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Studies on Owner-Occupied Housing, Taxation and Portfolio Choice

Tuukka Saarimaa

ACADEMIC DISSERTATION

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Title of thesis	Studies on Owner-Occupied Housing, Taxation and Portfolio Choice
Author	Tuukka Saarimaa
Supervisors	Heikki A. Loikkanen, PhD, Professor Department of Geography University of Helsinki P.O. Box 17 (Arkadiankatu 7) FI-00014, University of Helsinki Finland Kalle Määttä, LL.D., Professor Department of Economics and Business Administration University of Joensuu P.O. Box 111 FI-80101 Joensuu Finland
Pre-examiners	Essi Eerola, PhD, Principal Economist Government Institute for Economic Research (VATT) P.O. Box 1279 (Arkadiankatu 7) FI-00101 Helsinki Finland Viggo Nordvik, PhD, Research Director NOVA - Norwegian Social Research P.O. Box 3223 Elisenberg N-0208 Oslo Norway
Opponent	Viggo Nordvik, PhD, Research Director NOVA - Norwegian Social Research
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Abstract

Housing is a necessity and an important part of household welfare. For this reason, a number of different subsidies and government regulations have been implemented with the aim of ensuring a reasonable housing standard for all households. This thesis is concerned with one of the most notable features of the Finnish housing subsidy system which is the promotion of homeownership through tax subsidies, i.e. indirectly through tax law. The thesis consists of four chapters. The first chapter serves as an introductory background for chapters 2–4 which constitute the main contribution of the thesis. These chapters include three individual empirical studies that address owner-occupied housing and its tax-treatment from different points of view.

The introductory chapter starts with a short overview of recent Finnish housing market developments and housing policy. Then it discusses the basic aspects of households' tenure choice concentrating on agency problems involved with different tenure modes that may justify their different tax treatment. Furthermore, it covers various reasons proposed in the economics and popular literature on why homeownership should be favoured through public policy compared to renting.

Chapter 2 analyses the tax incentives for mortgage demand. In 1993 a major tax reform was implemented in Finland which changed the tax deduction rates of mortgage interest, and thus, changed households' incentives to borrow. The chapter studies whether households have responded to these changes. The results, based on the difference-in-differences method, show that high income households with high marginal tax rates have responded to the reduced tax incentives by reducing their mortgage borrowing compared to the control group, for whom the incentives to borrow remained more or less the same.

Chapter 3 connects owner-occupied housing and mortgage debt into a broader context of household portfolio choice. The chapter presents empirical evidence on whether debt-financed owner-occupied housing, due to its nature as background risk, has an adverse effect on the amount of stocks in a household's portfolio. The results indicate that owner-occupied housing has an adverse effect on household stockholding. More precisely, a higher house value at a given level of net wealth clearly reduces the probability that a household enters the stock market.

Chapter 4 is concerned with the largest individual housing subsidy in Finland which is the non-taxation of imputed rental income. The chapter estimates the size of the subsidy and analyses its effects on household income distribution. The results indicate that owner-occupied housing has a significant impact on the well-being of many households and that the government loses significant amounts of tax revenue due to this provision. The chapter also compares the current tax system where imputed rental income is untaxed to two alternative tenure neutral tax systems where imputed rental income is taxed. The main finding is that the effects of the reform on overall inequality depend vitally on the way the increased tax revenue is transferred back to the households.

Keywords: owner-occupied housing, tax subsidy, mortgage interest deduction, portfolio choice, imputed rental income

General Contents

Chapter 1: Introduction

1 Introduction

Housing is a major contributor to household welfare. Housing is a necessity that satisfies a basic need for shelter. Housing costs are the largest individual item in households' consumption bundle, and often, residential property is the single most important asset in households' portfolios. As a consumption good, housing is peculiar in other ways as well.[1] Not only are houses durable, but they are also spatially fixed and unique. Although close substitutes exist, exactly identical houses cannot be found. Furthermore, the level of housing consumption can be adjusted only by incurring a cost. For homeowners this cost can be substantial, but also renter households face transaction costs when moving.

In addition to a consumption motive, households need to consider investment aspects when they choose their tenure mode and the amount of housing services to consume. Henderson and Ioannides (1983) argue that homeowners' consumption and investment decisions are intertwined. Because homeowners cannot own only a fraction of the house they reside in, consumption demand for housing services, in effect, introduces a lower bound for housing investment. In this case, a homeowner's consumption and investment decisions are no longer separable. Furthermore, a mortgage is usually needed to finance the purchase of a house. Through mortgage financing financial intermediaries, mostly commercial banks in Finnish case, are more involved in the housing market than in any other market for consumer durables. This may create vulnerability to the economy as was witnessed by a deep recession partly driven by credit losses in Finland in the early 1990s and more recently by the sub-prime mortgage crisis in the U.S.

The supply side of housing markets also differs from usual commodity markets. Housing supply is fixed in the short run and may be inelastic even in the longer run because of inherent scarcity of land suitable for residential construction. Thus, in the short run any demand shocks will be reflected in house prices creating price volatility. This in turn, may enhance business cycles because construction firms base their housing starts on price expectations. Also wealth effects from housing wealth to aggregate consumption may be stronger than from other assets because of the way housing wealth is distributed among households.

[1] Early reviews of housing economics are Quigley (1979), Arnott (1987) and Smith et al. (1988). A more recent survey is Whitehead (1999). Miles (1994) offers a general treatment of housing and its connection to the wider economy. Olsen (1987) addresses econometric issues in housing market research.

Because of the importance of housing to household welfare and the economy as a whole, a number of different subsidies and regulations have been implemented with the aim of ensuring a reasonable housing standard for all households and promoting economic stability. This collection of studies deals with the most notable feature of the Finnish housing subsidy system which is the promotion of homeownership through tax subsidies i.e. indirectly through tax law. These provisions are the non-taxation of imputed rental income and capital gains, and the tax deductibility of mortgage interest. Since these tax subsidies are the largest form of housing subsidy in Finland, it is crucial to study whether they have the intended effect of promoting household welfare. If the provisions do not increase household welfare one should ask whether the provision are in place because of special interest group pressure or because current homeowners as voters are in a position to keep these provision in place.[2] Because many countries offer similar tax subsidies to homeowners, the results from these studies should be of interest not only to Finnish academia and policy-makers but also internationally.

The adverse effects of lenient tax treatment of owner-occupied housing are well documented in the economics literature. First of all, lenient taxation of housing induces households to consume more housing, and thus, increases the existing housing stock at the expense of other productive or business capital stock in the economy. This misallocation of capital resources may lead to slower economic growth and reduced living standards in the long run. For example, Gervais (2002) uses a dynamic general equilibrium model and finds that taxing imputed rental income at the same rate as business capital would substantially increase the stock of business capital and decrease the housing stock.[3]

Second, because of imperfect capital markets households' life-cycle consumption profile is distorted as households need to save for a down-payment when buying a house. Lenient taxation promotes this by making homeownership artificially cheap, and thus, encouraging households to save at a young age when their income is low, which is not optimal from consumption smoothing point of view.

[2] Using a calibrated general equilibrium model, Eerola and Määttänen (2006) find that a median voter has a large share of her wealth in housing (the model is calibrated to U.S. household data), and thus, is reluctant to vote for a revenue neutral tax reform that imposes a higher tax on housing and a lower tax on business capital even when this implies a rise in the wage rate.

[3] Other studies that analyse the efficiency aspects of taxing owner-occupied housing include among others Berkovec and Fullerton (1992), Poterba (1992) and Skinner (1996).

Third, households are encouraged to hold portfolios that are not optimally diversified. Homeowners' wealth is usually tied to a single risky asset that is often debt-financed. This position exposes homeowners to a background risk which may discourage them from taking additional financial risk when compiling their asset portfolios.[4] Furthermore, Berkovec and Fullerton (1992) argue that taxing capital gains from owner-occupied housing would raise welfare also because through taxation (with full loss offset) the government takes part of the risk involved with individual properties. This is possible because house price movements may not be synchronised across regions. When full loss offset is permitted taxation reduces potential losses and gains at household level and distributes them nationally allowing the government to diversify away the local house price risk.[5]

On the other hand, the main argument in favour of subsidising owner-occupied housing is that it creates positive externalities. These externalities may be manifested on two margins. First, homeownership in itself may create externalities, and second, externalities may arise from housing consumption in general. This is an important distinction because it affects the choice of optimal policy instruments. For example, should the government subsidise low-income households so that they can make the transition to homeownership, or should it promote housing consumption in general? These issues are discussed more thoroughly in the latter part of this chapter.

This introductory chapter serves as a background for Chapters 2–4. It starts with a short overview of Finnish housing market development and policy. Then it discusses the basic aspects of households' tenure choice concentrating on agency problems involved with different tenure modes that may justify their different tax treatment. Furthermore, it covers various reasons proposed in the economics and popular literature on why homeownership should be favoured through public policy compared to renting. The usual argument in this literature in favour of subsidising owner-occupied housing is that housing consumption and

[4] Flavin and Yamashita (2002) showed using historical asset return data from the U.S. that a mean-variance efficient portfolio of highly leveraged homeowners includes clearly a lower share of stocks compared to homeowners without leverage. Brueckner (1997) offers an analytic presentation of the result.

[5] Sheffrin and Turner (2001) quantify this effect using U.S. data. They find, however, that homeowners are less well-off under a capital gains tax with full offset than under the current U.S. tax system of no capital gains taxes. However, this aspect may not be so important in Finland where house price movements actually have been quite synchronised across regions, although the capital region has exhibited sharper price swings.

homeownership in particular create positive externalities. This chapter also reviews shortly empirical literature on evidence for such externalities and contrasts these findings on the current tax treatment of owner-occupied housing in Finland.

The main contribution of the dissertation is in chapters 2–4. These chapters include three individual empirical studies that address owner-occupied housing and its taxation from different points of view. Chapter 2 analyses the tax incentives for mortgage demand. In 1993 a major tax reform was implemented in Finland which changed the tax deduction rates of mortgage interest, and thus, changed households' incentives to borrow. The chapter studies whether households have responded to these changes. Chapter 3 connects owner-occupied housing and mortgage debt into a broader context of household portfolio choice. The chapter presents empirical evidence on whether owner-occupied housing has an adverse effect on the amount of stocks in a household's portfolio. Chapter 4 is concerned with the largest individual housing subsidy in Finland which is the non-taxation of imputed rental income. The chapter estimates the size of the subsidy and analyses its effects on household income distribution. This chapter also assesses which type of households would gain or lose if the subsidy was eliminated.

The rest of the introductory chapter is organised as follows. Next section of this introductory chapter provides background information on Finnish housing market development and policy. Section 3 presents the main aspects of household's tenure choice. Section 4 discusses the main reasons proposed in favour of lenient taxation of owner-occupied housing and presents some empirical findings from the literature. The final section provides a summary of the main results of chapters 2–4.

2 Finnish housing markets and policy: an overview

The government is heavily involvement in housing markets in Finland through a variety of taxes, subsidies and various forms of regulation. This section shortly reviews the main aspects and recent history of Finnish housing policy.[6] Up until the mid 1990s, Finnish housing markets were subject to a high degree of regulation. The owner-occupied housing sector was

[6] Loikkanen and Lönnqvist (2007) offer a more thorough overview of the development of housing markets and institutions in Finland and in the Helsinki metropolitan area in particular. See Bengs and Loikkanen (1991) for a review of earlier developments.

regulated indirectly through financial market regulation and private rental markets were subject to rent control. However, the past 20 years have been a time of deregulation. In the late 1980's, financial markets were liberalised. Before the liberalisation interest rates were regulated which led to negative real interest rates and credit rationing. Borrowing for the purpose of house purchase required heavy up-front saving from the households and mortgage maturities were relatively short, less than 10 years. The improved availability of mortgage loans and longer repayment periods released the excess demand created by financial regulation which together with rapid economic growth triggered a boom in house prices in the late 1980s. House prices busted as the economy went into a deep recession in the early 1990's and have been increasing again rapidly since the late 1990's as result of economic recovery, low interest rates and migration.[7] Further deregulation took place in the mid 1990s when rent controls were abolished from new rental contracts in 1992 and were phased out totally by 1995.[8]

One of the main features of Finnish housing policy is lenient taxation of owner-occupied housing. Since the tax reform of 1993 the income tax system in Finland is a so-called dual income tax system where capital and labour income are divided as different types of income and are taxed with different tax rates. Capital income is taxed with a flat rate, currently at 28 percent, whereas labour income is taxed with a progressive rate. When compared to landlords, the Finnish tax system offers three major concessions for households living in owner-occupied dwellings:[9]

1. non-taxation of imputed rental income,
2. non-taxation of capital gains from the sale of an owner-occupied dwelling, if the taxpayer or her family has used it as their primary dwelling (home) for at least two consecutive years, and
3. deductibility of interest on a loan taken for the purpose of home purchase or improvement (a mortgage loan).[10]

[7] See Kalela et al. (2001) for more details on the Finnish recession and recovery.
[8] For further details on the Finnish rent control system see Lyytikäinen (2006)
[9] Finland is not an exception internationally in this respect. See e.g. Englund (2003). A further tax subsidy to housing in Finland is the non-taxation of the low-income housing allowances, which is not covered here.
[10] To be precise, in Finland house loans are not assumable mortgages but personal loans. However, most Finnish house loans are secured by a home.

It is important to note that the deductibility of mortgage interest can be seen as a tax subsidy only because the corresponding income (imputed rent and capital gains) is untaxed. If imputed rents and capital gains were taxed, interest payments should be seen as an expense from producing taxable income and deductibility should not be regarded as a tax subsidy. This is the case with landlords; they pay taxes on rental income and capital gains but are allowed to deduct interest expenses from this income before the tax is levied. Furthermore, both homeowners and landlords are required to pay a municipal property tax.

Due to these provisions in the tax code, the government loses significant amounts of tax revenue. The Government Institute for Economic Research estimated that in 2006 the tax revenues forgone from the non-taxation of imputed rental income and capital gains were 1.8 billion and 0.9 billion euros, respectively. The tax revenue forgone through mortgage interest deductibility was roughly 0.5 billion. At the same time, the overall government tax revenue collected through income and wealth taxes was about 12 billion euros. These figures do not take into account behavioural responses from the households if an actual tax reform is implemented but they should give an idea about the magnitude of the issues under scrutiny.

Although imputed rental income is not taxed in Finland currently, it has been subject to taxation for the most part of the post World War II period. Before 1974 imputed rental income was determined according to local rent level or some predetermined rate of return on assessed house value. The valuation principles varied between regions and the assessed values were set so low that the practical meaning of the tax was very small for most taxpayers. In 1974 the tax on imputed rental income was relieved even further. Imputed rental income became untaxed on part of the house value below a certain limit. Again the assessed tax values were set well below market values and in practise only very large or luxurious dwellings were subject to the tax. Tax values were later increased to resemble market values more closely. For example, Bengs and Loikkanen (1991) report that in 1981 only 38,000 taxpayers paid taxes on imputed rental income, whereas in 1985 the number was more than 100,000. Finally, the tax on imputed rental income was abolished altogether as part of a major

tax reform in 1993.[11] At the same time, a municipal property tax was introduced that is levied on all property owners, landlords and homeowners alike.[12]

In addition to tax subsidies to all homeowners, the government subsidises housing through housing allowances targeted to low income households. The allowances are not tied to tenure, but most of the recipients live in rental dwellings.[13] Students and pensioners have their own allowance systems besides the general housing allowance. The overall amount paid out through these allowances was about 1 billion euros in 2007.

Besides direct allowances and tax subsidies, the government offers subsidised loans to municipalities and non-profit building companies to provide social housing.[14] These loans can be used either to build new housing or to purchase dwellings from the existing housing stock.[15] The owners of the dwellings financed through subsidised loans are required to comply with statutes governing tenant selection and they are only allowed to charge rents corresponding to capital expenditure and maintenance costs (known as cost recovery rent). The tenants for subsidised rental dwellings are selected on the basis of social suitability and financial need. In terms of household income, tenants living in subsidised units are less well off than the population as a whole. However, according to a recent assessment of the Finnish housing finance and subsidy system, 73 percent of Finnish households were eligible for a subsidised unit.[16] Although the importance of social housing construction has diminished in the recent past, social housing still constitutes about 15 percent of the total housing stock. This is partly due to a history of rent controls on free market rental units. During the era of rent control majority of new rental housing was provided through subsidised construction.

[11] The tax reform is described more closely in Chapter 2.
[12] Already before 1993, some municipal user charges were based on assessed tax value of the house. These were also replaced by the property tax. For details of the property tax in Finland see Lyytikäinen (2007).
[13] Lyytikäinen (2008) provides details of the general housing allowance and the economic incentives it creates to households.
[14] These consist mostly of the so-called ARAVA loans. There is also a similar interest subsidy scheme besides the ARAVA scheme. We will not make a further distinction here because of the similarity of the two schemes.
[15] The dwellings are either rental or right of occupancy dwellings. Previously also homeowners were eligible for ARAVA loans. However, this policy ended in 1997. Nowadays, low-income homeowners are eligible for a separate interest subsidy scheme where the government pays part of the interest payments when the interest rate exceeds a certain limit. During recent times of low interest rates, the practical meaning of this subsidy has been small.
[16] See Ministry of the Environment (2002).

In addition to providing social housing, municipalities are strong actors in Finnish housing markets due to their zoning monopoly on the land in their area. Furthermore, municipalities set the property tax rates, although they have to comply with quite narrow limits set by the central government.

3 Housing tenure choice

A household's tenure choice involves a simultaneous choice of the amount of housing services to consume and the allocation of its asset portfolio. Arnott (1987) argues that in a perfectly competitive economy, a household's consumption and portfolio composition decisions are separable. In this case, it makes no difference whether a household owns or rents because by purchasing other assets a household can achieve same state-contingent consumption possibilities under both tenure modes.

However, as Arnott (1987) points out, in reality owner-occupied and rental housing differ on several dimensions. First, homeowners face higher transaction costs associated with moving than renters.[17] Second, homeowners enjoy a greater security of tenure compared to renters. Third, unlike renting homeownership involves a portfolio decision on the part of the household; not only is a house a major capital asset, in most cases a mortgage is needed to finance the purchase. As Henderson and Ioannides (1983) argue one must distinguish consumption demand for housing services and investment demand for housing capital. Fourth, homeowners are exposed to an asset price risk, and possibly, an interest rate risk, whereas renter households face a rent risk.[18] Fifth, because of imperfect capital markets prospective homeowners need to save for a down-payment in order to qualify for a mortgage. This also exposes these renter households to a house price risk due to house price fluctuations and timing of their future house purchase. Sixth, homeowners and landlords are taxed differently, which may create a wedge between the user-cost faced by a homeowner and the rent faced by a renter household living in a similar dwelling. For the above reasons, we observe some empirical regularities in housing markets. For example, wealthier and high-

[17] Usually, it is assumed that homeowners face greater transaction costs due to, for example, realtor fees. In Finland homeowners also have to pay a transfer tax when they buy a house. The tax depends on property type. First-time buyers under the age of 40 are relieved from paying the tax. Also landlords have to pay the transfer tax.

[18] See Sinai and Souleles (2005).

income households are more likely to own and households with shorter expected stays are more likely to rent.

A typical way of comparing the two tenure modes from a household's point of view is to make net present value calculations of cash-flows to see which tenure type is the cheaper option for a given length of residence spell.[19] Some studies of tenure choice concentrate on agency costs related to renting. Henderson and Ioannides (1983) emphasise the "fundamental rental externality" that arises from the fact that landlords are unable to observe the tenants utilisation rate (the tear and wear tenants inflict on the dwelling).[20] Thus, the rents cannot accurately reflect the utilisation rate, which leads to inefficient levels of utilisation by renters because they do not bear the full cost of utilisation they inflict on the dwelling.

