



From:
OECD Journal: Economic Studies

Access the journal at:
<http://dx.doi.org/10.1787/19952856>

The Evolution of Homeownership Rates in Selected OECD Countries: Demographic and Public Policy Influences

Dan Andrews, Aida Caldera Sánchez

Please cite this article as:

Andrews, Dan and Aida Caldera Sánchez (2011), "The Evolution of Homeownership Rates in Selected OECD Countries: Demographic and Public Policy Influences", *OECD Journal: Economic Studies*, Vol. 2011/1.

http://dx.doi.org/10.1787/eco_studies-2011-5kg0vswqpmg2

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

The Evolution of Homeownership Rates in Selected OECD Countries: Demographic and Public Policy Influences

by

Dan Andrews and Aida Caldera Sánchez*

Homeownership rates have increased significantly in many OECD countries over recent decades. Using micro-econometric decomposition techniques, this paper shows that part of this increase can be explained by changes in the characteristics of households, including age, household structure, income and education. Nevertheless, a significant portion of the change in homeownership rates remains unexplained by shifts in household characteristics, leaving a potential role for public policy in explaining developments in homeownership rates. Panel estimates suggest that the relaxation of down-payment constraints on mortgage loans has increased homeownership rates among credit-constrained households over recent decades, resulting in a rise in the aggregate homeownership rate that is comparable with the impact of population ageing. In countries where tax relief on mortgage debt financing is generous, however, the expansionary impact of mortgage market innovations on homeownership is smaller. This is consistent with the tendency for such housing tax relief to be capitalised into real house prices, which may crowd-out some financially constrained households from homeownership at the margin. The impact of housing policies regulating the functioning of the rental market, such as rent regulation and provisions for tenure security, on tenure choice is also explored.

JEL classification: R21, R31, G21, H24.

Keywords: Housing markets, homeownership, mortgage markets, financial regulation, taxation.

* Dan Andrews (e-mail: dan.andrews@oecd.org) and Aida Caldera Sánchez (e-mail: aida.calderasanchez@oecd.org) both work at the OECD Economics Department. The authors would like to thank Jørgen Elmeskov, Åsa Johansson, Giuseppe Nicoletti and Jean-Luc Schneider as well as Paul Cheshire and Sveinbjörn Blöndal for their valuable comments and Catherine Chapuis for excellent statistical work as well as Irene Sinha for excellent editorial support. The views expressed in this paper are those of the authors and do not necessarily reflect those of the OECD or its member countries.

Aggregate homeownership rates have increased significantly in many OECD countries over recent decades. A deeper understanding of the factors driving these trends is useful, given the potential consequences of homeownership for economic performance. On the one hand, homeownership has been linked to better educational outcomes – and, thus, future income prospects – for resident children (Haurin *et al.* 2002), as well as broader societal benefits. The latter includes the idea that homeownership provides the most stable tenure arrangement to satisfy basic household needs and promotes a more active and informed citizenry (Di Pasquale and Glaeser, 1999). On the other hand, rates of residential mobility tend to be lower among homeowners than renters – possibly reflecting the higher moving costs associated with owner-occupied housing – which may make homeowners more susceptible to spells of unemployment.

Even if the broader net effects of homeownership are unclear, it is still important to understand the factors driving homeownership rates to the extent that boosting homeownership has been a public policy goal in many OECD countries. For instance, a higher homeownership rate has been explicitly pursued by successive administrations in the United States. In 2002, President Bush outlined “a comprehensive agenda to help increase the number of minority homeowners by at least 5.5 million before the end of the decade” (see Bush, 2002), while in 1994, President Clinton requested an “... effort to dramatically increase homeownership in our nation over the next six years” (see Clinton, 1994). Moreover, homeownership developments have recently been at the forefront of policy discussion in Australia and New Zealand – two countries where the acquisition of the family home is likened to the attainment of the national dream (see Moran, 2006; Ferguson, 1994).

Consistent with these ideas, public policy in OECD countries is generally geared to enhancing homeownership, whether through the preferential tax treatment of housing investment or broader changes in financial markets that have alleviated credit constraints.¹ While it is tempting to conclude that such factors have underpinned a shift towards homeownership as the preferred mode of tenure in many OECD countries, part of the increase in homeownership rates over this period could simply reflect demographic and socio-economic influences. For example, the tendency for homeownership rates to rise with age implies that aggregate homeownership rates would have increased in OECD countries over recent decades – even if nothing else changed – due to population ageing.

Accordingly, this paper explores the extent to which trends in homeownership rates in a sub-set of OECD countries reflect changing household characteristics – including age, household structure, incomes and education – and policy influences such as mortgage market innovations and tax reliefs on mortgage debt financing.

Some new findings emerge:

- Overall, changes in household characteristics can account for around three-quarters of the increase in aggregate homeownership rates in Austria and the United Kingdom over the decade from the mid-1990s to mid-2000s, but only around one-third of the increase

in Canada, Germany, Spain, Switzerland and the United States. In Australia and especially Italy, other factors appear to have played a particularly important role in shaping homeownership patterns.

- On average, population ageing has boosted the aggregate homeownership rate by $\frac{3}{4}$ -1 percentage point among the countries analysed, with the effect being particularly noticeable in Switzerland, Germany, Denmark and Canada. Changes in real household incomes have had more varied impacts, boosting aggregate homeownership rates by more than 1½ percentage point in Canada, Denmark, and Finland, while having negligible effects on the evolution of homeownership rates in Germany and other continental European countries. In comparison, shifts in household size and structure have – on average – exerted a modest downward influence on aggregate homeownership rates, although this effect varies somewhat across the countries studied. Finally, an increase in the share of immigrant (and ethnic minority) households has tempered the rise in aggregate homeownership rates in some countries.
- A significant proportion of the change in aggregate homeownership rates is, however, not explained by changes in the characteristics of the population, signalling a possible shift in the relative attractiveness of owner-occupied housing over recent decades and the possible influence of public policy settings:
 - The relaxation of down-payment constraints on mortgage loans has increased homeownership rates among credit-constrained, lower-income households. The estimated contribution of such mortgage market innovations to the change in aggregate homeownership rates is broadly comparable with the impact of population ageing.
 - Policies such as mortgage interest deductibility tend to be regressive since the probability of homeownership rises with income. The results indicate that such tax relief may distort the impact of other policies and potentially crowd-out financially constrained households from homeownership via house price capitalisation effects.
 - Rent regulations and provisions for tenure security implicitly impact homeownership by making renting more attractive. Nevertheless, rental market regulations may impose costs, to the extent that they are capitalised into housing costs, reduce the supply of rental housing and increase rigidity in the housing market, with possible adverse consequences for residential mobility.

The remainder of the paper is structured as follows. Section 1 discusses the link between homeownership and public policy in OECD countries, while Section 2 documents trends in homeownership rates in selected OECD countries and discusses some potential drivers of these trends. Section 3 outlines the empirical strategies used in the paper. It first describes the decomposition technique adopted to isolate the contribution of shifts in household characteristics to the change in aggregate homeownership rates. It then outlines the cross-country panel framework used to analyse the effect of mortgage market innovations and tax policies on homeownership rates. It finally specifies the cross-sectional model used to investigate the potential link between rental market regulations and tenure choice. Section 4 discusses the results of the effects of non-policy factors in homeownership rates, while Section 5 discusses the results on the influence of public policy on homeownership rates. The last section concludes.

1. Homeownership and public policy in OECD countries

Public policy in OECD countries tends to favour homeownership relative to renting and other investments, via the preferential tax treatment of owner-occupied housing. For example, while mortgage interest costs are tax deductible in many OECD countries, few countries tax imputed rent and those that do often substantially under-estimate the rental value.² Moreover, while property tax is often viewed as a substitute for taxation of imputed rent, the magnitude of the tax is rarely sufficient to offset the subsidy provided by mortgage interest deductibility.

The main economic argument for subsidising homeownership is that ownership may give rise to positive spillovers for society, although the case for subsidising homeownership is far from clear (see Box 1). In some instances, it is likely that homeownership is mistakenly attributed a causal influence for outcomes that are actually due to unobserved individual or household characteristics (Dietz and Haurin, 2003). For example, it is typically argued that children of homeowners perform better at school than those of renters. But this finding may simply reflect the impact of unobserved factors, such as the possibility that parents with a view to the longer term may be more likely to purchase a home and invest in their children. Nevertheless, focusing too closely on such identification issues may unduly divert attention from the broader idea that homeownership provides the most stable tenure arrangement to satisfy basic household needs – a plausible hypothesis that does not necessarily lend itself to econometric verification.

Whether it is due to the household needs hypothesis or a causal interpretation of the associations discussed in Box 1 the notion that public policy should favour homeownership over renting is active in many OECD countries. This economic rationale has sometimes been reinforced by a tendency to liken owner-occupation to the attainment of a “national dream”. Accordingly, many OECD governments pursue higher rates of homeownership – implicitly or explicitly – as a public policy goal. Therefore, understanding the drivers of aggregate homeownership rates is important from the perspective of public policy.

Box 1. The Economic Benefits and Costs of Homeownership

The main economic argument for subsidising owner occupation is that homeownership may give rise to positive spillovers for society. While the literature has identified many possible spillovers, this box focuses on four key areas: wealth accumulation, child outcomes, social capital and mobility.¹ There is competing evidence for each hypothesis and a common problem is establishing causality since any correlation between homeownership and a variable of interest (*e.g.* wealth) may simply reflect the influence of a third omitted factor. The veracity of the arguments may also hinge on other policy settings and circumstances in a country.

1. A Vehicle for Asset/Wealth Accumulation: For myopic households, homeownership – to the extent that it creates an orientation towards the future (Sherraden 1991; OECD, 2003) – may result in a higher rate of wealth accumulation than otherwise. The act of taking out mortgage debt may also prompt a change in household spending behaviour, by making households pre-commit themselves to a scheme that is costly to break. However, the effectiveness of using one’s house as a means of forced savings has weakened considerably over recent decades, given the increased prominence of housing equity withdrawal and mortgage refinancing (Li and Yang, 2010).

With the move away from publicly-funded retirement systems, homeownership is playing an increasingly important role in maintaining the standard of living of households in retirement. In Australia, the incidence of poverty amongst older households is very high according to conventional measures, but

Box 1. The Economic Benefits and Costs of Homeownership (cont.)

falls dramatically once implicit rents are taken into account (Yates and Bradbury, 2009). Hirayama (2010) makes a similar argument with respect to Japan.

Against this, buying a house entails higher transaction costs than renting (Haurin and Gill, 2002) making it an illiquid investment. The timing of the purchase also tends to matter, especially given the volatility of housing prices. Indeed, recent experience in the United States highlights that policies that promote homeownership can have adverse consequences for mobility to the extent that they have been associated with a rise in negative equity (Ferreira *et al.* 2008; Caldera Sánchez and Andrews, 2011).

2. Better Outcomes for Children: Homeownership has been linked to better outcomes for children in terms of test scores and behaviour (Haurin *et al.* 2002). This may reflect the added geographic stability and improved home environment associated with homeownership compared with renting. It is unclear, however, whether the positive correlation between homeownership and child outcomes is causal. This may reflect the fact that in some datasets, family wealth is not measured. To the extent that family wealth affects both the likelihood of becoming a homeowner and child test scores, studies based on such datasets will overstate the impact of homeownership on child school performance (Dietz and Haurin, 2003). Even when family wealth is measured, however, unobserved parental characteristics are likely to confound the analysis. Green and White (1997) present an example where there are two types of parents – investors and non-investors. Since this characteristic of parents is unlikely to be observed, any estimate of the impact of homeownership on child test scores will be upwardly biased if investor-type parents are more likely to purchase a home and invest in their children.²

3. Community Engagement and Voting Behaviour: Homeownership tends to be associated with more active and informed citizens (Di Pasquale and Glaeser, 1999) and more residentially stable neighbourhoods. Homeowners might be more likely to make political choices that favour the long-run health of their community (such as more investment in green space, see Richer, 1996), while renters have an incentive to favour policies bringing immediate benefits relative to long-run gains. However, the positive impact of homeownership on political engagement may be over-stated due to endogeneity bias – people who are more likely to participate in community activities may also be more likely to be homeowners (Englehardt *et al.* 2010).

Against this, homeowners have an incentive to restrict new supply – through support for zoning and land-use regulations – in order to raise house prices, which is likely to impose costs on outsiders (Glaeser and Shapiro, 2003; Hilber and Robert-Nicoud, 2010).

4. Homeownership Adversely Affects Labour Mobility: Labour mobility is lower and thus unemployment higher among owner-occupants than renters because of the high transaction cost of moving (Oswald 1996; Caldera Sánchez and Andrews, 2011). Of course, there are also costs associated with residential mobility. Hanusek *et al.* (2004) show that student turnover, particularly student entry during the school year, reduces achievement gain, and the effects are felt by everyone in the school, not just those who themselves move.

1. It has also been argued that homeowners take better care of their property (Di Pasquale and Glaeser, 1999), and are both happier (Rossi and Weber, 1996) and healthier (Benzeval and Judge, 1996). However, the extent to which this relationship is causal is unclear and the true relationship could, in fact, be negative if homeowners face greater anxiety due to their increased financial obligations (Nettleton and Burrows, 1998).
2. It should also be noted that the money spent on owner-occupied housing investment might crowd-out other family-specific investments that have a more direct payoff to children's outcomes (Aaronson, 2000). For example, Currie and Yelowitz (1998) argue that public housing has a positive effect on school retention because subsidised housing allows money to be directed to other family needs.

2. Evolution and potential drivers of homeownership rates in selected OECD countries

Table 1 shows how aggregate homeownership rates in selected OECD countries have evolved since the 1990s, based on household-level micro datasets (see Appendix A for a discussion of the data sources).³ Homeownership rates have generally increased, particularly in Canada, Switzerland and Spain, while declines have been recorded in Australia and Luxembourg. The general increase in homeownership rates since the 1990s may partly reflect demographic trends, and in particular, the increase in the average age in OECD countries over recent decades. Population ageing affects the aggregate homeownership rate because older people have higher rates of homeownership than younger people. Across OECD countries, the probability of homeownership rises significantly between 25 and 44 years of age – the family formation years – and tends to peak in the 55-64 age bracket (see Figure 1). This implies that aggregate homeownership rates in OECD countries would have increased over recent decades because of ageing populations, even if nothing else changed.

