ELSEVIER

European Economic Review 47 (2003) 857–875

EUROPEAN ECONOMIC REVIEW

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Financial market imperfections and home ownership: A comparative study

Maria Concetta Chiuri[a,b,*], Tullio Jappelli[b,c]

[a] *Department of Economics, Università di Bari, via C. Rosalba 53, 70124 Bari, Italy*
[b] *CSEF, Department of Economics, Università di Salerno, Fisciano (Salerno) 84084, Italy*
[c] *Center for Economic Policy Research, London, UK*

Abstract

We explore the determinants of the distribution of owner occupancy rates across age groups using a collection of microeconomic data on 14 OECD countries. In most, the survey is repeated over time. This allows us to construct an international dataset, merging data on 39 national household surveys with aggregate data on down payment ratios. We find strong evidence that the availability of mortgage finance – as measured by down payment ratios – affects the distribution of owner occupancy rates across age groups, especially at the young end. The results are consistent with previous theoretical models and have important implications for the debate on the relation between saving and growth.

JEL classification: G2; R2

Keywords: Home ownership; Financial markets

1. Introduction

The owner occupancy rate of young households varies significantly by country. In Australia, Canada, the United States and the United Kingdom, for instance, homes are purchased early in life and the owner occupancy rate is already high at young ages. In other countries, such as Austria, Italy, Japan and Spain, homes are purchased later on and the average age at first purchase is in the late 30s or 40s.

From the individual's point of view, tenure choice is determined by permanent income, the cost of owning relative to renting and demographic variables. Due to

* Corresponding author. Tel.: +39-080-5049340; fax: +39-080-5049149.
E-mail address: mc.chiuri@dse.uniba.it (M.C. Chiuri).

0014-2921/03/$ - see front matter
PII: S0014-2921(02)00273-8

asymmetric information and other credit market frictions, lenders often require equity contributions from borrowers when granting a home mortgage loan. Thus, besides permanent income, also accumulated savings in the form of liquid wealth to be used as down payment is an important factor determining the timing of home purchase. In the real estate literature, there is in fact substantial evidence that the down payment affects mortgage availability and the timing of home purchase of young individuals, at least in the US, see for instance Duca and Rosenthal (1994) and Haurin et al. (1997).

Only recently the literature has examined the macroeconomic impact of down payment constraints. Ortalo-Magné and Rady (1998, 1999) show that, in the absence of a bequest motive, a higher down payment ratio reduces the equilibrium distribution of the owner occupancy rate of the young generation. Their model implies that in countries with tighter credit markets (e.g., with a higher down payment) one should observe lower levels of owner occupancy rates among the young than in countries where credit is more easily available. This hypothesis is the main focus of the paper.

Prior studies have relied on simulation results or descriptive comparisons to analyze the effect of international differences in home mortgage down payment ratios. Hayashi et al. (1988) use simulations to show that differences in down payment ratios explain some of the difference in saving rates between the United States and Japan, while the different tax treatment of home ownership plays only a minor role. Boleat (1987) and Lea et al. (1997), among others, point out that different regulations across countries affect the development of mortgage markets and the availability of housing. 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 on macroeconomic policy. No study, however, has provided econometric evidence linking the down payment constraint to the international differences in owner occupation rates.

The paper uses data from a collection of 39 individual national surveys spanning almost 30 years and 14 countries. To control for selection issues and for the endogeneity of co-residence arrangements the focus is on *individuals* (not *households*) aged 26–55, with a total of almost 300,000 observations. For each individual, we observe age, gender, homeownership status, and education. The data set is then merged with panel data on the down payment ratio, taken as the most comparable indicator of mortgage availability across countries. Given the structure of the data set, in some specifications we can estimate the effect of the down payment ratio on the occupancy rates of various age groups controlling also for country and time effects. [1]

Understanding the reasons for the difference in the occupancy rates of various age groups has important policy implications. If the main reasons why the occupancy rates differ can be traced to mortgage market imperfections, then the integration of European credit markets will induce dramatic changes in each country's housing and

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

mortgage markets and in the age pattern of home ownership. If instead the main source of international differences is due to demand 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 owner occupancy rates vary across age groups and countries, and uncover substantial international differences in down payment ratios. In speculating as to the sources of such differences, we single out regulation and different degrees of judicial enforcement. Section 3 presents the microeconomic data set and the important distinction between households and individuals on which we base the empirical analysis. The heart of the paper is Section 4, which presents econometric estimates of the effect of the down payment ratio on the owner occupancy rates in three age groups (26–35, 36–45, and 46–55). We find that a lower down payment is associated with a higher occupancy rate of the young, and has no effect on that of the middle aged, consistent with the theoretical model of Ortalo-Magné and Rady (1998, 1999). 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. Housing finance and the age distribution of owner occupancy rates

