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Maria Concetta Chiuri* **and Tullio Jappelli****

Abstract

We explore the determinants of the international pattern of home ownership using the Luxembourg Income Study (LIS), a collection of microeconomic data on fourteen OECD countries. In most, the cross-section is repeated over time and includes several demographic variables carefully matched between the different surveys. This allows us to construct a truly unique international dataset, merging data on more than 400,000 households with aggregate panel data on mortgage loans and down payment ratios. After controlling for demographic characteristics, country effects, cohort effects and calendar time effects, we find strong evidence that the availability of mortgage finance – as measured by outstanding mortgage loans and down payment ratios – affects the age-profile of home ownership, especially at the young end. The results have important implications for the debate on the relation between saving and growth.

Keywords: home ownership, financial markets
JEL Classification: G2, R2.

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1. Introduction

The timing of home purchase varies significantly by country. In Australia, Canada, the United States and the United Kingdom, for instance, homes are purchased early in life and the age-profile rises sharply already at young ages. In other countries (such as Austria, Italy and Spain) homes are purchased later on and the average age at first purchase is in the late thirties or forties. This paper represents the first systematic attempt to account for these differences. There are a variety of reasons why the age profile of home ownership may differ across countries, such as household composition, house prices and tax incentives. We try to control as much as possible for these factors but focus primarily on the possible role of the availability of finance and of credit market imperfections.

Up to now, international comparisons of housing markets have relied on simulation studies or aggregate data. Hayashi, Ito and Slemrod (1988) use simulations to show that differences in home mortgage down payment ratios explain some of the difference in saving rates estimated in the United States and in Japan, while the different tax treatment of home ownership plays only a minor role. MacLennan et al. (1999) give a set of useful statistics on European housing markets and speculate that asymmetries in market structure, institutions and tax policies not only affect the degree of competition, but can also have far-reaching implications for macroeconomic policy.

The main contribution of this paper is its exploitation of a large international dataset to study the determinants of housing tenure. The sample of households is a collection of 39 individual national surveys spanning almost 30 years and 14 countries, with a total of over 400,000 observations. Home ownership and age are observed in all of them, along with other appropriately matched demographic variables. Our dataset is then merged with country panel data on indicators of access to housing finance markets (the ratio of mortgage lending to GDP and the down payment ratio). Given the richness of the dataset, we can estimate the age profile of home ownership controlling for individual country effects, time (or cohort) effects, demographic variables, proxies for permanent income and mortgage market indicators.[1]

Understanding the reasons for the difference in the age profile of home ownership has important policy implications. If the main reasons why the profiles differ can be traced to supply-side factors – e.g., mortgage market imperfections – then the integration of European credit markets will induce dramatic changes in each country's housing and mortgage markets and in the age pattern of home ownership. If instead the main source of international differences is demand-side effects (such as household formation and composition), or to intergenerational networks operating on a different scale across countries, then the impact of financial markets integration will be far less powerful.

In Section 2 we review various reasons why the age profile of home ownership may vary across countries. Above all we deal with some institutional features of housing finance

[1] Deaton (1999) has recently pointed out the importance of merging household surveys from different countries in order to test formally for the impact of institutional differences. This paper represents an attempt to work in this direction.

markets. We uncover substantial international differences in the size of the mortgage market and in down payment ratios. In speculating as to their sources, we single out judicial efficiency, asymmetric information between borrowers and lenders, and regulation. Section 3 presents the microeconomic data set and the characteristics of the sample. In the empirical analysis we focus on basic demographic variables (age, marital status, household composition, education); we are therefore confident that the various surveys are broadly comparable, across years as well as across countries. The heart of the paper is Section 4, which presents our econometric estimates and the predicted age profile of home ownership for various levels of mortgage lending/GDP ratios and down payment ratios. We find that access to financial markets increases the probability of becoming home owner at young ages, a result consistent with theoretical models of intertemporal choice, housing and credit constraints. Section 5 summarizes the evidence and sets out the main implications for the integration of European financial markets and the ongoing debate on the link between saving and growth.

2. International differences in housing finance markets

Our point of departure is the significant international differences in levels of home ownership and the timing of purchases. Figure 1 displays the age profile of home ownership in the fourteen countries surveyed: Australia, Austria, Belgium, Canada, Finland, France, Germany, Italy, Luxembourg, the Netherlands, Spain, Sweden, the United Kingdom and the United States. Each profile is based on household-level data and obtained by the fitted values of a probit regression of home ownership on a third-order age polynomial.[2] Individual country curves are differently shaped. In Italy and Austria, for instance, the proportion of owner-occupation rises slowly with age and peaks just before retirement. This contrasts sharply with the pattern in countries such as the United States, the United Kingdom, Canada and Australia, where peaks are ten or fifteen years earlier.

There are several possible explanations for the different patterns of home purchase shown in Figure 1. A first set of factors are genuine differences in the demographic composition of the population and in permanent income. For many households, the timing of household formation and the arrival of children coincide with plans to buy a house. Moreover, household resources are certainly correlated with the home purchase decision.[3] A second set of explanations discussed in Section 3 centers on sample selection issues.

What we are most interested in, however, is the interaction between the timing of home purchase and market imperfections that limit mortgage lending. Among the many possible

[2] Details about data definitions and consistency across countries are postponed to Section 3.

[3] One should also consider the possibility that household formation depends on the availability of housing and the potential endogeneity of several demographic variables with respect to the home purchase decision. For instance, the average age at marriage might be higher when couples cannot afford to buy a house. Although they are potentially important, we disregard these effects and consider demographic variables as exogenous.

indicators of mortgage market imperfections, the variables on which we focus are two related indicators of the availability of mortgage finance: first, simply the size of the mortgage market, as measured by the aggregate ratio of outstanding mortgage lending to GDP; second, the required down payment, which forces even impatient consumers to curb consumption early in life in order to accumulate enough assets to make the down payment (Artle and Varaya, 1978). This constraint is binding only if households have a preference for owning, as opposed to renting. In the theoretical literature, this is usually explained by assuming that a house yields higher utility when owned than when rented.[4] Thus, under very standard and reasonable assumptions, the timing of home purchase depends directly on the level of the down payment ratio: the lower the ratio, the earlier the purchase.

The main hypothesis that we test is whether, controlling for demographic factors, proxies for permanent income and national institutional features, the availability of credit and indicators of mortgage market imperfections (such as down payment constraints) affect the timing of home purchase.

Table 1 reports several indicators of housing finance markets for the 14 countries of our sample: the 1986-96 average of the ratio of outstanding mortgage loans to GDP, the spread between the mortgage rate and a long-term reference rate, the typical mortgage maturity, and the minimum down payment ratio (by decade). The down payment ratio refers to conventional home-purchase loans to first-time buyers.[5] In constructing the down payment 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). Since virtually no country has readily available yearly data on down payments, the implicit assumption is that the variable changes slowly over time. The Appendix gives more detail on the construction and definition of this variable.