Table 1. **Aggregate homeownership rates in selected OECD countries**

	Circa 1990s ¹	2004 ²
Australia	71.4	69.5
Austria	46.3	51.6
Belgium	67.7	71.7 ³
Canada	61.3	68.9
Denmark	51.0	51.6
Finland	65.4	66.0
France	55.3	54.8 ³
Germany	36.3	41.0
Italy	64.2	67.9
Luxembourg	71.6	69.3
Netherlands	47.5	55.4 ³
Spain	77.8	83.2
Switzerland	33.1	38.4
United Kingdom	67.5	70.7
United States	66.2	68.69

1. 1987 for Austria, 1990 for Spain, 1991 for Italy, 1992 for Denmark and Switzerland, 1994 for Canada, France, Germany and the Netherlands, 1995 for Australia, Belgium and Finland, 1997 for Luxembourg and the United States.

2. 2003 for Australia, 2007 for Germany and the United States.

3. The data are particularly dated for Belgium (2000), France (2000) and the Netherlands (1999).

Sources: OECD, Luxembourg Income Study (LIS), GSOEP and the American Housing Survey.

The tendency for homeownership rates to change within age brackets over time, however, suggests that more is going on than just compositional effects (Figure 1). While homeownership rates within income quartiles have also changed over time (see Figure 2), homeownership rates may have also been affected by shifts in underlying household structure, such as the deferral of marriage and childbearing and the rise of single-parent households. Changes in education attainment, which may proxy for wealth and/or permanent income, may also matter.

Mortgage markets are also likely to be important since owner-occupied housing constitutes a household's single largest financial outlay, and generally requires debt financing. Housing finance markets have changed drastically over recent decades,

reflecting a wave of financial deregulation motivated by broader economic efficiency goals. There has been considerable cross-country variation in the timing of reform and the extent to which the financial sector was regulated in the earlier period (Abiad et al. 2008; Andrews, 2010). These changes in financial market regulation have significantly lowered borrowing costs for housing, resulting in a substantial expansion in the supply of mortgage loans in many countries (ECB, 2009a; Ellis, 2006), with potential implications for homeownership rates.

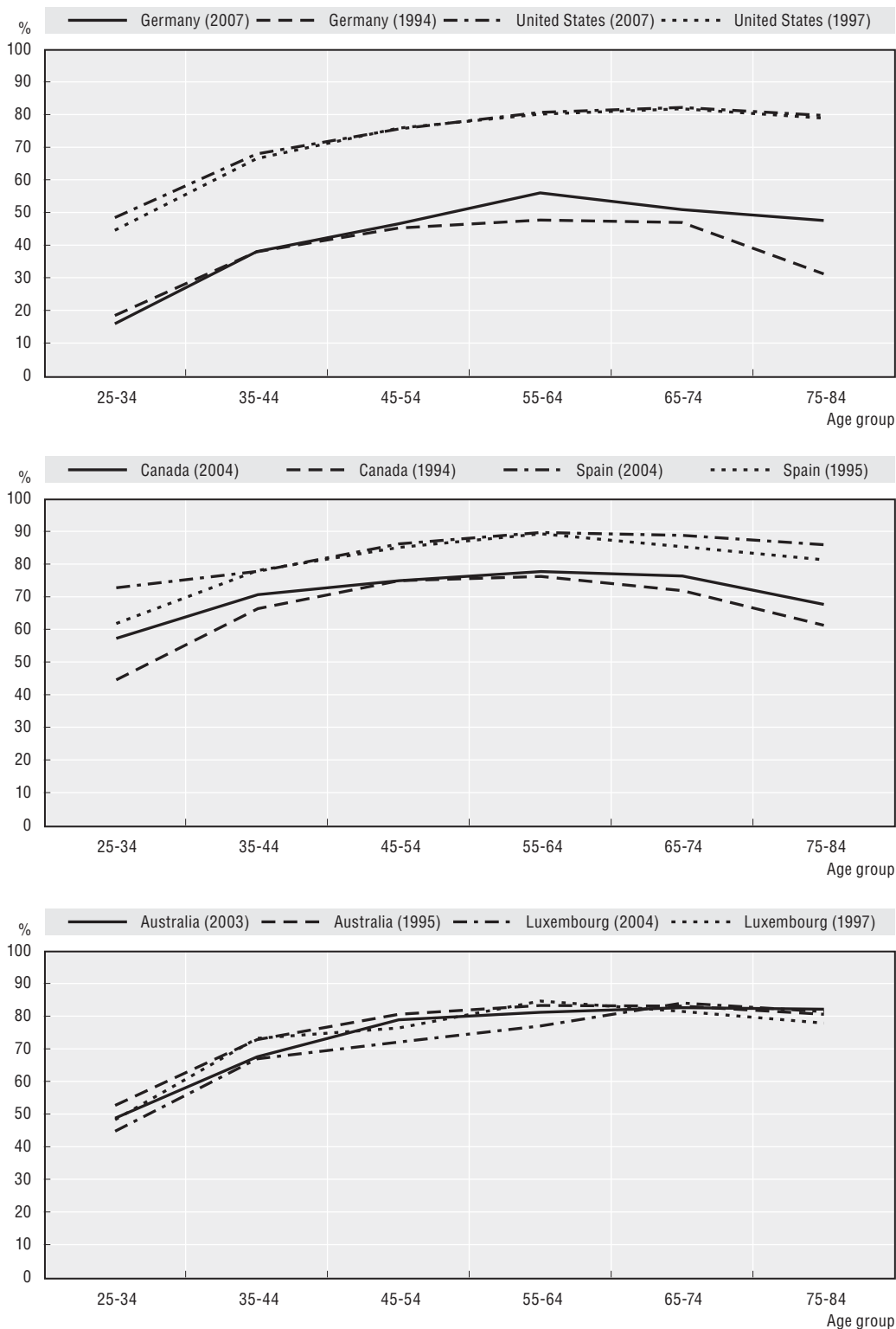
An important consequence of mortgage market deregulation was to significantly reduce deposit requirements, thereby easing the down-payment constraint for many households wishing to become homeowners.⁴ The down-payment constraint tends to be particularly binding for financially-constrained households, especially younger households who have had less time to accumulate a deposit. Previous empirical research shows that from the late 1970s until the early 1990s, homeownership rates among younger households tended to increase more in those countries where the maximum loan-to-value (LTV) ratio rose, implying a reduction in the down-payment constraint (Chiuri and Jappelli, 2003).⁵ While the maximum permissible LTV has risen in many OECD countries since the 1990s, important cross-country differences remain (see Andrews et al., 2011).⁶

Cross-country differences in homeownership rates may also reflect differences in the tax treatment of housing. The wedge between the market interest rate and the debt financing cost of housing (the after-tax interest rate) provides one indicator of the extent to which the tax system favours owner-occupied housing with respect to debt financing (see Johansson, 2011). While this simplified measure is imperfect, it nevertheless serves as a useful indicator since households generally finance their house purchase with debt.⁷ According to this indicator, tax relief is most generous in the Netherlands and effectively zero in countries where mortgage loans are not tax favoured (Figure 3).

The impact of tax relief on mortgage-debt-financing costs on homeownership, however, is unclear. One reason for this is that such tax relief generally takes the form of a deduction against earned income rather than a credit and, thus, are worth more to high-income earners (Andrews et al. 2011). To the extent that homeownership rates amongst high income earners in countries that do not allow mortgage interest deductibility (e.g. Australia) are still relatively high, it is likely that these households would still be homeowners in absence of the subsidy (Figure 2).⁸ This suggests that such tax reliefs have little effect on aggregate homeownership rates and the effect may in fact be negative, if tax reliefs get capitalised into real house prices (Capozza et al. 1996; Andrews, 2010) and make homeownership less affordable for lower income households than otherwise (Bourassa and Yin, 2007; Hilber and Turner, 2010).

Finally, the paper analyses the impact of rental market regulations on homeownership, though the focus is on explaining cross sectional differences in homeownership – as opposed to changes over time – due to data constraints. Two specific measures of rental market regulations – rent control and security of tenure – based on a recent OECD Housing Questionnaire are adopted. The rent control variable captures regulations setting limits on rents and rent increases, including the pass-through of costs onto rents. Rent controls appear to be comparatively strict in countries with a relatively large rental sector (e.g. Sweden, the Netherlands, and Germany) while rent controls are lax in countries such as the United Kingdom and the United States. Meanwhile, security of tenure takes into account the length of the average rental contract, whether contract

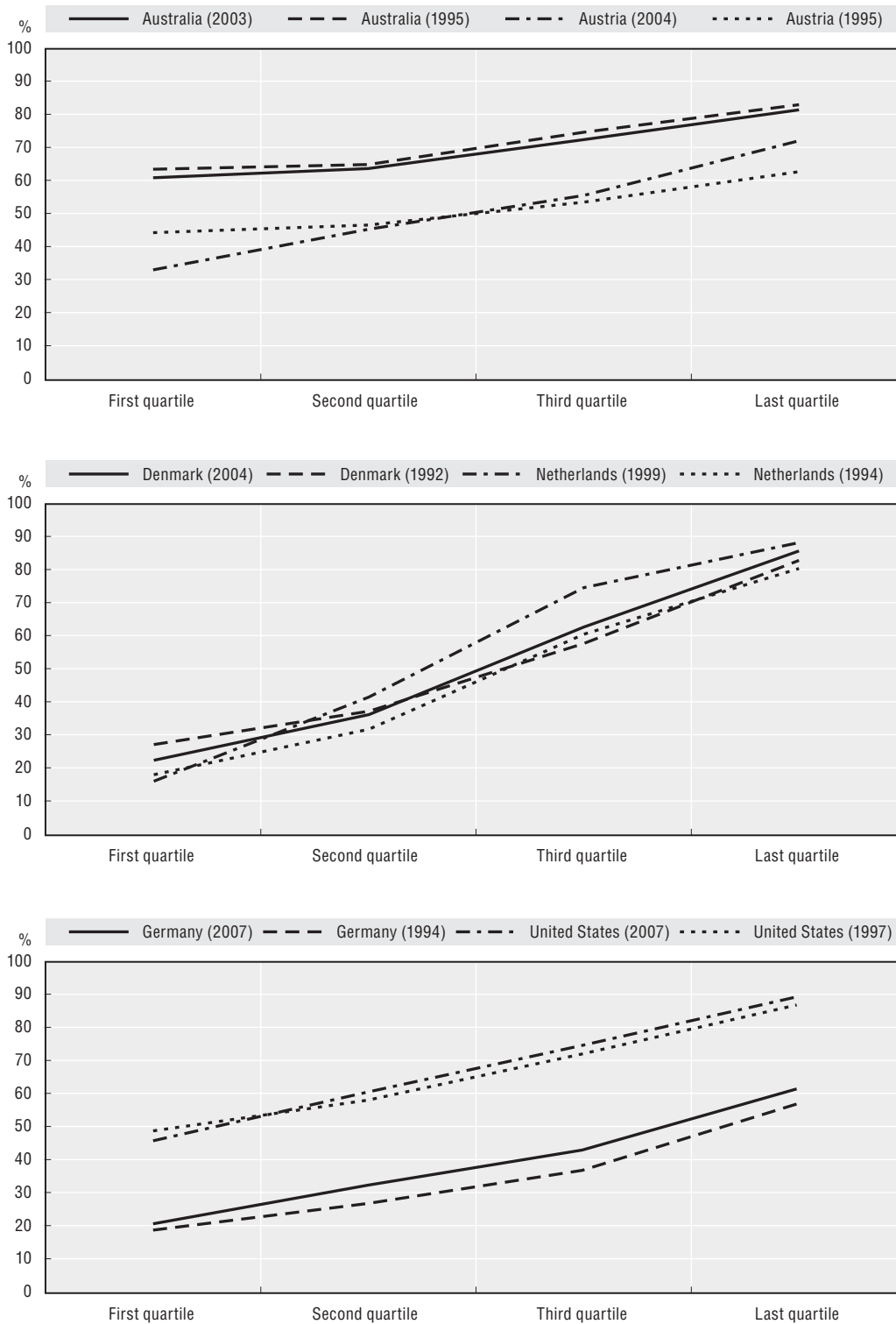
Figure 1. Homeownership rates by age group¹
Selected OECD Countries



1. These six countries have been chosen for presentational purposes. The equivalent charts for the remaining countries in Table 1 are available in Andrews and Caldera Sánchez (2011).

Sources: OECD, Luxembourg Income Study (LIS), GSOEP and the American Housing Survey.

Figure 2. Homeownership rates by household disposable income quartile¹
Selected OECD Countries

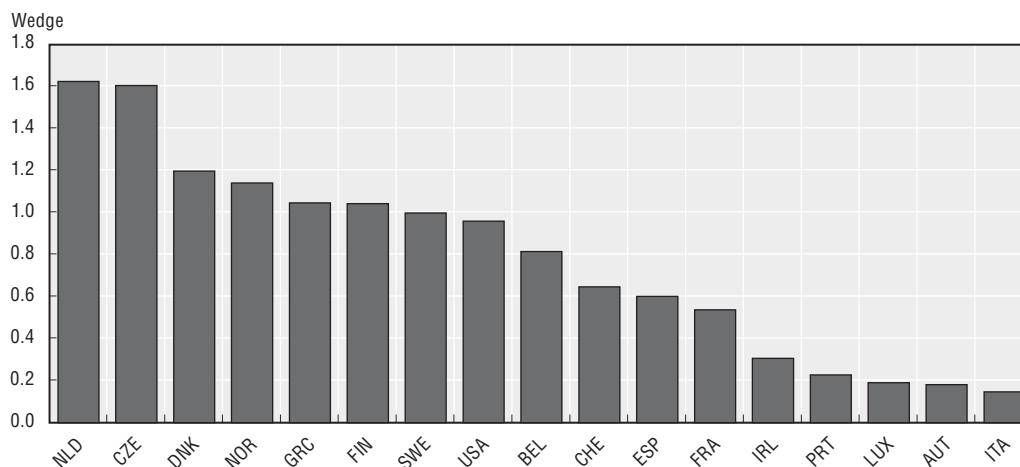


1. These six countries have been chosen for presentational purposes. The equivalent charts for the remaining countries in Table 1 are available in Andrews and Caldera Sánchez (2011).