Our point of departure is the significant international differences in levels of owner occupancy rates by age. Fig. 1 displays the age profile of home ownership between age 26 and 55 in the 14 countries surveyed. Each profile is based on individual data aggregated by age groups and is obtained by the fitted values of a regression of home ownership on a third-order age polynomial.[2]

Individual country curves are differently shaped. In Australia, Canada, the UK and the US, for instance, the proportion of owner occupation at age 25 is already 30 percent or higher, reaches 60 percent at age 35 and flattens out after age 40. Scandinavian countries such as Sweden and Finland have similar shapes. This contrasts sharply with the pattern of Italy, Belgium, France and Spain, where owner occupancy rates at age 25 are very low (10 percent or less) and the profile increases slowly through age. The proportion of homeowners in Germany, Austria and the Netherlands at young ages is also relatively low, reflecting the overall low level of owner occupancy rates, not exceeding 60 percent even after age 50.

Among the many possible factors affecting the age distribution of ownership across countries, the paper focuses on the required down payment ratio, which forces even impatient consumers to curb consumption early in life in order to accumulate enough assets to qualify for a home purchase (Artle and Varaya, 1978). This constraint is binding 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

[2] Details about data definitions are postponed to Section 3.

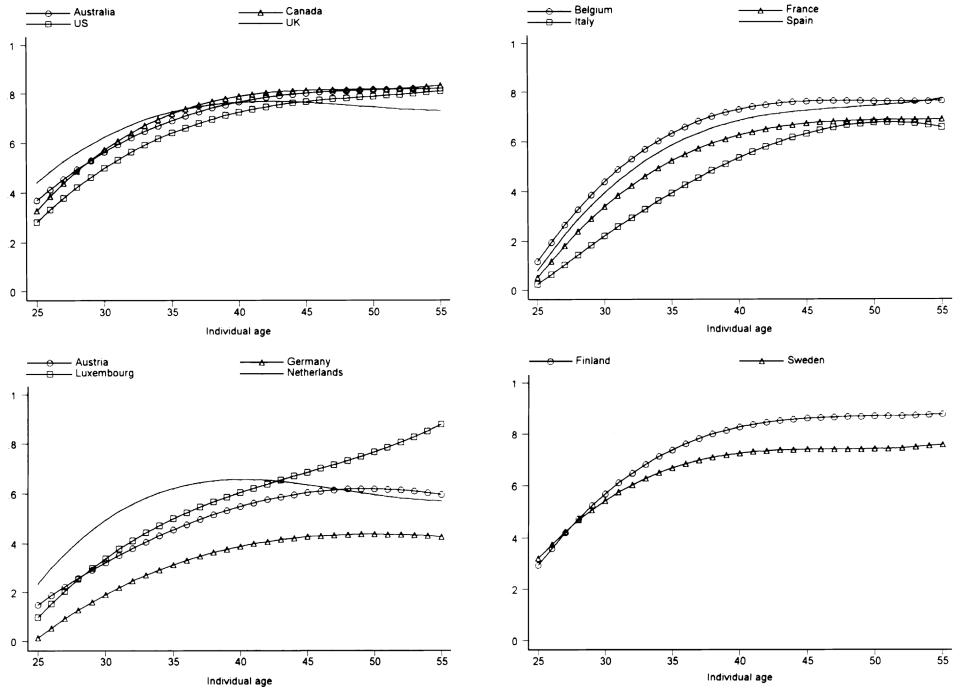

Fig. 1. Individual countries home ownership profiles. Surveys in each country are aggregated over all years.

utility when owned rather than when rented.[3] Thus, under very standard and reasonable assumptions, for a given household with a given wealth, the timing of home purchase depends directly on the level of the down payment ratio: the lower the ratio, the earlier the purchase.

Even though it seems self-evident that for an individual with a given wealth the down payment affects the timing of home buying, it is not straightforward to show that the down payment distorts also the *overall distribution of properties across age groups*. A key reference to account for differences in such distribution is Ortalo-Magné and Rady (1998, 1999), who consider a model of the housing market with income heterogeneity and an exogenous down payment constraint where individuals with finite horizons and no bequest motive choose housing and non-housing consumption over the life cycle. The model makes sharp predictions about the effect of a change in the down payment constraint. In particular, a financial liberalization allows young agents to acquire a home, thereby increasing the house price and affecting the equilibrium distribution of owner occupancy rates across age groups.

[3] 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.

Empirically, the model is consistent with the UK evidence, where the credit market liberalization of the 1980s was associated with a marked increase in the owner occupancy rates of the young relatively to the old and a boost in house prices. Comparing regimes with different down payments, the model therefore implies that in countries with more liberal credit markets one should observe an age distribution of owner occupancy rates more tilted towards the young.