Table 1 shows that mortgage markets differ widely from country to country. In Canada, the United States, the United Kingdom, Sweden and Finland, it is well developed, the down payment is relatively low, and mortgage maturity normally exceeds 20 years. In some other countries (Belgium, Italy, Germany and Spain) the market is relatively thin and the down payment high.

Cross-country variability in the volume of mortgage lending can be traced to supply factors (interest rate spreads and rationing) or demand factors (earnings profiles, age structure of the population, ownership preference, tax incentives for owning and debt, intergenerational

[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 eviction or rent increases; (2) tax incentives for owning; (3) there may be no alternative to owning because of imperfections and regulations in the rental market.

[5] In some countries there is no statutory minimum down payment ratio and payment arrangements are at the discretion of the individual lender. In that case we assume that the minimum down payment ratio equals the minimum observed average down payment ratio in the decade.

transfers). In the empirical analysis, we control for demand factors; accordingly we focus here on the supply side.

The spread between borrowing and lending rates is an important indicator of mortgage market imperfections. In itself, a spread is consistent with equilibrium models of the mortgage market (in which it depends on transaction costs and is negatively correlated with the supply of loans) or with asymmetric information models (in which there is no necessary relation). Among our 14 sample countries (Table 1) the differences in 1986-96 spreads are negligible, while the cross-country variation in mortgage lending is huge. The spread varies from –2.3 percentage points in Spain (a country with comparatively mortgage debt) to about 1.5 points in Italy and Austria (also with low levels of debt) and the United States (at the other end of the spectrum). In short, there is simply no correlation between the spread and the size of the mortgage market lending, which suggests that indicators of credit rationing may be more relevant than interest spreads.

The down payment ratio is a direct indicator of credit rationing; it exhibits considerable variability, both cross-country and over time. Table 1 shows that in the last three decades rationing has been most pervasive in Austria, Belgium, Germany, Italy, Luxembourg and Spain, and is directly reflected in the relatively small size of these countries' mortgage markets. The table also shows that in most cases the down payment has declined, thanks to the easing of regulation and increased competition between intermediaries. But this does not hold for every country. In Sweden and the United States, the average down payment in the nineties was higher than in the eighties.

Even though it seems self-evident to think that high down payment ratios will affect the timing of home buying, this may not always be the case. Intergenerational transfers could ease the down payment constraint. There are two ways in which such transfers interact with the desire to acquire a home. If transfers help households to meet the down payment, the "effective" and binding amount might be lower than reported in Table 1, because family networks can circumvent mortgage market imperfections.[6] 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 down payment.[7] Thus, the effect of the down payment on the timing of purchase is not a priori obvious, making the empirical analysis more interesting and informative.

Although the down payment constraint can be regarded as an indicator of credit rationing, it is also a mortgage contract term that is chosen by lenders and therefore it itself depends on incentives to repay debt obligations and institutional design. Thus one may wonder why down payment requirements differ so greatly. Jappelli and Pagano (1994) focus on three main explanations: (1) *regulation* of minimum down payment requirements, (2) *asymmetric*

[6] While a network of informal markets may overcome housing finance imperfections, to be effective transfers have to be well timed. They must come when they are needed, i.e. when credit constraints are binding. Bequests are very unlikely to serve this purpose: what is needed is *inter vivos* gifts or loans.

[7] Engelhardt (1994) and Guiso and Jappelli (1998) analyze the importance of this channel and find that *inter vivos* transfers reduce saving time in both the United States and Italy. From an economic point of view, however, the magnitude of this effect is not large.

information between borrowers and lenders, and (3) the *cost of enforcing contracts* and the *willingness to repay*.

The most obvious impact on lenders' behavior comes from regulation, which often simply imposes minimum down payment ratios for mortgage loans. These vary considerably between countries: until the eighties they were 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.

The extent of asymmetric information between borrowers and lenders can also affect mortgage market performance. In the United States, Canada, and the United Kingdom loan applications are processed rapidly because specialized credit reference agencies report the credit histories of all applicants and creditors share information. 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 is potentially greater (Jappelli and Pagano, 1999). In the presence of severe information problems, lenders protect themselves with larger down payment ratios.

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

Table 2 evaluates the efficiency of the judicial system and the willingness to repay debt obligations in the different countries. The indicators of "judicial efficiency" and "rule of law" capture different degrees of willingness to repay. Though they are fairly crude, they could be taken as a proxy for moral hazard problems for lenders. We also focus on proxies for enforcement costs in mortgage markets, i.e. the average length of housing mortgage foreclosure proceedings and legal expenses as a percentage of the price of the mortgaged house. Unfortunately, these indicators are available only for the 1980s and are averaged over time.

On the basis of these indicators, Belgium, Germany, Italy and Spain feature less efficient judicial systems and lengthier duration of mortgage foreclosure.[8] The Italian case in particular stands out. Due to the slowness of its judicial process, debt collection and repossession can be very costly 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 price. At the other extreme, the Netherlands, Canada, and the United States feature high judicial efficiency and a quick mortgage foreclosure process.

Figure 2 plots the ratio of mortgage lending to GDP against two indicators reported in Table 2 (judicial efficiency and duration of foreclosure). The size of the mortgage market correlates positively with judicial efficiency and negatively with duration: that is, the

[8] The variables in Table 2 are closely inter-related. For instance, legal expenses and foreclosure duration are positively correlated. Judicial efficiency correlates negatively with duration. Rule of law correlates positively with judicial efficiency and negatively with duration.

countries with better judicial systems are also those that feature the deepest mortgage markets. Figure 3 suggest that judicial efficiency is negatively and duration positively correlated with down payment ratios. This descriptive evidence suggests that enforcement problems may be at the roots of the international differences in mortgage lending and in down payment ratios.

Here we focus primarily on international differences in the size of the mortgage market and in down payment ratios, but one might want to consider several other factors. Almost everywhere there is significant government involvement in mortgage lending, either directly or through tax incentives (EC Mortgage Federation, 1990; MecLennan et al., 1999). Subsidies for home ownership and direct government intervention (such as social housing programs) are also important, as are the tax treatment of property and the regulation of rental markets. Finally, macroeconomic factors and the business cycle can also have impact. We cannot control explicitly for all these variables, but in our econometric model we consider them assuming that they are captured by country fixed effects and calendar time effects.

3. The international data set

The Luxembourg Income Study (LIS) is a research project by CEPS-INSTEAD to enhance international comparability among twenty-five different household surveys. The main focus is on income and taxation, and to date the 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 home ownership. Wealth and consumption data are generally lacking or difficult to compare internationally. Since we use only the basic demographic variables we can refer mostly to the original surveys without need of further corrections or imputations.

