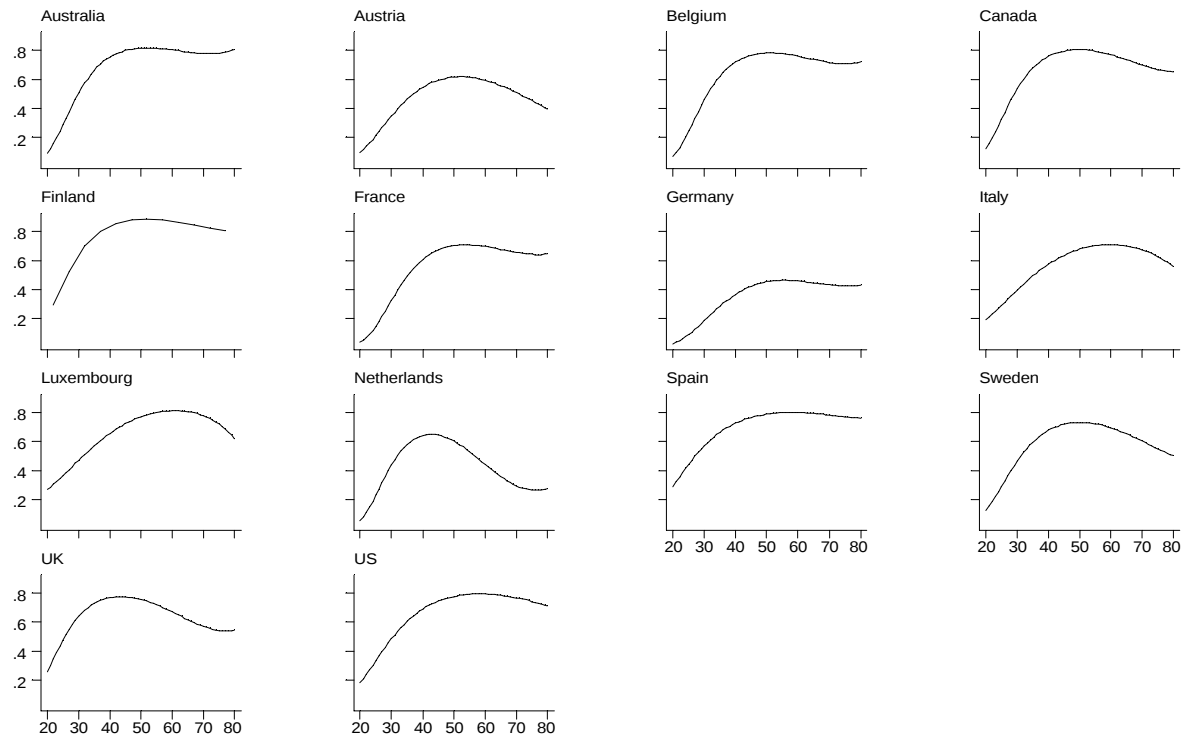


Figure 2

**Age profile of homeownership profiles for various levels of the downpayment ratio:
Grouped data regressions**

The figure plots the age profile of homeownership. This profile is the same in all countries as implied by regression (3) in Table 6 with grouped data. Except for the downpayment ratio, the predicted values of the regression are evaluated at the sample mean of each of the explanatory variables.