In a more general framework, however, offsetting factors could be at work. A down payment constraint can also affect labor supply (inducing people to work harder) or the timing of marriage. Intergenerational transfers also interact with the desire to acquire a home. If transfers help households to meet the down payment, the constraint might not be binding, because family networks can circumvent mortgage market imperfections.[4] Engelhardt and Mayer (1998) and Guiso and Jappelli (2002) analyze the importance of this channel and find that some households do indeed receive gifts, and that inter vivos transfers reduce the timing of home purchase in both the United States and Italy. Similarly, if young individuals expect an inheritance, they may choose to rent and wait to receive the bequest, avoiding the need to save for the down payment. Finally, one should also consider that in some countries house prices might be low relatively to earnings, making housing more affordable. Thus, the proposition that credit market imperfections affect the age distribution of owner occupied housing among the young is not a priori obvious, making the empirical analysis more interesting and informative.

Table 1 reports two indicators of housing finance for the 14 countries of our sample: The 1986–1996 average of the ratio of outstanding mortgage loans to GDP and the down payment ratio (by decade). The down payment indicators in Table 1 generally refer to conventional home-purchase loans to first-time buyers.[5] In some countries or periods, there is no statutory minimum down payment ratio. Since contract terms are at the discretion of individual lenders, down payment statistics refer to the average down payments extended to homebuyers. In that case, the value reported in the table is the minimum value of the average down payment in the decade. In such cases, therefore, changes in the down payment may reflect changes in the composition of borrowers, rather than genuine changes in mortgage market conditions. Since virtually no country has readily available yearly data on down payments, the implicit assumption is that the variable changes slowly over time.

Mortgage markets differ widely from country to country and these differences are associated with differences in the down payment ratio. Given that the size of the mortgage market is certainly affected by the demand for housing, we rely on the down payment ratio as a direct indicator of rationing. Table 1 shows that in the last three decades mortgage credit has been less easily available in Austria, Belgium, Germany, Italy, Luxembourg and Spain. The table also shows that in many countries the down payment has declined, thanks to the easing of regulation and increased competition

[4] 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 unlikely to serve this purpose: what is needed is inter vivos gifts or loans.

[5] In constructing the down payment series, we have updated the data set of Jappelli and Pagano (1994) to the 1990s using data from Maclennan et al. (1999), Lea and Diamond (1992), Lea et al. (1997).

Table 1
Housing finance: An international comparison

Country	Outstanding mortgage loans/GDP (percent)	Down payment ratio (percent)			Duration of mortgage foreclosure (in months)	Efficiency of the judicial system (0–10 scale)
	1986–1996	1971–1980	1981–1990	1991–1995	1990	1980–1983
Australia	19.30	30	20	20	9	10
Austria	4.24	40	40	20	15	9.5
Belgium	20.08	35	25	20	24	9.5
Canada	41.32	25	25	20	4.75	9.25
Finland	32.35	20	15	20	6	10
France	22.02	20	20	20	11	8
Germany	28.92	35	35	20	15	9
Italy	5.49	50	44	40	48	6.75
Luxembourg	25.61	40	40	40	12	-.-
Netherlands	43.29	25	25	25	2.5	10
Spain	15.01	40	20	20	36	6.25
Sweden	56.50	10	5	25	6	10
UK	51.87	19	13	5	4.75	10
US	43.61	20	11	11	9	10

Outstanding mortgage loans over GDP are 1986–1996 averages. Annual GDP is drawn from IMF Financial Statistics. Duration of mortgage foreclosure proceedings refer to 1990 (Source: European Mortgage Federation, 1996). Data for duration in Australia, Austria, Canada, Luxembourg, and United States have been provided by country experts. 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 1980–1983 and the scale is 0–10, with lower scores indicating lower efficiency.

between intermediaries. But this does not hold for every country. In Sweden, for instance, the down payment in the 1990s was higher than in the 1980s.

In some countries, the down payment can be regarded as a truly exogenous indicator of credit rationing. The most obvious case comes from regulation, which often simply imposes minimum down payment ratios for mortgage loans. These vary considerably between countries: Until the 1980s 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.

In the absence of regulation, however, the down payment is a term of the mortgage contract that is chosen by lenders and therefore it itself depends on incentives to repay debt obligations and ultimately on the pool of borrowers. The recent law and finance literature emphasizes the importance of differences in the legal system and judicial efficiency for the performance of credit markets (La Porta et al., 1998), suggesting that the cost of enforcing contracts and of disposing of collateral can affect the required down payment ratio. The last two columns of Table 1 reports a direct measure of enforcement costs in mortgage markets (the length of housing mortgage foreclosure proceedings) and an indicator of judicial efficiency. On the basis of these indicators, Belgium, Germany, Italy and Spain feature lengthier duration of mortgage foreclosure and less efficient courts. The Italian case in particular stands out. Due to the slowness of its judicial process, debt collection and repossession can be very time consuming