Miceli (1989) uses a stylised model to address this issue. He abstracts from many traditional explanations for the tenure choice decision and concentrates on the asymmetric information problem raised by Henderson and Ioannides (1983). In his model, tenure choice is driven by an adverse selection mechanism in the rental market and transaction costs associated with homeownership. Given two types of households that differ according to their utilisation rate (high and low), Miceli finds that when landlords are unable to observe the household type the low types strictly prefer owning to renting and the high types remain indifferent. This is because landlords are forced to collect rents that cover their opportunity cost and the average utilisation costs inflicted by the tenants. Adding transaction costs incurred by homeowners in this model changes this so that now the high types strictly prefer renting and low types' choice depends on the comparison of the suboptimal rental contract that they are offered and the transaction cost incurred if they own. At a given utilisation level, there is a transaction cost above which low types will rent and below which they will own. In addition, in Miceli's model in their respective optimum low types who own will always consume more housing than low types who rent. Miceli's model shows that asymmetric information leads to an inefficient equilibrium where some households consume less than the optimal amount of housing.

[19] An example is Mills (1990) who calculates occupancy times needed to justify owner-occupancy in the U.S.
[20] More precisely, landlords are unable to observe the utilisation rate *ex ante* and are also unable to fully charge the tear and wear from the tenants *ex post*.

In addition to transaction costs, homeownership may be undesirable or unattainable for some households because houses can be bought only in large bundles and often require a down-payment for a mortgage. Furthermore, a substantial share of a homeowner household's wealth is tied to a single risky asset creating a risky asset portfolio. As Brueckner (1997) shows households have to balance the disutility from an undiversified portfolio and the disutility of paying high rents when making their tenure decision.

The problem of inefficient utilisation is not limited to rental markets, however. Due to the fact that houses usually outlive their owners, or their residence spells, homeowners (the same way as renters) may not have incentives to take socially optimal care of their houses, because prospective buyers are not able to perfectly monitor the condition of the house.[21] In other words, homeowners may not fully internalise the cost of utilisation because they are not the sole claimants of the market value of the house. This phenomenon is coined as the "resale externality" in the housing economics literature.[22] Ben-Shahar (2004) argues that when a seller has better information than the buyer on the quality of the house, the seller may use improvement and maintenance as signals of house quality. Although the signal itself is productive, inefficient overinvestment is possible in Ben-Shahar's framework given asymmetric information. Furthermore, if sellers can perfectly fake an investment in house improvement (which is unproductive), the fake investment is a dominating strategy and leads to a waste of resources.

Linneman (1985) introduces the notion of relative landlord efficiency in producing housing services. Linneman argues that there are reasons why, in some instances, landlords are more efficient than homeowners in producing housing services from a given structure. Particularly in multifamily units and densely populated residential areas landlords' production costs may be substantially lower than those of homeowners. This is manifested, for example, through more efficient maintenance of common facilities and through lower bargaining costs in the case of externalities or disputes among tenants. On the other hand, a landlord-tenant relationship is a bilateral agreement that encourages opportunistic behaviour from both parties. Because it is expensive or even impossible to include all contingencies into a rental contract, there is an incentive to internalise these costs through vertical integration, i.e.

[21] This is a classic problem of lemons. See Akerlof (1970).
[22] Harding et al. (2000) find no empirical evidence on resale externality in the U.S. housing markets, whereas Iwata and Yamaga (2007) find such evidence from Japanese housing markets.

through homeownership. Linneman suggests that different types of housing markets have differing degrees of relative landlords efficiency, and also, differing degrees of homeownership when other factors are controlled for.

Indeed, Linneman's proposition is, at least partly, confirmed by Table 1 where Finnish housing stock is classified in terms of housing tenure and structure type in 2004. From Table 1 we see that single family detached houses are rarely rented. However, a large percentage of apartments in row houses and even in multi-storey blocks are owner-occupied. This is partly due to a more lenient tax treatment of owner-occupied housing compared to rental housing. If Linneman's arguments are valid, general tax subsidies to owner-occupied housing may lead to tenure modes that are inefficient in particular housing structures. Table 1 also hints that part of the households' choice to become homeowners is tied to the demand for single-family houses, which offer more privacy, bigger yards and other amenities not available in multi-family units.

Table 1. Finnish housing stock according to tenure and structure type in 2004.

	Percentage of overall housing stock	Percentage owner-occupied
Single family detached house	38.3 %	94.7 %
Two-family detached house	3.4 %	69.5 %
Row house	15.7 %	63.4 %
Multi-storey block	41.7 %	41.6 %

Source: Author's calculations from the 2004 Wealth Survey produced by Statistics Finland. Sampling weights are used in the calculations in order to make them representative of the whole population

4 Why subsidise owner-occupied housing?

The main argument in favour of subsidising owner-occupied housing is that it creates positive externalities. The tax subsidies related to housing affect households' decisions on two margins. First, they affect the choice of renting versus owning, and second, they affect the level of housing consumption. It is often argued that both of these decisions involve externalities. Next, we will consider these margins in turn in the light of the current tax subsidies in Finland.

4.1 Externalities from homeownership

There are various reasons why homeownership might create externalities. First, homeowners own an asset that's value is tied to the quality of their community. This creates incentives for homeowners to engage and vote for activities that makes their community more attractive, and thus, increases the value of their property. Renters, on the other hand, may lack these incentives because a more attractive community leads to higher rents and the direct benefits to renters from improving their community may be less than the increase in rents. Furthermore, homeowners tend to favour longer-term investments because they are most likely to capitalise in house values.[23] However, some of the activities engaged by homeowners may also create negative externalities. For example, Glaeser and Shapiro (2002) argue that homeowners are more likely to oppose new residential building close to their property, and to hinder minorities' chances to move into their community. Oswald (1999) points out that local political power groups consisting of homeowners may also discourage business start-ups through tighter zoning and planning laws the same way as they may hinder new residential development.

Homeownership also creates barriers to mobility because homeowners face substantially higher transaction costs than renters. A high ownership-rate and reduced household mobility may create inefficiencies in the labour market. Oswald (1999), among others, has argued that reduced mobility leads to higher unemployment mainly for two reasons. First, because of high transaction costs homeowners are less likely to move after employment. Second, a high ownership-rate naturally translates into low turnover in the rental market because the number of rental units is low. This reduces mobility of the labour force in general. Not only is this likely to lead to a higher unemployment rate, but also, it may lead to a situation where people work in jobs that are not ideally suited for them. Thus, increased unemployment is not so much due to homeowners themselves being more unemployed, but instead, unemployed people are less mobile than in a society where free market renting is more prevalent. High transaction costs are internalised by homeowners and, as such, do not create externalities. However, higher unemployment may increase the overall tax burden in an economy through, for example, higher unemployment benefits.

[23] See DiPasquale and Glaeser (1999) for a simple model of investment in local amenities and public goods that demonstrate these results.

Of course, as pointed out by Glaeser and Shapiro (2002), durability of housing and short run spatial fixity of the housing stock means that even if the society is completely made up of renters, mobility is possible in the short run only through exchange of workers between areas. That is, increased mobility is not an answer to a local temporary downturn because the households who flee the area must find housing in the new location. On the other hand, reduced mobility may also be beneficial because it creates incentives to invest in social capital, to connect to local community and to gain knowledge of important local issues. Furthermore, children may benefit from a more stable living environment.

Oswald (1999) also recognises that homeowners commute much more and longer distances than renters which contributes to congestion, and thus, induces a cost to all traffic users. This aspect has a lot to do with the house structure type that homeowners demand. Usually, single-family houses are not up for rent and owning is the only option for households with preference for this type of housing. Furthermore, single family houses are more or less always situated on the fringe part of an urban area. So in effect, a subsidy targeted at owner-occupied housing creates incentives to choose single family housing.

Finally, homeowners may take better care of their property than renters or landlords. However, due to the fact that houses usually outlive their owners, homeowners (the same way as renters) may not have sufficient incentives to take socially optimal care of their houses, because prospective buyers are not able to perfectly monitor the condition of the house. It may be that homeowners do not bear the full cost of their utilisation, but instead, they partly pass it on to future owners.

4.2 Externalities from housing consumption

Glaeser and Shapiro (2002) list three main positive externalities that might arise from housing consumption. First, a sufficiently poor standard of housing may create fire risks and advance the spreading of diseases. Furthermore, deterioration of buildings may agglomerate and create slums which may breed crime, for example. Second, better housing may create aesthetic amenities that benefit one’s neighbours or even casual passers-by. Third, housing may increase the well-being of children.

Clearly, the first externality is not very relevant in today's Finland or most industrialised countries. However, since policies tend to be path-dependent, it is worth at least to entertain the notion that part of the justification for large scale housing subsidies still stems from such considerations. Nonetheless, it seems that a general tax subsidy to all homeowners is a particularly cost-inefficient way of reducing sub-standard housing. Surely, building standards, zoning laws and targeted allowances are better suited for this aim.

The second externality is based on the fact that when an individual improves her property it increases in value. However, the improvement may also increase the value of neighbouring properties. When making the investment decision, the individual takes into account only the value increase in her own property not the surrounding ones, and thus, the marginal social benefits from the improvement exceed the marginal private costs.[24] Of course, it's difficult to draw a line on when an improvement creates externalities only through aesthetics and when the improvement raises housing standards. It is clear, though, that not all improvements create aesthetic externalities. As Rosen (1985) remarks, painting outside walls creates spill-over effects, whereas painting interior walls does not. Furthermore, because people's tastes are heterogeneous it is also possible that aesthetic improvements may, in fact, create negative externalities. Also, as pointed out by Glaeser and Shapiro (2002), excessively fancy homes may provoke envy. Relating the discussion again to general tax subsidies that are in place in Finland, it seems clear that they do not fulfil the criteria of a Pigouvian subsidy. The usual Pigouvian argument is that subsidies should be targeted directly at those activities that create positive externalities (Rosen, 1985).

The third externality, benefits to children, can be justified if the society in general cares more about the well-being of children relative to parents, or that the family member in charge of housing decisions does not take into account the well-being of all family members, children in particular. However, it seems that these goals can be reached more easily by giving poor households a housing subsidy that does not depend on housing tenure.

[24] Ioannides (2002) finds that homeowners' maintenance decisions are positively affected by the maintenance decisions of their neighbours. This suggests that individual maintenance decisions may bring about improvements in the whole neighbourhood through a social multiplier effect.

As was already pointed out earlier, housing consumption may also create negative externalities. Naturally, any efficiency losses created by distortive taxation are larger if the favoured activity also creates negative externalities. Voith (2001) has argued that subsidising housing consumption encourages people to live outside city centre where lot sizes, and thus, houses are larger. If households, and especially rich households, do indeed move away from the city, this may have a negative effect on the households who remain in the city. Glaeser and Shapiro (2002) argue that if a subsidy creates incentives to consume more housing mainly for the rich, it leads to more segregation by the rich. That is, rich households tend to sort more into rich neighbourhoods.

4.3 Empirical evidence on externalities

Credible empirical evidence on these issues is scarce, largely due to econometric problems in identification. For example, DiPasquale and Glaeser (1999) find, using data from the U.S. and Germany, that homeownership is correlated with various indicators of social involvement, such as membership in non-professional organisations and local politics. However, they point out that causal interpretations of their results are inappropriate because of endogeneity problems.

Glaeser and Shapiro (2002) study a number of externalities and find very little evidence of positive externalities related to housing consumption. They do find some evidence of positive externalities from homeownership but most of their results suffer from poor identification. Dietz and Haurin (2003) review the empirical literature on social and private micro-level consequences of homeownership.[25] They find that the most solid result from the literature is that homeownership has a positive effect on various child outcomes. However, the main conclusion that they draw is that there are still huge gaps in the research agenda on the effects of homeownership, and that existing studies are plagued with econometric and statistical problems, such as endogeneity of key variables. For example, the problem with studying the effects of homeownership on child outcomes is establishing a credible causal link. It may be that children of homeowners do better than children of renters not because their parents are homeowners, but simply because their parents are different from the renter parents. If these

[25] Haurin et al. (2003) review the literature on the effects of neighbourhood homeownership rates. However, the policy perspective of their survey concentrates more on the optimal mix of different tenures in neighbourhoods and whether it is beneficial to cluster or disperse homeowners within a given geographical area.

differences are unobservable, a regression explaining some child outcome variable suffers from an omitted variables problem making the homeownership dummy endogenous.

Munch et al. (2006) find empirical evidence that homeownership does hinder mobility of Danish households, but increases the chances of finding a local job. Furthermore, Munch et al. (2008) find that homeownership has a negative effect on job-to-job mobility both in local jobs and jobs outside the local labour market. On the other hand, they find that homeownership has a negative effect on unemployment risk and a positive effect on wages. However, these effects are private in nature and cannot be used as arguments in favour of a Pigouvian subsidy to homeownership. Green and Hendershott (2001) use state level panel data from the U.S. and find that homeownership seems to hinder mobility of middle age-classes (35–64), and thus, leads to higher unemployment. They are also vary of interpreting this as a causal mechanism because of possible sorting of households across states. Pehkonen (1999) finds tentative evidence on the positive link between regional homeownership and unemployment using Finnish data.

Another way of looking for external effects of homeownership is to see whether house prices are higher in neighbourhoods with high ownership rates. Coulson et al. (2003a and 2003b) find that house prices are indeed higher in neighbourhoods with high ownership rates. However, even if the results cited here truly have a causal interpretation, it is far from clear that a general tax subsidy to homeowners is the best way to subsidise the aspects that create positive externalities. For example, Green and White (1997) argue that instead of giving tax subsidies to all homeowners, more targeted policies toward low-income households would be more cost-effective in promoting homeownership.

4.4 Administrative efficiency

Often the taxation of homeownership and especially of imputed rental income is seen impossible because of the difficulties in assessing this implicit income. Furthermore, an often heard argument is that if we start taxing housing services from owner-occupied housing we should also start taxing services from owned cars and other durable consumption goods.[26]

[26] See Aaron (1970) for a more general discussion.

Even though this argument is correct in principle, it misses an important point, which is that a well-functioning tax system is also one that has low administrative costs.

Valuation of the service stream from various durable goods would be administratively costly. And even though a different tax treatment of rented and owned durables creates efficiency losses, taxing the service stream from all consumer durables would most likely not be efficient. However, owner-occupied housing seems to be the one case that is an exception, given the scale of the housing stock, and thus, the scale of the created efficiency loss to the economy, and available assessment methods for tax valuations. This suggests that the tax subsidies to owner-occupied housing cannot be justified using administrative efficiency arguments.

5 Overview of the dissertation

The above discussion serves as a background for the main part of the dissertation. The issues raised so far are important aspects of households' tenure choice and housing consumption decisions, and must be taken into account when assessing optimal housing policies. We now turn to the main part of the dissertation.

Chapters 2–4 include three individual empirical studies that address owner-occupied housing and its taxation from different points of view. Chapter 2 analyses the demand for mortgage debt. Mortgage interest deductibility lowers the effective price of mortgage debt and therefore should increase households' demand for it. In 1993 a major tax reform was implemented in Finland which changed the tax deduction rates of mortgage interest, and thus, changed households' incentives to borrow. The chapter studies whether households have responded to these changes.

Chapter 3 connects owner-occupied housing and mortgage debt into a broader context of household portfolio choice. Because of lenient taxation of owner-occupied housing, households are more likely to become homeowners and households' portfolios contain more housing capital than they otherwise would. This exposure to a single risky asset that is often leveraged may affect a household's willingness to take the additional financial risks. Chapter

3 provides econometric evidence on whether owner-occupied housing and leveraged housing capital in particular has an adverse effect on homeowners' demand for stocks.

Chapter 4 is concerned with the size of the tax subsidy resulting from non-taxation of imputed rental income and the way it is distributed among households. According to empirical evidence reviewed above, efficiency aspects alone cannot justify the large tax subsidies related to owner-occupied housing. Chapter 4 analyses whether distributional arguments can be used to defend the subsidies. The results from this chapter can also be used to assess which type of households would gain or lose if the subsidy was eliminated. Short summaries of chapters 2–4 follow.

Chapter 2: Tax Incentives and Demand for Mortgage Debt: Evidence from the Finnish 1993 Tax Reform

Previous studies from different countries show that the extent of tax deductibility of interest expenses has major implications for households' borrowing behaviour. This chapter utilises a major tax reform implemented in Finland in 1993 to analyse the demand for mortgage debt by Finnish households. The tax reform significantly reduced the incentives to use debt financing in home acquisition for high-income households. Before the reform, mortgage interest was deductible according to a progressive tax schedule creating a so-called upside-down effect, which means that the benefit from the deduction was the greater the higher was the taxpayer's income. After the reform, the deduction is made according to a flat schedule and the benefit no longer depends on taxpayer's income.

Basically, one can distinguish three groups of taxpayers that were differently affected by the reform. First, for low-income taxpayers, i.e. those in lower tax brackets, the subsidy resulting from mortgage interest deduction was slightly increased. Thus, for low-income taxpayers the incentive to borrow was also increased. Second, taxpayers in the middle tax brackets were (virtually) unaffected by the reform. And finally, for high-income taxpayers the subsidy was reduced and so was their incentive to borrow. This setting can be seen as a natural experiment, where one can distinguish multiple treatment groups and a control group. The treatment groups include households, who were affected by the reform and the control group

are those, who were unaffected. This grouping is the basis of the analysis and enables the use of the difference-in-difference technique.

In Chapter 2, household level repeated cross-section data from the 1990–2000 Income Distribution Surveys of Statistics Finland is used to study whether Finnish households responded to these changed incentives to borrow. The results suggest that high income households with high marginal tax rates have clearly responded to the reduced tax incentives by reducing their mortgage borrowing. The results remain robust after controlling for observable household characteristics and to several sensitivity tests based on sub-samples of the data.

Furthermore, since the construction of the control and treatment groups was somewhat arbitrary, an alternative identification strategy was used which does not suffer from this problem. The second strategy is based on the notion that under a progressive tax and deduction schedule taxable income affects mortgage demand in two ways. First, because housing is a normal good an increase in income should lead to an increase in housing demand and consequently in mortgage demand. Second, under a progressive tax schedule an increase in income leads to a higher marginal tax rate and effectively lowers the after-tax price of mortgage debt. Consequently, higher income leads to higher mortgage demand due to this price effect as well. From a cross-section analysis it is very difficult to identify these effects. However, after the tax reform the after-tax price of mortgage debt is the same for all taxpayers regardless of their income. Therefore, with cross-section data from both before and after the reform the impact of the tax-price effect can be identified. This alternative strategy also lent strong support for the difference-in-differences results.

Chapter 3: Owner-occupied Housing and Demand for Risky Financial Assets: Some Finnish Evidence

Chapter 3 of this dissertation studies the linkage between owner-occupied housing and households' financial portfolio choice. Most of a homeowner's wealth is usually tied to a single risky asset that is often debt financed. This exposes the household to a background risk that may affect the household's desire to take additional risks in its financial decision-making. The first part of this chapter follows the example of Flavin and Yamashita (2002). It analyses,

using a theoretical simulation model, how a leveraged position in owner-occupied housing affects a homeowner's optimal portfolio choice under current investment environment in Finland.

In the theoretical model, a household maximises expected utility of wealth with respect to holdings of financial assets conditional on the current value of its house and net wealth. The motivation for the model is that once a homeowner household commits itself to a particular level of housing consumption, the optimal adjustment interval may be very long because of adjustment costs. Obviously, the costs of adjusting the quantities of financial assets are smaller. The optimal portfolio mix depends on the expected return and variance of the portfolio, and household's risk aversion parameter. Using Finnish asset return data from 1995–2005, the maximisation problem is solved for different levels of household risk aversion and house value-to-net wealth ratio which captures the extent of the household's exposure to house price risk. The results indicate that a leveraged position in housing has a clear negative effect on the share of stocks in a mean-variance efficient portfolio.

The second part of the chapter studies how owner-occupied housing actually affects households' financial portfolios using Finnish household data. The econometric results show that owner-occupied housing has an adverse effect on household stockholding. More precisely, a higher house value at a given level of net wealth clearly reduces the probability that a household enters the stock market. This result can be interpreted in two ways. First, at a given net wealth level higher house value exposes households to higher house price risk which might induce them to mitigate their stockholding. Second, higher house value at a given level of net wealth and mortgage debt automatically means a lower level of financial wealth for the household. So the result may indicate that some households do not see it worthwhile to enter the stock market given their low level of financial wealth and possible entry and participation costs. Although, the results hinted that the latter effect is more important, the relative importance of these two effects cannot be deduced explicitly from the data used.