We concentrate on a group of fourteen relatively homogeneous countries excluding, for instance, such transition economies as Poland and Russia, which feature housing subsidies and mortgage markets that are fundamentally different from those of the market economies. Other countries are excluded for lack of data on significant demographic variables, home ownership, or down payment ratios.

The sample period spans three decades overall. In all the countries selected except Luxembourg and Austria the cross-section is repeated over time, providing an opportunity to exploit the time-variability of home ownership and differences between households and countries. The earliest surveys are for the United States (the 1974 CENSUS) and Canada (the 1975 Survey of Consumer Finances), the latest ones for 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 cases the survey design has changed (as in Germany, before and after re-unification). In the Netherlands we rely on two different surveys (the 1983 and 1987 Supplementary 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 unique international dataset for 400,000 households. Table 3 gives the sources and the total number of observations for each country. The number of surveys varies (only one in Luxembourg and Austria and four in the United States, Australia and the Netherlands). There is also considerable variability in the number of

observations. 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).

We carefully matched variables in all the selected surveys to create an unbalanced, repeated cross-sectional dataset. The demographic variables that we were able to match are ownership status (owner or renter), household size, number of earners, a dummy for couples, age, gender and educational level of the household head. The matching process is detailed in the Appendix. The main problem was to recode education. In the original surveys the education variable sometimes appears as years of education, in other cases as the highest degree attained, in others still as age at completion of education. We decided to recode into three levels (low, middle and high), based on the 7 categories defined by the International Standard Classification of Education (ISCED, 1997). Full details are given in the Appendix.

Any study that uses microeconomic data must have a definition of the household and of the head of household. These problems are more difficult when one uses repeated cross-sectional data and especially data in different countries. The definition that we use is mainly taken from the original surveys, where the determination of the head is sometimes left to the respondent, but is usually income-based. However, whenever in the original surveys the head is a female and the spouse is a male, we define the head to be the male.[9] During the years spanned by our sample (1974-95), household composition changed considerably in all countries examined. Because of the increase in the number of single persons and the decline in fertility, all countries in Table 4 (except Belgium) experienced a decline in the average number of household members.

Table 5 reports the proportion of household heads in six age brackets in each country (country surveys are aggregated over time). The age distribution of heads is concave in all countries, with cells generally containing 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 (4.16 and 5.39 percent, respectively). This difference does not only reflect differences in the age structure of the population. Rather Italians and Spaniards young adults tend to live with their parents well beyond the age of 25, owing to higher unemployment and more difficult access to independent living arrangements (either rent or purchase). Furthermore, since independent young households in these two countries are, on average, richer sample selection may be correlated with wealth and hence with home ownership.[10] A related problem is the use, in the empirical analysis, of the age of the head to describe the behavior of the household. In nuclear households this is not a bad assumption, but when co-residence of relatively mature young adults with their parents is widespread, as in Italy and Spain, the age of the "household" is not a well-defined concept.

The proportion of homeowners in each age bracket is reported in Table 6, which reproduces the patterns described in Figure 1 and signals substantial differences in the level and timing of home ownership across countries. As far as the level is concerned, Austria,

[9] Details are given in the Appendix.

[10] For this reason, we dropped the households with head younger than 25 years.

France, Germany and the Netherlands feature relatively low ownership rates. For timing, in Finland and in the United Kingdom ownership is already widespread in the first age bracket. In these two countries and in Australia, Canada, Sweden and the United States the bulk of home purchases are made in the head's early or mid-30s. In other countries (such as Austria and Germany) there is a gradual increase. In Spain the proportion of homeowners in the youngest age bracket is only apparently high, because the cell size is so small. In Finland and Sweden housing policies favor cooperative housing which we consider ownership. The profile is increasing up to age 40 in both countries, with a marked decline in Sweden after retirement age. Note also the wide difference between Belgium and the Netherlands. In Belgium home ownership is quite common even in old age, while in the Netherlands the elderly sell their homes after retirement and rely mainly on social renting.

The final step is to merge the microeconomic dataset with panel data on the mortgage-GDP ratio and on down payments.[11] Annual data on the mortgage-GDP ratio are readily available, but down payments are decade averages, so if for a particular country the survey is repeated in a given decade, we assign different values for mortgage lending, but the same value for the down payment ratio. That is, mortgage lending varies with each survey and country, while the down payment ratio varies by country and decade. But both are constant for all households surveyed in a particular year and country. From the point of view of individual households, the aggregate mortgage-GDP ratio and the average down payment ratio are truly exogenous variables. However, as we shall see, any inferences must take into account the special nature of our sample.

4. Empirical results

The main advantage of our approach over previous comparative studies of housing markets is that we can test the hypothesis that access to credit affects home ownership using microeconomic data and a truly exogenous proxy for imperfections.

The econometric model posits that the probability of buying a house for household *i* in country *c* and year *t* is a function of a third-order polynomial in age common to all countries, a set of demographic variables $X_{i,c,t}$ (education, household composition, number of earners, gender of household head, marital status), and indicators of access to mortgage finance $D_{c,t}$:

$$\Pr(H_{i,c,t}=1)=\alpha+f(age_{i,c,t})+\beta X_{i,c,t}+\delta_1 D_{c,t}+\delta_2\left(D_{c,t}\times age_{i,c,t}\right)+\gamma_c+\mu_t \qquad (1)$$

[11] The average home ownership rate 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 owner-occupation. This implies that households acquire homes even where the down payment is high, borrowing very little or not at all. We take this as indirect evidence that a high down payment affects the timing of home purchase, but does not discourage people from becoming home owners. Econometric evidence for this hypothesis is produced in Section 4.

The main hypothesis is that mortgage market imperfections affect the home ownership profile. We expect this effect to be greatest for the young, who lack collateral and must save up before they can buy. We thus interact the mortgage-GDP ratio and the down payment ratio (the *D* variables) with age.

The regression includes a full set of country effects γ_c (c=1,…C–1), and a full set of calendar time effects μ_t (t=1,…T–1). Time effects capture aggregate macroeconomic shocks, while country effects control for relevant institutional differences (such as taxation, access to social housing and rent controls). Equation (1) brings out that variables that are constant between countries or periods are not identified, because they are collinear with the fixed effects γ_c and μ_t. The reason why we can identify the effect of the mortgage-GDP ratio and of the down payment ratio is that they vary both across countries and over time.