Sources: OECD, Luxembourg Income Study (LIS), GSOEP and the American Housing Survey.

Figure 3. **Tax relief on debt financing cost of homeownership,¹ 2009**

Wedge increasing in the degree of tax relief



1. This indicator takes into account if interest payments on mortgage debt are deductible from taxable income and if there are any limits on the allowed period of deduction or the deductible amount, and if tax credits for loans are available (see Johansson, 2011 for details). For countries that have no tax relief on debt-financing costs, this indicator takes the value of zero. These countries include: Australia, Canada, Germany, the United Kingdom, Hungary, Japan, Korea, New Zealand, Poland, Slovenia, the Slovak Republic and Turkey. However, data limitations (related to tenure data) mean that not all of these countries are included in the subsequent econometric analysis (see Appendix A).

Sources: Calculations based on OECD Housing Market questionnaire. See Johansson, (2011) for details.

length is freely negotiable and the extent of notice required in the event that the rental contract is terminated. According to this measure, security of tenure tends to be relatively high in Portugal and Austria, while much lower in English-speaking countries. These measures are discussed at length in Johansson (2011), and are also utilised in Andrews *et al.* (2011) and Caldera Sánchez and Andrews (2011).

3. Empirical strategy

This section outlines the empirical frameworks used to analyse the extent to which changes in aggregate homeownership rates can be attributed to shifts in households' characteristics and public policy influences, including mortgage market innovations, tax arrangements and rental regulations. Panel estimation techniques are used to update and reassess earlier research highlighting the link between changes in down-payment constraints and homeownership rates (Chiuri and Jappelli, 2003). Unfortunately, it is not possible – due to data limitations – to estimate the direct impact of housing tax arrangements on homeownership rates over time. Instead, the paper investigates whether the impact of financial market deregulation on homeownership rates is affected by the extent to which housing is tax advantaged. This is a natural extension to recent empirical research, which shows that housing demand shocks – such as financial deregulation – are more likely to be capitalised into real house prices in countries where tax relief on mortgage debt financing is generous (Andrews, 2010). Finally, the paper uses the two newly constructed indicators of rent regulation and tenant protection discussed above to investigate the extent to which such policies increase the relative attractiveness of renting in a broader sample of countries (see Appendix A for details). The cross-sectional nature of this modelling, however, makes it difficult to identify the contribution of rental market regulations to changes in aggregate homeownership rates over time.

3.1. Non-policy influences on tenure choice

A variant of the Blinder-Oaxaca Decomposition (Blinder, 1973; Oaxaca, 1973) is utilised to decompose the change in the homeownership rate into the part that can be explained by changing household characteristics – including age, household size and structure – and changing propensities for homeownership given these characteristics. While this approach is somewhat partial as it assumes that trends in homeownership rates are demand-driven, it is nonetheless useful given the interest in estimating the contribution of changing household characteristics to aggregate homeownership rates over time. The decomposition technique involves two steps. As a first step, a binomial logit regression framework is employed to model the probability of homeownership for each OECD country:

$$\Pr(Own = 1) = \frac{\exp(X'b)}{[1 + \exp(X'b)]} \quad (1)$$

where $\Pr(Own = 1)$, or P , is the probability that a household will choose to be an owner, given the relevant household characteristics in the vector X . A transformation of equation (1) yields:

$$\ln\left(\frac{P}{1-P}\right) = Y = X'b = \sum b_i X_i \quad (2)$$

Implying that the dependent variable is the log of the odds that a particular tenure choice will be made.

In turn, to decompose the change in the homeownership rate over time (e.g. between 1994 and 2004) the following calculations are performed:

- The average probability of homeownership in 1994 (\bar{P}_{1994}) and 2004 (\bar{P}_{2004}) is calculated based on (1) setting each relevant independent variable equal to its sample mean and applying the estimated logistic coefficients.
- The decomposition of the change in the probability of homeownership (P) can be then expressed as:⁹

$$\bar{P}_{2004} - \bar{P}_{1994} = (\bar{X}^{2004} - \bar{X}^{1994})\beta^{2004} + \bar{X}^{1994}(\beta^{2004} - \beta^{1994}) \quad (3)$$

“Explained effect” “Unexplained effect”

where \bar{X}^t is a row vector of average values of the independent variables and β^t is a vector of coefficient estimates for period t (where t equals 1994 or 2004). The change in the homeownership rate can be decomposed into two parts:

- *Explained effect*: captures the impact of shifts in household characteristics, such as age, household size and structure, household income and education.
- *Unexplained/residual effect*: captures changes in a household’s underlying propensity to become a homeowner, holding household characteristics constant. This effect may reflect both changes in behaviour and the impact of housing policies.

The vector X includes a number of variables relevant to the decision to become a homeowner:

- The head of household’s age is controlled for via a series of dummy variables covering seven age ranges (20-24, 25-29, 30-34, 35-44, 45-54, 55-64 and 65 and above).
- Household size and four different household structures: couples without dependents; couples with dependents; singles without dependents and singles with dependents. While changes in household structure will affect household size, there may also be

changes in household size independent of household structure if families chose to have fewer children over time.

- Real household disposable income is included to capture the financial capacity to afford a down-payment and service a mortgage.¹⁰ Educational attainment is also included, since current income may be an imperfect proxy for permanent income or wealth (Goodman, 1988).
- Controls for health status, ethnicity, immigrant status and linguistic skills are also included, although these variables are not available for all countries.
- Dummy variables capturing the residential location of the household (e.g. state/province for large countries; city for small economies) are included, where possible, as a proxy for the relative prices of homeownership and renting.¹¹

Since most of these variables are categorical, the specification has sufficient flexibility to control for non-linearities. In the case of the income variable, which is continuous, income-squared is included. Interactions between real income and each age bracket were also included to proxy for unobserved wealth effects, while interactions between real income and the household structure terms were included to proxy for an unobserved budget constraint (see Li, 1977). Finally, the potential simultaneity between tenure choice and household formation decisions is not addressed. Instead, it is assumed that the decision to form a household or change a household type is made prior to the tenure choice decision, which has been a common approach in the literature (see Yates, 2000). While this is a strong assumption, the data-intensive nature of this exercise (the modelling is repeated for 12 OECD countries) makes this potential simultaneity issue impractical to address.

3.2. Policy influences on tenure choice

After estimating the contribution of shifts in household characteristics to changes in aggregate homeownership rates, the role of selected public policies is assessed using panel and cross-section regression techniques.

3.2.1. Mortgage market innovations and tax policy

To estimate the impact of mortgage market innovations – specifically, changes in the down-payment constraint – on homeownership rates over time, a cross country panel model is estimated:

$$HO_{i,t}^{Quartile2^j} = \alpha + \delta_1 LTV_{i,t} + \delta_2 LTV_{i,t} * Taxrelief_i + \delta_3 Z_{i,t-1} + \rho_i + \eta_t + \varepsilon_{i,t} \quad (4)$$

where I denotes country and t year. To the extent that the tenure decision of the “marginal homebuyer” will be most sensitive to changes in the down-payment constraint, the dependent variable in equation (4) is the homeownership rates of the marginal buyer. Two proxies are used to measure the marginal buyer: all households in the second income quartile and households aged 25-34 years in the second income quartile.¹² LTV is the maximum LTV ratio and Taxrelief is a time invariant variable capturing the extent of tax relief on mortgage debt financing (see Figure 3).

The vector Z further controls for real household income, real interest rates, price-to-rent ratio, real construction costs and the share of the total population aged 25-34. The homeownership rates of the remaining income/age groups (i.e. income quartiles 1, 3 and 4) are also included in Z to control for the influence of unobserved factors on homeownership and to make the implications for the aggregate homeownership rate clearer.¹³ The

regressions also contain country-fixed effects (ρ), which control for time invariant country-specific factors, such as cultural attitudes toward homeownership, and time fixed effects (η) to capture common global shocks, such as the relatively benign macroeconomic environment that possibly increased the attractiveness of homeownership in the first half of the 2000s (see Li, 2005). The standard errors are clustered at the country level in order to allow for an arbitrary variance-covariance matrix within each country.

A priori and holding all else equal, δ_1 is expected to be positive while δ_2 will be negative if the expansionary impact of financial deregulation on homeownership amongst marginal buyers is smaller in environments with more generous tax relief. The latter may reflect the tendency for generous housing tax policies to be capitalised into real house prices (see Andrews, 2010), thereby making owner-occupation less affordable for the marginal buyer than otherwise. The inclusion of the interaction term relaxes the slope homogeneity assumption of the conventional fixed effects model, and allows the impact of changes in LTVs on homeownership to vary with the extent of tax relief. The overall impact of a change in the down-payment constraint on homeownership is given by $(\delta_1 + \delta_2 * \text{Taxrelief}_i)$. The direct effect of Taxrelief, however, cannot be identified since a fixed effects panel estimator is employed and this (time invariant) term would be subsumed in the country-fixed effects.

It is important to recognise that this estimation framework is quite partial, and cannot fully capture more complex dynamic feedback effects between changes in LTVs and other important variables, such as the house price to rent ratio. Moreover, the framework does not control for the influence of compositional changes in the dwelling stock, which have the potential to influence homeownership rates. For instance, in a sample of European countries over the period 1994-2001, Hilber (2007) finds that a greater proportion of apartments in the dwelling stock tends to raise the likelihood of renting. While both of these factors are likely to be important, data constraints make them difficult to address at present and the results should thus be interpreted with some caution.

3.2.2. Tenure choice and rental regulations

The effect of rental regulations on tenure choice is estimated using a cross-country probit model. Due to the absence of time series data on rental regulations, however, it is not possible to estimate the contribution of rental regulations to the change in aggregate homeownership rates over time. The following probit model is estimated:

$$\Pr_{hi} (Own = 1) = \Phi(\alpha + \beta P_i + H_{hi} \phi + C_i \Gamma + e) \quad (5)$$

where Φ denotes the normal distribution, h denotes household and i denotes country. \Pr is the probability that a household will choose to be an owner, given the relevant household characteristics, such as income, education, employment status, summarised in the vector H and country-specific rental regulations, including rent control and security of tenure (P). The vector C controls for other country-specific factors that may impact households' tenure decision, including national household income and urbanisation, while the error term e captures shocks and unobservable factors affecting the households tenure choice and errors are clustered at the country-level.¹⁴

Unfortunately, this estimation framework is unable to address the potential endogeneity between rental market policies and tenure choice, which may arise if existing policies are framed in response to a country's tenure structure. The lack of plausible instruments and time series data on rental regulations make this problem difficult to

address and the results should thus be treated with caution.¹⁵ Moreover, it should be noted that rental regulations – if sufficiently strict – may reduce the supply of rental accommodation and give rise to spillover effects on the demand for homeownership. However, it is not possible to distinguish these unintended supply side effects from the more obvious demand side effects of rental regulations.

4. Empirical results: non-policy influences on tenure choice

The estimated coefficients from the pooled logistic regression, equation (1), are reported in Table B.1 of Appendix B, while the marginal effects are shown in Table 2. The coefficients are generally of the expected sign and, across the 12 countries studied, the models – on average – predict individual tenure status correctly approximately 75% of the time, which is comparable with previous studies (see Yates, 2000; Gyourko and Linneman, 1997).

The probability of homeownership increases with age, as indicated by the age dummies which are positive and highly significant. Households aged 45-64 years tend to have the highest homeownership propensities, holding other characteristics constant, although this effect tends to vary across countries, as suggested by the different homeownership-age gradients in Figure 1. In the United States, a head of household aged 45-64 years is 37 percentage points more likely to be a homeowner than where the head is aged 20-24 years, holding all else equal. By contrast, in Germany, the same household type is 54 percentage points more likely to be a homeowner, than younger counterparts.

Relative to the benchmark household of a couple without children, the probability of homeownership tends to be significantly lower for single-headed households, particularly those with children, possibly reflecting unobserved financial resource constraints.¹⁶ Consistent with this, household size tends to be positively related to the probability of homeownership in most of the countries analysed.

The probability of homeownership rises with real household disposable income, though at a diminishing rate, as implied by the negative coefficient on the income squared term. This is broadly consistent with the homeownership-income gradients presented in Figure 2. The impact of a 10% rise in household income on the probability of homeownership is particularly strong in Denmark, Finland and Germany (Figure 4), consistent with the relatively high degree of homeownership inequality between income groups in these countries (Figure 2).