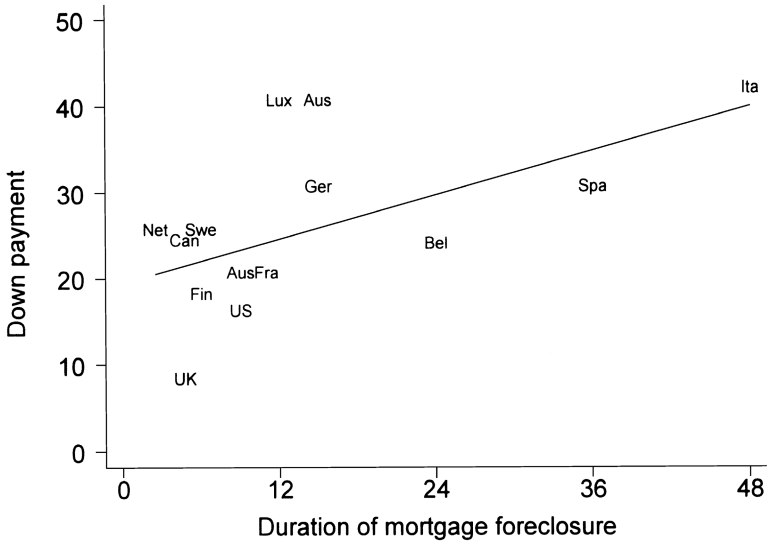

Fig. 2. Down payment ratio and duration of mortgage foreclosure (in months). The down payment ratio is averaged over all years.

(4 years). At the other extreme, the Netherlands, Canada, and the United States feature high judicial efficiency and a quick mortgage foreclosure process.[6]

Fig. 2 shows that the down payment ratio correlates positively with the duration of mortgage foreclosure. Since duration and other indicators of judicial efficiency are exogenous with respect to the demand for housing, in a regression framework they provide valid instruments allowing us to address the potential endogeneity of the down payment ratio.[7]

3. The international data set

The Luxembourg Income Study (LIS) is a research project by CEPS-INSTEAD to enhance international comparability among several 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

[6] The extent of asymmetric information between borrowers and lenders can also affect the terms of the mortgage contract. In the United States, Canada, and the United Kingdom lenders can require less collateral because specialized credit reference agencies report the credit histories of all applicants and creditors share information about potential borrowers. 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, 2002).

[7] In principle, a more active mortgage market could lead to court congestion and therefore to a longer foreclosure procedure. However, in a cross-country framework this factor is an unlikely source of variability of the length of foreclosure.

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 14 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 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 in the owner occupation rates of various age groups and in down payment ratios within each country. The earliest surveys are for the United States (the 1974 CPS) 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).

Most studies using microeconomic data refer to the household as the unit of analysis and to the "age of the household" as the age of the household head. In the present context, this standard procedure is unwarranted and can induce severe selection bias because household formation interacts with the decision to buy a house. On the one hand, the decision to marry and have children affects the ownership status; but at the same time credit markets imperfections, which force the young to save for the down payment, affect living arrangements and the timing of household formation. To overcome the problems of the endogeneity of household formation with respect to credit market imperfections, we choose to perform the analysis at the *individual*, rather than at the *household* level. The main advantage of this procedure is that individual demographic characteristics (age and gender) are well-defined, exogenous variables with respect to the decision to purchase a home.

Since in the surveys the home ownership variable refers to the household (not to the individual), and virtually all surveys lack information on which member exactly in the household owns the house, this strategy also requires assumptions and sample restrictions. We drop from the sample individuals younger than 25 years to make sure that all sample units have completed school. We then define someone to be a home owner if he or she either is the head of those households owning the house or is the head's spouse; in other words, we define somebody to be a home owner if he or she owns and is a single or, in case of couples, if either spouse owns. To avoid having more owners than houses, we select only male individuals. [8]

[8] We treat same sex couples as single male parent with a male child; that is, we consider the head (the primary income unit) as the owner, and the other household member as not owner. Conducting the analysis for females, rather than males, produces qualitatively similar results as those reported in the text.

In case of co-residence (children living with parents), one should distinguish two cases: Either the child lives in the home owned by the parents (and should therefore be treated as not owning), or the elderly parent lives in the home acquired by the child (and in this case the child should be treated as the owner). Since we do not have information in the surveys to attribute ownership to individual household members, first of all we define the head of the household as the male with the highest income. We then assume that all adults other than the head (the primary income unit) and the spouse (if present) are not owners. For a 30-year old individual living with a 60-year old parent this is a reasonable assumption. But clearly, classification errors increase with age: For instance, it is conceivable that a 50-year old individual living with a 75-year old parent purchased the house or received it as a gift, although he is not the primary income unit.

Selecting out those over 55-year old should reduce substantially these potential classification errors. Excluding the elderly from the analysis is desirable also because the determinants of ownership in old age are likely to be driven by a rather different set of factors than for the young (for instance, the availability of reverse mortgages).[9] Finally, in the empirical analysis we shall estimate the impact of the down payment ratio in three separate age bands (26–35, 36–45 and 46–55), and at least in the first two groups the amount of classification error should not be a concern.