On the other hand, it seems that housing has only a small effect if any on the share of financial assets a household invests in stocks conditional on stockholding. However, the results concerning the share invested in stocks may suffer from a poorly identified model and

should be taken only as suggestive. Further work is needed in this respect. What comes to other important factors behind stockholding, wealthier and more educated households are clearly more likely to own stocks and also invest a larger share of their financial wealth into stocks.

Chapter 4: Imputed Rental Income, Taxation and Income Distribution in Finland

Chapter 4 examines the effects of imputed rental income from owner-occupied housing on income distribution in Finland. It also considers the distributional effects of levying a tax on imputed rental income. As already mentioned earlier in this chapter, the adverse effects of lenient taxation of owner-occupied housing are well documented in the economics literature. The purpose of Chapter 4 is to evaluate whether the tax advantages can be justified from a distributional point of view.

The first part of Chapter 4 discusses the notion of tenure neutrality in taxation. It illustrates the tax subsidy to homeowners under the current Finnish income tax system by comparing the tax treatment of homeowners and landlords. Because the Finnish income tax system is based on taxing net income, i.e. income net of expenses accrued from producing this income, this part also discusses the appropriate deductible items from gross imputed rental income.

The empirical exercise in Chapter 4 is problematic because imputed rental income comes in non-monetary form as housing services, and thus, is unobservable to the researcher (and the tax authority). The chapter overcomes this problem by using a hedonic rent regression based on free market rents to predict imputed rental values for homeowners. These rental values are then used as the tax base for the new tax. The dataset used in this study is the 2004 Wealth Survey produced by Statistics Finland. This is a good dataset for the purposes of this study because it includes better location information than is usually found in Finnish national level household surveys, and thus, allows the estimation of more plausible hedonic models.

A distributional analysis of the effects of moving to a tenure neutral tax system must include an assumption about how the increased tax revenue is distributed back to the economy so that the overall amount of government tax revenue stays constant. Two alternative ways are considered in Chapter 4. In the first scheme, the increased tax revenue was returned to all

adult individuals as equal size lump-sum transfers. In the second scheme, the capital income tax rate was lowered so that the total tax revenue collected through the capital income tax stayed constant. Due to the nature of the data, conducting experiments with different tax rate cuts in labour income taxes was impossible, although this would probably be a more realistic alternative compared to the ones considered here. Furthermore, the calculations presented in this chapter ignore any behavioural responses from the households

Main findings of Chapter 4 can be summarised as follows. The results indicate that owner-occupied housing has a significant impact on the well-being of many households. In 2004 imputed rental income constituted on average about 10.7 percent of homeowner households' disposable income. The government also loses significant amounts of tax revenue because imputed rental income is untaxed. The estimated tax revenue forgone in 2004 was 1.9 billion euros. This amounts to almost 15 percent of the total government income and wealth tax revenue collected that year. Furthermore, the tax subsidy resulting from non-taxation of imputed rental income is skewed toward high-income households who are more likely to be homeowners and also more likely to own outright. However, also some low-income households are homeowners and they may find it difficult to cope with tax payments if a tax on imputed rental income is implemented.

The effects on overall inequality depend vitally on the way the increased tax revenue is transferred back to the households. Under the lump-sum transfer per adult scheme income inequality decreased slightly compared to the current system, whereas under the lower capital income tax scheme inequality clearly increased. The results suggest that any attempt to reform the taxation of housing to a more tenure neutral direction should be accompanied by a package of tax cuts that would mitigate the negative short run effects to current homeowners.

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Chapter 2:

Tax Incentives and Demand for Mortgage Debt: Evidence from the Finnish 1993 Tax Reform

Tax Incentives and Demand for Mortgage Debt: Evidence from the Finnish 1993 Tax Reform

Tuukka Saarimaa

Abstract:
The 1993 Finnish tax reform reduced the incentives to use mortgage financing in home acquisition for high-income households. Before the reform, mortgage interest was deductible according to a progressive schedule which meant that the benefit from the deduction was the greater the higher was the taxpayer's marginal income tax rate. After the reform, the deduction is made according to a flat schedule and the benefit no longer depends on taxpayer's marginal income tax rate. This setting can be seen as a natural experiment, where one can distinguish multiple treatment groups and a control group. This paper uses household level repeated cross-section data from before and after the reform to study whether Finnish households have responded to these changes in incentives to borrow. The results, based on the difference-in-differences technique, show that high income households with high marginal tax rates have responded to the reform by clearly reducing their mortgage borrowing compared to the control group.

Keywords: mortgage interest deduction, tax incentives, natural experiment
JEL classification: H31, D91.

1 Introduction

Mortgage interest deduction has always been a controversial housing policy tool. Over the years a variety of arguments have been stated in favour and against the provision. One of the main arguments by the opponents is that by eliminating the deduction the government can raise significant amounts of tax revenue. Furthermore, it is argued that the subsidy does not increase housing consumption or reduce the budget share of households' housing expenses as intended, but instead only inflates house prices. Finally, even if the deduction is successful in increasing housing consumption efficiency losses may emerge because of overinvestment in housing relative to a more neutral tax system.

Although the above arguments may be valid, the nature of mortgage interest deduction is often misunderstood in public debate. The fundamental tax advantage that homeowners receive in Finland is not the deductibility of mortgage interest but non-taxation of imputed rental income and capital gains. The removal of mortgage interest deduction would not eliminate the fundamental tax advantage but would tilt the advantage in favour of those wealthy and high-income homebuyers who are less dependent on debt financing. In fact, the deductibility of mortgage interest can be seen as a way to extend the fundamental tax advantage to households who must rely on mortgage financing in order to purchase a home.[27] In any case, the implicit assumption behind the above arguments is that taxation truly influences homebuyers' choice of financing. The purpose of this paper is to study whether this is in fact the case.

The literature on the effects of taxation and interest subsidies on mortgage demand has grown steadily during the last 15 years or so. One branch of research has studied mortgage demand in the broader context of household portfolio choice. Studies concentrating on taxation include Agell and Edin (1990) using cross-sectional Swedish, and King and Leape (1998) using cross-sectional U.S. data. The results from these studies suggest that mortgage demand is indeed sensitive to marginal tax rates. The conclusion is strengthened by Agell et al. (1995) who find that limitations in the amount of interest eligible for deduction in Sweden have mitigated the effect of taxation on mortgage demand found earlier by Agell and Edin (1990).

[27] See e.g. Woodward and Weicher (1989) and Hendershott et al. (2003).

There are also a number of studies that explicitly focus on mortgage demand. In a series of papers, Jones (1993, 1994 and 1995) argues that the demand for owner-occupied housing is not a sufficient explanation for households' mortgage demand. He argues that households with mortgage debt have two options for investing their savings. Either they can invest in non-housing assets or they can reduce their holdings of mortgage debt, which yields a return in form of saved interest expenses. The optimal saving plan is the one that offers highest risk-adjusted return.[28] Crucial to the decision is whether mortgage interest is tax deductible. Using U.S. and Canadian data Jones finds that non-housing portfolio considerations do play a major role in households' mortgage decisions.[29] Follain and Dunsky (1997) constrain their analyses on U.S. homeowners and concentrate on the difference between the costs of equity and debt financing a household faces, and on household's itemisation status.[30] Their results indicate that the demand for mortgage debt is sensitive to the difference in the after-tax costs of equity and debt financing, which suggests that the elimination of mortgage interest deduction would decrease mortgage demand substantially. Ling and McGill (1998) use a similar approach and find evidence that taxation is an important factor driving mortgage demand.

Some studies have exploited tax reforms that created exogenous variation in the tax deduction rate of mortgage interest to deal with endogeneity problems. These include Maki (1996 and 2001) using U.S., Hendershott et al. (2003) and Hendershott and Price (2006) using U.K., Fjærli (2004) and Sommervoll (2007) using Norwegian, Alan and Leth-Petersen (2006) using Danish and Jappelli and Pistaferri (2006) using Italian data. All but Jappelli and Pistaferri (2006) conclude that household behaviour is sensitive to changes in taxation. Jappelli and Pistaferri (2006) attribute their result to credit-rationing or to the lack of financial information and information about changes in the after-tax interest rate on the part of Italian households. Martins and Villanueva (2006) studied the effects of a reform on a program that subsidises mortgage interest payments of young and low-income Portuguese households. The reform introduced a ceiling on house value that could be financed through the program. Using the fact that the reform should affect mostly the behaviour of eligible households living in high-

[28] See also Brueckner (1994).
[29] However, Manchester and Poterba (1989) show that U.S. households who obtain second mortgages are on average less wealthy than other households with similar characteristics. Although their result is only suggestive, they argue that second mortgages are used primarily for consumption not portfolio diversification purposes. See also Moriizumi (2000) for more discussion and Japanese evidence.
[30] In the U.S., a taxpayer's marginal tax rate affects the price of mortgage debt only if the taxpayer itemises its deductions. A taxpayer is allowed to itemise only if its overall amount deductions exceed a certain limit. Otherwise it has to take the standard deduction which is equal to all taxpayers.

price regions as their identification assumption, they report clearly negative interest rate elasticities of the probability of obtaining a mortgage. Furthermore, they report substantial concentration of loan amounts of eligible individuals at the discontinuity points of their budget constraint created by the reform.

This paper also takes advantage of a tax reform that changed the incentives to borrow of Finnish households. In 1993 the Finnish government introduced a dual income tax system, in which capital and labour income are divided as different types of income and are taxed with different tax rates. The new system replaced a progressive tax rate on all income with a flat rate on capital income and a separate progressive rate on labour income. Before the reform, mortgage interest was deductible according to a progressive schedule creating a so-called upside-down effect, which means that the value of the deduction subsidy was the greater the higher was the taxable income and the marginal income tax rate of the taxpayer. After the reform, mortgage interests are deductible according to a flat rate equal to the capital income tax rate. Thus, as a result of the reform, the link between taxpayer's income and the after tax cost of mortgage debt was broken.

We use household level repeated cross-section data from before and after the reform to study whether Finnish households have responded to these changes in incentives to borrow. One can distinguish three groups of taxpayers that were differently affected by the reform. First, for low-income taxpayers, i.e. those in lower tax brackets, the subsidy resulting from mortgage interest deduction was slightly increased. Thus, for low-income taxpayers the incentive to borrow was also increased. Second, taxpayers in the middle tax brackets were (virtually) unaffected by the reform. And finally, for high-income taxpayers the subsidy was reduced and so was their incentive to borrow. This setting can be seen as a natural experiment, where one can distinguish multiple treatment groups and a control group. The treatment groups include households, who were affected by the reform and the control group are those, who were unaffected. This grouping is the basis of our analysis and enables the use of the difference-in-difference technique.

The results of the paper indicate that high income households with high marginal tax rates have responded to the reduced tax incentives by clearly reducing their mortgage borrowing. The results remain robust after controlling for observable household characteristics and to

several sensitivity tests based on sub-samples of the data. Furthermore, since the construction of the control and treatment groups was somewhat arbitrary we used an alternative identification strategy which does not suffer from this problem. This alternative strategy also lent strong support for the difference-in-differences results.

The results of this paper may be useful for other policy areas besides housing and mortgage markets. For example, the demographic development in many western countries has led governments to seek ways of increasing voluntary retirement savings. One way to do this is to create tax incentives for these purposes. When contemplating current tax incentive schemes or reforms of these schemes, it is of obvious importance to know whether households really respond to tax incentives.

The paper proceeds as follows. In section 2, the central features of Finnish housing and mortgage markets, and the 1993 tax reform are outlined. This section also illustrates the effect of the 1993 tax reform on households' incentives to borrow. In section 3, the empirical strategy is presented in more detail. In section 4, the data and estimation results are presented. Section 5 concludes.

2 Finnish housing markets and the 1993 tax reform

2.1 Background: Finnish housing markets and institutional changes

When studying the effects of a particular reform one must account for other reforms and economic changes coinciding with it. Next we will shortly review the development of Finnish housing markets and institutions before and after the 1993 tax reform. In the latter part of the 1980's Finnish financial markets were liberalised. Before the liberalisation interest rates were regulated which led to negative real interest rates and credit rationing. Mortgage borrowing required heavy up-front saving from the households and annuities were relatively short.[31] Together with rapid economic growth the improved availability of mortgage loans and longer repayment periods triggered a boom in house prices, which can be seen in Figure 1. The house prices busted as the economy went into a deep recession in the early 1990's and have

[31] See Bengs and Loikkanen (1991) for an overview of earlier development of Finnish housing markets and institutions.

been increasing again rapidly since the late 1990's as result of economic recovery, low interest rates and migration.[32]

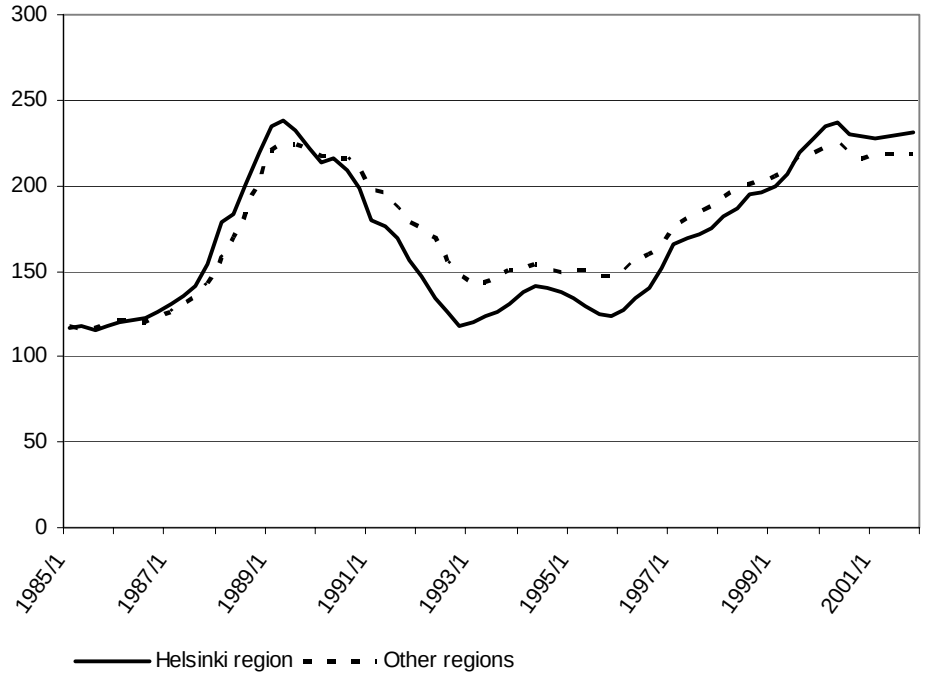

Figure 1. Development of Finnish house prices in real terms, 1985–2001 (1983=100). Source: Statistics Finland.

The recession made its mark also on the mortgage market. The banking sector was hit especially hard as collateral values collapsed and more and more businesses went bankrupt.[33] Figure 2 illustrates the development of the real mortgage stock of Finnish households and the average mortgage interest rate during the 1980's and 1990's. The high interest rates in the early 1990's were due to an unsuccessful defence of a fixed exchange rate after which the Finnish Markka was devaluated by 12 percent in November 1991 and floated in September 1992. The decline in the mortgage stock was a result of both declined demand for mortgage debt during the recession and a tightened lending policy by the banking sector as a reaction to credit-losses.

[32] The Finnish GDP collapsed about 12 percent in 1991–1993. At the same time unemployment rate rose from 3.5 percent in 1990 to 18.4 percent in 1994. See Kalela et al. (2001) for more details on the Finnish recession and recovery.

[33] In Finland there are only few financial firms concentrated on private housing finance. The biggest mortgage suppliers are general commercial, savings and co-operative banks.

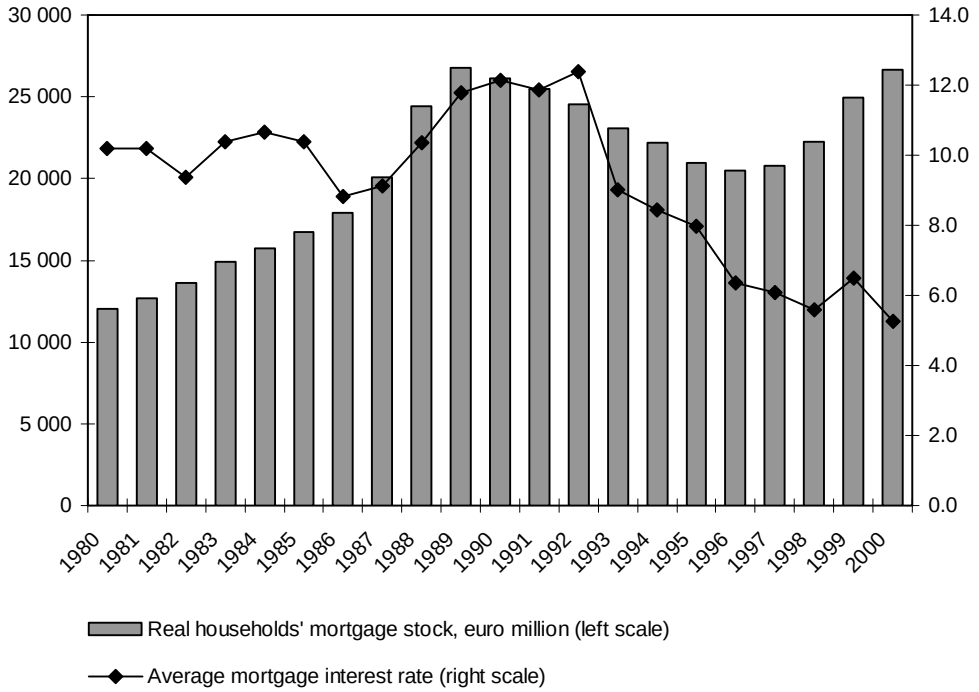

Figure 2. Finnish mortgage stock and average mortgage interest rate in 1980–2000.
Source: Statistics Finland.

Although the liberalisation of financial markets increased mortgage availability in the long run, the ratio of mortgage stock to GDP in Finland is still relatively low in international comparisons. According to European Central Bank (2003) the ratio of mortgage stock to GDP in Finland was 21 percent in 2001.[34] Homeownership is the dominant tenure in Finland. Figure 3 shows, how the ownership rate increased steadily throughout the 1970's and 1980's, reaching the high point of almost 75 percent in 1990. The main reasons behind this development have been the tax-favoured status of owner-occupied housing and a long history of rent control. In 1991–1995 rent controls were finally phased out. The removal has probably increased the availability of rental dwellings and affected the tenure choice of households. Homeownership rate declined from 75 percent in 1990 to about 68 percent in 2001.

[34] According to the ECB (2003) mortgage stock to GDB ratio in 2001 was on average 33 percent in the Euro area and 39 percent in the EU. Highest ratios can be found in the Netherlands (74 percent), Denmark (67 percent) and the U.K. (60 percent).

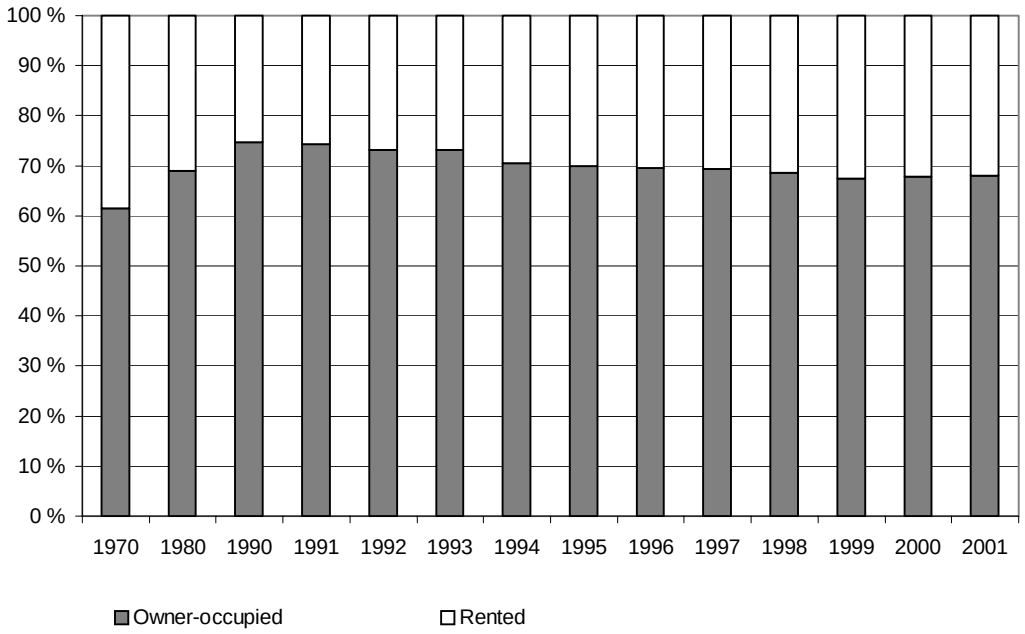

Figure 3. Housing Tenure shares in Finland, 1970–2001.
Source: Statistics Finland.