The regression is estimated with grouped data, where each cell consists of an age/year/country observation. Demographic variables are constructed accordingly, so that for instance the variable "male" is the proportion of male-headed households at age *i* in year *t* and country *c*. In our final sample we have 1,917 cells on 14 countries in 17 different years. Since the sample is a collection of surveys from different countries, we need to take into account that observations might be positively correlated within each survey. This is an application of neighborhood effects induced by survey designs that are based on clusters of observations. The positive correlation between observations might inflate the standard errors (Deaton, 1997, p. 73–78). We therefore use a robust variance-covariance matrix assuming that observations between the different samples are independent, but not necessarily within each individual survey.[12]

While there is no strong theoretical justification for considering cohort effects in home ownership, they are potentially important because they can account for increases in productivity and resources across generations, hence for the common rise in ownership rates. As the separate effect of age, time and cohort cannot be estimated independently, however, in an alternative specification we drop the calendar time dummies and introduce a cohort effect θ_b as a separate regressor, where year of birth b=t–age:

$$\Pr(H_{i,c,t}=1)=\alpha+f(age_{i,c,t})+\beta X_{i,c,t}+\delta_1 D_{c,t}+\delta_2\left(D_{c,t}\times age_{i,c,t}\right)+\gamma_c+\theta_b \qquad (2)$$

In the empirical specification the cohort effect θ_b is tightly parameterized, but other functional forms (for instance, cohort dummies or higher order polynomials in year of birth) do not affect the results.

[12] Detailed information on clustering and stratification in single surveys is not available. We therefore proceed under the assumption that each of the 39 surveys is drawn randomly, and that individual errors are uncorrelated between different surveys and years. However, we control for country and calendar time fixed effects, thus allowing the error term to vary within each country and year.

The regression coefficients are reported in Table 7. The first column refers to the specification in equation (1) with year effects and uses the ratio of outstanding mortgage lending to GDP as an indicator of the availability of finance. Household size and the dummy for couples are positive and statistically different from zero. The largest impact is for a couple (an increase of 23 percentage points in the probability). The dummy for households with more than two income recipients is negative, while the coefficients of education and of male household heads are not statistically different from zero. Each of the three age coefficients is statistically different from zero at the 1 percent level.

The coefficient of the mortgage-GDP ratio is positive, statistically different from zero at the 1 percent level, and large in absolute value. The coefficient of the interaction term has an opposite sign, indicating that the derivative of the probability of owning with respect to the mortgage-GDP ratio is large and positive at young ages and falls with age.

The estimates in Table 7 do not consider that the various cells are estimated with different numbers of observations.[13] The error term is therefore heteroskedastic, and a more appropriate procedure might be weighted least squares using as weights $w_{i,c,t} = \left[\frac{n_{i,c,t}}{h_{i,c,t}(1-h_{i,c,t})} \right]^{\frac{1}{2}}$, where *n* is the number of observations and *h* the probability of ownership in each cell. Such a minimum chi-square estimator produces results that are qualitatively quite similar to those in Table 7. The coefficient of the mortgage-GDP ratio is 0.75 with a *t*-statistic of 3.1 and that of the interaction term is –0.015 with a *t*-statistic of –4.9.

Since the effect of age is non-linear, it is easier to interpret if we plot the predicted age profile (Figure 4). The figure also shows most clearly the effect of mortgage finance availability on the probability of home ownership. The profile is evaluated for three different values of the mortgage-GDP ratio (5, 20 and 50 percent). The size of the credit market tilts the profile. For the youngest age brackets, home ownership is some 20 percentage points higher in countries with a 50 percent mortgage-GDP ratio (close to the values of Sweden and the United States in the nineties) than those where the ratio is 5 percent (Italy in the seventies). The lines intersect at age 55, and then the pattern reverses. This result dovetails perfectly with a model in which credit market imperfections affect the timing of home acquisition.

In the second specification we add year of birth and drop the calendar time dummies, as in equation (2) (results are given in Table 7, column 2). The cohort effect is positive, with ownership increasing by 0.4 percentage points for each year of birth, regardless of country. Still, the two coefficients of the mortgage-GDP ratio are virtually unchanged, and the impact of mortgage availability is largest in the youngest age group.

The other two regressions of Table 7 replace the mortgage-GDP ratio with the down payment ratio. The sign and significance of the demographic variables do not change appreciably. The effect of the down payment is as expected and is plotted in Figure 5. Lowering it from 50 percent (as in Italy in the seventies) to 20 percent (as in France) or to 5

[13] The average number of observations in each cell is 192, but 5 percent of the cells are based on less than 50 observations (the minimum is 11) and 5 percent on more than 500 observations (the maximum is 1849).

percent (as in the United Kingdom in the nineties) increases the predicted probability by 15 or 20 percentage points, respectively. Also according to this specification, the down payment effect reverses its sign at older ages.

Given the potential endogeneity of headship in Italy and Spain, we repeat the estimations excluding these two countries from the analysis. In both specifications the effect of the demographic variables is essentially unaffected and the coefficients of implied effect of the mortgage-GDP ratio and of the down payment ratio on the probability of purchase and on the age-profile of ownership are unchanged.[14]

Before concluding, an important caveat is in order. As we repeatedly stress, our regressions do not consider explicitly some important determinants of home ownership. Such factors as housing policies (tax incentives for ownership, subsidies, rent control and social housing programs), labor market effects (migration and other determinants of the demand for housing) and genuine differences in owning/renting preferences certainly affect the housing market and the timing of home purchase. In our specification, the effects of these omitted variables are captured by fixed country effects. These fixed effects are no more than an admission of ignorance, because the variables that affect the demand for housing are difficult to measure and to compare across countries. In order to identify their effects, one would need time-varying regressors at the country level.

As an exploratory and descriptive analysis, we have considered the correlation coefficients of the estimated fixed effects with the proxies for judicial enforcement reported in Table 2. Our focus in this procedure is narrow. We wished to check whether the mortgage-GDP ratio and the down payment ratio are sufficient indicators for the effect of mortgage market imperfections, or whether we are missing important dimensions through which international differences in enforcement affect mortgage markets and hence home ownership. It turns out that in each of the specifications reported in Table 7 the correlation coefficients between the estimated country effects and the proxies for enforcement in Table 2 are not statistically different from zero. We take this descriptive evidence to indicate that the size of the mortgage market and the down payment ratio are the best suited statistic most likely to capture international differences in institutional and economic constraints in mortgage markets.[15]

[14] As a sensitivity check, we also exclude Australia and Finland from the sample. In these two countries age is reported in large bands and the age profile of home ownership is less reliable. The results are almost identical.

[15] Rule of law indicators are available also on a yearly basis from 1982 to 1995. However, for developed countries the time-variability of this variable is quite limited (and for some of the countries rule of law is actually a constant). Since rule of law is collinear with the fixed effects, if it is introduced as a separate regressor the estimated coefficient comes with a large standard error.