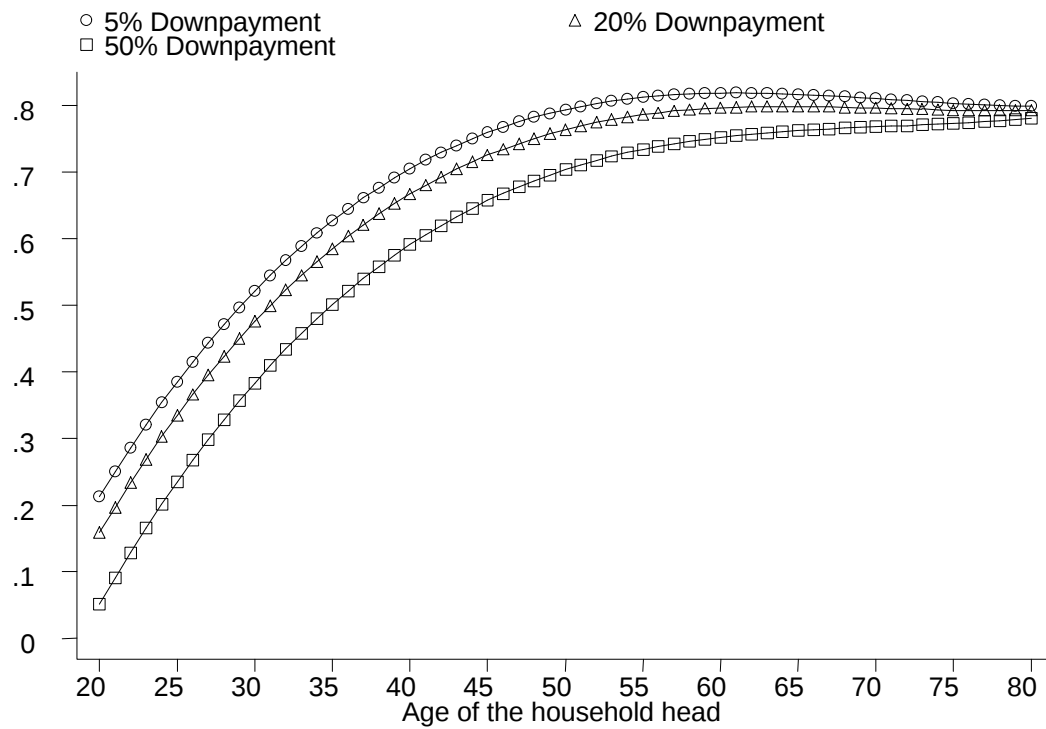


Figure 3

**Age profile of homeownership profiles for various levels of the downpayment ratio:
Probit regressions**

The figure plots the age profile of homeownership. This profile is the same in all countries, as implied by the probit regression (3) in Table 7. Except for the downpayment, the age profile is evaluated for a couple with one earner, middle education, living in the United States.

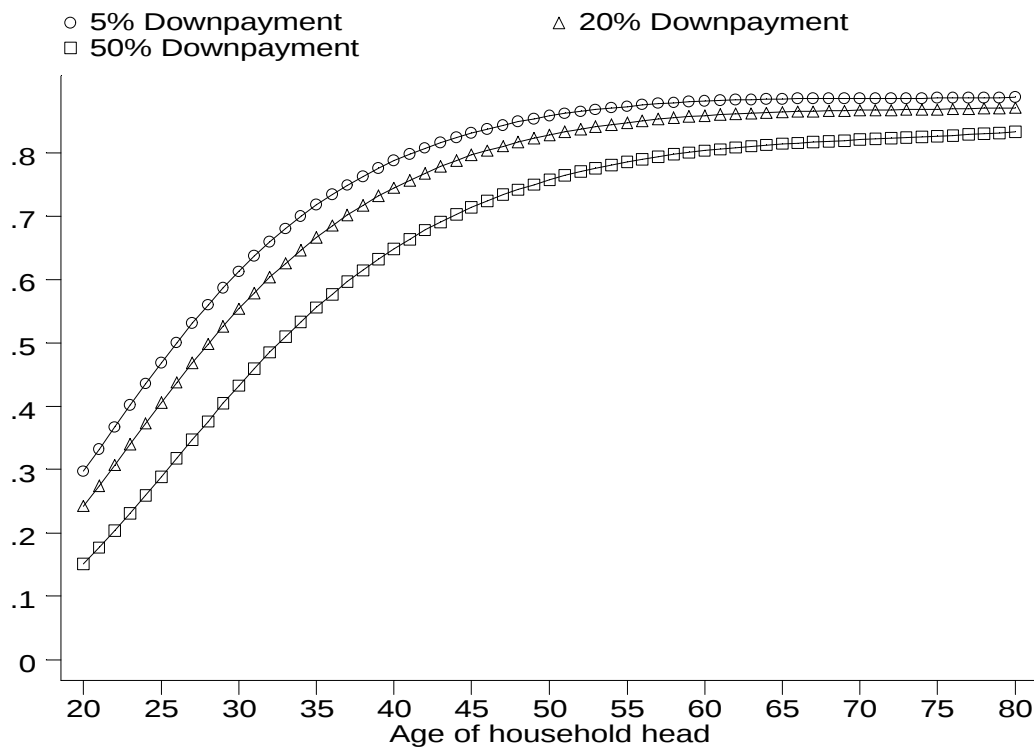


Figure 4

**Age profile of homeownership profiles for various levels of the downpayment ratio:
Grouped data regressions with time effects**

The figure plots the age profile of homeownership. This profile is the same in all countries as implied by a regression similar to (3) in Table 6 or (3) in Table 7, but substituting the year-of-birth variable with time dummies. Except for the downpayment ratio, the predicted values of the regression are evaluated at the sample mean of each of the explanatory variables.