2.2 Tax reform and the incentive to borrow

Before the 1993 tax reform in Finland income taxation was based on all nominal income regardless of the source (labour or capital). However, the effective tax rate on capital income from different assets varied considerably because of different concessions and exemptions. In particular, imputed rental income from owner-occupied housing was taxed only on the part of house value that exceeded a certain limit. In practice, most owner-occupiers did not pay any taxes on imputed rental income, mainly because houses were valued well below market rates. All this together with the possibility to deduct mortgage interest expenses according to a progressive schedule made mortgage debt a good way to pursue tax arbitrage goals especially for high-income taxpayers with high marginal tax rates. One of the main goals of the 1993 reform was to harmonise the taxation of capital income from different assets by broadening the tax base and to eliminate tax arbitrage possibilities. This is clearly stated in the Government bill 200/1992 for the Income Tax Act.

In 1993 the Finnish government introduced a dual income tax system, in which capital and labour income are divided as different types of income and are taxed with different tax rates. The new system replaced a progressive tax rate on capital income with a flat rate of 25

percent, whereas labour income remained under a progressive schedule. In addition, the tax code was simplified by harmonising the deduction rules for different capital assets. In 1993, a new municipal property tax was also introduced, while the national tax on imputed rental income was abolished. At the same time some municipal-level payments on property such as the street maintenance fee, land tax and presumptive taxation of property were eliminated. In effect, the taxation of the return from owner-occupied housing remained unchanged due to these reforms. Landlords, in addition to being liable for the new property tax, continue to pay capital income taxes on rental income and capital gains they receive. So in effect, owner-occupied housing is still clearly tax-favoured compared to rental housing in Finland. Furthermore, a stamp tax on interest income was phased in between 1991 and 1994, from where on the stamp tax rate has been equal to capital income tax rate.[35]

In the Finnish tax system the deductibility of interest expenses is determined according to the purpose of use of the debt. Interest expenses that are deductible in Finland include interest on mortgage loans,[36] interest on government secured student loans and interest expenses accrued from producing taxable income. Mortgage debt refers here only to acquisition debt, including construction and home improvement. Interest on loans taken for consumption purposes is not tax deductible even if primary residence is used as collateral. However, before the reform a limited amount of consumer credit interest was deductible. In the new system, interest expenses are deductible from capital income. Thus, the deduction rate is the same as the tax rate on capital income. If interest expenses exceed capital income, the taxpayer is allowed to deduct the resulting tax deficit from her labour income tax liability in form of a tax credit. In this situation the deduction rate is equal to the capital income tax rate, except first-time homebuyers are allowed to deduct the tax deficit resulting from mortgage interest at 30 percent rate. Table 1 summarises the interest deduction rules from 1990 to 2000.

[35] The stamp tax on interest income was first introduced in 1991 when the rate was 10 percent. The rate was increased to 15 in 1992, to 20 in 1993 and finally to 25 percent in 1994.
[36] To be precise, Finnish house loans are not assumable mortgages but personal loans that are not tied to a particular dwelling. However, most Finnish house loans are secured by a home.

Table 1. Interest deduction rules in 1990–2000.

Year	Deduction rate	Percentage deductible	Limit (€) single[c]	Limit (€) married	Limit (€) one child[d]	Limit (€) two or more children
1990	Progressive (49.7)[a]	85	3 360	3 700	590	1 180
1991	Progressive (48.9)[a]	80	3 360	4 040	590	1 180
1992	Progressive (51.7)[a]	75	3 360	4 370	670	1 350
1993	Flat (25 %)[b]	No limit	1 350	2 700	335	670
1994	Flat (25 %)	No limit	1 350	2 700	335	670
1995	Flat (25 %)	No limit	1 350	2 700	335	670
1996	Flat (28 %)	No limit	1 350	2 700	335	670
1997	Flat (28 %)	No limit	1 350	2 700	335	670
1998	Flat (28 %)	No limit	1 350	2 700	335	670
1999	Flat (28 %)	No limit	1 350	2 700	335	670
2000	Flat (29 %)	No limit	1 350	2 700	335	670

[a]Average deduction rate.

[b]For first-time buyers the deduction rate is 30 % from 1993 onwards.

[c]After 1992 the limits apply only to the tax credit from labour income tax liability. Interest deduction from capital income is unlimited.

[d]The limits for singles and married couples are inceared by the amounts in the last two colums.

The average deduction rate before the reform equals the marginal income tax rate which consists of a flat municipal income tax and a progressive state income tax. From Table 1 we see that the average deduction rate was almost halved because of the tax reform. Therefore, also the tax subsidy resulting from the deduction was halved. Before the reform there was a limit on the percentage of interest expenses eligible for deduction. This limit was removed in 1993. Furthermore, the amount of deductible interest expenses was limited before the reform. After the reform, the amount is limited only in a case where interest expenses exceed capital income, i.e. the size of the tax credit is limited not the amount of interest eligible for deduction. If the tax credit limit becomes binding a taxpayer can offset the resulting loss from her capital income accrued in the next ten years. However, the loss does not make the taxpayer eligible for another tax credit in future years.

Because the significant reduction in the deduction rate Finnish authorities legislated a transition period for high-income households, who had taken a mortgage before the reform, so that they could deduct more mortgage interests than others. Thus, for high-income households with a mortgage taken before the reform the incentives to shuffle current portfolios were reduced somewhat. The transition period ended in 1999 and the amount of the transitional subsidy was significantly reduced during the latter part of the 1990's. The enactment of the transitional subsidy highlights the fact that the tax reform substantially reduced the subsidy to

high-income households. Also the fact that first-time buyers can deduct interests at a higher rate may cause some problems in the econometric analysis, but the rate difference was reduced in the late 1990's.

3 Empirical strategy

Studying the effects of taxation on household behaviour is difficult for a number of reasons.[37] First, a fundamental problem of identification arises when using cross-section data when the marginal tax rate is a function of taxable income, which results in high collinearity between the two explanatory variables. Second, when the marginal tax rate is the same for all households, tax incentive effects cannot be identified from a single cross-section. Third, in a case where mortgage interest is deductible from taxable income of the taxpayer, marginal tax rate becomes an endogenous variable, i.e. the amount of mortgage debt a taxpayer chooses affects her marginal tax rate, and correspondingly, the marginal tax rate lowers the price of mortgage debt. Finally, especially in household investment considerations it may be that in fact future marginal tax rates are of importance in the household's decision. However, in the case of mortgage debt interest payments are highest at the start of repayment, and thus, future tax considerations should not play such an important role here as opposed to long-term investment decisions where the gains are realised and taxed in the future.

Our identification strategy is based on the fact that the 1993 tax reform was an exogenous event from the households' point of view and affected the cost of borrowing of different household groups in different ways. Thus, the reform resembles a natural experiment and repeated cross-section data from before and after the reform enable the use of the difference-in-differences technique. We follow Jappelli and Pistaferri (2006) who studied a similar reform in Italy and divide our sample into a control group and three treatment groups according to how the 1993 tax reform affected the cost of borrowing for these groups. Ideally, one would like to distinguish a control group that was clearly unaffected by the reform. However, this is impossible in this case and a control group can be defined only in approximate terms. The grouping was done in the following way. First, we imputed a marginal tax rate for each household, which depicts the interest deduction rate in the case

[37] See e.g. Poterba (2001).

where no tax reform was implemented. Basically we just added the local proportional tax rate (municipal and church tax) to the marginal state income tax rate of each household's head. The marginal income tax rates were calculated using labour income only and before mortgage interest is deducted. Since the Finnish income taxation is based on individuals, it was optimal for the household to deduct interest expenses from the income of the highest earner in the family in order to maximise the benefit from the deduction. We simply refer to this variable as the marginal income tax rate of the household. Based on this variable, we divide households into four groups. Households whose marginal income tax rate is between 22 and 28 percent serve as the control group. Remember that the deduction rate was set at 25 percent in 1993 and then increased slightly in the late 1990s. The first treatment group includes households with a marginal income tax rate below 22 percent (referred to as low group from now on). The second treatment group includes households with a marginal income tax rate between 29 and 40 percent (referred to as high1 group from now on). Finally, the third treatment group includes households with a marginal income tax rate above 40 percent (referred to as high2 group from now on).

We are interested in both the propensity and the amount to borrow. To illustrate the difference-in-differences technique, consider first a probit model for the propensity to borrow with one treatment and control group:

$$(1) \qquad P\left(y_{1i}=1 \mid G_i, T_i, \mathbf{x}_i\right) = \Phi\left(\delta_1 G_i + \delta_2 T_i + \delta_{12} G_i \times T_i + \mathbf{x}_i'\boldsymbol{\beta}\right),$$

where y_1 indicates that a household has a mortgage, $\Phi(.)$ is the cdf of the standard normal distribution, G = 1 if the household is in the treatment group and zero otherwise, T = 1 if the household is observed after the reform and zero otherwise, and the vector **x** includes household characteristics that control for observable group differences and an intercept. In a linear model with a similar structure, δ_{12} would be the so-called difference-in-differences estimator that identifies the average treatment effect on the treated.[38] However, as was shown by Puhani (2008) in the case of a probit model (or any model with a strictly monotonic link function) the average treatment effect on the treated is

[38] See Wooldridge (2002), p. 130.

$$ATET = \left[\Phi\left(\hat{\delta}_1 + \hat{\delta}_2 + \hat{\delta}_{12} + \bar{\mathbf{x}}'\hat{\boldsymbol{\beta}}\right) - \Phi\left(\hat{\delta}_1 + \hat{\delta}_2 + \bar{\mathbf{x}}'\hat{\boldsymbol{\beta}}\right) \right], \tag{2}$$

where the control variables in **x** are set at their sample means. The standard error for the treatment effect can be calculated using the delta method.[39]

The biggest drawback of the data sets used in this paper is that they do not include information on the households' outstanding mortgage debt before 1993. They do, however, include information on annual tax deductible mortgage interest payments for the entire period. This information is used here to study whether the 1993 tax reform affected the amount that households borrow.[40] The analysis is carried out in a standard tobit setting. The tobit model can be formulated in terms of a latent index as

$$\begin{aligned} y_{2i}^* &= \delta_1 G_i + \delta_2 T_i + \delta_{12} G_i \times T_i + \mathbf{x}_i'\boldsymbol{\beta} + \varepsilon_i \\ y_{2i} &= 0 \quad \text{if} \;\; \delta_1 G_i + \delta_2 T_i + \delta_{12} G_i \times T_i + \mathbf{x}_i'\boldsymbol{\beta} + \varepsilon_i \le 0, \\ y_{2i} &= y_{2i}^* \quad \text{if} \;\; \delta_1 G_i + \delta_2 T_i + \delta_{12} G_i \times T_i + \mathbf{x}_i'\boldsymbol{\beta} + \varepsilon_i > 0, \end{aligned} \tag{3}$$

where y_{2i}^* is the latent variable and y_2 is its observed counterpart which in this case is the observed amount of mortgage interest payments during a particular year, and $\varepsilon_i \sim N\left(0, \sigma^2\right)$. Our interest is in the observed y_2. For brevity, let $\mathbf{x}_2$ denote all the variables on the right-hand-side of (3). Now the conditional expectation of interest in the tobit model can written as[41]

$$E\left[y_{2i} \mid \mathbf{x}_{2i}\right] = \Phi\left(\frac{\mathbf{x}_{2i}'\boldsymbol{\beta}}{\sigma}\right)\left(\mathbf{x}_{2i}'\boldsymbol{\beta} + \sigma \frac{\phi\left(\frac{\mathbf{x}_{2i}'\boldsymbol{\beta}}{\sigma}\right)}{\Phi\left(\frac{\mathbf{x}_{2i}'\boldsymbol{\beta}}{\sigma}\right)}\right), \tag{4}$$

where $\phi(.)$ is the pdf of the standard normal distribution. Again following Puhani (2008) the treatment effect on the treated can be calculated the same way as in (2), i.e.

[39] In this paper, this is done using the WALD command in LIMDEP 8.0. See Greene (2002) for details.
[40] An overwhelming majority of Finnish households' mortgages are adjustable rate mortgages. For example, in 2001 94 percent of new mortgages in Finland had adjustable rates (Stephens, 2002). In most contracts the interest rate is adjusted every twelve months. For households who have moved within the survey years, interest payments will not give an accurate picture of the amount of mortgage debt they hold.
[41] See Wooldridge (2002) for details.

$$ATET = \Phi\left(\frac{\hat{\delta}_1 + \hat{\delta}_2 + \hat{\delta}_{12} + \overline{\mathbf{x}}'\hat{\boldsymbol{\beta}}}{\hat{\sigma}}\right)\left(\hat{\delta}_1 + \hat{\delta}_2 + \hat{\delta}_{12} + \overline{\mathbf{x}}'\hat{\boldsymbol{\beta}} + \hat{\sigma}\lambda\left(\hat{\delta}_1 + \hat{\delta}_2 + \hat{\delta}_{12} + \overline{\mathbf{x}}'\hat{\boldsymbol{\beta}}\right)\right) -$$

(5)

$$\Phi\left(\frac{\hat{\delta}_1 + \hat{\delta}_2 + \overline{\mathbf{x}}'\hat{\boldsymbol{\beta}}}{\hat{\sigma}}\right)\left(\hat{\delta}_1 + \hat{\delta}_2 + \overline{\mathbf{x}}'\hat{\boldsymbol{\beta}} + \hat{\sigma}\lambda\left(\hat{\delta}_1 + \hat{\delta}_2 + \overline{\mathbf{x}}'\hat{\boldsymbol{\beta}}\right)\right),$$

where $\lambda(.) = \phi(.)/\Phi(.)$. The treatment effect takes into account both the probability of taking a mortgage and the amount borrowed. The effect of the reform on these two margins cannot be identified separately.[42]

Because imputing marginal income tax rates is bound to produce some errors and the division of households into control and treatment groups is somewhat arbitrary in the above framework we also use an alternative identification strategy. The second strategy is based on the notion that under a progressive tax and deduction schedule taxable income affects mortgage demand in two ways.[43] First, because housing is a normal good an increase in income should lead to an increase in housing demand and consequently in mortgage demand.[44] Second, under a progressive tax schedule an increase in income leads to a higher marginal tax rate and effectively lowers the after-tax price of mortgage debt. Consequently, higher income leads to higher mortgage demand due to this price effect as well. From a cross-section analysis it is very difficult to identify these effects. However, after the tax reform the after-tax price of mortgage debt is the same for all taxpayers regardless of their income. Therefore, with cross-section data from both before and after the reform the impact of the tax-price effect can be identified. This strategy should not be so sensitive to possible errors in imputing marginal tax rates or to misallocation of households into control and treatment groups. Again income of household's head before mortgage deductions is used in the estimation because it captures the tax price effect that a household faced before the reform.

[42] See Angrist (2001).
[43] See also Fjærli (2004).
[44] In fact, this assumption may not be valid. It is not clear whether income should have an isolated effect on mortgage demand. This assumption, however, is not necessary for our approach.

In the alternative strategy, we test whether income has a different effect on the propensity to borrow and on the amount of interest payments before and after the reform. For example, in the probit model we are interest in the difference[45]

$$\text{interaction effect} = \frac{\partial P\left(y_2 = 1 \mid \mathbf{x}_{1i}, T = 1\right)}{\partial \ln INC_i} - \frac{\partial P\left(y_2 = 1 \mid \mathbf{x}_{1i}, T = 0\right)}{\partial \ln INC_i}. \tag{6}$$

Under the null hypothesis of no reform effect the interaction effect should be is zero. Again the standard errors for the interaction effects can be calculated using the delta method.

The validity of the above techniques depends on a number of assumptions. First, the tax reform must be exogenous with respect to the decision to borrow. Second, the reform must be exogenous with respect to changes in the sample composition. Third, there should not be any group-specific trends in the propensity to borrow. And finally, there should not be any simultaneous credit supply shifts correlated with the variables used for identification. We consider these assumptions after we present the results.

4 Empirical results

4.1 Data and variable description

The datasets used in this study are the 1990–2000 household surveys from the Income Distribution Survey (IDS) produced by Statistics Finland. The IDS includes information on various household characteristics such as socio-economic status, demographics, income, taxes, and housing. Most of the information is collected from administrative registers and some of the information is collected through interviews. The IDS is a stratified sample drawn from all private households in Finland where the strata are created according to socio-economic status and income. In order to minimise data collection costs and non-response, Statistics Finland assigns a higher inclusion probability to entrepreneurs and high-income households. The selected households are weighted in order to make the sample representative of the whole population. Each household is included in the sample for two consecutive years

[45] This interaction effect does not coincide with the coefficient of the interaction term in a probit or any nonlinear model. See Ai and Norton (2003).

so that every year half of the total sample is based on a new panel. Thus, the whole sample is renewed every other year. Because the techniques used in this paper require independent random samples we omit every other year from the analysis as a precaution. After this we are left with two years before (1990 and 1992) and four years after the reform (1994, 1996, 1998 and 2000).

As already mentioned, the main drawback of the data is that it does not include information on the outstanding mortgage debt before 1993. It does, however, include information on the tax deductible mortgage interest payments for the entire period. This, of course, does not provide accurate mortgage positions for the households but it is the best we can do with the data at hand. A problem arises in those cases where a household has taken a mortgage during the survey year. In these cases, interest payments underestimate the amount of outstanding mortgage debt. Unfortunately, we are unable to identify these households from the data. Furthermore, a potential problem arises if different household groups have different types of mortgage contracts. For example, if the households in the control group have mostly fixed rate mortgages compared to treatment groups where adjustable rate mortgage are more common, interest expenses would not correctly describe the evolution of mortgage amounts through time among different groups and would be a problem for the difference-in-differences technique. However, since the majority of mortgages in Finland are adjustable rate mortgages this should not be a great source of concern but should be kept in mind when interpreting the tobit results. The measurement error is, of course, not an issue in the probit model.

Some summary statistics from the 1990–2000 IDS samples are presented in Table 2. On average, households with a mortgage are younger, have larger families and houses, are more likely to be married and have higher incomes. The effect of the recession can also be seen from Table 2. Households' disposable income does not rise to the level of 1990 until 1998. Furthermore, average dwelling size has clearly risen from 1990 to 2000.

Table 2. Descriptive statistics from the 1990–2000 IDS samples.

	1990		1992		1994	
Variable	**Mortgage**	**No mortgage**	**Mortgage**	**No mortgage**	**Mortgage**	**No mortgage**
Age	41.43	50.87	41.49	50.42	40.99	51.40
Household size	2.91	1.95	2.95	1.95	2.94	1.94
Percentage married	0.68	0.39	0.67	0.40	0.63	0.39
Disposable income	32 960	21 561	31 003	20 942	30 589	20 708
Mortgage interest	2 810	0.00	3 075	0	2 238	0
Floor area	93.87	68.49	94.81	69.64	96.16	72.52
Observations	4 552	6 893	3 818	6 599	3 024	5 940
	1996		**1998**		**2000**	
	Mortgage	**No mortgage**	**Mortgage**	**No mortgage**	**Mortgage**	**No mortgage**
Age	42.45	50.60	43.51	51.15	43.47	51.51
Household size	2.98	1.91	2.86	1.87	2.85	1.88
Percentage married	0.66	0.39	0.64	0.38	0.64	0.37
Disposable income	31 561	20 791	34 157	21 657	36 896	23 972
Mortgage interest	1 734	0.00	1 414	0	1 619	0
Floor area	101.1	72.73	103.0	72.17	105.6	73.55
Observations	3 228	6 121	3 603	5 742	3 870	6 553

Notes: Author's calculations from the 1990–2000 IDS data sets. Statistics are calculated using sampling weights. Income and mortgage interest are deflated into 2000 values.