4. Conclusions

We have explored the determinants of home ownership 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 affect the age profile of home ownership, obliging young households to save and postpone home purchase until later in life. We find that in countries with deep mortgage markets the home ownership profile is much more tilted towards the young; and that lowering the down payment ratio by 30 percentage points (say, from 50 to 20 percent) would increase home ownership for young families by about 15 percentage points. This effect is attenuated and then reversed at older ages. These econometric results control for fixed country effects and calendar time effects and are robust with respect to the particular sample used.

The study has implications for housing markets in Europe. Many changes in mortgage rules have been made in the past decade: down payments have been lowered in many countries, restrictions on maturities abolished, legal costs reduced and second mortgages introduced. Credit reference agencies on households are now operating on a large scale. These changes have undoubtedly sharpened competition between lenders; credit terms for prospective home buyers will improve accordingly. The econometric estimates suggest that convergence of European mortgage markets will shift the ownership profile towards younger cohorts and at least temporarily prompt higher demand for home mortgages.

Our findings also have far-reaching implications for the literature on saving. Given a down payment constraint, the young must save before they can purchase a home. Deaton (1999) points out that this raises the aggregate wealth-income ratio and reinforces the link between saving and growth in finite-horizon models. The econometric estimates show that the down payment ratio is an important determinant of the timing of home purchase. Insofar as the distortion in the age-profile of home ownership translates into higher saving by the young, credit market imperfections become an explanatory factor for international differences in the aggregate saving rate.

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Data Appendix

1. The household head

The definition of head of 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. The specific definition of head is reported 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, either male or female in the case of a single adult 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: A definition of household head is not provided. However, the interviewer selects the reference person and this person provides information about other household members.

Germany: The 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 owner 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 eldest person.

Spain: The head of household is the person who contributes financially to the household on a regular basis and takes care of paying the bills, etc.

Sweden: The head of the family is the person with the highest earnings, including pensions. If a person is full-time self-employed he/she will be the head, irrespective of income level.

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 spouse), 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 of the same gender, the male.

United States: A family is defined as a group of two persons or more (one of whom is the householder or head) residing together and related by birth, marriage, or adoption.

2. Variables used in the estimation

AGE OF THE HOUSEHOLD HEAD. In Australia and Finland the surveys report selected age categories. In these cases, the age variable is recoded as the midpoint of the interval.

GENDER OF THE HOUSEHOLD HEAD. The variable is 1 for male head, 0 for females.

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

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

NUMBER OF EARNERS As a general rule, this variable is defined as the number of individuals with positive wages, salaries or income from self-employment.

EDUCATIONAL LEVEL OF THE HEAD The level of detail of this variable varies from survey to survey. In some cases the respondent reports years of education, in others the level of attainment in (approximate) years of education. In a few cases, the variable is reported as "age at completed education." We code the original variables as 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, often corresponding to the end of 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 that 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 into the three dummy indicators.

COUPLE The variable is 1if the head has a spouse or a cohabiting steady partner.

SELF-OWNED OR RENTED HOUSING Details available for home ownership 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.

OUTSTANDING MORTGAGE LOANS / GDP Mortgage loans refer to outstanding loans against mortgages on residential property. The main source for European countries between 1986 and 1996 is the European Mortgage Federation (1997), Table 14. For years before 1986 we impute a value for mortgage loans based on the growth rate of the series between 1986 and 1990. For Canada the source is the Statistics Flow of Funds Accounts. For the United States the source is the Federal Reserve Statistical Release (Flow of Funds Accounts). For Australia the source is the Bank of Australia Bulletin. Annual GDP is drawn from IMF Financial Statistics.

DOWN PAYMENT RATIO We update 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). Even though the down payment might have changed during a decade, where possible we take the average of the minimum ratios. We generally refer to conventional loans without mortgage insurance, government guarantees or subsidies. In some countries there is no statutory minimum down payment and payment arrangements are at the discretion of the individual lender. In that case we assumed that the minimum is equal to the minimum observed average down payment ratio in the decade.

TABLE 1

HOUSING FINANCE: AN INTERNATIONAL COMPARISON

The interest rate spread is the average interest rate on mortgage loans less a long-term reference rate. Source: European Mortgage Federation (1997), 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 GDP is drawn from IMF Financial Statistics. Mortgage maturity is drawn from Lea et al. (1997) and refers to 1990. The down payment ratios are average values for three decades (1971-80, 1981-90, and 1991-97). See Appendix for sources on mortgage loans and down payment ratios.

Country	**Outstanding mortgage loans / GDP**	**Interest rate spread**	**Mortgage maturity**	**Down payment ratio**		
				1971-80	**1981-90**	**1991-97**
Australia	19.30	-.-	-.-	30	20	20
Austria	4.24	1.52	20-30	40	40	20
Belgium	20.08	1.02	15-20	35	25	20
Canada	41.32	-.-	30	25	25	20
Finland	32.35	1.23	10-15	20	15	20
France	22.02	0.95	15-20	20	20	20
Germany	28.92	1.10	25-30	35	35	20
Italy	5.49	1.47	15	50	44	40
Luxembourg	25.61	-1.02	15-20	40	40	40
Netherlands	43.29	0.41	30	25	25	25
Spain	15.01	-2.30	15-20	40	20	20
Sweden	56.50	0.20	20-30	10	5	25
United Kingdom	51.87	1.08	25	19	13	5
United States	43.61	1.60	30	20	11	20

TABLE 2

EFFICIENCY OF THE JUDICIAL SYSTEM AND COSTS AND DURATION OF MORTGAGE FORECLOSURE PROCEEDINGS: 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 is 0 to 10, with lower scores indicating lower efficiency. Source: La Porta et al. (1997). 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 0 to 10 with lower scores for less tradition of law and order. Source: La Porta et al. (1997). Legal expenses as percent of the price of the mortgaged house and duration of mortgage foreclosure proceedings refer to 1990 and are drawn from European Mortgage Federation (1996). Data for duration in Austria, Canada, Luxembourg, and United States have been obtained by country experts.