Households with higher levels of education are more likely to be homeowners. While tertiary education tends to be positively associated with homeownership, this variable is not always statistically significant, possibly reflecting the relatively high correlation with household income. This is particularly the case in continental European economies, such as Austria, Spain and Switzerland. The impact of education on the probability of being a homeowner is particularly strong in the United Kingdom – household heads that are tertiary educated are 16 percentage points more likely to be a homeowner than those without post-secondary education (see Table 2).¹⁷

The probability of homeownership is generally lower for immigrant households – particularly in Italy and Luxembourg – and minority households and those not proficient in the official language of the country. In the United States, African Americans and Hispanic Americans are over 15 percentage points less likely to be homeowners than other Americans (Table 2), which is consistent with existing research (see Gabriel and Rosenthal,

Table 2. **Marginal-effects coefficients from the tenure choice equation¹**

Dependent variable: Probability of being a homeowner

	(1) Austria		(2) Finland		(3) Italy		(4) Spain		(5) Switzerland	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Age of Household Head										
25-29 years	-0.003	(0.056)	0.117***	(0.022)	-0.272***	(0.053)	0.055**	(0.025)	-0.268***	(0.037)
30-34 years	0.112**	(0.044)	0.194***	(0.019)	-0.234***	(0.049)	0.084***	(0.020)	-0.131**	(0.054)
35-44 years	0.170***	(0.039)	0.258***	(0.020)	-0.078*	(0.042)	0.102***	(0.022)	0.061	(0.061)
45-64 years	0.299***	(0.034)	0.397***	(0.023)	0.013	(0.035)	0.176***	(0.026)	0.239***	(0.057)
65 years and over	0.286***	(0.033)	0.413***	(0.016)	0.065*	(0.034)	0.192***	(0.021)	0.327***	(0.059)
Household structure										
Household Size	0.089***	(0.013)	0.041***	(0.014)	0.013*	(0.008)	..	..	0.086***	(0.019)
H2: Couple with dependents	-0.016	(0.032)	-0.034	(0.021)	-0.125***	(0.044)	0.000	(0.011)	-0.019	(0.043)
H3: Single without dependents	-0.046**	(0.023)	-0.017	(0.026)	-0.167***	(0.035)	-0.043***	(0.012)	-0.063*	(0.034)
H4: Single with dependents	-0.131***	(0.039)	-0.218***	(0.041)	-0.366***	(0.098)	-0.083***	(0.026)	-0.171***	(0.042)
Male household head	0.029*	(0.017)	0.010	(0.013)	-0.002	(0.015)	0.011	(0.009)	0.122***	(0.025)
Real Household Disposable Income										
Income ('000s of national currency)	0.004***	(0.001)	0.012***	(0.002)	0.003***	(0.000)	0.004***	(0.000)	0.001***	(0.000)
Education of household head										
Tertiary	-0.014	(0.029)	0.058***	(0.016)	0.050**	(0.023)	-0.009	(0.011)	0.027	(0.033)
Indicators of socio-economic disadvantage										
Disability (Household Head)	..	..	-0.016	(0.016)	-0.038	(0.029)	..	..	..	..
Disability (Spouse of Household Head)	..	..	0.028	(0.020)	0.001	(0.040)	..	..	..	..
Ethnic minority	-0.298***	(0.031)	-0.006	(0.023)	..	..	..	..	..	..
Immigrant/Foreigner	..	..	..	..	-0.345***	(0.034)	..	..	-0.258***	(0.021)
Regional dummies	No		Yes		Yes		Yes		No	
Surveys	1987, 2004		1995, 2004		1991, 2004		1990, 2004		1992, 2004	
Number of observations	16 294		20 488		16 171		33 986		9 547	
Classification rate	64.78%		82.36%		68.72%		80.80%		69.64%	

Note: Robust standard errors in parentheses. * significant at 10%, ** significant at 5%; *** significant at 1%.

1. The regression results are based on a sample that pools data from the most recent household survey available, and data from an earlier period (generally the mid-1990s). The benchmark case against which the estimated coefficients and marginal probabilities are interpreted is a head of household aged 20-24, in a couple relationship with no children, with relatively low education and good health and not from an immigrant/ethnic background. See Appendix B for more details.

Source: OECD calculations based on household datasets sourced from LIS, the GSOEP and the American Housing Survey.

Table 2. Marginal-effects coefficients from the tenure choice equation¹ (cont.)

Dependent variable: Probability of being a homeowner

	(1) Canada		(2) Denmark		(3) Germany		(4) United States		(5) Australia		(6) Luxembourg		(7) United Kingdom	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Age of Household Head														
25-29 years	-0.002	(0.028)	0.007	(0.010)	0.146***	(0.049)	0.111***	(0.009)	0.086***	(0.018)	0.055	(0.046)	0.078***	(0.011)
30-34 years	0.089***	(0.024)	0.070***	(0.010)	0.278***	(0.043)	0.172***	(0.007)	0.173***	(0.013)	0.115***	(0.037)	0.166***	(0.008)
35-44 years	0.145***	(0.022)	0.140***	(0.009)	0.417***	(0.037)	0.247***	(0.007)	0.250***	(0.012)	0.182***	(0.035)	0.233***	(0.008)
45-64 years	0.237***	(0.020)	0.244***	(0.008)	0.512***	(0.034)	0.369***	(0.008)	0.367***	(0.014)	0.244***	(0.038)	0.340***	(0.009)
65 years and over	0.228***	(0.017)	0.301***	(0.007)	0.588***	(0.027)	0.365***	(0.005)	0.365***	(0.010)	0.274***	(0.028)	0.340***	(0.007)
Household structure														
Household Size	0.015***	(0.005)			0.013**	(0.007)	0.014***	(0.002)	..	..	0.056***	(0.013)		
Couple with dependents	-0.086**	(0.034)	0.079***	(0.009)	0.029*	(0.016)	..	..	0.021*	(0.012)	-0.031	(0.034)	0.044***	(0.010)
Single without dependents	-0.187***	(0.024)	-0.161***	(0.006)	-0.143***	(0.012)	..	..	-0.254***	(0.014)	-0.065**	(0.028)	-0.166***	(0.009)
Single with dependents	-0.340***	(0.038)	-0.211***	(0.010)	-0.167***	(0.018)	..	..	-0.334***	(0.025)	-0.042	(0.051)	-0.277***	(0.016)
Male household head	0.029***	(0.007)	0.115***	(0.005)	-0.012	(0.010)	..	..	-0.024**	(0.011)	-0.007	(0.022)	0.013**	(0.006)
Married	..	..	..	..	..	..	0.223***	(0.006)	..	..	..	..	..	..
Divorced, widowed, separated	..	..	..	..	..	..	0.049***	(0.005)	..	..	..	..	..	..
Real Household Disposable Income														
Income ('000s of national currency)	0.003***	(0.001)	0.001***	(0.000)	0.008***	(0.000)	0.003***	(0.000)	0.002***	(0.000)	0.003***	(0.000)	0.006***	(0.001)
Education of household head														
Secondary	0.002	(0.009)	..	..	0.087***	(0.009)	0.054***	(0.005)	..	..	..	..	..	..
Associate	0.046***	(0.009)	..	..	0.060***	(0.016)	0.061***	(0.005)	0.070***	(0.008)	0.101***	(0.033)	0.162***	(0.005)
Tertiary	0.019	(0.011)	0.064***	(0.007)	0.046***	(0.014)	0.067***	(0.006)	0.041***	(0.011)	-0.037	(0.025)	0.162***	(0.007)
Indicators of socio-economic disadvantage														
Disability (Household Head)	-0.041***	(0.009)	..	..	-0.027**	(0.012)	..	..	..	..	..	..	-0.121***	(0.005)
Disability (Spouse of Household Head)	-0.021	(0.013)	..	..	..	..	..	..	..	..	..	..	-0.057***	(0.007)
Ethnic minority	..	..	..	..	..	..	..	..	..	..	..	..	-0.065***	(0.011)
Immigrant/Foreigner	..	..	-0.305***	(0.007)	..	..	..	..	..	..	-0.353***	(0.021)	..	..
Non-English Speaking Background	..	..	..	..	..	..	..	..	-0.111***	(0.015)	..	..	..	..
African American	..	..	..	..	..	..	-0.180***	(0.007)	..	..	..	..	..	..
Hispanic	..	..	..	..	..	..	-0.164***	(0.008)	..	..	..	..	..	..
Asian	..	..	..	..	..	..	-0.202***	(0.013)	..	..	..	..	..	..
American Indian	..	..	..	..	..	..	-0.074***	(0.022)	..	..	..	..	..	..
Regional dummies	Yes		No		Yes		Yes		Yes		No		Yes	
Surveys	1994, 2004		1992, 2004		1994, 2007		1997, 2007		1995, 2003		1997, 2004		1999, 2004	
Number of observations	68 578		96 133		17 877		78 266		16 908		6 136		52 708	
Classification rate	77.52%		75.31%		70.81%		77.52%		76.85%		77.95%		75.49%	

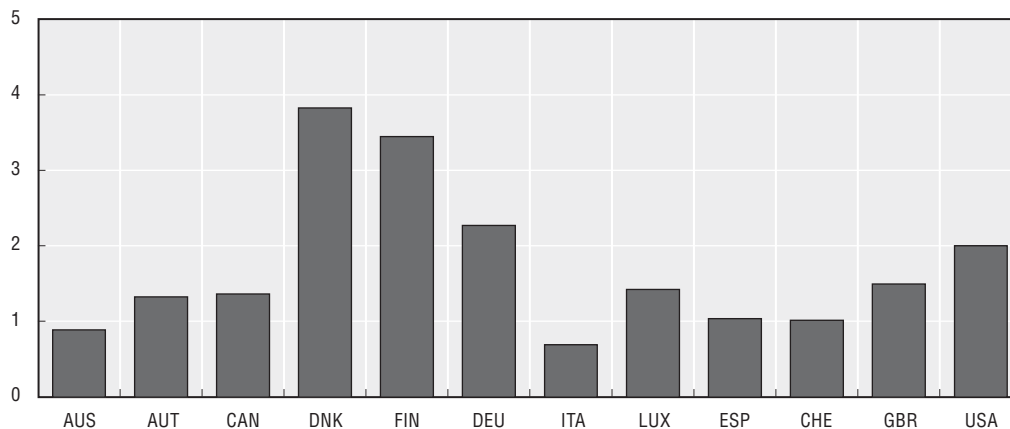
Note: Robust standard errors in parentheses. * significant at 10%, ** significant at 5%; *** significant at 1%.

1. The regression results are based on a sample that pools data from the most recent household survey available, and data from an earlier period (generally the mid-1990s). The benchmark case against which the estimated coefficients and marginal probabilities are interpreted is a head of household aged 20-24, in a couple relationship with no children, with relatively low education and good health and not from an immigrant/ethnic background. See Appendix B for more details.

Source: OECD calculations based on household datasets sourced from LIS, the GSOEP and the American Housing Survey.

Figure 4. **Impact of a 10% increase in household disposable income on the probability of being a homeowner¹**

Percentage change in the probability of being a homeowner, selected OECD countries



1. Calculations are based on the marginal effects estimation contained in Table 2, and show the impact on the probability of a 10% rise in household income from the sample mean level.

Source: OECD calculations based on household datasets sourced from LIS, the GSOEP and the American Housing Survey.

2005). The probability of homeownership also tends to be lower amongst households affected by health problems, possibly reflecting the financial strain associated with illness.

4.1. Decomposing the change in aggregate homeownership rates

By combining the coefficient estimates with changes in the average characteristics over time (these changes are discussed in Appendix E of Andrews and Caldera Sánchez, 2011), it is possible to decompose the change in the aggregate homeownership rate as given by equation (3). Figure 5 decomposes the actual change in aggregate homeownership across the two survey years (expressed in percentage points) into three parts: the portion explained by changes in the age structure (the darker bar), the contribution of non-age factors (*e.g.* household structure, income *etc.*; the lighter bar) and a part unexplained by the model (shaded bar). The latter may reflect changes in economic behaviour and/or the impact of policy settings, which will be investigated in later sections. The 12 countries can be separated into two broad groups according to the observed changes in homeownership rates.

4.1.1. Rising homeownership rates: Austria, Canada, Germany, Italy, Spain, Switzerland, the United Kingdom and the United States

- Changes in the characteristics of the population generally account for around three-quarters of the increase in aggregate homeownership rates in Austria and the United Kingdom.
- In Canada, Germany, Spain, Switzerland and the United States, changes in the characteristics of the population can only account for approximately one-third of the increase in aggregate homeownership rates, implying an important role for other factors.
- For Italy, the explained contribution to the change in the aggregate homeownership rate is negative, suggesting that other factors account for the rise in the aggregate homeownership rate.

4.1.2. *Broadly flat or declining homeownership rates: Australia, Denmark, Finland, and Luxembourg*

- While the aggregate homeownership rate rose slightly in Denmark and Finland over the period studied, changes in the characteristics of the population implied a much larger increase in homeownership than what actually occurred. This implies that the aggregate homeownership rate in these countries would have declined considerably, had it not been for a shift in the characteristics of the population towards homeownership.
- In Australia and Luxembourg, the aggregate homeownership rate declined by around 2 percentage points over the decade to the mid-2000s. Australia's homeownership rate would have declined further had it not been for a shift in the characteristics of the population towards homeownership.¹⁸ For both countries, the estimates point to a significant decline in the propensity for households to be homeowners, holding household characteristics constant.

The factors that account for the explained change in the aggregate homeownership rate are now briefly discussed. Appendix C contains the detailed decomposition estimates for each country.

4.1.3. *Age structure*

Across the 12 OECD countries studied, changes in the age structure boosted the aggregate homeownership rate by $\frac{3}{4}$ -1 percentage point on average, and the effect was somewhat larger in Switzerland, Germany, Denmark and Canada. Moreover, while the impact of population ageing was smaller in absolute terms in Australia and the United States, it nonetheless accounts for a significant proportion of the explained change in aggregate homeownership rates. Indeed, the estimates imply that the homeownership rate in Australia and Luxembourg would have declined even further over the period examined, had it not been for changes in age structure.¹⁹

4.1.4. *Other explained factors*

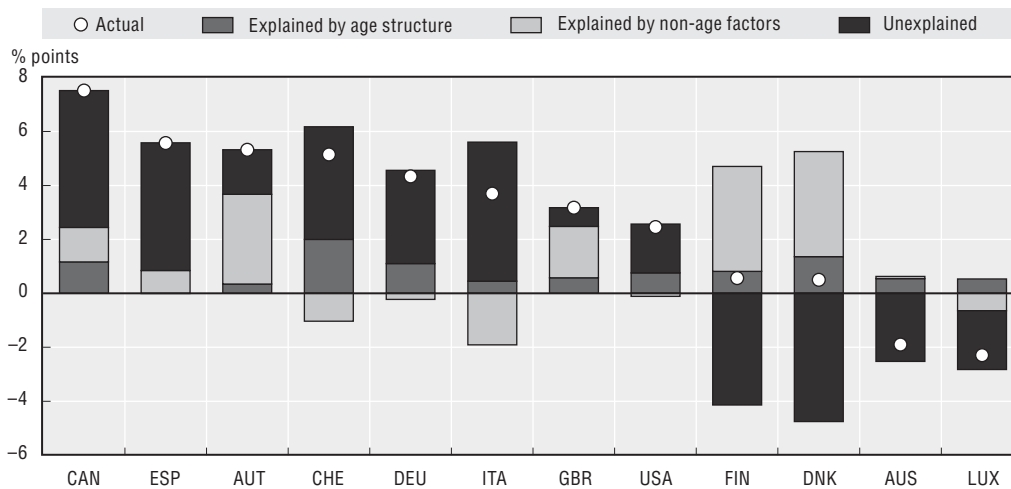
The decomposition estimates also suggest a role for changes in other household characteristics:

- Changes in household size and structure have generally exerted a downward influence on aggregate homeownership rates, particularly in Germany, Italy and Australia (Table 2). This generally reflects a rise in the share of single-headed households over the sample period, although in Italy a decline in average household size has also contributed. By contrast, changes in household size and structure have placed upward pressure on aggregate homeownership rates in Austria, Canada and Denmark.²⁰
- Growth in real household disposable income generally has placed upward pressure on homeownership rates, particularly in Denmark and Finland, which is consistent with the large estimate effect of household income on homeownership probabilities. By contrast, relatively stagnant household incomes have exerted modest downward pressure on aggregate homeownership rates in Germany, Italy and Switzerland.
- With the exception of the United Kingdom, the impact of changes in education on aggregate homeownership rates is generally modest.
- An increase in the socio-economic disadvantaged – proxied by ethnic/immigrant and health status – has generally exerted downward influence on aggregate homeownership rates. This is particularly the case with respect to immigrant households in Italy and

Luxembourg. In Canada, an increase in the incidence of disability has exerted downward pressure on aggregate homeownership rates.