Table 2 gives sources and average number of observations in each country. There is considerable variability in the number of observations. In Spain, each survey covers almost 20,000 males aged 25–55, and in Canada more than 12,000. In most cases, however, the number of observations per country is between 6000 and 9000 (2–3 percent of the total sample). Overall, the LIS survey allows us to construct an international data set for more than 285,000 males aged 26–55.

We carefully matched ownership status, age, gender and educational level in all the selected surveys to create an unbalanced, repeated cross-sectional data set. 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 seven categories defined by the International Standard Classification of Education (UNESCO, 1997). Details are given in the appendix.

Table 3 reports the proportion of household heads and individuals in three age brackets (26–35, 36–45 and 46–55) in each country (country surveys are aggregated over time). The age distribution of heads and individuals is concave in all countries, with cells generally containing between 32 and 36 percent of the relative national sample. However, the weight of the first age bracket is generally higher in the sample based on individuals. Italy and Spain stand out, where the incidence of young heads is much lower (23.20 and 27.20 percent, respectively) than that of individuals (35.49 and 34.22 percent). Clearly, the low proportion of heads in these two countries does not reflect differences in the age structure of the population, as witnessed by the individual distribution. Rather, Italian and Spanish young adults tend to live with their parents

[9] In some of the countries we observe a declining ownership rate in old age. As noted by Green and Hendershott (1996), this might be due to cohort effects in housing demand.

Table 2
The international dataset

Country	Data sources and years available	Number of individuals per survey	Average cell size
Australia	Australian Income and Housing Survey: 1981, 1985, 1989, 1994	7868	437
Austria	Austrian Microcensus: 1987	5918	148
Belgium	Panel Survey of the Centre for Social Policy: 1985, 1988, 1992	3575	89
Canada	Survey of Consumer Finances: 1975, 1981, 1987, 1991	12,487	312
Finland	Income Distribution Survey: 1987, 1991	9622	1203
France	Family Budget Survey: 1984, 1989, 1994	7564	189
Germany	German Socio Economic Panel Study: 1984, 1989, 1994	3715	100
Italy	Bank of Italy Survey of Household Income and Wealth: 1986, 1991, 1995	6250	156
Luxembourg	Luxembourg Social Economic Panel Study: 1985	1730	43
Netherlands	Additional Enquiry on the Use of Public Services: 1983, 1987. Socio-Economic Panel: 1991, 1994	3115	78
Spain	Expenditure and Income Survey: 1980, 1990	19,341	484
Sweden	Income Distribution Survey: 1992, 1995	8473	212
UK	Family Expenditure Survey: 1986, 1991, 1995	4372	109
US	March Current Population Survey: 1974, 1979, 1986, 1991	9052	226
All countries	39 Surveys	285,324	206

The number of observations refers to the average number of all males aged 26–55 in each survey.

well beyond the age of 25, owing to higher unemployment and more difficult access to independent living arrangements (either rent or purchase). Since independent young households in Italy and Spain are, on average, richer, household formation is correlated with wealth and hence with home ownership. The comparison between the distribution of heads and individuals clearly shows that if one were to focus on households, rather than individuals, one would induce severe selection bias, especially at the young end.

The proportion of individual owner occupancy rate in each age bracket is reported in Table 4, which reproduces the patterns described in Fig. 1 and signals substantial differences in the level and in the age distribution of owner occupied housing. As far as the level is concerned, Austria, France, Germany and the Netherlands feature relatively low owner occupancy rates. For timing, in Canada, Finland, Sweden, the United

Table 3
Sample composition by age, percentage values

Country		26–35	36–45	46–55
Australia	Households	38.35	35.00	26.65
	Individuals	39.16	34.82	26.02
Austria	Households	31.80	35.61	32.59
	Individuals	36.27	34.55	29.18
Belgium	Households	35.15	35.24	29.61
	Individuals	38.77	34.10	27.14
Canada	Households	39.73	33.42	26.85
	Individuals	40.70	33.30	25.99
Finland	Households	26.67	39.91	33.42
	Individuals	29.57	39.00	31.43
France	Households	34.75	36.46	28.78
	Individuals	37.22	35.49	27.30
Germany	Households	33.85	33.56	32.59
	Individuals	37.29	32.33	30.38
Italy	Households	23.20	36.33	40.47
	Individuals	35.49	31.78	32.73
Luxembourg	Households	26.91	33.17	39.92
	Individuals	34.38	31.48	34.14
Netherlands	Households	39.09	37.04	23.86
	Individuals	39.06	37.15	23.79
Spain	Households	27.20	35.33	37.46
	Individuals	34.22	33.08	32.70
Sweden	Households	30.42	34.75	34.83
	Individuals	29.57	34.93	35.50
United Kingdom	Households	35.70	34.75	29.55
	Individuals	37.52	34.32	28.15
United States	Households	39.77	33.17	27.06
	Individuals	41.05	32.75	26.20

The table reports the proportion of household heads and individual males in each age bracket. Statistics are computed using sample weights. Country values are aggregated over different years.