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

TABLE 3

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 4

AVERAGE HOUSEHOLD SIZE

Country	Year	Household size	Country	Year	Household size
Australia	1981	2.70	Italy	1986	3.16
	1985	2.57		1991	3.09
	1989	2.55		1995	3.00
	1994	2.48			
Austria	1987	2.28	Luxembourg	1985	3.03
Belgium	1985	2.87	Netherlands	1983	2.77
	1988	3.00		1987	2.59
	1992	2.87		1991	2.50
				1994	2.54
Canada	1975	3.03	Spain	1980	3.73
	1981	2.98		1990	3.46
	1987	2.77			
	1991	2.56			
Finland	1987	2.87	Sweden	1992	2.27
	1991	2.75		1995	2.17
France	1984	2.82	UK	1986	2.60
	1989	2.77		1991	2.47
	1994	2.65		1995	2.49
Germany	1984	2.78	US	1974	2.90
	1989	2.70		1979	2.67
	1994	2.64		1986	2.62
				1991	2.60

TABLE 5

SAMPLE COMPOSITION BY AGE

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	25-29	30-39	40-49	50-59	60-69	70-79
Australia	10.69	23.34	22.92	15.69	13.14	14.21
Austria	10.03	20.06	17.68	14.58	18.91	18.74
Belgium	10.01	23.20	19.19	17.86	17.44	12.31
Canada	12.90	25.38	19.46	16.09	13.76	12.40
Finland	11.63	24.02	22.25	16.30	14.71	11.09
France	9.15	23.24	20.18	17.56	16.51	13.36
Germany	8.91	19.30	18.38	19.51	18.45	15.44
Italy	4.16	18.73	21.63	22.68	19.31	13.50
Luxembourg	8.60	22.59	21.33	19.50	13.94	14.04
Netherlands	10.80	25.06	20.31	14.96	15.69	13.18
Spain	5.39	19.63	21.99	22.32	18.71	11.95
Sweden	11.71	20.11	21.01	16.79	14.46	15.92
United Kingdom	10.02	21.84	20.11	16.29	16.80	14.94
United States	12.83	24.57	19.64	16.67	14.95	11.33

TABLE 6

HOME OWNERSHIP BY THE AGE OF THE HOUSEHOLD HEAD

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

Country	25-29	30-39	40-49	50-59	60-69	70-79	Average
Australia	33.74	60.27	75.46	82.37	81.69	79.98	70.06
Austria	23.46	43.49	48.63	52.62	52.22	37.88	44.32
Belgium	31.98	59.36	71.76	75.18	73.65	69.82	65.58
Canada	35.93	59.46	73.33	73.75	70.28	58.65	62.81
Finland	43.61	67.70	79.43	81.33	79.39	74.34	72.19
France	20.36	47.03	63.06	66.90	68.83	63.37	57.10
Germany	11.39	33.28	45.36	54.03	56.71	39.01	42.81
Italy	31.42	47.88	65.55	69.96	71.23	65.74	62.91
Luxembourg	39.71	54.18	71.35	75.89	81.66	67.94	66.60
Netherlands	33.50	55.16	61.65	55.78	38.92	24.00	47.57
Spain	48.10	67.57	76.53	78.66	79.81	76.55	74.33
Sweden	32.36	49.91	60.49	64.40	59.80	52.94	54.42
United Kingdom	59.05	70.62	76.30	74.99	66.40	56.92	68.56
United States	37.70	59.53	73.42	78.00	78.84	74.80	67.15

TABLE 7

GROUPED DATA REGRESSIONS

The table reports grouped data regressions for the probability of owning the house of residence. The number of cells used in the estimation is 1,917. T-ratios are reported in parenthesis. Standard errors are corrected for clustering.

Variable	With time Effects (1)	With cohort effects (2)	With time Effects (3)	With cohort effects (4)
Constant	–1.385 (–4.455)	–1.802 (–5.526)	–1.033 (–3.605)	–1.368 –(4.414)
Age	0.078 (3.890)	0.087 (4.374)	0.084 (4.026)	0.089 (4.320)
Age^2	–0.001 (–2.741)	–0.001 (–3.046)	–0.001 (–3.173)	–0.0014 (–3.345)
Age^3 (× 1,000)	0.005 (2.159)	0.005 (2.431)	0.006 (2.594)	0.007 (2.738)
Gender	0.129 (1.286)	0.140 (1.343)	0.053 (0.475)	0.063 (0.625)
No. of adults	0.032 (1.896)	0.032 (1.985)	0.025 (1.395)	0.025 (1.427)
No. of children <18 years	0.031 (1.733)	0.028 (1.513)	0.017 (0.933)	0.016 (0.850)
Two earners	–0.087 (–1.513)	–0.107 (–1.912)	–0.076 (–1.002)	–0.088 (–1.174)
More than two earners	–0.143 (–3.558)	–0.156 (–4.226)	–0.119 (–2.542)	–0.123 (–2.753)
Couple	0.231 (2.445)	0.213 (2.061)	0.203 (2.224)	0.186 (2.054)
Education (middle)	0.085 (1.411)	0.079 (1.590)	0.108 (1.837)	0.101 (2.124)
Education (high)	–0.061 (–0.801)	–0.014 (–0.205)	–0.084 (–1.041)	–0.039 (–0.583)
Mortgages-GDP	0.918 (3.972)	0.860 (3.243)		
Mortgages-GDP×Age	–0.016 (–5.081)	–0.016 (–4.951)		
Down Payment Ratio			–0.839 (–2.669)	–0.851 (–3.047)
Down Payment Ratio×Age			0.014 (3.216)	0.014 (3.090)
Year of birth		0.004 (3.527)		0.004 (2.704)
Country Effects	YES	YES	YES	YES
Time Effects	YES	NO	YES	NO
R squared	0.83	0.82	0.79	0.78

FIGURE 1

INDIVIDUAL COUNTRIES HOME OWNERSHIP PROFILES

The figure reports age profiles of home ownership in the 14 countries surveyed. Each profile is obtained by the fitted values of a probit regression of home ownership on a third-order age polynomial. Surveys in each country are aggregated over all years.