Figure 5. **The contribution of ageing to the change in the aggregate homeownership rate¹**

Circa 1995 to 2005, selected OECD countries



1. The dot refers to the actual change in the aggregate homeownership rate over the period studied. This can be decomposed into a part explained by changes in household characteristics – which include age structure and other non-age factors such as household structure, household income, and education – and a component which is unexplained by changes in household characteristics.

Source: OECD calculations based on household datasets sourced from LIS, the GSOEP and the American Housing Survey.

Table 3. **Contribution of household size and structure to the change in aggregate homeownership**

Percentage point contribution, ranked in order of combined effect

	Explained by household size (1)	Explained by household structure (2)	Combined effect (3) = (1) + (2)
Austria	1.1	0.2	1.2
Canada	0.1	0.3	0.4
Denmark	..	0.3	0.3
Luxembourg	-0.1	0.1	-0.1
Finland	-0.3	0.2	-0.1
United Kingdom	..	-0.1	-0.1
Spain	..	-0.4	-0.4
Switzerland	-0.6	0.2	-0.4
United States	0.0	-0.4	-0.5
Australia	..	-0.7	-0.7
Italy	-0.4	-0.4	-0.8
Germany	-0.2	-0.8	-1.0

Note: The combined effect corresponds to the household size and structure bar in Figure C.1 and and C.2. For Australia, Denmark, Spain and the United Kingdom, the decompositions are based on regressions that do not include household size.

Source: OECD calculations based on household datasets sourced from LIS, the GSOEP and the American Housing Survey.

5. Empirical results: policy influences on tenure choice

Given that shifts in household characteristics can only explain part of the change in aggregate homeownership rates (Figure 5), there may be a role for policy factors in explaining these developments. For instance, the increased propensity for homeownership amongst households in the United States, holding their characteristics constant, is consistent with the considerable relaxation of lending standards that made mortgage debt available to households who would not otherwise have been homeowners (Doms and Krainer, 2007). Accordingly, this section sheds light on the influence of innovations in mortgage markets, tax relief on mortgage debt financing and rental market regulations on homeownership rates. For purposes of continuity, it is important to note that this analysis is generally based on the 12 countries studied in Section 4 plus Belgium, France and the Netherlands (see Appendix A). However, the results are broadly similar if the latter three countries are excluded.

5.1. Mortgage market innovations

The results from the cross-country panel estimation of equation (4), which examines the link between changes in the down-payment constraint and homeownership rates amongst marginal buyers, are summarised in Table 4. Other control variables (including demographic and socio-economic influences on homeownership) are not shown in the table for sake of brevity. To aid interpretation, an estimate of the total impact of financial deregulation evaluated at the sample median value of housing tax relief is also provided. In addition, Figure 6 shows the impact of a 10 percentage point rise in the LTV on the homeownership rate of different groups – relative to the group-specific sample median

Table 4. **Panel estimation of homeownership rates**

Households in income quartile 2

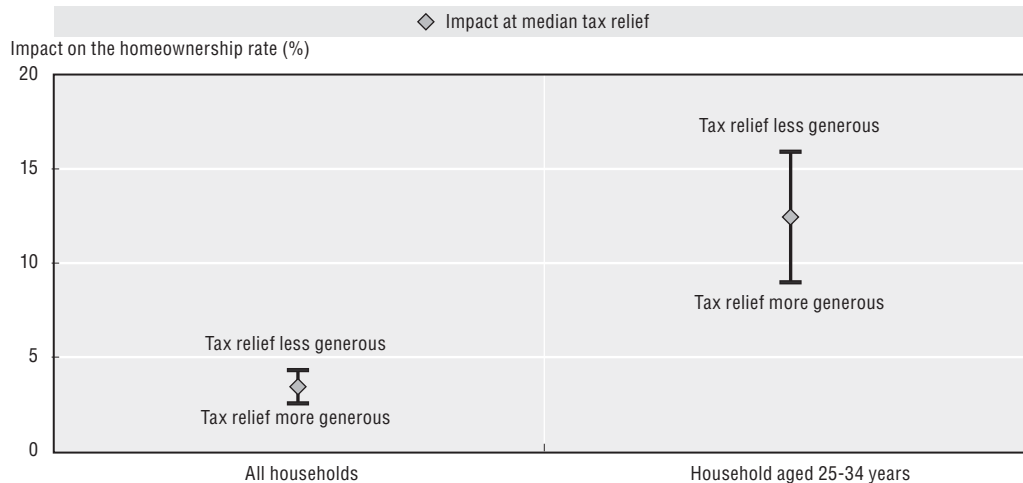
	All households		Households 25-34 years	
	(1)	(2)	(3)	(4)
Variables of interest				
Loan to value ratio (LTV)	0.255***		0.594***	
	[0.054]		[0.125]	
LTV x Tax relief	-0.189**		-0.471*	
	[0.086]		[0.268]	
Financial reform index		5.742		11.215*
		[4.119]		[6.255]
Financial reform index x Tax relief		-12.307***		-26.102***
		[3.005]		[6.325]
Impact of financial deregulation terms on homeownership rates evaluated at the median of the structural features (p-values in brackets)				
LTV	0.192***		0.437***	
	[0.001]		[0.000]	
Financial reform index		1.636***		2.509***
		[0.002]		[0.001]
Observations	63	60	60	57
Number of Countries	16	16	15	15
R-squared	0.93	0.93	0.82	0.79

Note: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The regression includes country and time fixed effects and control variables, such as real household disposable income, real interest rates, real construction costs, house price-to-rent ratio, share of population aged 25-44 years and the homeownership rates of other income/age groups. The sample includes the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Luxembourg, the Netherlands, Spain, Switzerland, the United Kingdom and the United States.

homeownership rate – and how this impact varies with the extent of housing tax relief. Results are also presented using an index of financial reform (Abiad *et al.* 2008; see Figure 4 in Andrews, 2010), in place of the LTV, to demonstrate the robustness of the estimates (Columns 2 and 4). While additional analysis suggests the results are also broadly robust to controlling for evolution of the dwelling stock (as measured by the number of dwellings), changes in the composition of the dwelling stock may also matter for homeownership (Hilber, 2007). Unfortunately, data constraints make it difficult to test the importance of this hypothesis over the period of analysis.

With the above caveat in mind, financial deregulation has been associated with an increase in homeownership among households who are potentially financially constrained, via a reduction in the down-payment constraint. The estimates imply that a 10 percentage point increase in the LTV (*i.e.* a reduction in the down-payment constraint) could raise the homeownership rate of households in the second income quartile by 1.9 percentage points, holding all else equal (including the price-to-rent ratio). By comparison, a 10 percentage point increase in the LTV could raise the homeownership rate of households aged 25-34 years in the second income quartile by 4.4 percentage points,

Figure 6. Homeownership, financial deregulation and housing tax relief
Impact of a 10 percentage point increase in the maximum LTV ratio on the homeownership rate of households in the second income quartile relative to the sample median homeownership rate



Note: The figure shows the impact of a 10 percentage point – or one standard deviation – rise in the maximum LTV on the homeownership rate of each group. The impact on homeownership is expressed in percentage terms, relative to the sample median homeownership rate for each group, to control for differences in median level of homeownership between each group. The dot shows the estimated impact of an increase in the LTV on the group-specific homeownership rate when tax relief on mortgage debt financing is set equal to the sample median level. The upper (lower) bound shows the estimated impact when tax relief is set at 0.5 standard deviations below (above) the sample median level.

When Tax relief is set to the sample median, the overall impact coefficient on LTV is 0.19 for all households and 0.44 for those aged 25-34 years (see columns 1 and 3 of Table 3). In turn, these coefficients are used to construct the following policy experiments:

- All households in the second income quartile: a 10 percentage point rise in the LTV is associated with a 1.9 percentage point rise in the group-specific homeownership rate. This is equivalent to a 3.4% rise – as indicated by the dot – relative to the group-specific sample median homeownership rate of 55.6%.
- Households aged 25-34 years in the second income quartile: a 10 percentage point rise in the LTV is associated with a 4.4 percentage point rise in the group-specific homeownership rate. This is equivalent to a 12.4% rise – as indicated by the dot – relative to the group-specific sample median homeownership rate of 35.1%.

Sources: LIS and OECD calculations. LTVs are plotted in Figure 14 of Andrews, Caldera Sánchez and Johansson (2011) and are sourced from Chiuri and Jappelli (2003), Catte *et al.* (2004) and ECB (2009).

holding all else equal. This is consistent with the idea that the down-payment constraint particularly affects younger households, who have had less time to accumulate a deposit.

Back of the envelope calculations suggest that the impact of a relaxation in the down-payment constraint on aggregate homeownership rates is in the same ballpark as the impact of population ageing on aggregate homeownership rates. Overall, the estimates imply that a 10 percentage point increase in the maximum LTV could be associated with a 0.5 percentage point increase in the aggregate homeownership from a sample median aggregate homeownership rate of 63.6%. In comparison, changes in the age structure boosted the aggregate homeownership rate by $\frac{3}{4}$ -1 percentage point on average across the 12 OECD countries studied.

5.2. Tax relief on mortgage debt financing

The impact of mortgage market innovations on homeownership, however, is also influenced by the extent of tax relief for mortgage debt financing. The interaction between LTV and Taxrelief is negative and significant, which suggests that in countries with more generous tax relief on debt financing, the expansionary impact of an increase in the LTV ratio on the homeownership rate of financially-constrained households is smaller. In a typical OECD country, a 10 percentage point increase in the LTV is associated with a 4.4 percentage point rise in the homeownership rate of households aged 25-34 years in the second quartile. In a country where tax relief is half a standard deviation more generous, however, the impact is only 3.2 percentage points.

Thus, tax reliefs can distort the impact of other policies such as mortgage market innovations, and indirectly crowd-out financially constrained households from homeownership. This may reflect the greater tendency for house price capitalisation of demand shocks to occur in countries where housing tax relief is generous (see Andrews, 2010). In such environments, it is possible that the increase in the required deposit – due to higher real house prices – may have offset the easing of the down-payment constraint, thereby reducing housing affordability for the marginal buyer.²¹ This interpretation is consistent with studies that show that higher real house prices can reduce homeownership rates amongst marginal buyers, by discouraging saving for a deposit and/or significantly increasing the period required to save for a deposit (Engelhardt, 1997; Engelhardt and Mayer, 1988).

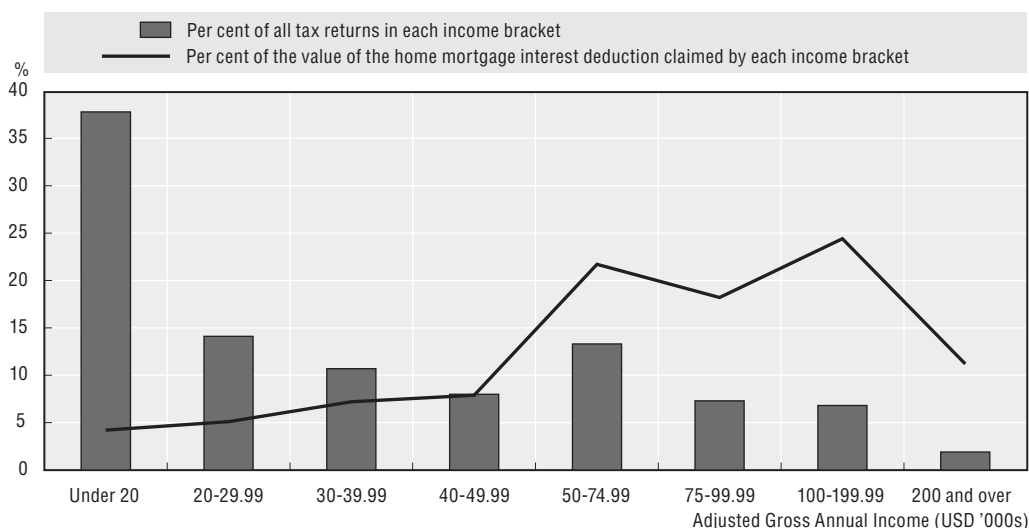
Of course, mortgage market innovations tend to have a direct effect on real house prices, irrespective of housing taxation arrangements, which may have offset the easing of the down-payment constraint on homeownership. For example, Andrews (2010) estimates that financial deregulation has boosted real prices by as much as 30% in the average OECD country over recent decades. The extent to which this reduces affordability for the marginal buyer, however, also depends on the extent to which housing supply responds, with the evidence suggesting that the impact of financial deregulation on house prices is smaller in environments where housing supply is more responsive to price developments (see Andrews, 2010; Favara and Imbs, 2009). Indeed, additional modelling (not presented here) suggests that the adverse affect of generous housing tax policies on homeownership is more acute in countries with more rigid housing supply, which is consistent with existing evidence from the United States (Toder *et al.* 2010). This hypothesis is tested by including a triple interaction term (Financial Reform*Taxrelief*Supplyelasticity) in the estimation framework outlined above (estimates of the elasticity of housing supply are sourced from Caldera-Sánchez and Johansson, 2011). However, this interaction term is not

always significant, especially in the specifications that include the LTV in place of the Financial Reform Index.