Kingdom and the United States the bulk of home purchases are made in the late 20s or early 30s.[10] On the other hand, in Austria, Germany, Italy, Spain and Luxembourg the proportion of owner occupied housing in the first age bracket is relatively low, and the bulk of home purchase occurs in middle age.

The final step is to merge the microeconomic data set with the down payment data reported in Table 1. Since down payment data are decade averages, if for a particular country the survey is repeated in a given decade, we assign the same value for the down payment ratio. That is, the down payment ratio is constant for all individuals surveyed in a particular decade and country.

[10] In Finland and Sweden, housing policies favor cooperative housing which we consider ownership.

Table 4
The age profile of home ownership, percentage values

Country	Age 26–35	Age 36–45	Age 46–55
Australia	51.02	74.34	79.90
Austria	34.01	54.31	60.40
Belgium	44.00	71.57	75.40
Canada	58.10	77.25	81.56
Finland	53.76	81.29	86.74
France	34.88	61.88	68.62
Germany	18.49	39.15	43.69
Italy	22.20	54.40	66.00
Luxembourg	33.71	61.19	77.98
Netherlands	50.19	64.59	60.11
Spain	40.00	67.80	73.83
Sweden	54.91	71.64	74.67
United Kingdom	63.80	75.06	74.54
United States	49.29	71.61	78.94

The table reports the proportion of individual homeowners (males only) in each age bracket. Country values are averaged over different years.

4. Empirical results

A straightforward test of the proposition that credit market imperfections affect the age distribution of owner occupied housing is to regress the down payment ratio on the proportion of owner occupation in selected age groups. We expect the down payment effect to be greatest for the young, who lack collateral and must save up before they can buy. Running separate regressions for each age group identifies the effect of the down payment on the curvature of the age profile of ownership, and does not require identification of the level of this profile.

Regressions are estimated with grouped data, where each cell consists of an age/year/country observation. Since the cells are estimated with different numbers of observations, we implement a weighted least-squares method using as weights $w_{i,c,t} = [n_{a,c,t}/(h_{a,c,t}(1-h_{a,c,t}))]^{1/2}$, where n and h are, respectively, the number of observations and the probability of ownership in age group a, country c and year t.[11] 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. The positive correlation might inflate the standard errors, an application of neighborhood effects induced by survey designs that are based on clusters of observations (Deaton, 1997, pp. 73–78). We therefore use a robust variance–covariance matrix assuming that observations

[11] The average number of observations in each cell is 206; 5 percent of the cells are based on less than 60 observations (the minimum is 22) and 5 percent on more than 500 observations (maximum is 1726).

Table 5
Regression results for the home ownership rate

		Age 26–35	Age 36–45	Age 46–55
Cross-section using country-averages:	Down payment ratio	−1.01	−0.75	−0.45
		(0.26)	(0.26)	(0.31)
	Adjusted R^2	0.51	0.37	0.08
	Observations	14	14	14
Cross-section using country-averages: Instrumental Variable	Down payment ratio	−1.51	−0.77	−0.34
		(0.66)	(0.46)	(0.54)
	Observations	14	14	14
Repeated cross-section with time effects	Down payment ratio	−0.94	−0.74	−0.54
		(0.13)	(0.12)	(0.15)
	High education	−0.03	−0.04	0.04
		(0.13)	(0.13)	(0.16)
	Adjusted R^2	0.75	0.69	0.87
	Observations	39	39	39
Repeated cross-section with time and country effects	Down payment ratio	−0.25	−0.38	0.04
		(0.08)	(0.10)	(0.11)
	High education	−0.11	−0.04	0.13
		(0.11)	(0.07)	(0.11)
	Adjusted R^2	0.99	0.99	0.99
	Observations	39	39	39

The table reports weighted regressions for the probability of owning the house of residence. Standard errors are reported in parentheses. All regressions include a constant term.

between the different samples are independent, but not necessarily within each individual survey. [12]

As a preliminary test we exploit the cross-country variability in ownership rates and regress country means of owner occupancy rates in three different age categories (26–35, 36–45, and 46–55) against the country average of the down payment ratio. Later, we relax this assumption and control for additional factors affecting owner occupancy rates with country fixed effects and calendar time effects.

The cross-sectional sample consists of 14 observations for each of the three age groups, and the results are reported in Table 5. In each of the regressions the coefficient of the down payment ratio is negative, but largest, in absolute value, in the first two age groups. Furthermore, the coefficient is statistically different from zero at

[12] Detailed information on clustering and stratification in individual 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. This assumption is questionable because some of the underlying surveys in the LIS are panel data sets or contain a panel section (e.g., the Italian SHIW). However, in some specifications we control for country and calendar time fixed effects, and therefore the residual correlation between sampling units should not be an excessive concern.