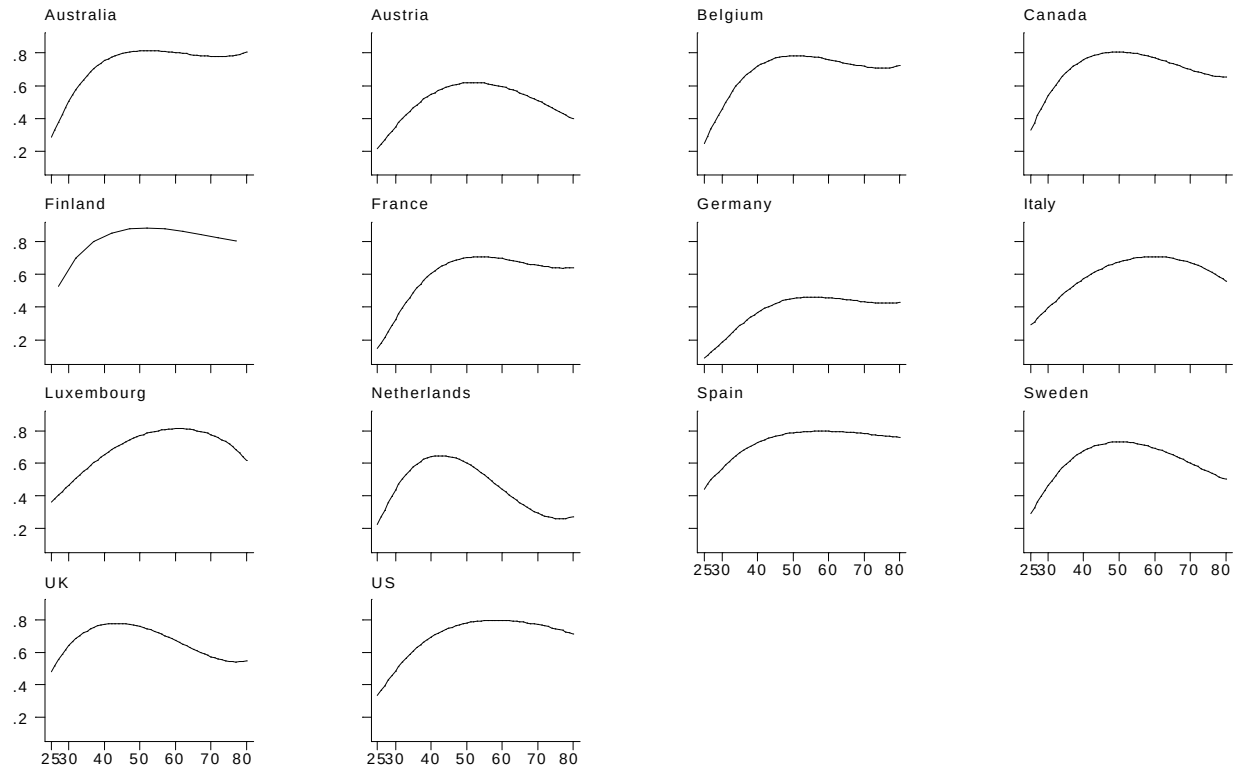
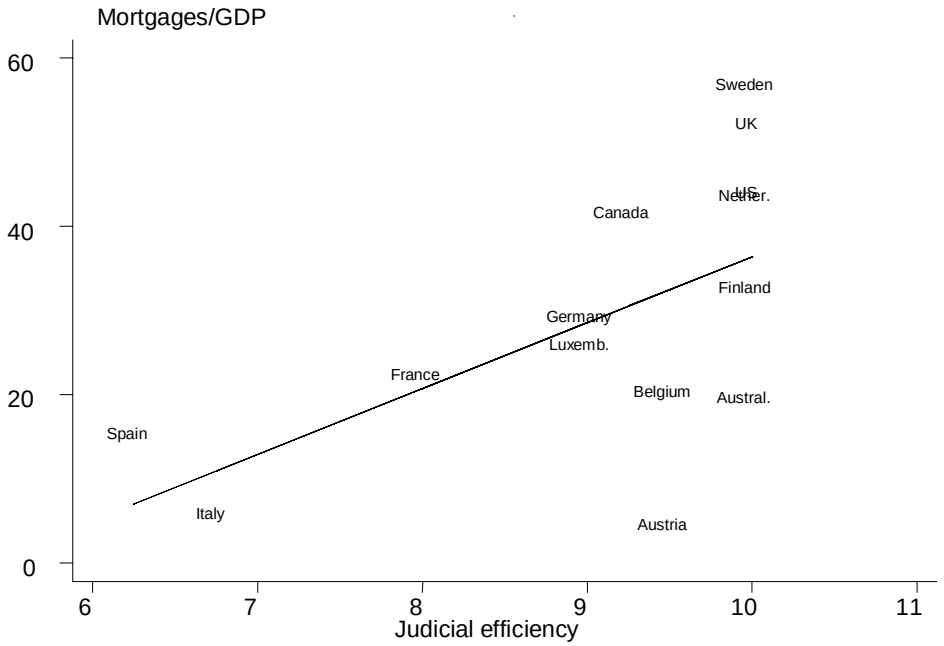


FIGURE 2

MORTGAGE LOANS, JUDICIAL EFFICIENCY AND DURATION OF MORTGAGE FORECLOSURE PROCEEDINGS

The figures plot the 1986-96 average of outstanding mortgage loans as a percentage of GDP against judicial efficiency and duration of mortgage foreclosure proceedings. Data and sources and definitions are reported in Tables 1 and 2.



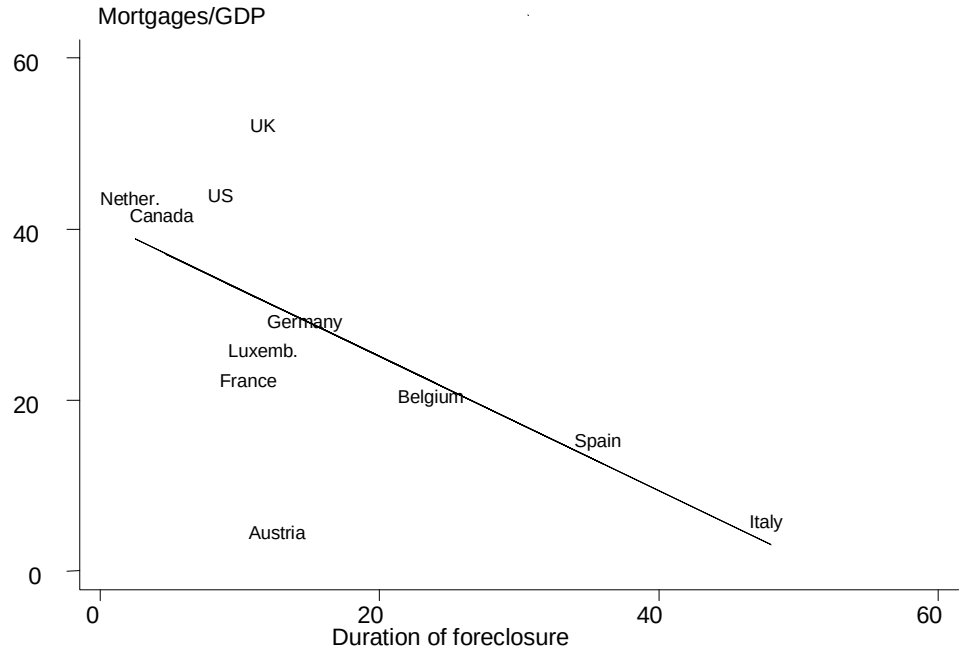
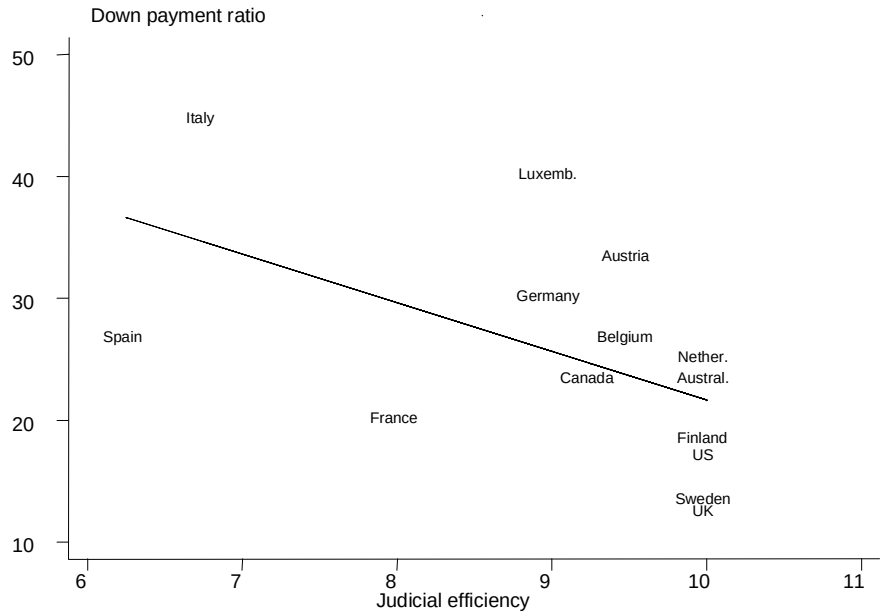