Since the direct effect of tax relief on the homeownership rate of households in the second income quartile (i.e. the marginal buyer) is not modelled, it is possible that this effect – to the extent it is positive – could offset the indirect effect identified above.²² However, the direct effect is likely to be economically small since tax reliefs for debt financing costs generally take the form of a deduction against earned income, which is worth less to households in the second income quartile than to high-income earners. This is supported by data from the United States, which show that the bulk of the value of the mortgage interest deduction is claimed by a relatively small fraction of households with high incomes (Figure 7). For example, while over half of all filed tax returns in 2003 pertained to adjustable gross incomes of less than 30 000 USD, this income bracket accounted for just 9% of the value of mortgage interest deductions. By contrast, taxpayers with adjustable gross incomes over 75 000 USD claimed 54% of the value of home mortgage interest deductions, despite only accounting for 16% of tax filers.

Figure 7. **Who benefits from the home mortgage interest deduction?**

United States, 2003¹



1. The columns show the share of tax filers in each income bracket, while the line shows the share of the value of mortgage interest deductions claimed by each income bracket. For instance, while 38% of all filed tax returns in 2003 pertained to adjustable gross incomes of less than 20 000 USD, this income bracket accounted for only 4% of the value of mortgage interest deductions. As noted in Prante (2006), while adjustable gross income differs somewhat from other measures of personal income, this distinction does not affect the distributional analysis shown above.

Source: Calculations from Prante (2006) based on Internal Revenue Service data.

5.3. Rental market regulations

Results also suggest a role for rental market regulations in influencing tenure choice, with stricter rent regulation and greater tenant protection associated with lower

probability to be a homeowner in the sample of countries studied. The results from the probit estimation of equation (5) reported in Table 4 show that²³:

- Higher rent controls, measured by the rent control index (column 1) are associated with lower probability of homeownership. Similarly, higher security of tenure is also associated with lower homeownership (column 2).
- The estimates imply that decreasing rent control from the average observed in the sample of countries by ½ a standard deviation (or to the level in Ireland) would raise average homeownership by 4 percentage points. Lowering the security of tenure by ½ a standard deviation would, in turn, increase average homeownership by 2 percentage points.

Rental market regulations may impose costs, however, to the extent that they are capitalised into housing costs and undermine flexibility in the housing market. Across OECD countries, residential mobility tends to be lower – *all else equal* – in countries where rental market regulations are stricter, as measured by the degree of rent control and security of tenure (see Caldera Sánchez and Andrews, 2011). This may reflect the reluctance of sitting tenants in heavy regulated dwellings to move and give up their below-market rents.

Table 5. **The effect of policies on tenure choice**¹

Policies	(1) Rent control	(2) Security of tenure
Dependent variable = 1 if homeowner; 0 if tenant (living in the private or social sector)		
Policy	-0.083*** (0.002)	-0.071*** (0.003)
Number of observations	224 359	235 953
Number of countries	22	22

1. This analysis covers the following countries: Australia, Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, the United Kingdom and the United States. Regressions include control variables on household characteristics such as real household disposable income, age, education, employment status, household size, cohabitation status; as well as controls for the degree of urbanisation and total national income. Values are marginal effects. The coefficients correspond to the impact of one unit change in the probability to be a homeowner estimated at the mean of the independent variables. The sample is restricted to individuals who are the head of the household and aged 24-66 to avoid the results being influenced by atypical tenureship. The estimates are weighted by individual sampling probability. Robust standard errors clustered at the country level are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Sources: OECD calculations based on 2007 EU-SILC for European countries, 2007 HILDA for Australia, 2007 SHP for Switzerland, 2007 AHS for the United States and the OECD Housing Market questionnaire.

6. Conclusion

The results highlight the contribution of changes in demographic, socio-economic and selected policy variables to explaining patterns in aggregate homeownership rates across OECD countries over recent decades. Since the mid 1990s, part of the change in homeownership rates can be explained by changes in household characteristics. In some of the countries studied, population ageing and increases in real household incomes can each account for around 1 percentage point of the rise in aggregate homeownership rates, although the contribution of these factors can vary significantly across countries. Shifts in household characteristics, however, cannot account for all of the change, leaving a potential role for public policy in explaining developments in homeownership rates. Innovations in mortgage markets appear to have boosted aggregate homeownership rates,

and rough estimates suggest that this effect appears to be broadly comparable with the impact of population ageing. However, there is some evidence that the impact of mortgage market innovations has been distorted by generous housing tax relief, especially for lower income households due to the resulting increase in house prices. The evidence also suggests that rental market regulations impact homeownership by making renting more attractive, but these policies also carry costs.

To the extent that boosting homeownership is a public policy goal in some OECD countries, these results highlight some of the unintended consequences of current housing tax arrangements in many OECD countries. Of course, higher homeownership rates may not necessarily be desirable to the extent that they may constrain residential and labour mobility (see Caldera Sánchez and Andrews, 2011). Moreover, while alleviating credit constraints is generally desirable, it is important to acknowledge that the relaxation in lending standards can go too far, especially if this is associated with insufficient regulatory supervision as illustrated by recent developments in the United States (see Andrews, Caldera Sánchez and Johansson, 2011).

Notes

1. See Andrews, Caldera Sánchez and Johansson (2011) for a discussion of the tax treatment of housing investment and mortgage market developments.
2. For a discussion on housing taxation, see Andrews, Caldera Sánchez and Johansson (2011).
3. The study uses various household-level micro datasets, such as the Luxembourg Income Study (LIS), American Housing Survey (AHS), German Socio-Economic Panel (GSOEP) and the European Union Statistics on Income and Living Conditions (EU-SILC). While a number of data sources are utilised to improve country coverage, coverage still varies significantly between the three main empirical strategies owing to the specific data requirements of each approach (see Appendix A).
4. Asymmetric information and other credit market friction mean that lenders often require equity contributions (i.e. a down-payment) from borrowers when granting a home mortgage loan.
5. Similarly, Duca and Rosenthal (1994) found that borrowing constraints lowered the United States homeownership rate by around 8 percentage points, disproportionately affecting younger households.
6. Regulatory ceilings on LTV ratios have tended to be particularly binding in Germany, while in other countries, LTVs are effectively capped by lengthy legal procedures in the event of default (Catte *et al.* 2004).
7. The specific focus on tax relief to debt financing is also appropriate, given the important changes that have taken place in mortgage markets in OECD countries over recent decades.
8. Tax relief on mortgage debt financing also encourages households (particularly those with high incomes) to hold more debt than otherwise (Hendershott *et al.* 2002).
9. This is the expression for the Blinder-Oaxaca decomposition based on a linear regression. To account for the binary dependent variable and the non-linear nature of equation (1), however, a more involved non-linear procedure proposed by Fairlie (1999) is adopted, although the intuition is essentially the same as in the linear case. See Appendix C of Andrews and Caldera Sánchez (2011) for more details.
10. This is obtained by deflating the nominal income measure contained in the survey by the consumer price index.
11. To the extent that housing costs tend to be higher in large cities, regional dummies may provide a reasonable proxy for relative house prices.
12. In the context of equation (4), this implies that $j = 2$ and a separate model is estimated for both groups.
13. For example, if the homeownership rate of the other income quartiles is not held constant, then it is possible that a rise in the LTV could increase $HO^{\text{Quartile}2}$ at the expense of another income

quartile, thereby making inferences about the impact on the aggregate homeownership rate difficult.

14. The model does not include regional-fixed effects because data on household location are not available for more than half of the countries in the sample.
15. A possible solution is to include country-fixed effects to control for time-invariant, country-specific factors. However, since the policy variables in equation (5) are only measured at a single point, their impact on tenure could no longer be identified since they would be subsumed in the country-fixed effects.
16. In half of the countries studied, there tends to be little difference between the probability of homeownership for couple-headed households with children compared with those without. While it is not possible to separate household structure into the same categories for the United States, the probability of homeownership tends to be higher amongst married households and households where the head has been previously married.
17. By contrast, the estimates from the tenure choice equation for Australia – which is most comparable with the United Kingdom – suggest a much smaller impact of education on the probability to be a homeowner. For example, households with tertiary and associate-level (i.e. trade) qualifications in Australia are only 4 percentage points and 7 percentage points more likely to be homeowners than those without post-secondary education.
18. Additional modelling (not shown) based on the Household, Income and Labour Dynamics in Australia Survey suggests a further unexplained decline in Australia's homeownership rate up until 2007.
19. The decomposition estimates suggest that changes in the age structure had little impact on the aggregate homeownership rate in Spain. This reflects the fact that while the average age increased by over one year in Spain over the period studied, the share of households in the 45-64 age bracket – the group with the highest propensity to be homeowners according to the tenure choice equation – declined somewhat. This result is robust to using different age brackets in the tenure choice estimation.
20. In Canada, the positive contribution from household structure reflects a decline in single-headed households coupled with a negative marginal impact of being a single-headed household on homeownership propensities (Table 2).
21. For instance, Battelino (2009) notes that a particular problem for first-home owners in Australia is that the rise in the ratio of house prices to income has substantially increased the deposit required to access the market.
22. The direct effect of tax relief for debt financing costs on homeownership is not modelled since the variable used to proxy tax relief is time invariant and is thus subsumed in the country-fixed effects.
23. The control variables, omitted from the table for the sake of brevity and listed at the bottom of Table 3 are generally of the expected sign and significance. The results are also robust to controlling for cross-country differences in the share of private rentals in the housing stock.

References

- Aaronson, D. (2000), "A Note on the Benefits of Homeownership", *Journal of Urban Economics*, Vol. 47: pp. 356-269.
- Abiad, A., E. Detragiache and T. Tressel (2008), "A New Database of Financial Reforms", IMF Working Paper WP/08/266, IMF, Washington, DC.
- Andrews, D., A. Caldera Sánchez and A. Johansson (2011), "Housing Markets and Structural Policies in OECD countries", *OECD Economics Department Working Papers*, No. 836, OECD, Paris.
- Andrews, D. and A. Caldera Sánchez (2011), "Drivers of Homeownership Rates in Selected OECD Countries", *OECD Economics Department Working Papers*, No. 849, OECD, Paris.
- Andrews, D. (2010), "Real House Prices in OECD Countries: The Role of Demand Shocks and Structural and Policy Factors", *OECD Economics Department Working Papers* No. 831, OECD, Paris.
- Battelino, R. (2009), "Housing and the Economy", Remarks to the 6th National Housing Conference, Melbourne Convention and Exhibition Centre, Melbourne, 25 November. Available at: www.rba.gov.au/speeches/2009/sp-dg-251109.html.

- Benzeval, M. and K. Judge (1996), "Access Health-Care in England – Continuing Inequalities in the Distribution of GPs", *Journal of Public Health*, 18(1), pp. 33-40.
- Blinder, A.S. (1973), "Wage Discrimination: Reduced Form and Structural Variables" *Journal of Human Resources* 8, pp. 436-55.
- Bourassa, S.C. (1995), "A Model of Housing Tenure Choice in Australia", *Journal of Urban Economics*, 37(2): pp. 161-175.
- Bourassa, S.C. and M. Yin (2007), "Tax Deductions, Tax Credits and the Homeownership Rate of Young Urban Adults in the United States", *Urban Studies* 45, pp. 1141–61.
- Burgess, R. and N. Skeltys (1992), "The Findings of the Housing and Location Choice Survey: An Overview", National Housing Strategy Background Paper 11, Canberra.
- Bush, G.W. (2002), "A Home of Your Own: Expanding Opportunities for All Americans", available online at: <http://georgewbush-whitehouse.archives.gov/infocus/homeownership/toc.html>.
- Caldera Sánchez, A. and D. Andrews (2011), "To Move or Not to Move: What Drives Residential Mobility in the OECD?", *Economics Department Working Papers* No. 846, OECD, Paris.
- Caldera Sánchez, A. and Å. Johansson (2011), "The Price Responsiveness of Housing Supply in OECD Countries", *OECD Economics Department Working Papers*, No. 837, OECD, Paris.
- Capozza, D., R. Green and P. Hendershott (1996), "Taxes, Mortgage Borrowing, and Residential Land Prices", In *Economic Effects of Federal Tax Reform*, ed. H.J. Aaron and W.G. Gale, Brookings Institution Press, Washington, pp. 171-198.
- Catte, P., N. Girouard, R. Price and C. André (2004), "Housing Markets, Wealth and the Business Cycle", *OECD Economics Department Working Papers*, No. 394, OECD, Paris.
- Chiuri, M. and T. Jappelli (2003), "Financial Market Imperfections and Homeownership: A Comparative Study", *European Economic Review* 47(5), pp. 857-875.
- Chiuri, M. and T. Jappelli (2010), "Do the Elderly Reduce Housing Equity? An International Comparison", *Journal of Population Economics* 23(2), pp. 643-663.
- Clinton, W.J. (1994), "Letter from President Clinton to HUD Secretary Henry Cisneros", 3 November, available online at: www.globalurban.org/housing_us.htm.
- Currie, J. and A. Yelowitz (1999), "Are Public Housing Projects Good for Kids?", NBER Working Paper No. 6305.
- Dietz, R.D. and D. Haurin (2003), "The Social and Private Micro-Level Consequences of Homeownership", *Journal of Urban Economics* 54, pp. 401-450.
- DiPasquale, D. and E. Glaeser (1999), "Incentives and Social Capital: Are Homeowners Better Citizens?", *Journal of Urban Economics*, 45(2), pp. 354-384.
- Doms, M. and J. Krainer (2007), "Innovations in Mortgage Markets and Increased Spending on Housing", Federal Reserve Bank of San Francisco Working Paper 2007-05.
- Duca, J. and S. Rosenthal (1994), "Borrowing Constraints and Access to Owner-Occupied Housing", *Regional Science and Urban Economics* 24, pp. 3101–3122.
- Engelhardt, G.V. (1997), "Do Targeted Savings Incentives for Homeownership Work? The Canadian Experiment", *Journal of Housing Research* 8(2), pp. 1237-1268.
- Engelhardt, G.V. and C.J. Mayer (1998), "Intergenerational Transfers, Borrowing Constraints, and Saving Behavior: Evidence from the Housing Market", *Journal of Urban Economics* 44(1), pp. 135-157.
- Engelhardt, G.V., M.D. Eriksen, W.G. Gale and G.B. Mills (2010), "What Are the Social Benefits of Homeownership? Experimental Evidence for Low-Income Households", *Journal of Urban Economics*, 67(3), pp. 249-258.
- ECB (2009), "Housing Finance and Monetary Policy", Working Paper Series No. 1069.
- Fairlie, R.W. (1999), "The Absence of the African-American Owned Business: An Analysis of the Dynamics of Self-Employment", *Journal of Labor Economics*, 17(1), pp. 80-108.
- Favara, G. and J. Imbs (2009), "Credit Supply and the Price of Housing", unpublished mimeo.
- Ferguson, G. (1994), *Building the New Zealand Dream*, Palmerston North, Dunmore Press.
- Ferreira, F., J. Gyourko and J. Tracy (2008), "Housing Busts and Household Mobility", NBER Working Paper No. 14310.