4.2. Difference-in-differences results

Before estimation, we eliminated households with disposable income below €10,000 from the final sample because they are most likely to be credit-constrained and not able to respond to the reform anyway. This leaves us with a final sample size of 55,088 households (19,709 before and 35,379 after). Both homeowners and renters are included. Of these, 21,767 households had tax deductible mortgage interest expenses. Table 3 reports the size of control and treatment groups before and after the reform. From Table 3 it is obvious, that for a clear majority of Finnish households the tax reform reduced the incentives to borrow through a mortgage.

Table 3. Number of households in the control and treatment groups.

	Low	**Control**	**High1**	**High2**	**All**
Before	943	1 399	9 317	8 050	19 709
After	1 837	2 091	19 731	11 720	35 379
All	2 780	3 490	29 048	19 770	55 088

In Table 4, we present difference-in-differences results using a probit model for the propensity to borrow. In the first model, only group and time dummies and interaction terms are included. The second model includes various household characteristics that should control for systematic differences between the control and treatment groups. The control variables include age, sex and education level of household head, a dummy variable indicating a married couple, number of children in the household, the urbanisation rate of the municipality the household resides in (urban, semi-urban and rural), and floor area and house type of the household's residence. We report marginal effects for the dummy variables and the treatment effects presented in equation (2).

The results in Table 4 show that the groups clearly differ in propensity to borrow before the reform as expected. The households in the low group were less likely to borrow than the control group and both high groups were more likely to borrow than the control group. The signs of the treatment effects are as expected. However, the effect is statistically significant only for the high2 group for which the imputed marginal tax rates are above 40 percent. The results are virtually identical after we control for observable household characteristics, except now the before reform group differences are smaller.

Table 4. Difference-in-differences results from probit models, propensity to borrow.

	Marginal and treatment effects	**Standard error**	**Marginal and treatment effects**	**Standard error**
low	-0.073**	0.025	-0.093**	0.025
high1	0.250**	0.016	0.133**	0.017
high2	0.477**	0.014	0.281**	0.018
after the reform	0.036	0.020	0.007	0.021
treatment for low	**0.024**	**0.017**	**0.007**	**0.023**
treatment for high1	**-0.024**	**0.021**	**-0.010**	**0.022**
treatment for high2	**-0.110****	**0.021**	**-0.100****	**0.024**
control variables	no		yes	
N (y = 1)	55 088 (21 767)		55 088 (21 767)	
log-L	-34 967		-30 911	
pseudo R^2	0.07		0.21	

Notes: Pre-reform years are 1990 and 1992 and the post-reform years are 1994–2000.The control variables include age, sex and education level of household head, a dummy indicating a married couple, number of children in the household, urbanisation rate of household's municipality, floor area and building type of household's residence. Marginal and treatment effects are evaluated at sample means of the control variables. Standard erros for the treatment effects are calculated using the delta method. ** and * indicate that the effects are statistically significant at 1and 5 percent level, respectively.

Table 5 presents the results for the amount of interest payments from a tobit model. The results are very similar to the probit models. However, now the negative treatment effect for high1 group is also statistically significant. After controlling for observable household characteristics, the treatment effects are smaller as are the pre-reform group differences. The results in Tables 4 and 5 clearly indicate that high income households with high marginal tax rates have responded to the reduced tax incentives by clearly reducing their mortgage borrowing.

Table 5. Difference-in-differences results from tobit models, the amount of interest payments.

	Marginal and treatment effects	**Standard error**	**Marginal and treatment effects**	**Standard error**
low	-61.89*	26.99	-124.4**	42.51
high1	612.4**	24.23	388.9**	33.55
high2	1636**	31.03	949.3**	37.04
after the reform	32.93	19.52	-24.99	37.73
treatment for low	**29.03**	**34.15**	**-14.82**	**43.64**
treatment for high1	**-240.0****	**70.84**	**-165.0****	**62.79**
treatment for high2	**-822.4****	**114.9**	**-555.6****	**89.93**
control variables	no		yes	
N (y > 0)	55 088 (21 767)		55 088 (21 767)	
log-L	-225 602		-221 017	

Notes: Pre-reform years are 1990 and 1992 and the post-reform years are 1994–2000.The control variables include age, sex and education level of household head, a dummy indicating a married couple, number of children in the household, urbanisation rate of household's municipality, floor area and building type of household's residence. Marginal and treatment effects are evaluated at sample means of the control variables. Standard erros for the treatment effects are calculated using the delta method. ** and * indicate that the effects are statistically significant at 1and 5 percent level, respectively.

In Table 6 we report the results from our alternative identification strategy. In Table 6, income is in log form because for some reason the probit models failed to converge when level variables were used. In the tobit models also the dependent variable is in log form. The results show that after the reform income has clearly a smaller effect on both the propensity to borrow and the overall amount to borrow than before the reform. In fact, it seems that about half of the total positive income effect before the tax reform was due to the tax price effect. These results offer support for the results obtained using the difference-in-differences approach. Overall the reduction in mortgage interest payments due to the reform is substantial if one compares the results to the average payments reported in Table 2. This is somewhat surprising given the transitional subsidy scheme aimed toward high-income households.

Table 6. Results for the alternative identification strategy.

Probit models:	**Marginal and interaction effects**	**Standard error**	**Marginal and interaction effects**	**Standard error**
log of income	0.284**	0.006	0.189**	0.007
after the reform	0.767**	0.025	0.684**	0.033
interaction effect of				
log of income and time	**-0.122****	**0.007**	**-0.101****	**0.007**
control variables	no		yes	
N (y = 1)	55 088 (21 767)		55 088 (21 767)	
log-L	-34 915		-30 887	
pseudo R^2	0.07		0.20	
Tobit models:	**Marginal and interaction effects**	**Standard error**	**Marginal and interaction effects**	**Standard error**
log of income	2.213**	0.045	1.291**	0.044
after the reform	4.050**	0.364	2.653**	0.303
interaction effect of				
log of income and time	**-0.999****	**0.052**	**-0.705****	**0.045**
control variables	no		yes	
N (y > 0)	55 088 (21 767)		55 088 (21 767)	
log-L	-94 440		-89 861	

Notes: Pre-reform years are 1990 and 1992 and the post-reform years are 1994–2000.The control variables include age, sex and education level of household head, a dummy indicating a married couple, number of children in the household, urbanisation rate of household's municipality, floor area and building type of household's residence. Marginal and treatment effects are evaluated at sample means of the control variables. Standard erros for the treatment effects are calculated using the delta method. ** and * indicate that the effects are statistically significant at 1and 5 percent level, respectively.

The fact, that the dependant variable under scrutiny is limited to be non-negative poses some problems in interpreting the results. A tempting interpretation of our result would be that not only has the tax reform induced a lower propensity to take a mortgage for high-income households but also that those who do take a mortgage take smaller mortgages on average than before the reform. However, as is argued by Angrist (2001), in general, these so-called conditional on positive effects cannot be identified in this setting. The tobit results take into account both the probability of having a mortgage and the amount borrowed as can be seen from equation (4).

A further concern with the econometrics is that the tobit model is inconsistent if normality or homoscedasticity assumptions of the error term are violated. One possible alternative would be to use some robust estimator like the censored least absolute deviations estimator (CLAD) proposed by Powell (1984). However, the CLAD model is defined in terms of the latent index and treatment effects cannot be calculated for the observed variable. The tobit estimation were repeated using a simple linear model with OLS and the results were very similar.

4.3 Robustness checks and confounding factors

We conducted some robustness checks to our analysis not reported here for brevity. First, we excluded the year 1992 and compared 1990 to post-reform years. The results were virtually the same using both the difference-in-differences and the alternative identification strategy. Thus, it seems that households did not react to any announcement of the coming tax reform in 1992.[46] Then we started to exclude post-reform years closest to the reform one by one, i.e. compared 1990 to 1996–2000 period, 1990 to 1998–2000 period and so on. Again the results were very similar using both strategies. We also lowered the income threshold first to €5,000 euros and also used the entire sample. Again the results were the same when we repeated the steps discussed above. This is to be expected because the income threshold mostly affects the low group which was non-responsive anyway. Furthermore, the results were robust to exclusion of the highest five percent of the income distribution.

Finally, we have to consider whether the tax reform is the only plausible explanation for the results. First of all, there should be no reason to doubt the exogeneity of the tax reform. Perhaps the most severe confounding factor would be a shift in credit supply that is somehow correlated with household income. The Finnish mortgage stock has grown considerably since the late 1990's due to economic recovery, low interest rates and longer annuities in the new loans. This has meant that low- and middle-income households have probably had the opportunity to take larger mortgages than before. This could confound the results found in Tables 3 to 5. However, we also repeated the analysis by excluding1998 and 2000. Again the results were unchanged. This gives support for the tax reform story because new larger mortgages became available only in the late 1990s.

Another major confounding factor in the early 1990's was, of course, the recession. Since the banks experienced major credit losses during that time, the expected reaction from this would be that high-income households would be in a better position to obtain a mortgage relative to lower income households, and thus, we should find a stronger positive income effect after the recession. Furthermore, due to the recession unemployment risk probably rose more for low-

[46] The exact time of the announcement of a coming tax reform is unclear. The government bill for the income tax was dated on the 25th of September 1992. However, some information about the nature of the reform must have surfaced even earlier.

income households relative to high-income households which may have an adverse effect on mortgage demand of low-income households. However, the effect we find is exactly the opposite. If the recession had the described effects our results are probably underestimates of the true effects. Furthermore, rent controls were phased out in 1992–1995 which again should affect the tenure choice of households. However, it is difficult to know which types of households were on the margin that may switch or may have switched tenure due rent control relaxes. Furthermore, homeownership is still clearly tax favoured after the tax reform because imputed rental income and capital gains are untaxed. This means that the tax reform did not induce incentives for high-income households to make different tenure choices than before.

5 Conclusions

The 1993 Finnish tax reform reduced the incentives to use mortgage financing in home acquisition for high-income households. Before the reform mortgage interest was deductible according to a progressive schedule creating a so-called upside-down effect, which means that the benefit from the deduction was the greater the higher was the taxpayer's income and marginal income tax rate. After the reform, the deduction is made according to a flat schedule, and thus, the benefit no longer depends on taxpayer's marginal income tax rate.

This paper used household level repeated cross-section data from before and after the reform to study whether Finnish households have responded to these changed incentives. One can distinguish three groups of taxpayers that were differently affected by the reform. First, for low-income taxpayers, i.e. those in lower tax brackets, the subsidy resulting from mortgage interest deduction was slightly increased. Thus, for low-income taxpayers the incentive to borrow was also increased. Second, taxpayers in the middle tax brackets were (virtually) unaffected by the reform. And finally, for high-income taxpayers the subsidy was reduced and so was their incentive to borrow. This setting can be seen as a natural experiment, where one can distinguish multiple treatment groups and a control group. The treatment groups include households, who were affected by the reform and the control group are those, who were unaffected. This grouping is the basis of the analysis in this paper and enables the use of the so-called difference-in-difference technique.

Our results, based on the difference-in-differences approach, show that high income households with high marginal tax rates have responded to the reduced tax incentives by clearly reducing their mortgage borrowing compared to the control group. The results remain robust after controlling for observable household characteristics and to several sensitivity tests based on sub-samples of the data. Furthermore, since the construction of the control and treatment groups was somewhat arbitrary we used an alternative identification strategy which does not suffer from this problem. This alternative strategy also lent strong support for the difference-in-differences results. However, some caution should be taken when interpreting the results because the reform coincided with turbulent times in the Finnish economy and obviously all confounding factors cannot be ruled out.

The results of this paper are in line with previous results from other countries, except Jappelli and Pistaferri's (2006) analysis of Italian households, and should be useful when various tax incentive plans are proposed or considered. Furthermore, the elimination of mortgage interest deduction is often suggested in public debate. Our results indicate that the elimination would result in a reduction in mortgage demand. Hendershott et al. (2003) and Hendershott and White (2006) show that this indeed happened in the U.K. when mortgage interest deductibility (so-called MIRAS scheme) was phased out. The decline in mortgage demand would have implications for both financial and housing markets. The elimination of mortgage interest deduction would not, however, eliminate the fundamental tax advantage to owner-occupied housing, which is the non-taxation of imputed rental income and capital gains. Thus, the effect on the demand for owner-occupied housing remains ambiguous because households can mitigate the rise in the user-cost resulting from the elimination by substituting mortgage debt with own equity. The elimination might postpone households' transition to homeownership or even household formation, and result in riskier household portfolios if households substitute debt with equity financing. These questions should prove as fruitful lines for future research.

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Chapter 3:

Owner-Occupied Housing and Demand for Risky Financial Assets: Some Finnish Evidence

Owner-Occupied Housing and Demand for Risky Financial Assets: Some Finnish Evidence

Tuukka Saarimaa

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Abstract:
This paper studies the linkage between owner-occupied housing and portfolio choice. Using a theoretical simulation model with Finnish asset return data we find that a leveraged position in housing has a clear negative effect on the share of stocks in a mean-variance efficient portfolio. The second part of the paper studies how owner-occupied housing actually affects households' financial portfolios using Finnish household data. The main result indicates that the more valuable house a homeowner resides in, at a given level of net wealth, the less likely it is to own stocks. However, it seems that housing has only a small effect if any on the share of financial assets a household invests in stocks conditional on stockholding.

Keywords: portfolio choice, owner-occupied housing
JEL classification: D14, D91, G11, R21.

1. Introduction

Housing services are a necessity and a major component of household consumption expenditures. For example, Englund et al. (2002) report that a household living in Western Europe or in North America spends on average 25 to 35 percent of its income on housing. In addition to a consumption motive, households must consider investment aspects when choosing their housing tenure mode, the quantity of housing services to consume, and the size of mortgage debt. In fact, housing is by far the largest individual component of households' wealth. Statistics Finland report that in 1998 housing constituted 66 percent of Finnish households' overall gross wealth. Further calculations from household level data (the 1998 Wealth Survey of Statistics Finland) reveal that it is common for a young Finnish homeowner to invest two to three times its entire net wealth into housing using mortgage financing, and even for middle-aged homeowners a house constitutes on average almost 100 percent of their net wealth. At the same time, only about 15 percent of Finnish households had stockholdings and the average share of financial wealth invested in stocks was only about 25 percent.

A natural question that arises in light of these figures is whether such a high portfolio share of housing is optimal from portfolio diversification point of view, or whether it's driven by institutional constraints that prevent households from separately choosing the level of housing consumption and investment. Theoretical literature on this issue began with Henderson and Ioannides (1983) who introduced a model where a housing consumption motive introduces a lower bound for housing investment for homeowners. This simply means that a homeowner cannot own only a fraction of the house it resides in. If a homeowner's housing consumption demand is equal or larger than investment demand, consumption and investment decisions are no longer separable. Brueckner (1997) connects the Henderson and Ioannides model into a mean-variance portfolio decision framework. He shows that when consumption demand for housing is equal or larger than investment demand, homeowners' investment portfolios are no longer necessarily efficient in a mean-variance sense. Homeowners could attain a larger expected return on their portfolios without increasing its variance by adjusting their housing investment. They are prevented from doing so, however, because their housing investment is constrained by consumption demand. That is, homeowners tolerate inefficiency in their portfolios because adjusting the level of housing investment would create utility losses by lowering the amount of housing services consumed.

Flavin and Yamashita (2002) quantify these effects using numerical simulation. They show using historical asset return data in the U.S. that house value-to-net wealth ratio has a dramatic effect on the share of risky financial assets in a household's mean-variance efficient portfolio. This is because a leveraged position in a volatile asset such as housing exposes households to a background risk that has an adverse effect on their desire to take additional risks in their financial portfolios.[47]

The above argumentation suggests that any empirical analysis of households' financial portfolio choices should take housing directly into account. This is particularly true in Finland where the promotion of homeownership has been and still is a central part of housing policy. Mainly this is manifested as lenient tax treatment of owner-occupied housing relative to rental housing. In Finland, imputed rental income and capital gains from owner-occupied housing are untaxed and mortgage interest is tax deductible. On the other hand, rental income and capital gains received by landlords are fully taxed. Because of these provisions in the tax code the return to homeownership is higher; however, the non-taxation of capital gains also makes the investment riskier because capital losses are not deductible. In addition to a general tax subsidy to all homeowners, the Finnish government promotes homeownership through a partial government guarantee of mortgage loans from private financial institutions and an interest subsidy scheme targeted at low and middle-income households. Not only do these schemes make homeownership the cheapest way to acquire housing services for a majority of Finnish households, but they also encourage young, relatively low-wealth households to hold portfolios consisting mainly of leveraged housing capital. Thus, housing consumption demand in the spirit of Henderson and Ioannides (1983) and Bruekcner (1997) may be a major factor driving the financial portfolio choices of Finnish households.

The purpose of this paper is twofold. First, we employ a simulation approach similar to Flavin and Yamashita (2002) to study how investing in owner-occupied housing affects a homeowner's optimal portfolio choice under current investment environment in Finland. The main contribution, though, is to study how homeownership actually affects households'

[47] Yamashita (2003) and Yao and Zhang (2005) present microeconometric evidence which shows that investing in owner-occupied housing has a negative effect on the stockholdings of U.S. households.

stockholding behaviour using micro data of Finnish households. This paper is also the first rigorous empirical analysis of the determinants of Finnish household portfolios.

The findings of this study can be summarised as follows. Simulation results show that in the light of historical asset returns a leveraged position in housing has a clear negative effect on the share of stocks in a mean-variance efficient portfolio. This effect is amplified for more risk-averse households. Econometric results reveal that housing investment has an adverse effect on Finnish households' probability to hold stocks. This result can be interpreted in two ways. First, at a given level of net wealth higher house value exposes households to higher house price risk possibly inducing them to mitigate their stockholding. On the other hand, higher house value at a given level of net wealth and mortgage debt automatically means a lower level of financial wealth for the household. So the result may also indicate that some households do not enter the stock market simply because they do not have funds to invest because almost their entire wealth consists of housing. Although, the results hinted that the latter effect is more important, the relative importance of these two effects cannot be deduced explicitly from the data. The results concerning the amount invested in stocks conditional on participating are inconclusive. However, it seems that housing has only a small effect if any on the share of financial assets invested in stocks.

The rest of the paper is organised as follows. Section 2 presents the simulation results based on the model by Flavin and Yamashita (2002) where owner-occupied housing is introduced into a mean-variance portfolio framework. In section 3, econometric results using household level data are presented. Section 4 concludes.

2. Housing in a mean-variance portfolio framework

2.1. Theoretical model

In this section, we use the model introduced by Flavin and Yamashita (2002) to study how owner-occupied housing affects household portfolio choice. The model can be used to simulate what the optimal portfolio shares should be in theory for a homeowner household with a leveraged position in housing using data on historical asset returns. In the model, owner-occupied housing and mortgage debt are introduced as part of a homeowner's portfolio problem in an otherwise traditional mean-variance framework. The model abstracts from the

tenure choice problem by assuming that homeownership is the preferred tenure due to e.g. tax distortions and agency costs related to renting. A homeowner's total net wealth at time *t* is

$$W_t = \mathbf{X}_t'\mathbf{I} + P_t H_t, \tag{1}$$

where $\mathbf{X}_t$ is a (1 x *n*) vector of amounts held in $i = 1,\ldots, n$ risky assets, $\mathbf{I}$ is vector of ones, H_t the quantity of housing and P_t the unit price of housing. The last element in $\mathbf{X}_t$ represents mortgage holdings. The constraints on financial asset holdings are

$$-P_t H_t \le X_{n,t} \le 0, \tag{2}$$

$$X_{i,t} \ge 0, \quad i = 1,...,n-1. \tag{3}$$

Constraint in (2), the mortgage constraint, states that the household can borrow only up to house value and cannot be a mortgage lender. Constraint (3) requires non-negative financial asset holdings. Thus, the household can only borrow through a mortgage debt. The asset returns are random and are decomposed into the expected return and a stochastic component as follows: $R_{i,t} = \mu_i + \varepsilon_{i,t}$ and $R_{H,t} = \mu_H + \varepsilon_{H,t}$, with $E\left[R_{i,t}\right] = \mu_i$ and $E\left[R_{H,t}\right] = \mu_H$. The covariance matrix of the returns is given by $\mathbf{\Omega} = E\left[\boldsymbol{\varepsilon}_t \boldsymbol{\varepsilon}_t'\right]$, where $\boldsymbol{\varepsilon}_t \equiv \left(\varepsilon_{1,t},...,\varepsilon_{n,t},\varepsilon_{H,t}\right)'$. The vector of expected returns on financial assets is defined as $\boldsymbol{\mu} \equiv \left(\boldsymbol{\mu}_1,...,\boldsymbol{\mu}_n\right)'$. Now the household's optimisation problem can be expressed in terms of choosing asset shares $\mathbf{x}_t$:

$$\max_{\mathbf{x}_t} \left\{ \left(\mathbf{x}_t'\boldsymbol{\mu}\right) + h_t\mu_H - \frac{A}{2}\left[\mathbf{x}_t, h_t\right]' \mathbf{\Omega}\left[\mathbf{x}_t, h_t\right] \right\} \tag{4}$$

$$\text{s.t. } 1 = h_t + \mathbf{x}_t'\mathbf{I},$$
$$-h_t \le x_{n,t} \le 0,$$
$$x_{i,t} \ge 0, \quad i = 1,...,n-1,$$

where $h_t \equiv P_t H_t / W_t$ and $\mathbf{x}_t \equiv \mathbf{X}_t / W_t$. The idea is that the household maximises expected utility of wealth with respect to holdings of financial assets conditional on the current value of

h_t, which we refer to as the housing constraint.[48] The motivation for this is that once a homeowner household commits itself to a particular level of housing consumption, the optimal adjustment interval may be very long because of adjustment costs. Arguably, the costs of adjusting the quantities of financial assets are smaller. The household's risk preferences are represented by the Arrow-Pratt coefficient of relative risk aversion, A.