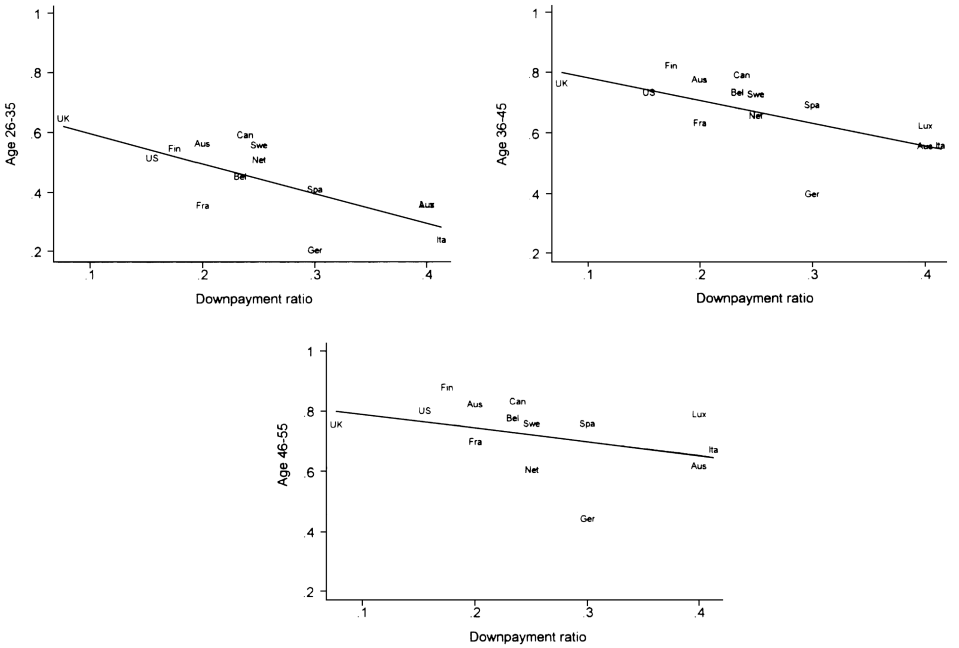

Fig. 3. The effect of the down payment on the shape of the home ownership profile. Country data are averaged over all years.

the 1 percent level only in the two youngest age groups. Fig. 3 shows graphically the effect of mortgage finance availability on the owner occupancy rates in the three age groups. Going from the youngest to the oldest age group, the regression line becomes increasingly flatter. In particular, an increase in the down payment from 20 percent (as in Australia or France) to 40 percent (as in Italy) is associated with a reduction in the owner occupancy rate of 20.2 percentage points in the 26–35 age group, 15 percentage points in the 36–45 age group and has no statistical effect on the oldest age group. These results dovetails the predictions of Ortalo-Magné and Rady (1998, 1999), where an increase in the down payment ratio reduces the equilibrium distribution of owner occupancy rates at young ages.

The cross-sectional data allow us also to address the potential endogeneity of the down payment ratio with respect to the distribution of ownership. As discussed in Section 2, the duration of mortgage foreclosure is a valid instrument, because it is an exogenous variable with respect to the demand for housing and because it is correlated with the down payment. In fact, the coefficient of duration in the down payment regression (the first-stage regression) is 0.43, with a t-statistic of 2.39.

The instrumental variable regression in Table 5 confirms the previous findings: the effect of the down payment is much larger, in absolute value, in the youngest age

group, and only in this group the coefficient is statistically different from zero at the 1 percent level.[13]

The evidence based on cross-country variability in owner occupancy rates by age groups is based on the assumption that variation in owner-occupancy rates depends only on the availability of credit. However, the demand for housing could depend also, to say the least, on permanent income, the cost of owning relative to renting, and the pattern of intergenerational transfers. Furthermore, almost everywhere there is significant government involvement in mortgage lending, either directly or through tax incentives (European Mortgage Federation, 1990; Maclennan et al., 1999). Finally, macroeconomic factors and the business cycle can also have an impact.

To control for some of these effects and check the robustness of the results, we rely on the fact that in most countries the cross section is repeated over time, and that the down payment ratio exhibits some time variability. The third and fourth groups of regressions are based on 39 age/year/country observations for each age group (one for each survey).

Each regression in the third group includes a full set of calendar time effects and the proportion of individuals with high education as a proxy for permanent income. In every age group estimation, the coefficient of the down payment is very similar to the cross-sectional estimates. The coefficient of education is not statistically different from zero.

In the fourth group of regressions we introduce also a full set of country dummies. In these regressions, all variables that are constant between countries or periods are collinear with the fixed effects and are not identified. The down payment is identified because it varies both across countries and over time. The effect of the down payment is considerably attenuated with respect to the regressions based on country averages, but the pattern of results is confirmed. The coefficient of the down payment is negative and statistically different from zero for the first two age groups, small in absolute value and not statistically different from zero in the 46–55 age group. The down payment effect is also economically significant: An increase in the down payment of 20 percentage points is associated with a reduction in the owner occupancy rate of 5 and 7.6 percentage points in the 26–35 and 36–45 age groups, respectively.