FIGURE 3

DOWN PAYMENT RATIO, JUDICIAL EFFICIENCY AND LENGTH OF MORTGAGE FORECLOSURE

The figures plot the average down payment ratio against respectively judicial efficiency and length of mortgage foreclosure. The down payment ratio is averaged over all years. Data and sources and definitions are reported in Tables 1 and 2.



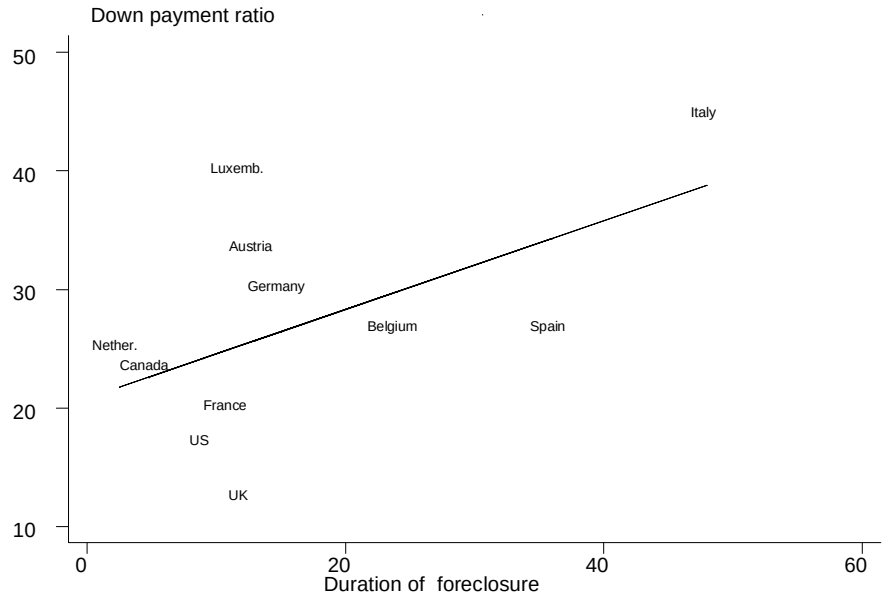


FIGURE 4

AGE PROFILES OF HOME OWNERSHIP FOR VARIOUS MORTGAGE/GDP RATIOS: REGRESSION WITH TIME EFFECTS

The figure plots the age profile of home ownership. The profile is based on regression 1 of Table 7. Except for the ratio of outstanding mortgages to GDP, the predicted values of the regression are evaluated at the sample mean of each of the explanatory variables.

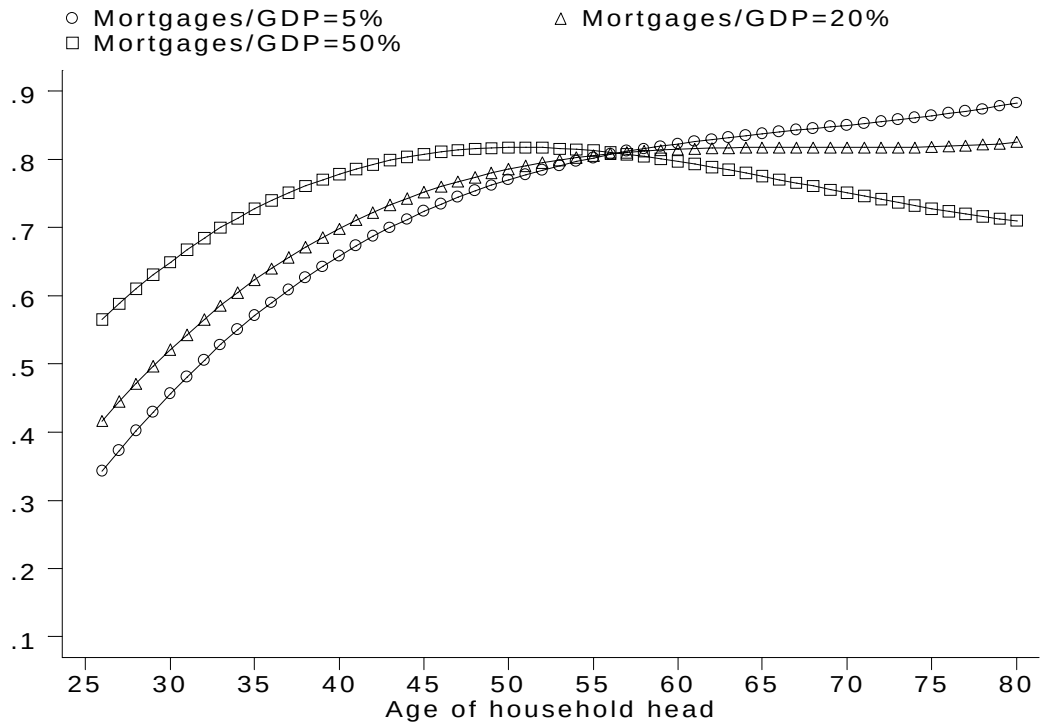


FIGURE 5

AGE PROFILES OF HOME OWNERSHIP FOR VARIOUS DOWN PAYMENT RATIOS: REGRESSION WITH TIME EFFECTS

The figure plots the age profile of home ownership. The profile is based on the regression reported in column 3 of Table 7. Except for the down payment ratio, the predicted values of the regression are evaluated at the sample mean of each of the explanatory variables.