2.2 Optimal portfolios with Finnish asset return data

Following Flavin and Yamashita (2002) we estimate $\boldsymbol{\mu}_t$, μ_H and $\boldsymbol{\Omega}$ using historical data on Finnish asset and housing returns and solve the optimisation problem in (4) for different values of the housing constraint and the risk aversion parameter. We use quarterly asset return data on five broad asset classes from 1995 to 2005. Eleven years is a rather short period, especially when considering homebuyers investment horizons. However, major institutional reforms took place during the early 1990's. Most notably, a major reform on capital income taxation was implemented in 1993, rent controls were phased out on private rental dwellings during 1992–1995, and Finland joined the EU in 1995 and EMU in 1999. The last mentioned have meant a period of low inflation and nominal interest rates. Furthermore, from 1993 onwards foreign investors have been allowed to freely invest in Finnish securities.[49] Using data from before 1995 would not give a true picture of the current investment opportunities available to households and the linkages between different asset returns.

Table 1 reports mean quarterly asset returns, standard deviations, and the correlation matrix for the asset returns. Details of the calculations can be found in the appendix. The real after-tax quarterly returns from different assets range from 0.21 percent from bank accounts to 2.15 percent from owner-occupied housing. Housing has been a very profitable investment in Finland during the period. Houses have even outperformed stocks: they offered a slightly higher return and a lower standard deviation. However, this is mostly due to the fact that Finnish house prices busted in the early 1990's and have increased rapidly since. Moreover, the risk of the housing investment a homeowner faces is probably underestimated in these

[48] This formulation of the objective function is based on the assumptions that the utility function is of the constant relative aversion (CRRA) form and asset returns are normally distributed. See Flavin and Yamashita (1998) or Blake (1996) for details.

[49] Oikarinen (2006) finds evidence of a structural break in the long-run relationship between stock and house prices in Finland at beginning of 1993. He concludes that this was probably due to the abolition of foreign ownership restrictions in the stock market.

calculations because we use a nationwide house price index which ignores the idiosyncratic or house specific part of the risk.[50] Of course, using a stock index as a measure of risk and return of stock investments probably underestimates the risks involved in stock investment of a typical stockowner household who owns individual stocks instead of an index or other mutual funds.

Housing returns are negatively correlated with other assets except for stocks. Compared to other countries, housing has offered high returns in Finland.[51] Finnish asset returns are most comparable to the ones found by Iacoviello and Ortalo-Magné (2003) with U.K. data except that in Finland housing and bond returns have a negative correlation as opposed to a positive one in the U.K. This may be because our data on bond returns include short maturities, which are found to have a negative correlation with housing returns in the U.K. Flavin and Yamashita (2002) find negative but insignificantly small correlations between housing and all financial asset returns in the U.S.

Table 1. Mean quarterly returns and correlation matrix of asset returns, 1995–2005.

	Bank account	Bonds	Stocks	Mortgage	House
Return	0.0021	0.0106	0.0207	0.0083	0.0215
s.d.	0.0016	0.0151	0.0860	0.0030	0.0190

Correlation matrix

	Bank account	Bonds	Stocks	Mortgage	House
Bank account	1.0000				
Bonds	0.7263	1.0000			
Stocks	0.0338	-0.1954	1.0000		
Mortgage	0.8528	0.6420	-0.0214	1.0000	
House	**-0.2263**	**-0.2208**	**0.3689**	**-0.2317**	1.0000

Table 2 reports the simulated optimal portfolios for different levels of the housing constraint and risk aversion using the returns and the correlation matrix reported in Table 1. The values of the housing constraint correspond to age group averages in the parentheses calculated from the 1998 Wealth Survey of Statistics Finland. Table 2 is constructed so that the financial asset shares sum up to one and the value of -1 for mortgage means that the house is fully mortgaged. With low levels of risk aversion (A = 1) the optimal portfolio consist of only

[50] See Englund et al. (2002) and the appendix for details. In fact, Englund et al. (2002) report that the house specific risk alone is much larger than the risk measured by a general house price index. The difference is smaller with longer investment horizons.
[51] See Iacoviello and Ortalo-Magné (2003) for further discussion on country differences.

stocks, regardless of the housing constraint. However, with higher levels of risk aversion the share of stocks declines as the household replaces stocks with bonds. Interestingly, even at very high levels of risk aversion bank accounts are not included in the optimal portfolio.[52] This is true even when the housing constraint is introduced. The most interesting prediction from the simulation model concerning our econometric models is that with moderate and high levels of risk aversion ($A \geq 2$), the optimal share of stocks depends negatively on the housing constraint. That is, the higher the housing constraint the lower is the optimal share of stocks in the financial portfolio. At very high levels of risk aversion and housing constraint it is optimal for a homeowner not to hold stocks. The results are similar to the ones obtained by Flavin and Yamashita (2002).

Table 2. Optimal portfolio shares with different values of the housing constraint, *h*.

House value-to-net wealth ratio	Assets	Degree of risk aversion				
		A = 1	A = 2	A = 4	A = 8	A = 10
***h* = 2.295**	**Bank account**	0	0	0	0	0
(18–30)	**Bonds**	0	0.5088	0.8217	0.9782	1
	Stocks	1	0.4912	0.1783	0.0218	0
	Mortgage	-1	-1	-1	-1	-1
***h* = 1.516**	**Bank account**	0	0	0	0	0
(31–40)	**Bonds**	0	0.4432	0.7561	0.9126	0.9439
	Stocks	1	0.5568	0.2439	0.0874	0.0561
	Mortgage	-1	-1	-1	-1	-1
***h* = 1.016**	**Bank account**	0	0	0	0	0
(41–50)	**Bonds**	0	0.4011	0.7140	0.8705	0.9018
	Stocks	1	0.5989	0.2860	0.1295	0.0982
	Mortgage	-1	-1	-1	-1	-1
***h* = 0.871**	**Bank account**	0	0	0	0	0
(51–60)	**Bonds**	0	0.3889	0.7018	0.8583	0.8896
	Stocks	1	0.6111	0.2982	0.1417	0.1104
	Mortgage	-1	-1	-1	-1	-1
***h* = 0.716**	**Bank account**	0	0	0	0	0
(61–70)	**Bonds**	0	0.3758	0.6888	0.8453	0.8766
	Stocks	1	0.6242	0.3112	0.1547	0.1234
	Mortgage	-1	-1	-1	-1	-1
***h* = 0.789**	**Bank account**	0	0	0	0	0
(71 +)	**Bonds**	0	0.3820	0.6949	0.8514	0.8827
	Stocks	1	0.6180	0.3051	0.1486	0.1173
	Mortgage	-1	-1	-1	-1	-1

In Table 2 the decreasing pattern of stock investment is driven by the household's desire to hedge against the increase in the risk of its portfolio induced by housing. If, however, there

[52] Of course in reality, money is kept in bank accounts due to liquidity and possibly buffer-stock considerations.

are entry or participation costs to stock markets housing investment may, in effect, crowd-out investment in stocks. In other words, if the house takes a sufficiently large share of overall wealth, it may be optimal for the household not to participate in the stock market simply because the gain from doing so does not exceed the costs. Empirical evidence suggests that surprisingly small participation costs are sufficient to deter households from participating in the stock market.[53] We will return to this in the econometric part. Furthermore, for homeowners who are expecting to move up the housing ladder in the future, it may optimal to accumulate housing wealth because it works as an insurance against house price risk. This is true especially if the household is expecting to move within the same housing market where house prices are highly correlated. This aspect is emphasised by Nordvik (2001) and Sinai and Souleles (2005).

3. Econometric analysis

3.1 Data and descriptive analysis

In the econometric analysis, we use data from the 1998 Wealth Survey of Statistics Finland. Along with portfolio information, the Wealth Survey includes information on various household characteristics such as socio-economic status, demographics, income, taxes, and housing. Part of the information in the survey is collected from various administrative registers. The amounts of various assets are collected through interviews. The sample is a stratified sample drawn from all private households in Finland where the strata are created according to socio-economic status and income. For practical reasons, entrepreneurs and high-income households are assigned a higher inclusion probability to the final sample which includes all in all 3893 households. The selected households are given sampling weights so that the sample can be made representative of the whole population. We start the empirical analysis by reporting some descriptive statistics. Table 3 presents the percentage of households owning particular assets and liabilities, and the asset shares of total wealth classified by household net wealth and age.

[53]Vissing-Jorgenson (2002) finds that a mere annual cost of 50 dollars (in 2000 prices) was enough to explain the nonparticipation of half of the nonparticipant households in the U.S. in 1994. 260 dollars was enough to explain the behavior of 75 percent of nonparticipants. This reflects the fact that nonparticipants had very little financial wealth to invest in the first place.

Table 3. Asset ownership by net wealth quartiles and age in Finland, 1998.

		Net wealth quartile				
	All	**I**	**II**	**III**	**IV**	**top 5 %**
			Percentage holding the asset			
Listed stocks	14.9	2.6	9.8	11.5	35.7	56.6
Mutual funds	3.4	1.6	0.9	1.8	9.3	16.8
Bonds	2.6	0.6	1.1	1.4	7.0	12.1
Owner-occupied dwelling	63.7	4.4	56.0	95.2	99.3	98.6
Mortgage	28.3	8.6	35.1	38.5	31.1	28.5
			Percentage of total financial assets			
Listed stocks	19.5	2.4	8.1	5.0	24.2	33.9
Mutual funds	2.9	0.4	0.8	1.4	4.2	5.0
Bonds	2.6	1.3	0.4	0.7	3.3	2.8
			Percentage of total gross assets			
Owner-occupied dwelling	59.2	42.4	66.0	73.3	53.0	42.5
Mortgage	10.0	82.3	31.0	11.9	4.2	2.6
			Average holdings			
Average total net wealth, €	86 865	1 292	28 062	83 059	239 473	501 749
Average stockholding, €	17 298	1 961	4 637	4 471	28 801	79 473
Average house value, €	92 166	45 540	52 004	73 964	134 395	223 112
Average mortgage, €	34 873	45 285	38 990	29 772	33 637	47 690
			Age group			
	Under 25	**25 - 34**	**35 - 44**	**45 - 54**	**55 - 64**	**Over 64**
			Percentage holding the asset			
Listed stocks	10.6	11.6	14.9	19.9	18.0	12.1
Mutual funds	2.4	3.6	3.0	4.1	4.2	2.9
Bonds	1.5	1.7	2.3	1.8	3.9	3.7
Owner-occupied dwelling	11.3	39.4	66.5	77.6	81.9	72.6
Mortgage	10.7	36.2	49.3	37.5	19.3	5.2
			Percentage of total financial assets			
Listed stocks	8.8	18.4	17.3	18.5	21.7	21.5
Mutual funds	3.1	1.0	3.6	2.6	6.9	1.8
Bonds	2.6	0.4	2.7	3.3	2.3	2.9
			Percentage of total gross assets			
Owner-occupied dwelling	46.3	61.3	66.8	58.8	53.1	57.9
Mortgage	25.5	28.1	20.0	7.6	3.2	0.6
			Average holdings			
Average total net wealth, €	15 363	51 260	90 387	123 419	141 556	104 261
Average stockholding, €	4 254	10 662	13 857	16 071	25 238	22 075
Average house value, €	68 876	88 834	102 982	96 333	91 734	81 428
Average mortgage, €	39 894	44 381	41 586	25 838	23 148	12 392

Notes: House refers to the households primary dwelling. Average holdings are calculated conditional on ownership. Sampling weigths are used in the calculations.
Source: Author's calculations from the 1998 Wealth Survey.

About 15 percent of Finnish households had direct stock investments in 1998. Households' participation in the stock market (both directly and through mutual funds) clearly increases with household wealth level. The same is true for bond ownership indicating that wealthier households have more complete portfolios. Similar pattern is evident in the share of financial

wealth invested in stocks. Furthermore, households in the top half of the wealth distribution are almost exclusively homeowners. Interestingly, wealthy households also hold significant amounts of mortgage debt. This seems to indicate that mortgage debt is used for portfolio balancing purposes. In other words, these households understand that paying down the mortgage may not be the ideal investment strategy, but instead it may be optimal to invest in stocks and enjoy arbitrage returns. This opportunity is enhanced by the deductibility of mortgage interest in taxation and is more attractive for wealthy households for whom a leveraged position in housing does not necessarily induce a highly risky financial position.

Stock ownership follows a hump-shaped age pattern peaking after the age of 45 and dropping again after retirement. However, once a household owns stocks there is no clear age pattern in the share of financial wealth invested in stocks. Similar but stronger, age pattern is evident with homeownership which peaks a little later than stock ownership. The figures in Table 3 also give some indication that the age pattern of housing and mortgage choices does not entirely coincide with the age pattern of stockholding in the way the simulation model predicts. Thus, either age has a direct effect on stockholding or age is correlated with something that is not accounted for in these simple calculations.

In the econometric models, we concentrate on homeowners and discard the possible sample selection problems associated with dropping renter households from the sample. Since we are interested in portfolio choice, only households who have sufficient funds to form a reasonable portfolio are included in the analysis. We exclude households with financial wealth smaller than €1000. This eliminates 397 households. We also exclude households with negative overall net wealth and annual income smaller than €5000 which eliminates additional 54 households. Furthermore, we eliminate outliers by excluding observations with a house value-to-net wealth ratio greater than 20,[54] a mortgage expenses to annual disposable income ratio greater than 1 and a negative net housing wealth. These exclusions eliminate 25 households. Finally, we exclude households where the household head was a student. There were only 6 student households left after the initial trimming and none of them had stockholdings. This leaves us with a final sample size of 2437 homeowners. Table 4 presents descriptive statistics for key variables in various sub-samples that are used in the econometric models.

[54] This figure corresponds to a 95 percent mortgage loan-to-house value ratio. Usually banks offering mortgages in Finland require that the loan-to-value ratio does not exceed 80 or 85 percent when the house is bought.

Table 4. Descriptive statistics for key variables in different sub-samples of homeowners.

	All	All, mortgage>0	All, mortgage=0	All, Stocks>0	Stocks>0, mortgage>0	Stocks>0, mortgage=0
N	2 437	1 064	1 373	774	315	459
Percentage holding stocks	0.26	0.27	0.26	1.00	1.00	1.00
	[0.005]	[0.016]	[0.014]	.	.	.
Share of fin. wealth in stocks	0.09	0.08	0.09	0.33	0.32	0.34
	[0.005]	[0.007]	[0.007]	[0.014]	[0.021]	[0.019]
income / 10 000	2.84	3.42	2.46	3.33	3.74	3.04
	[0.038]	[0.056]	[0.046]	[0.080]	[0.122]	[0.100]
net wealth / 10 000	14.1	11.9	15.5	21.0	16.7	24.0
	[0.310]	[0.397]	[0.444]	[0.824]	[1.076]	[1.151]
age	53.0	43.1	59.6	51.1	43.4	56.5
	[0.416]	[0.425]	[0.486]	[0.702]	[0.788]	[0.851]
number of adults	1.88	1.95	1.83	1.96	1.95	1.98
	[0.019]	[0.025]	[0.027]	[0.032]	[0.043]	[0.047]
number of children	0.58	1.05	0.27	0.59	0.95	0.34
	[0.024]	[0.045]	[0.021]	[0.039]	[0.071]	[0.037]
female household head	0.36	0.30	0.40	0.29	0.25	0.31
	[0.013]	[0.019]	[0.018]	[0.023]	[0.031]	[0.031]
University degree (%)	0.09	0.12	0.07	0.19	0.22	0.18
	[0.007]	[0.012]	[0.008]	[0.017]	[0.026]	[0.022]
house / 10 000	9.58	10.7	8.81	11.8	12.4	11.5
	[0.164]	[0.224]	[0.225]	[0.331]	[0.485]	[0.447]
mortgage / 10 000	1.36	3.39	.	1.36	3.31	.
	[0.059]	[0.102]	.	[0.101]	[0.169]	.
h	0.92	1.31	0.65	0.75	1.05	0.55
	[0.020]	[0.044]	[0.008]	[0.027]	[0.058]	[0.013]
m	0.25	0.63	.	0.18	0.44	.
	[0.019]	[0.043]	.	[0.025]	[0.057]	.

Notes: Mean values of key variables in different sub-samples. Stantdard errors are in the brackets. Sampling weights are used in the calculations. Variables h and m refer to house value-to-net wealth and mortgage-to-net wealth ratios, respectively. Source: Author's calculations from the 1998 Wealth Survey.

3.2 Econometric models and endogeneity of key variables

We follow the basic guidelines from previous econometric research on household portfolio choice and model both the participation decision and the share of financial assets held in stocks. The variable of interest in the numerical simulation model was house value-to-net wealth ratio. However, in the econometric models the levels of house value and mortgage debt are used as key explanatory variables because a major multicollinearity problem was

found when these variables are divided by net wealth.[55] This choice of variables should not have a major effect on the results since we are directly controlling for net wealth. The house value variable is estimated by the homeowner. This, of course, is a biased estimate of the true market value of the house. However, this variable is exactly what we are interested in because the portfolio choices of homeowners are based on their own evaluation of their situation, including the value of their house.

There are reasons to be suspicious about the exogeneity of the key explanatory variables. For example, homeowners who have high valuations of what their house is worth may also hold more positive expectations on how well the stock market performs, and thus, are more willing to invest in stocks.[56] Even more worrying is that the Wealth Survey data set does not include a proxy variable for risk aversion, which is the main driver of household stockholding under expected utility theory. Since these omitted variables may also be correlated with households' housing choices, our key explanatory variables are possibly endogenous. Dealing with endogeneity in a binary choice model is somewhat difficult, especially when one of the possibly endogenous variables is a corner solution variable, which is the case here with mortgage debt. Roughly half of the homeowners in our sample are outright owners and have zero holdings of mortgage debt. Fortunately, there is a simple way to test exogeneity using a two-step procedure introduced by Rivers and Vuong (1988).[57] Consider a model

$$y_{1i} = 1\left(\mathbf{z}_{1i}'\boldsymbol{\beta}_1 + \alpha y_{2i} + \delta y_{3i} + \varepsilon_{1i} > 0\right), \tag{5}$$

$$y_{2i} = \mathbf{z}_i'\boldsymbol{\beta}_2 + \varepsilon_{2i}, \tag{6}$$

$$y_{3i} = \mathbf{z}_i'\boldsymbol{\beta}_3 + \varepsilon_{3i}, \tag{7}$$

where y_1 indicates stockholding and 1(.) is an indicator function taking the value 1 if the statement in the parenthesis is true and 0 otherwise. Equation (5) is the structural equation of interest and (6) and (7) are the reduced forms for house value and mortgage debt, denoted by y_2 and y_3, respectively. The vector $\mathbf{z}$ includes all exogenous variables including the ones in $\mathbf{z_1}$ with some elements (the instruments) that are not included in $\mathbf{z_1}$. The error terms are assumed

[55] The correlation coefficient for these variables in the sample of homeowners was 0.96. The correlation for the level variables was only 0.26.
[56] Dominitz and Manski (2007) find evidence that U.S. households have heterogeneous expectations on stock returns, and that households with more positive expectations also hold more stocks.
[57] See Wooldridge (2002) pp. 474–478 for further details.

to be independent of $\mathbf{z}_1$ and **z.** However, if the error term in the structural equation is correlated with y_2 and y_3, the usual univariate probit estimation of (5) leads to inconsistent estimates. The Rivers-Voung test procedure involves two steps. First, estimate the reduced form models in (6) and (7) using OLS to obtain the residuals for each model. Second, add these residuals as additional right-hand side variables in (5) and estimate the model as a univariate probit using maximum likelihood. A joint test on the significance of the coefficients of the residuals is a test for exogeneity.[58] The share of financial wealth invested in stocks or mutual funds is modelled using the sample selection framework. Using instrumental variables in a sample selection model is more straightforward because the second step can be estimated simply as a linear regression as proposed by Heckman (1979).