- Gabriel, S.A. and S.S. Rosenthal (2005), "Homeownership in the 1980s and 1990s: Aggregate Trends and Racial Gaps", *Journal of Urban Economics* 57, pp. 101-127.
- Glaeser, E.L. and J.M. Shapiro (2003), "The Benefits of the Home Mortgage Interest Deduction", *Tax Policy and the Economy*, 17, pp. 37-82.
- Green, R. and M. White (1997), "Measuring the Benefits of Homeowning: Effects on Children", *Journal of Urban Economics* 41, pp. 441-461.
- Goodman, A. (1988), "An Econometric Model of Housing Price, Permanent Income, Tenure Choice, and Housing Demand", *Journal of Urban Economics* 23, pp. 327-353.
- Gyourko, J. and P. Linneman (1997), "The Changing Influences of Education, Income, Family Structure and Race on Homeownership by Age over Time", *Journal of Housing Research* 8, pp. 1-26.
- Hanushek, E.A., J.F. Kain and S.G. Rivkin (2004), "Disruption versus Tiebout Improvement: The Costs and Benefits of Switching Schools", *Journal of Public Economics* 88, pp. 1721-1746.
- Haurin, D. and L. Gill (2002), "The Impact of Transaction Costs and the Expected Length of Stay on Homeownership", *Journal of Urban Economics* 51, pp. 563-584.
- Haurin, D., T. Parcel and R. Haurin (2002), "Does Homeownership Affect Children's Outcomes?", *Real Estate Economics*, No. 30, pp. 635-666.
- Hendershott, P.H., G. Pryce and M. White (2002), "Household Leverage and the Deductibility of Home Mortgage Interest: Evidence from UK House Purchasers", *NBER Working Paper No. 9207*.
- Hilber, C.A.L (2007), "The Determinants of Homeownership across Europe: Panel Data Evidence", presented at the 54th Annual North American Meetings of the Regional Science Association International Savannah, 9 November.
- Hilber, C.A.L and F. Robert-Nicoud (2010), "On the Origins of Land Use Regulations: Theory and Evidence from US Metro Areas", *Spatial Economics Research Centre Discussion Paper No 38*, January, London School of Economics.
- Hilber, C.A.L and T.M. Turner (2010), "The Mortgage Interest Deduction and Its Impact on Homeownership Decisions", *SERC Discussion Paper No. 0055*, London, London School of Economics.
- Hirayama, A. (2010), "The Role of Home Ownership in Japan's Aged Society", *Journal of Housing and the Built Environment* (25), pp. 175-191.
- Johansson, Å, (2011), "Housing Policies in OECD and Candidate for Accession Countries: Survey-Based Data and Implications", *OECD Economics Department Working Papers*, OECD, Paris, forthcoming.
- Li, M. (1977), "A Logit Model of Homeownership", *Econometrica* 45, pp. 1081-97.
- Li, W. (2005), "Moving Up: Trends in Homeownership and Mortgage Indebtedness", *Federal Reserve Bank of Philadelphia Business Review*, Quarter 1, pp. 26-34.
- Li, W and F. Yang. (2010), "American Dream or American Obsession? The Economic Benefits and Costs of Homeownership", *Federal Reserve Bank of Philadelphia Business Review*, Quarter 3, pp. 20-30.
- Moran, A. (2006), *The Tragedy of Planning: Losing the Great Australian Dream*, Melbourne: Institute of Public Affairs.
- Nettleton, S. and R. Burrows (1998), "Mortgage Debt, Insecure Homeownership and Health: An Exploratory Analysis", *Sociology of Health and Illness* 20, pp 731-753.
- Oaxaca, R.L. (1973), "Male-Female Wage Differentials in Urban Labor Markets", *International Economic Review* 14, pp. 693- 709.
- OECD (2003), *Asset Building and the Escape from Poverty: A New Welfare Policy Debate*, OECD, Paris.
- Prante, G. (2006), "Who Benefits from the Home Mortgage Interest Deduction?", Tax Foundation mimeo, 6 February. Available online at: www.taxfoundation.org/news/show/1341.html.
- Richer, J. (1996), "Explaining the Vote for Slow Growth", *Public Choice* 82, pp. 207-222.
- Rossi, P. and E. Weber (1996), "The Social Benefits of Homeownership: Empirical Evidence from National Surveys", *Housing Policy Debate* 7, pp. 1-35.
- Sherraden, M. (1991), *Assets and the Poor: A New American Welfare Policy*, M. E. Sharpe, Inc., New York.
- Toder, E., M. Austin Turner, K. Lim and L. Getsinger (2010), *Reforming the Mortgage Interest Deduction*, Tax Policy Center, Urban Institute and Brookings Institution, Washington, DC.

Yates, J. (2000), "Is Australia's Home-Ownership Rate Really Stable? An Explanation of the Change between 1975 and 1994", *Urban Studies* 37(2), pp. 319-342.

Yates, J. and B. Bradbury, (2010), "Home Ownership as a (Crumbing) Fourth Pillar of Social Insurance in Australia", *Journal of Housing and the Built Environment*, 25(2), pp. 193-211.

APPENDIX A

Data Sources

The data sources and country coverage varies somewhat according to the empirical approach. This Appendix provides a further elaboration on these issues.

Stylised facts and homeownership decomposition

To assess the contribution of shifts in household characteristics to aggregate homeownership rates over time, country-level household surveys from multiple time periods are required. Suitable household surveys for 12 OECD countries were obtained, primarily from the *Luxembourg Income Study* (LIS). For many of these countries, LIS provides around four or five cross sections, repeated at roughly five-year intervals, beginning in the early- to mid-1980s. At the time the modelling was undertaken, wave 6 surveys (circa 2004) were available for 11 OECD member countries: Australia, Austria, Canada, Denmark, Finland, Italy, Luxembourg, Spain, Switzerland, the United Kingdom and the United States. While the LIS database contains survey data for the United States, a consistent measure of the household's ethnic status – which has been shown to be an important determinant of homeownership (see Gabriel and Rosenthal, 2005) – is not available across the various surveys. Accordingly, the data for the United States in this paper are drawn from the 1997 and 2007 editions of the *American Housing Survey*. Similarly, since the wave 6 LIS dataset for Germany was not available at the time the decomposition analysis was undertaken, data for Germany are sourced from the 1994 and 2007 editions of the *German Socio-Economic Panel Study* (GSOEP). Accordingly, empirical decompositions are conducted for these 12 countries.

Repeated cross-sectional surveys are also available for Belgium, France and the Netherlands, but decompositions were not conducted for these countries since the latest available data were somewhat dated (circa 2000). Data of sufficient quality were lacking for Korea, Japan, New Zealand, Norway and Sweden,¹ and finally estimates are not presented for eastern European countries such as Hungary, Poland and Slovenia.²

Cross-country panel analysis

The cross-country panel analysis – which estimates how changes in financial and tax policies influence homeownership rates of some population groups over time – also utilises data from LIS. Unlike the decomposition analysis which explicitly models tenure choice at the household level, this analysis aggregates the household data to two groups of interest: average homeownership rates of households in the second income quartile – a potential proxy for the marginal buyer – and the average homeownership rate of very

young households (aged 25-34 years) in the second income quartile. While the influence of financial and tax policies on the marginal buyer could also be tested by pooling the various surveys and estimating the impact at the household level, this is not possible due to restrictions on access to the LIS data.³

The sample consists of an unbalanced panel of 15 OECD countries, and homeownership rates are observed at 5-year intervals, generally beginning in the early-to-mid 1980s and concluding around 2004. More specifically, the sample includes the 12 countries mentioned above plus Belgium, France and the Netherlands, though for the latter three countries, the most recent (*circa* 2005) data are not available. Finally, unlike in the decomposition analysis, the data for both Germany and the United States are sourced from LIS to take advantage of the relatively long time series that the LIS database provides.

Cross-sectional analysis

A cross-sectional modelling approach is adopted to estimate the impact of rental regulations on tenure choice at the household level. The cross-sectional – as opposed to panel – approach reflects the fact that the indicators of rental regulations are only available at a single point in time. To the extent that the data requirements are less demanding, however, data for a much broader sample of OECD countries – based on more timely data (from 2007) – are utilised. The sample is based on 22 OECD countries, sourced from the European Union Statistics on Income and Living Conditions (EU-SILC) household database, the Household, Income and Labour Dynamics in Australia Survey, Swiss Household Panel and the American Housing Survey.

Notes

1. There are no time series data available for Korea, while Japan and New Zealand are not LIS members. The survey question referring to tenure status is missing for Norway and contains a large number of missing observations for Sweden.
2. While survey data for these countries are available, the tenure choice equations tend to perform poorly for Eastern European countries – possibly due to the very high rates of homeownership, which make it difficult to distinguish the impact of household characteristics on homeownership.
3. It is not possible to directly access the various LIS household surveys due to confidentiality restrictions. Instead, the data are accessed by sending a statistical code to a server, and estimation results are subsequently returned. This process effectively places computational limits on the estimation, which means that it is very cumbersome to estimate models that require the pooling of numerous households datasets.

APPENDIX B

Empirical Results

The regression results in Table B.1 are based on a sample that pools data from the most recent household survey available, and data from an earlier period (generally the mid-1990s). The benchmark case against which the estimated coefficients and marginal probabilities are interpreted is a head of household aged 20-24, in a couple relationship with no children, with relatively low education and good health and not from an immigrant/ethnic background.

In initial specifications for Australia, Denmark, Spain and the United Kingdom, the coefficient on household size was negative. This appears to reflect a multicollinearity problem between household size and household structure, so household size was excluded from the baseline tenure choice equation. For Austria, Denmark, Finland, Italy, Spain and Switzerland, data constraints mean that it is only possible to assess the relationship between education and homeownership using a dummy variable which takes the value 1 if the household head has tertiary education. For Australia, Canada, Germany, Luxembourg, the United Kingdom and the United States, more detailed data on the educational level of the household head are available. For approximately one-half of the countries modelled, the interaction terms between income and age/household structure were insignificant and, thus, excluded from the baseline regression, while regional dummies are included in two-thirds of the countries studied.

Table B.1. **Logistic regression coefficients from the tenure choice equation**

Dependent variable: Probability of being a homeowner

	(1) Austria		(2) Finland		(3) Italy		(4) Spain		(5) Switzerland	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Age of Household Head										
25-29 years	-0.022	(0.225)	0.488***	(0.136)	-1.126***	(0.217)	0.544*	(0.302)	-1.680***	(0.395)
30-34 years	0.444**	(0.188)	1.160***	(0.139)	-0.978***	(0.198)	0.895***	(0.290)	-0.694**	(0.307)
35-44 years	0.679***	(0.170)	1.593***	(0.132)	-0.350*	(0.179)	1.028***	(0.281)	0.241	(0.262)
45-64 years	1.239***	(0.157)	2.277***	(0.131)	0.053	(0.163)	1.663***	(0.280)	1.020***	(0.248)
65 years and over	1.233***	(0.162)	2.985***	(0.139)	0.303*	(0.164)	2.044***	(0.283)	1.430***	(0.255)
Household structure										
Household Size	0.333***	(0.050)	0.173***	(0.044)	0.056	(0.035)	..	..	0.367***	(0.084)
H2: Couple with dependents	-0.039	(0.127)	-0.112	(0.091)	-0.590***	(0.178)	0.003	(0.093)	-0.057	(0.197)
H3: Single without dependents	-0.142	(0.094)	-0.084	(0.108)	-0.711***	(0.141)	-0.320***	(0.091)	-0.249	(0.158)
H4: Single with dependents	-0.485***	(0.165)	-0.936***	(0.146)	-1.496***	(0.446)	-0.560***	(0.154)	-0.877***	(0.289)
Male household head	0.105	(0.068)	0.044	(0.061)	-0.011	(0.069)	0.092	(0.076)	0.562***	(0.125)
Real Household Disposable Income										
Income	0.029***	(0.005)	0.062***	(0.006)	0.000***	(0.000)	0.040***	(0.004)	0.011***	(0.002)
Income squared	0.000***	(0.000)	0.000***	(0.000)	0.000***	(0.000)	0.000***	(0.000)	0.000***	(0.000)
Education of household head										
Tertiary	-0.089	(0.113)	0.295***	(0.064)	0.222*	(0.114)	-0.080	(0.087)	0.117	(0.146)
Indicators of socio-economic disadvantage										
Disability (Household Head)	..	..	-0.067	(0.072)	-0.166	(0.127)	..	..	..	..
Disability (Spouse of Household Head)	..	..	0.126	(0.095)	0.005	(0.184)	..	..	..	..
Ethnic minority	-1.269***	(0.168)	-0.023	(0.113)	..	..	..	..	..	..
Immigrant/Foreigner	..	..	..	..	-1.436***	(0.152)	..	..	-1.382***	(0.148)
Constant	-2.292***	(0.220)	-2.694***	(0.165)	0.387*	(0.221)	-0.572*	(0.315)	-2.780***	(0.355)
Interaction terms										
Income * Age	No		No		No		No		No	
Income * Household structure	No		No		Yes		No		No	
Regional dummies	No		Yes		Yes		Yes		No	
Surveys	1987, 2004		1995, 2004		1991, 2004		1990, 2004		1992, 2004	
Number of observations	16 294		20 488		16 171		33 986		9 547	
Classification rate	64.78%		82.36%		68.72%		80.80%		69.64%	

Note: Robust standard errors in parentheses, * significant at 10%, ** significant at 5%, *** significant at 1%.