In each regression in the fourth group, the coefficient proportion of individuals with high education is not statistically different from zero. Since different education groups have different age-earnings profiles, the impact of borrowing constraints might vary by education. We therefore check that the coefficient of the interaction of the down payment with the education variable is not statistically different from zero in any of the three age groups.

The number of surveys per country and the periods in which countries are observed differ considerably. For instance, the US and Canada are the only countries observed

[13] Results are similar if the list of instruments includes also 1982–1995 averages of the indicators of judicial efficiency and rule of law discussed by La Porta et al. (1998). Data on these indicators are available on a yearly basis from 1982 to 1995 for all 14 countries of our sample except Luxembourg. However, in the remaining 13 countries, there is almost no time variability of both variables (and for some countries rule of law is actually constant). This prevents us from using an instrumental variable approach in the other regressions of Table 5 based on repeated cross sections.

during the 1970s, and Sweden is observed twice, but both surveys refer to the 1990s, see Table 2. Since the 39 surveys are scattered around a relative long time period, this also implies that the time dummies in the previous regressions sometimes single out individual surveys; therefore they are hardly interpretable as a common time effect. As a final check of the robustness of the results, we compute cells in 5-year time intervals (1971–1975, 1976–1980, up to 1991–1995), and introduce in the regressions a full set of country fixed effects and of 5-year time effects. The coefficient of the down payment is basically unchanged with respect to the fourth group of regressions.

Before concluding, an important caveat is in order. Our regressions do not consider explicitly 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 some of our specifications, fixed country effects capture the effect of these omitted variables. Thus, in order to estimate the impact of the down payment on the age profile of owner occupancy rates, we must assume that these factors affecting home ownership are either constant over time, or uncorrelated with the dynamics of the down payment ratio in individual countries.

5. Conclusions

We explored the determinants of owner occupancy rates by age groups using an international data set based on almost 300,000 individuals in 14 countries. Due to the dual relation between household formation and credit market imperfections, we choose to perform the analysis at the level of the individual (for which the concept of age is a well-defined, exogenous characteristic), rather than at the level of the household. The empirical results are consistent with the hypothesis that mortgage market imperfections – as measured by the down payment ratio – oblige young individuals to save and postpone home purchase until later in life, thereby affecting the distribution of owner occupancy rates across age groups.

We find that in countries with relatively high down payment ratios the proportion of owner occupation of the young is relatively low; and that in countries where the down payment ratio is 40 percent the proportion of owner occupied housing of the young is 5–8 percentage points lower than in countries with down payment ratios of 20 percent. This result takes into account the potential impact of fixed country effects, which might attenuate the estimated effect of the down payment. These empirical findings are consistent with tenure choice theory, for instance with the theoretical contribution of Artle and Varaya (1987) and the simulation analysis of Hayashi et al. (1988), and particularly with the equilibrium model of owner occupancy rates recently proposed by Ortalo-Magné and Rady (1998, 1999).

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 maturity 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 homebuyers will improve accordingly. The econometric estimates suggest that convergence of European mortgage markets is likely to increase the owner occupancy rates of younger cohorts and at least temporarily prompt higher demand for home mortgages.

Our findings also have 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 and of the owner occupancy rates of the young. 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.

Acknowledgements

The TMR Network Program on *Saving and Pensions*, the Italian National Research Council (CNR), the Ministry of University and Scientific Research (MURST) and the IRISS-C/I project provided financial support. We thank two referees, Rob Alessie, Charles Grant, Thierry Magnac, Mario Padula, Luigi Pistaferri, Guglielmo Weber and especially Steve Pischke for helpful comments.

Appendix A. Variables used in the sample construction and estimation

AGE. In Australia and Finland, the earliest surveys report home ownership in selected age categories: 25–29; 30–34; 35–39; 40–44; 45–49; and 50–54. In these cases, the age variable is recoded as the midpoint of the interval.

EDUCATIONAL LEVEL. 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 seven categories defined by the International Standard Classification of Education (ISCED, 1997). The dummy HIGH LEVEL corresponds to 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.

SELF-OWNED OR RENTED HOUSING. Details available for home ownership vary by country. Most surveys distinguish between owned and rented living quarters. We define the head or spouse 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 and for all other household members.

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 Maclennan et al. (1999), Lea and Diamond (1992), Lea et al. (1997). The data on down payment ratios generally refer to conventional loans extended to first-time buyers without government guarantees and mortgage insurance. In countries where it is common to finance a house purchase by borrowing from different institutions (e.g., Germany), the down payment refers to the overall loan package. In countries where the maximum LTV ratio resulted from explicit regulation (such as Canada, Finland, France, Italy and Spain) the regulatory limit sometimes changed in the course of a decade; in this case we report the minimum value of the down payment during the decade. Where there is no statutory threshold and payments arrangements are at the discretion of individual lenders, we report the minimum value of the average down payment ratio in the decade.

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