In order to perform exogeneity tests, we need instruments that are correlated with house value and mortgage debt but are not correlated with the omitted variables in the error term in (5). As an instrument for house value, we use a quality adjusted regional house price index obtained from a hedonic regression.[59] Obviously, regional house prices affect housing choices of households, but regional house prices should not be correlated with the unobserved household characteristics. Of course, this is true only to the extent that particular types of households are not endogenously selected into particular housing market regions. It is not implausible that a household's location choice is correlated with, say, risk aversion. However, it is more plausible that risk aversion affects a household's location choice within a given labour market or urban area. In order to avoid this sorting problem, we use a broad regional division, i.e. NUTS 4, in constructing the house price index. The NUTS 4 level division corresponds quite nicely to labour market regions. To reiterate the motive for this instrument, it may be that households' location choice within a given labour market is partly driven by the same unobservable household characteristics as stockholding. However, we do not believe that households living in, for example, the Turku region are fundamentally different from the ones living in the Helsinki region after we control for observable household characteristics, such as income, wealth, age, education and occupation type.[60]

[58] The corner solution nature of mortgage debt does not invalidate the testing procedure because the distribution of the error term in (7) plays no role under the null hypothesis. If exogeneity of mortgage debt is rejected, however, the two-step procedure cannot be used to consistently estimate the marginal effects of interest in (5).
[59] See the appendix for details.
[60] As an auxiliary informal test for the exogeneity of the house price index we estimated a stockholding model for renters who serve as a control group. The idea is that if the sorting story is credible we should probably observe that among renters as well. So we included the regional house price index along with all our controls directly into a probit regression explaining renter households' stockholding. The house price index had no

Three variables are used to instrument mortgage debt. The first is an indicator that the household has used a bequest to finance the purchase of its first own house. Receiving a bequest can be seen as an exogenous wealth shock and should not be correlated with unobservable household characteristics. The second instrument is an indicator that the household is a first-time homeowner, i.e. it currently serves its first mortgage. This makes the household eligible for a larger tax deduction for mortgage interest than other households.[61] The third instrument is the price difference between the purchase price of the household's current dwelling and the selling price of its previous dwelling. This difference is positive (negative) for households who moved to a more (less) valuable dwelling. If this difference is positive households are more likely to use a mortgage to finance their new house, and the larger the positive difference is the larger is the needed mortgage to bridge the gap.

A rich set of household characteristics is controlled in the econometric models. These include current income, net wealth, age, education level, household composition, and socio-economic position or occupation type. Urbanisation rate is controlled to capture differences in access to financial services, opportunities for social interaction, and knowledge spill-over associated with urban environments.[62] We also include a dummy indicating that the household has inherited financial assets within the last five years. The results for first stage instrument performance and exogeneity tests are presented in Table 5. The first four rows in Table 5 include the first stage partial F-statistics for the explanatory power of the instruments and the Rivers-Vuong test statistics for all homeowners and also for sub-samples with and without a mortgage which are used later in the econometric analysis.[63] The lower part of Table 5 includes the first stage partial F-statistics and Hausman test statistics for exogeneity in the

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explanatory power in the sub-sample of renters (a *p*-value of 0.423) suggesting that there is no direct channel through which regional house price level affects households portfolio choice, but instead the possible effect comes indirectly through housing choices of homeowners.

[61] From 1993 onwards the mortgage interest deduction has been made from capital income according to a flat tax schedule. If a household's mortgage interest payments exceed capital income, which is the case for many young first-time buyers, the household is allowed to deduct the resulting tax deficit from its labour income tax liability in form of a tax credit. In this situation, the deduction rate is equal to the capital income tax rate except for first-time buyers. From 1993 to 1996 the capital income tax rate was 25 percent, and in 1997 and 1998 the tax rate was 28 percent. During this time the tax credit deduction rate for first-time buyers was 30 percent.

[62] Hong at al. (2004) find that social interactions play a role in stock market participation of U.S. households.

[63] Dividing the sample into homeowners with and without a mortgage also serves as an auxiliary test on the validity of the instruments. Households who own outright are likely to have lived in their homes longer, and thus, their location choice should not be as correlated with current house prices compared to homeowners with a mortgage who are likely to be more recent owners. The instruments perform well in both sub-samples.

sub-sample of homeowners with stockholdings used in the second step of the sample selection model. The Hausman tests were implemented using an auxiliary regression approach.

Table 5. Results for first stage instrument performance and exogeneity tests.

	All homeowners		**Mortgage > 0**		**Mortgage = 0**	
N	2 437		1 064		1 373	
1st stage tests:	house	mortgage	house	mortgage	house	mortgage
Partial F-test for instruments	110	74.6	59.1	12.6	81.4	
Rivers-Vuong test (p-value)	0.20	(0.904)	0.18	(0.916)	0.13	(0.714)

Homeowners with stockholdings:

	Stocks>0, all		**Stocks>0, mortgage>0**		**Stocks>0, mortgage=0**	
N	774		315		459	
1st stage tests:	house	mortgage	house	mortgage	house	mortgage
Partial F-test for instruments	37.8	24.6	29.0	4.3	16.4	
Hausman (p-value)	0.74	(0.996)	1.87	(0.393)	0.87	(0.351)

High partial F-statistics in the first stage indicate that the instruments have good explanatory power. The only specification where there is some doubt about the explanatory power of the instruments is in the sub-sample of stockowners with positive holdings of mortgage debt. The problem there was instrumenting mortgage debt. In that case, we reduced the number of instruments and used only the difference between purchase and selling price. The other two instruments had no explanatory power in this sub-sample. The price difference variable was statistically significant at 5 percent level; however, the F-statistic is small indicating the possibility of a weak instrument. Interestingly, the test results indicate that exogeneity is clearly not rejected in any model specification.

3.3 Econometric results

We start the analysis with the discrete choice of stockholding. The results of probit models are presented in Table 6. Because exogeneity of key variables was not rejected in any specification and the difficulty of estimating a model that allows for endogeneity in this setting, the reported marginal effects are from usual univariate probit models. The marginal effects are calculated at the sample means of the other covariates.

In the first model in Table 6, house value gets the expected negative sign and is clearly statistically significant, whereas mortgage debt is not. Thus, a higher house value decreases the probability of stockholding. The result can be interpreted in two ways. First, households may be hedging against house price risk induced by a valuable house compared to net wealth, a result that would be in line with the simulation results in section 2. Second, since increasing house value at given net wealth and mortgage levels necessarily lowers financial wealth available for stock investment, a negative sign of house value may simply indicate that entry and participation costs become prohibitive. Moreover, households with low financial wealth may be reluctant to hold stocks because they cannot diversify their stock portfolios efficiently.

Table 6. Probit models for stock market participation.

	All homeowners		**Mortgage > 0**		**Mortgage = 0**	
	Marginal effect	**Std. error**	**Marginal effect**	**Std. error**	**Marginal effect**	**Std. error**
income / 10 000	0.017	0.015	-0.008	0.038	0.010	0.019
(income / 10 000)^2	-5.2E-04	8.8E-04	3.1E-03	3.9E-03	-4.0E-04	9.7E-04
net wealth / 10 000	0.016**	0.002	0.019**	0.003	0.017**	0.002
(net wealth / 10 000)^2	-5.5E-05**	9.4E-06	-9.6E-05**	3.0E-05	-5.8E-05**	1.1E-05
age 25–34 (ref. < 25)	-0.022	0.090	-0.097	0.089	0.237	0.286
age 35–44	-0.093	0.079	-0.127	0.095	-0.011	0.209
age 45–54	-0.097	0.080	-0.174*	0.083	0.055	0.224
age 55–64	-0.120	0.075	-0.179**	0.064	0.029	0.219
age 65–	-0.093	0.086	-0.114	0.104	0.081	0.223
education = 1[a]	0.037	0.029	0.102	0.051	-0.013	0.036
education = 2	0.105**	0.032	0.119*	0.050	0.096*	0.043
education = 3	0.207**	0.052	0.212**	0.077	0.215**	0.076
house value / 10 000	**-0.009****	**0.002**	**-0.010****	**0.004**	**-0.008****	**0.003**
mortgage / 10 000	**0.002**	**0.005**	**0.0004**	**0.006**		
N (y = 1)	2 437 (774)		1 064 (315)		1 373 (459)	
Correctly predicted as 1	258 (33 %)		81 (26 %)		191 (42 %)	
Correctly predicted as 0	1 537 (92 %)		694 (93 %)		823 (90 %)	
Log-L	-1 194		-535		-637	

*Notes: Results are from probit models where all explanatory variables are treated as exogenous. The dependent variable indicates participation in the stock market either directly or trough mutual funds. All the models include the following control variables: occupation type of household head (9 categories), urbanisation rate of municipality (3 categories), education level of other household members (3 categories), an indicator that the household has inhereted financial assets within the last five years, number of adults and children in the household, and whether the household head was female. Sampling weights are used in the estimation. ** and * indicate statistical significance at 1and 5 percent level, respectively.*

[a] *Dummy variables for education level of household head. Reference group is comprehensive school only. 1 = high school or vocational school, 2 = higher vocational, 3 = university degree.*

In order to further investigate the role of leverage, we divide the sample of homeowners into those who have a mortgage and to those who do not. For the latter group, house value-to-net wealth ratio (h) cannot exceed 1, and so the division should give clearer evidence whether a

risky leveraged position in housing is driving the results. We find no support for this hypothesis. House value has a negative effect of similar magnitude on stockholding of both types of homeowners suggesting that the result is driven primarily by the crowd-out effect not by the risk induced by leveraged position in housing. This means that homeowners with more valuable homes simply have fewer funds available for stock market investment than homeowners with less valuable homes and identical net wealth level.[64] The marginal effect of house value may seem small but the result is also economically meaningful. For example, a one standard deviation increase in house value from the sample mean (about €95 000) decreases the probability of stockholding by about 6.5 percentage points.

The interpretation of the effect of total net wealth is interesting as well. When house value and the size of mortgage debt are controlled for, changes in net wealth are actually changes in financial wealth. Now, the positive effect of net wealth can be interpreted in two ways. First, as financial wealth increases households are more likely to be able to overcome any participation costs involved with entering the stock market. Second, this result suggests that households become less risk averse as they gain more wealth. Unfortunately, it is impossible to substantiate the relative importance of these two effects from the data. A final note on the probit models is that according to prediction percentages we are not really doing a good job in explaining the participation of homeowners to stock markets.

Next we look at share of financial wealth invested in stocks or mutual funds. Estimation is carried out in two steps as proposed by Heckman (1979). Identification of the model requires an exclusion restriction, i.e. a variable or variables that affect the participation decision but not the share invested.[65] Prime candidates in this context are variables that affect the cost of participating, such as availability of financial services near a household's residence. To achieve identification, we exclude the urbanisation rate variables from the level equation. Urbanisation rate can be seen as a proxy for the availability of financial services, and thus, as a proxy for participation costs. Once a household has entered the stock market, differences in

[64] To further test whether the results are different for the two sub-samples we implemented a likelihood ratio test that is an equivalent of the Chow-test. The test did not reject the null hypothesis of no difference between the two sub-samples, which again indicates that mortgage debt is not a major factor influencing the participation decision.

[65] Technically the model is identified even if exactly the same variables are used in both steps. However, in that case identification relies on the normality assumption in the probit model and the second step is suspect to severe multicollinearity.

access to financial services, opportunities for social interaction, and knowledge spill-over should not affect the share of financial wealth invested in stocks.[66] Table 7 presents the results. The first model is the usual sample selection model estimated using OLS, and the other two are estimated using 2SLS with and without the sample selection correction term.[67]

Table 7. Sample selection models for the share of stocks in financial portfolios.

	OLS		2SLS		2SLS		
	Coeff.	**Std. error**	**Coeff.**	**Std. error**	**Coeff.**	**Std. error**	**VIF**
constant	0.186	0.246	0.307	0.187	0.542	0.086	
income / 10 000	-0.041*	0.017	-0.049*	0.024	-0.048**	0.013	6.938
(income / 10 000)^2	0.002*	0.001	0.002	0.002	0.002**	0.0005	4.693
net wealth / 10 000	0.013**	4.4E-03	0.008*	4.0E-03	0.007**	2.0E-03	57.80
(net wealth / 10 000)^2	-4.9E-05*	1.9E-05	-2.7E-05*	2.2E-05	-2.1E-05**	5.3E-06	23.72
age 25–34 (ref. < 25)	-0.110	0.114	0.049	5.7E-02	-0.107	0.069	11.41
age 35–44	-0.248*	0.117	-0.055	0.061	-0.201**	0.067	22.72
age 45–54	-0.170	0.115	0.032	0.058	-0.124	0.069	28.64
age 55–64	-0.192	0.121	0.034	0.065	-0.129	0.072	21.73
age 65–	-0.236	0.125	dropped		-0.192*	0.084	12.82
education = 1[a]	0.033	0.039	0.023	0.029	0.015	0.033	2.542
education = 2	0.173**	0.048	0.132**	0.036	0.121**	0.033	4.307
education = 3	0.209**	0.070	0.138**	0.052	0.125**	0.042	6.687
house value / 10 000	**-0.0053**	**0.0028**	**-0.0042**	**0.0066**	**-0.0049**	**0.0058**	3.586
mortgage / 10 000	**0.0071**	**0.0057**	**0.0139**	**0.0154**	**0.0096**	**0.0150**	1.418
Inverse mills' ratio	0.232	0.140	0.041	0.101			27.96
N	774		774		774		
OLS R^2	0.15		0.15		0.14		

*Notes: Dependent variable is the share of financial assets invested in stocks or mutual funds. All the models include the following control variables: occupation type of household head (9 categories), education level of other household members (3 categories), an indicator that the household has inhereted financial assets within the last five years, number of adults and children in the household, and whether the household head was female. In the second model, standard errors are estimated using a non-parametric bootstrap with 1000 replications because a generated regressor is included. One age group is dropped because it included so few observations that the resampling often resulted in a sample that did not include households in that age group. Sampling weights are used in the estimation. ** and * indicate statistical significance at 1and 5 percent level, respectively. The last column includes the variance inflation factors for the variables.*

[a] *Dummy variables for education level of household head. Reference group is comprehensive school only. 1 = high school or vocational school, 2 = higher vocational, 3 = university degree.*

[66] We also estimated the models without exclusion restrictions and the results were almost identical. However, this may indicate that the exclusion restrictions are not valid in the sense that they do not explain participation particularly well and do not create much additional variation in the inverse Mills' ratio. An LR-test for joint significance of the urbanisation rate dummies in the probit model produced a *p*-value of 0.114. This suggests that we may have a problem with multicollinearity even with exclusion restrictions. High standard errors induced by multicollinearity may be one reason why we cannot reject the null hypothesis of no sample selection bias. The last column in Table 7 reports the variance inflation factors (VIF) for the key variables used in the model. They suggest that multicollinearity is a problem mainly for net wealth variables and the inverse Mills' ratio.

[67] Because exogeneity was not rejected in the first step probit models, the inverse Mills' ratios are calculated in the usual way.

The results are qualitatively similar to the probit results when it comes to variables that are statistically significant in both steps. In the first model in Table 7, house value gets the expected negative sign but the estimate is not very precise. The *p*-value for the coefficient is 0.060. Clearly this effect cannot be due to entry or participation costs since here we are dealing with homeowners with stockholdings. This would indicate that for homeowners with stockholdings, higher house value translates into a more risky portfolio which they balance by lowering the amount of stockholding.[68] In the 2SLS models, the coefficient of house value is negative and of similar magnitude as in the OLS but standard errors more than double and the coefficients are clearly not statistically significant. Furthermore, even if the assumption of exogeneity is true, the effect of house value seems rather small; a €10 000 increase in house value reduces the share of stocks by merely 0.5 percentage points.

Net wealth has a statistically significant positive effect on the share of financial wealth invested in stocks. Now that entry costs can be ruled out, the positive effect of net wealth suggests that households become less risk averse as they gain more wealth. This would indicate that household preferences exhibit decreasing absolute risk aversion, a result that is often found in empirical portfolio research. However, it must be emphasised that the discussion concerning the results from the sample selection models should be taken cautiously because of possibly poor exclusion restrictions and impreciseness of the coefficients of key housing variables. Furthermore, high standard errors induced by multicollinearity may also be partially responsible for not rejecting exogeneity using the Hausman test. On the other hand, the results concerning net wealth and education level seem robust across specifications.

The fact that exogeneity of house value or mortgage debt was not rejected in any of our model specifications is interesting. This suggests that homeowners' stockholding and housing choices are not driven by same unobservable variables. This means that either we are able to control for differences in risk aversion through control variables or that risk aversion does not significantly affect the housing and mortgage choices of Finnish homeowners. The latter case would indicate that housing and mortgage choices are driven primarily by consumption demand for housing services instead of investment demand for housing capital or mortgage

[68] Again we divided the sample into sub-samples with and without a mortgage. When using OLS, the coefficient of house value changed considerably closer to zero for the latter group but the difference between the coefficients in the two sub samples was not statistically significant. We also implemented a Chow test. The test rejects the null hypothesis that the coefficients are the same in both models. However, it is unclear what exactly drives this result because the sub-samples differ in many respects as can be seen from Table 4.

debt. So it seems that Finnish households think of owner-occupied houses as homes rather than investment vehicles and do not necessarily understand the financial risks involved. Of course this speculation critically hinges on the validity of our instruments and the power of the exogeneity tests. Nevertheless, this seems a fruitful avenue for future research on how households perceive the risks involved with homeownership.

The empirical results differ considerably from the predictions drawn from the simulation model in section 2. The most striking difference is the low level of actual stock market participation. Some of this can be explained by entry and participation costs and buffer stock saving motives. According to the econometric results, owner-occupied housing does offer a partial explanation for low levels of stockholding. However, considerable unexplained heterogeneity remains. This is in line with previous empirical findings on household portfolio choice from a number of countries as reported in e.g. Guiso et al. (2003). Some clear patterns do emerge from the econometric models in addition to housing. The most robust results were that net wealth and education level have a positive effect on both the decision to participate in the stock market and the share of financial wealth invested in stocks.

4. Conclusions

This paper studied the link between homeownership and household portfolio choice. The starting point for the paper was the finding by Flavin and Yamashita (2002) that given the historical returns on different assets in the U.S. homeowners with a leveraged position on housing should hedge against house price risk by holding fewer stocks. This paper replicated the simulation results using Finnish asset return data and showed that house price risk may indeed be an important factor influencing Finnish households' financial portfolios. The main contribution of the paper, however, was to put this prediction into an econometric test using the 1998 Wealth Survey, a household level data produced by Statistics Finland.