Sources: OECD, LIS, German socioeconomic Panel and American Housing Survey.

Table B.1. **Logistic regression coefficients from the tenure choice equation (cont.)**

Dependent variable: Probability of being a homeowner

	(1) Canada		(2) Denmark		(3) Germany		(4) United States		(5) Australia		(6) Luxembourg		(7) United Kingdom	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Age of Household Head														
25-29 years	-0.032	(0.100)	0.087	(0.113)	0.568***	(0.199)	0.548**	(0.059)	0.220	(0.246)	0.301	(0.292)	0.454***	(0.115)
30-34 years	0.498***	(0.101)	0.377***	(0.114)	1.118***	(0.194)	1.098**	(0.058)	0.795***	(0.229)	0.709**	(0.281)	1.076***	(0.119)
35-44 years	0.967***	(0.090)	0.844***	(0.112)	1.757***	(0.187)	1.627**	(0.055)	1.381***	(0.210)	1.148***	(0.273)	1.278***	(0.099)
45-64 years	1.580***	(0.085)	1.355***	(0.088)	2.241***	(0.185)	2.313**	(0.055)	1.857***	(0.208)	1.453***	(0.263)	1.687***	(0.109)
65 years and over	1.715***	(0.101)	1.905***	(0.083)	2.767***	(0.186)	3.007**	(0.058)	2.442***	(0.218)	1.934***	(0.266)	2.091***	(0.097)
Household structure														
Household Size	0.050***	(0.015)			0.031	(0.027)	0.067**	(0.008)	..	..	0.284***	(0.068)		
Couple with dependents	-0.351***	(0.085)	0.322**	(0.139)	0.150**	(0.067)	..	..	-0.250*	(0.144)	-0.138	(0.180)	-0.054	(0.108)
Single without dependents	-0.830***	(0.060)	-0.864***	(0.069)	-0.579***	(0.053)	..	..	-1.423***	(0.106)	-0.319**	(0.143)	-0.886***	(0.076)
Single with dependents	..	..	..	..	-0.713***	(0.094)	..	..	..	..	..	..	..	..
Male household head	0.151***	(0.024)	0.483***	(0.020)	-0.054	(0.040)	0.065**	(0.020)	-0.149**	(0.063)	-0.043	(0.122)	0.052*	(0.029)
Married	..	..	..	..	..	..	1.124**	(0.030)	..	..	..	..	..	..
Divorced, widowed, separated	..	..	..	..	..	..	0.287**	(0.029)	..	..	..	..	..	..
Real Household Disposable Income														
Income	0.021***	(0.002)	0.007***	(0.000)	0.001***	(0.000)	0.000**	(0.000)	-0.004	(0.005)	0.019***	(0.003)	0.015***	(0.004)
Income squared	0.000***	(0.000)	0.000***	(0.000)	-0.000***	(0.000)	-0.000**	(0.000)	0.000	(0.000)	0.000**	(0.000)	0.000***	(0.000)
Education of household head														
Secondary	0.013	(0.032)	..	..	0.358***	(0.040)	0.275**	(0.027)	..	..	..	..	..	..
Associate	0.199***	(0.033)	..	..	0.225***	(0.063)	0.298**	(0.029)	0.386***	(0.048)	0.635**	(0.259)	0.889***	(0.029)
Tertiary	0.036	(0.042)	0.285***	(0.027)	0.147***	(0.055)	0.321**	(0.032)	0.218***	(0.066)	-0.234*	(0.129)	1.003***	(0.045)
Indicators of socio-economic disadvantage														
Disability (Household Head)	-0.193***	(0.028)	..	..	-0.106**	(0.052)	..	..	..	..	..	..	-0.599***	(0.025)
Disability (Spouse of Household Head)	-0.089**	(0.045)	..	..	..	..	..	..	..	..	..	..	-0.320***	(0.038)
Ethnic minority	..	..	..	..	..	..	..	..	..	..	..	..	-0.318***	(0.053)
Immigrant/Foreigner	..	..	-1.298***	(0.039)	..	..	..	..	..	..	-1.706***	(0.097)	..	..
Non-English Speaking Background	..	..	..	..	..	..	..	..	-0.545***	(0.067)	..	..	..	..
African American	..	..	..	..	..	..	-0.767**	(0.027)	..	..	..	..	..	..
Hispanic	..	..	..	..	..	..	-0.659**	(0.031)	..	..	..	..	..	..
Asian	..	..	..	..	..	..	-0.921**	(0.051)	..	..	..	..	..	..
American Indian	..	..	..	..	..	..	-0.438**	(0.086)	..	..	..	..	..	..
Constant	-1.504***	(0.104)	-2.566***	(0.101)	-5.067***	(0.249)	-3.349**	(0.064)	-0.448**	(0.220)	-1.074***	(0.321)	-0.287**	(0.118)
Interaction terms														
Income * Age	Yes		Yes		No		No		Yes		No		Yes	
Income * Household structure	Yes		Yes		No		No		Yes		No		Yes	
Regional dummies	Yes		No		Yes		Yes		Yes		No		Yes	
Surveys	1994, 2004		1992, 2004		1994, 2007		1997, 2007		1995, 2003		1997, 2004		1999, 2004	
Number of observations	68 578		96 133		17 485		78 266		16 908		6 136		52 708	
Classification rate	77.52%		75.31%		70.81%		77.52%		76.85%		77.95%		75.49%	

Note: Robust standard errors in parentheses, * significant at 10%, ** significant at 5%, *** significant at 1%.

Sources: OECD, LIS, German socioeconomic Panel and American Housing Survey.

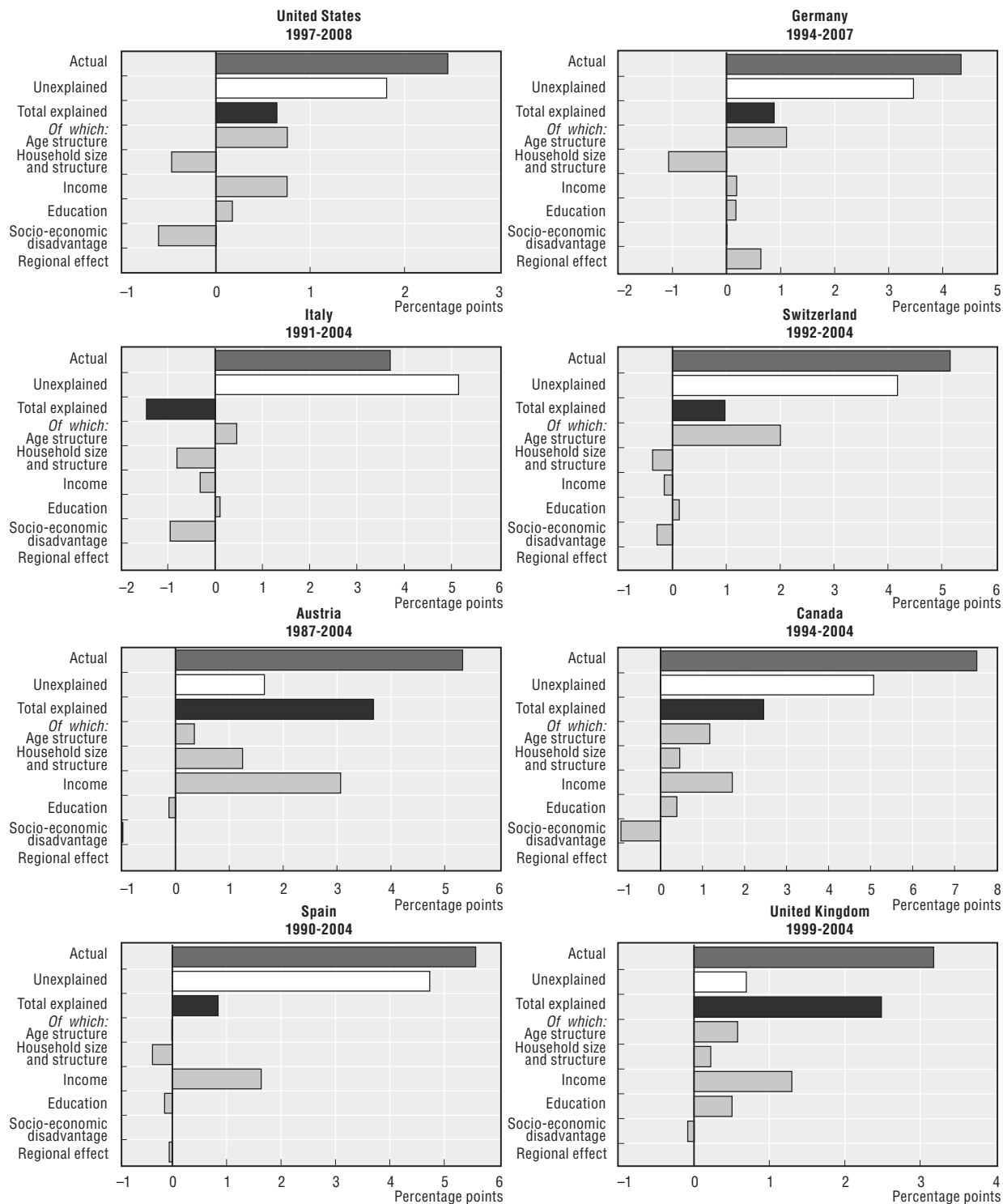
APPENDIX C

Detailed Decomposition Results

The following charts isolate the contribution of each explanatory variable included in the tenure choice equation to the change in the homeownership rate. Together, these characteristics sum to the total explained column. For some countries, the characteristics do not perfectly sum to the total explained bar, because variables that make a very small contribution (such as the regional dummies or the male household head dummy) are generally excluded for presentational purposes. Figure C.1 contains the detailed decomposition estimates for countries where the aggregate homeownership rate increased noticeably over recent times, while the estimates for countries where the aggregate homeownership rate has declined or changed little are shown in Figure C.2.

Figure C.1. Detailed decompositions: countries with rising homeownership rates

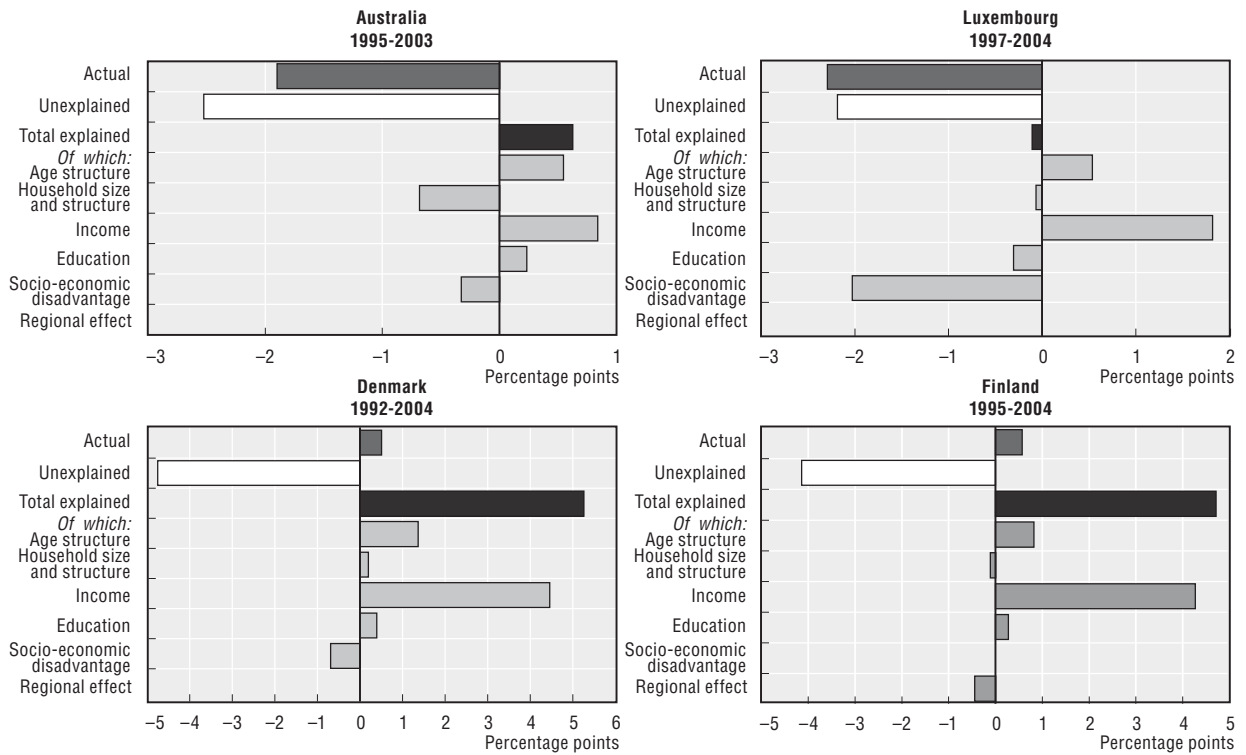
Fairlie non-linear decomposition



Source: OECD calculations based on Luxembourg Income Study (LIS), GSOEP and the American Housing Survey.

Figure C.2. **Detailed decompositions: countries with stable or declining homeownership rates**

Fairlie non-linear decomposition



Source: OECD calculations based on Luxembourg Income Study (LIS).