Econometric results tell us that owner-occupied housing has an adverse effect on household stockholding. More precisely, a higher house value at a given level of net wealth clearly reduces the probability that a household enters the stock market. This result can be interpreted in two ways. First, at a given net wealth level higher house value exposes households to house price risk which might induce them to mitigate their stockholding. On the other hand, higher

house value at a given level of net wealth and mortgage debt automatically means a lower level of financial wealth for the household. So the result may indicate that some households do not see it worthwhile to enter the stock market given their low level of financial wealth and possible entry and participation costs. Although, the results hinted that the latter effect is more important, the relative importance of these two effects cannot be deduced explicitly from the data we used. On the other hand, it seems that housing has only a small effect if any on the share of financial assets a household invests in stocks conditional on stockholding. However, the results concerning the share invested in stocks may suffer from a poorly identified model and should be taken only as suggestive. Further work is needed in this respect. What comes to other important factors behind stockholding, we find that wealthier and more educated households are clearly more likely to own stocks and also invest a larger share of their financial wealth into stocks.

The results have also policy relevance as they suggest that the prevailing Finnish housing policy of promoting homeownership has an unintended effect of inducing households to hold fewer stocks. This is in contradiction with the ongoing public debate where encouraging stockownership and long-term savings of Finnish households is seen as an important policy goal. This should be taken into account when evaluating housing policy and the adverse effects should be weighed against the benefits of promoting homeownership.

Some open questions remain for future work concerning housing and portfolio choice. Sinai and Souleles (2005) argue that owner-occupied housing should not be treated simply as an asset inducing a background risk for homeowners. Instead, the effective asset price risk depends on households' expected tenure length and moving behaviour. An interesting extension in this line of research would be to explicitly control for expected tenure length. One would also want to control for whether a homeowner is expected to move up or down the housing ladder. These extensions might also explain why we couldn't find evidence of risk aversion affecting the housing choices of Finnish households.

An interesting future avenue would also be to study how households adjust their financial portfolios just before and after the purchase of their first owner-occupied house. However, this line of research requires the use of panel data. Furthermore, two important institutional changes have occurred in Finland that should be of interest for future research. Namely, new

longer maturity mortgages have been introduced in Finland only recently. This should have an effect on the way households save during their life-cycle and on their expected moving frequency, both of which are closely connected to portfolio choice. In addition, mutual funds have made stockholding a possibility also for lower wealth households because through mutual funds these households are better able to diversify their portfolios. Both of these developments may have had a clear effect on household portfolios.

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Appendix. Calculation of asset returns for the simulation model.

The return from owner-occupied housing consists of capital gains, the rental value of housing services minus the costs of ownership, maintenance and depreciation. We estimate the capital gain using a national-level, quality adjusted house price index produced by Statistics Finland.[69] An estimate of the gross rental value of housing services is obtained using the 1998 Wealth Survey, where homeowners were asked to estimate their current house value. Using these values we estimate a hedonic regression to obtain a value for a constant quality house.[70] From renter households the data includes the rents they paid during the survey year. Again we used a hedonic regression to obtain an annual rent for a constant quality dwelling. The results are presented in Table A1. Due to small sample size, we assume that the marginal prices of attributes are equal across regions and allow the regional prices vary only through the intercept. The hedonic regression for house value is also used in constructing the regional house price index that is used as an instrument in the econometric models.

The annual gross rental return from housing was obtained by dividing the constant quality annual rent by constant quality house value. This gave us an estimate of roughly 5 percent for the average annual gross rental return. We assume that this stayed constant during 1995–2005. From this gross measure we subtract depreciation and property taxes.[71] Unfortunately, there exits no measures of the depreciation rate of physical housing stock in Finland, thus, we use a commonly used annual rate of 2 percent as our measure. The municipal property tax is calculated as the annual national average weighted by municipal property values. Imputed rental income is not taxed in Finland. Also capital gains are tax-exempt if the household has used the house as a primary home for at least two years which we assume is the case.

Stock returns are based on a dividend adjusted stock index of the Helsinki Stock Exchange (previously HEX and now OMX Helsinki index). The stock returns are taxed with a

[69] This approach has its drawbacks because using a nationwide house price index understates the true level of uncertainty a homeowner faces by ignoring the idiosyncratic or house specific part of the risk.
[70] There is empirical evidence suggesting that homeowners are fairly accurate in estimating their house value. There is also evidence that the estimation errors are not correlated with house or owner characteristics. See, for example, Kiel and Zabel (1999) who find that American homeowner's tend to overvalue their house by about 5 percent on average. If Finnish households have a similar tendency this would lead to underestimation of the rental return to owner-occupied housing with the method used here.
[71] We assume that households spend annually on maintenance an amount that keeps the house in constant condition. This way we don't have to separately account for maintenance costs and depreciation.

proportional capital income tax rate which varied from 25 to 29 percent during the research period. Government bond return data is a government bond total return index produced by Datastream and includes bonds of all maturities. The return to bank accounts is obtained from the statistics services of Bank of Finland. We subtract the stamp tax which equals the capital income tax rate from interest and government bond returns. Mortgage interest is also obtained from the Bank of Finland and it equals the average rate on new mortgage contracts. Nominal mortgage interest is tax deductible according to a flat rate equal to the capital income tax rate. The cost of living index of Statistics Finland is used to convert the returns into real terms.

Table A1. Results for the hedonic regression models.

	House value			Rent		
	Coeff.	**Std. Error**	**p-value**	**Coeff.**	**Std. Error**	**p-value**
constant	72 539	5 822	0.000	1 668	796.6	0.038
age	-669.0	96.82	0.000	-26.99	12.06	0.026
$(age)^2$	5.210	0.850	0.000	0.140	0.112	0.214
floor area	470.1	61.23	0.000	65.99	13.99	0.000
$(floor\ area)^2$	0.935	0.170	0.000	-0.082	0.086	0.342
detached[a]	29 881	5 231	0.000	125.9	585.2	0.830
two-family house	35 308	5 348	0.000	295.0	640.4	0.646
terraced	20 011	3 874	0.000	899.8	393.6	0.023
own lot	-4 569	3 877	0.239			
building material wood	-17 137	3 047	0.000	-997.6	382.3	0.010
urban[b]	27 190	2 989	0.000	1 647	485.5	0.001
semi-urban	5 881	3 153	0.062	285	557.6	0.610
Number of obs.		2 922			254	
F-test (p-value)		39.2 (0.000)			5.88 (0.000)	
Adjusted R^2		0.53			0.55	

Notes: The dependent variables are house value and annual rent in euros. In both models the explanatory variables include 76 NUTS 4 regional dummies. Omitted category is the Helsinki Region.

[a] *Dwelling type dummies, reference is multi-storey block*

[b] *Dummy variables indicating the urbanisation rate of municipality, reference is rural regions*

Chapter 4:

Imputed Rental Income, Taxation and Income Distribution in Finland

Imputed Rental Income, Taxation and Income Distribution in Finland

Tuukka Saarimaa

Abstract:
This paper analyses the effects of imputed rental income from owner-occupied housing and its taxation on income distribution in Finland. Using micro-data from the 2004 Wealth Survey produced by Statistics Finland we find that owner-occupied housing has a significant impact on the well-being of many households. In 2004 imputed rental income constituted on average about 10 percent of homeowner households' disposable income. Furthermore, including imputed rental income to household disposable income decreased overall inequality measured by the Gini index. The estimated tax revenue forgone in 2004 was 1.9 billion euros amounting to almost 15 percent of the total government income and wealth tax revenue collected that year. On the other hand, the tax subsidy resulting from non-taxation of imputed rental income is skewed toward high-income households who are more likely to be homeowners and also more likely to own outright. The paper also made a comparison of the current tax system where imputed rental income is untaxed to two alternative tenure neutral tax systems where imputed rental income is taxed. The results indicate that the effects on overall inequality depend vitally on the way the increased tax revenue is transferred back to the households. The calculations in this paper ignore any behavioural responses by the households.

Keywords: Imputed rental income, tax subsidy, income distribution.
JEL Codes: H23, H24, R21.

1 Introduction

Housing is an important part of household welfare and a number of different subsidies and regulations have been implemented with the aim of ensuring a reasonable housing standard for all households. One of the most notable features of the Finnish housing subsidy system is the promotion of homeownership through tax subsidies, i.e. indirectly through tax law.[72] Partly due to its lenient tax-treatment, homeownership is the dominant tenure in Finland as about 65 percent of Finnish households are currently homeowners, and even a larger percentage owns a home at some point during their live-cycle. Using the tax treatment of private landlords as a benchmark, the preferential tax treatment of homeowners in Finland consists of the following provisions. First, homeowners do not have to pay taxes on imputed rental income or capital gains. Second, homeowners are allowed to deduct mortgage interest expenses even though the income associated with this cost is not taxed. Finland is by no means an exception in international context in this respect, as in many countries owner-occupied housing is tax-favoured compared to other investments and housing tenure modes.[73]

The adverse effects of these types of tax subsidies to owner-occupied housing are well documented in the economics literature.[74] First of all, lenient taxation of housing compared to other investments leads to slower economic growth because it induces households to over-consume housing. This increases the existing housing stock at the expense of productive or business capital stock in the economy. Second, because of imperfect capital markets households' life-cycle consumption profile is distorted as households need save for a down-payment when buying a house. Third, households are encouraged to hold portfolios that are sub-optimal from diversification point of view. The main argument in favour of subsidising owner-occupied housing is that it creates positive externalities.[75] Although, the positive (or negative) externalities of homeownership are difficult to substantiate empirically, it seems that the major tax advantages to owner-occupied housing cannot be justified on efficiency

[72] Sometimes these subsidies are referred to as tax expenditures. This terminology highlights the fact that tax revenue lost due to different departures from the benchmark tax system should be accounted for in the expenditure side of the government budget.
[73] See Hendershott and White (2000) and Englund (2003) for surveys of different country practices and also for a review of the main aspects of taxing housing capital.
[74] See, for example, Skinner (1996), Gervais (2002) and Flavin and Yamashita (2002).
[75] See Dietz and Haurin (2003) for a review on social and private consequences of homeownership. Glaeser and Shapiro (2002) conduct empirical tests on various proposed externalities of homeownership.

grounds. This study uses household level data to evaluate whether the tax advantages can be justified from a distributional point of view.

The tax-favoured status of owner-occupied housing is well understood in Finland. For example, the Government Institute for Economic Research produces annually overall size estimates of different tax subsidies for budgetary purposes. However, there exists no attempt to evaluate the distributional impact of this policy.[76] The purpose of this study is to fill that gap in some important respects. First, we estimate the income advantage derived from owner-occupied housing and the impact it has on income distribution. In the second phase, we estimate the value of the subsidy resulting from the non-taxation of imputed rental income and provide an outline of the first round distributional incidence of the subsidy. In doing so, we compare two alternative ways of redistributing the increased tax revenue back to the households. First, we consider a scheme where each adult is given an equal size lump-sum transfer. Second, we lower the (flat) capital income tax rate so that the revenue accrued from taxing the larger capital income tax base where imputed rental income is now included stays constant. Unfortunately, because Finnish income taxation is based on incomes of individuals and because the data set used here is aggregated at household level, we cannot consider a reform where labour income taxes are lowered since we do not observe incomes of individual household members. The tax subsidy resulting from the non-taxation of capital gains is not measured in this study because of the difficulty in estimating capital gains. Furthermore, the analysis in this study ignores any behavioural responses from the households to the proposed tax reforms.

This exercise is problematic because imputed rental income comes in non-monetary form as housing services, and thus, is unobservable to the researcher. The paper overcomes this problem by using a hedonic rent regression to predict imputed rental values for homeowners which can then be used as the tax base. The dataset used in this study is the 2004 household Wealth Survey produced by Statistics Finland. This dataset is good for the purposes of this paper because it includes better location information than is usually found in Finnish national level household surveys and allows us to estimate more plausible hedonic models.

[76] There are some studies on the distribution of the benefit from mortgage interest deduction, see e.g. Viitamäki (1999). Latest overall size estimates can be found in Government Institute for Economic Research (2007).

Results from previous similar studies from different countries show that including imputed rental income to households' disposable income has only a small effect on overall inequality. On the other hand, most studies find that a tax on imputed rents would be progressive. This, of course, depends highly on whether the tax rate on imputed rental income is progressive or flat, and also on the way the increased tax revenue is returned to the households. Hills (1991) evaluates the distributional effects of tax advantages to owner-occupied housing in Great Britain. He finds that the benefit from the tax subsidies is clearly larger for households in the top income deciles. Follain et al. (1993) find that a tax on imputed rental income would progressive in the U.S. Yates (1994) uses Australian data and finds that imputed rental income has a significant impact on the well-being of many households, and that, including imputed rental income in households' disposable income slightly decreases overall inequality. Bourassa and Hendershott (1994) go a step further from Yates' results and evaluate the impact of taxing imputed rents in Australia. They find that a tax on imputed rental income would be clearly progressive. Recent contributors to the literature are Frick and Grabka (2003) who evaluate the impact of imputed rental income on income inequality in Great Britain, former West Germany and the U.S. They find that imputed rental income represents a significant share of owner-occupiers disposable income in all countries and including it into disposable income slightly decreases inequality.

Main findings of this study can be summarised as follows. The results indicate that owner-occupied housing has a significant impact on the well-being of many households. In 2004 imputed rental income constituted on average about 10.7 percent of homeowner households' disposable income. We also found that the government loses significant amounts of tax revenue because imputed rental income is untaxed. The estimated tax revenue forgone in 2004 was 1.9 billion euros. This amounts to almost 15 percent of the total government income and wealth tax revenue collected that year. Furthermore, the tax subsidy resulting from the non-taxation of imputed rental income is skewed toward high-income households who are more likely to be homeowners and also more likely to own outright. However, also some low-income households are homeowners and they may find it difficult to cope with tax payments if a tax on imputed rental income is implemented. We also find that the effects on overall inequality depend vitally on the way the increased tax revenue is transferred back to the households. Under the lump-sum per adult transfer scheme income inequality decreased

slightly compared to the current system, whereas under the lowered capital income tax scheme inequality clearly increased.

The rest of the paper is organised as follows. Section 2 illustrates the tax subsidy resulting from the non-taxation of imputed rental income. The section also presents the main aspects of current housing taxation in Finland and discusses the benchmark tax system including the choice of deductible items. In section 3 the empirical methodology for estimating imputed rental income for homeowners is presented. Section 4 reports the results of the distributional analysis. Section 5 concludes.

2 Defining the benchmark tax system

2.1. Tenure neutrality

Tax subsidies (or tax expenditures) are usually defined as departures from the normal or benchmark tax structure that result in favourable tax treatment of particular activities or taxpayer groups.[77] The concept is based on the notion that any income tax structure has two basic elements. The first element consists of the structural provisions necessary to implement the income tax on individuals and corporations, such as the determination of income, the rate level and the tax subject. This element constitutes the so-called normal tax structure. The second element consists of special provisions that deviate from a neutral tax system and are designed to favour particular industries, activities or taxpayer groups. Thus, the second element can be used to promote certain activities and to achieve social objectives the same way as direct expenditure programs.

Defining a benchmark tax system for residential housing is difficult because of the dual role a house serves both as consumption good and as capital investment. As a generator of housing services, a house satisfies consumption needs, and as an asset, a house is taken into consideration when making investment decisions. To put it in another way, a house is a piece of capital that is used in producing a consumption good, i.e. housing services.[78] These issues are very important when considering what provisions in the tax code actually constitute a tax

[77] See e.g. OECD (1996).
[78] See e.g. Englund (2003).

subsidy to homeowners.[79] Basically, there are two stands that one can take. First, a house can be seen as a piece of capital that produces an income stream to the owner. For landlords this income comes in monetary form as rental payments, whereas for homeowners the income comes implicitly in the form of housing services or as imputed rental income. Furthermore, both types of owners may receive capital gains or capital losses as house prices fluctuate. Second, owner-occupied housing can be seen simply as a durable consumption good and housing services as a stream of consumption.

The current income tax system in Finland is a so-called dual income tax system where capital and labour income are divided as different types of income and are taxed with different tax rates. Capital income is taxed with a flat rate, currently at 28 percent, whereas labour income is taxed with a progressive rate. Under the current system, homeowners do not have to pay taxes on imputed rental income and in most cases also capital gains are untaxed. The tax-treatment of landlords differs from homeowners in these respects. Landlords must pay capital income taxes on the net rental income they receive and in most cases landlords are required to pay taxes on the capital gains that are realised when the house is sold. Homeowners and landlords alike do not have to pay taxes on realised capital gains if they or their family have used the house as their home for at least two consecutive years. So in effect, capital gains are taxed for most landlords and are untaxed for most homeowners. If an owner-occupied house is seen as a piece income producing capital and if homeowners are compared to landlords, the tax advantage to homeowners comes from the non-taxation of imputed rents and capital gains. Both have to pay a municipal property tax.

In this framework, even though often highlighted in public debate, the deductibility of mortgage interest is not the fundamental tax subsidy that homeowners receive. In fact, it can be regarded as a tax subsidy only because the corresponding income (imputed rent and capital gains) is untaxed. If imputed rental income and capital gains were taxed, mortgage interest should be seen as an expense from producing taxable income and deductibility should not be regarded as a tax subsidy. The deductibility of mortgage interest can also be seen as a way to extend the fundamental tax advantage to less wealthy households who need mortgage financing to become homeowners.[80] However, if owner-occupied housing is seen simply as a

[79] Hills (1991) covers these issues at some length in the U.K. context.
[80] See e.g. Hendershott and White (2000).

durable consumption good, the deductibility of mortgage interest clearly constitutes a tax subsidy because in general interest on consumer credit is not tax deductible in Finland. This study concentrates on the former interpretation and treats owner-occupied housing as a capital investment and defines the tax subsidies within the framework of Finnish income tax code.

The tax subsidy resulting from non-taxation of imputed rental income and capital gains can be illustrated simply by comparing the after-tax return a landlord and a homeowner receive from investing in a similar house.[81] Consider a landlord who owns a house with a value of V. Under the current Finnish income tax system, the annual net after-tax return for a landlord can be written as

$$(1) \qquad I_L = (1-t)\left(\frac{R}{V} - d - \tau - i\frac{M}{V} + g\right)V,$$

where t is the capital income tax rate, R the gross rent, d includes depreciation, maintenance, operation and other costs incurred from the house, τ is the property tax rate, i the nominal interest rate, M the value of the loan taken for investment purposes and g the capital gain or loss.[82] A homeowner, on the other hand, receives the gross rental income in housing services, with a rental value of R, and is allowed to deduct mortgage interest payments. Thus, the net after-tax return for a homeowner can be written as[83]

$$(2) \qquad I_O = \left(\frac{R}{V} - d - \tau - (1-t)i\frac{M}{V} + g\right)V.$$

The difference of the after-tax returns is

[81] For a more general treatment see Englund (2003).
[82] Here we assume that the house is actually sold at the end of the year so that capital gains or losses are realised. Under the current Finnish income tax system capital gains are taxed at realisation not when they actually accrue.
[83] The assumption that landlords and homeowners face the same maintenance and operating costs is a simplification that may not be correct. For example, Englund (2003) argues that homeowners face lower maintenance and operating costs because home production is untaxed. Furthermore, as illustrated by Henderson and Ioannides (1983) landlords may face higher costs because tenants do not have incentives to take proper care of the dwelling they occupy. This leads to more depreciation or higher maintenance and monitoring costs. On the other hand, Harding et al. (2000) argue that homeowners alike do not have sufficient incentives to take care of their house because future buyers are unable to perfectly monitor the condition of the house. Furthermore, the relative efficiency of landlords and homeowners in producing housing services depends on the structure of the property. Landlords may be more efficient in producing housing services from a multi-unit structure while the opposite is true for single family housing units. See Linneman (1985).

(3) $$I_O - I_L = tV\left(\frac{R}{V} - d - \tau\right) + tVg.$$

The first part of equation (3) is the tax subsidy resulting from non-taxation of net imputed rental income and the second term is the tax subsidy resulting from non-taxation of capital gains. Under a tenure neutral tax system, the difference $I_O - I_L$ should be zero. Basically, this can be achieved in three ways: (a) by taxing the imputed rental income and capital gains of homeowners and allowing them to deduct mortgage interest and other expenses from producing this income, (b) by abolishing the tax on landlords' rental income and capital gains, and at the same time eliminating all deductions from landlords and homeowners, or (c) by abolishing the tax on landlords' rental income and capital gains but allowing them to deduct interest expenses accrued from producing rental income. Although the last two would make the tax system tenure neutral, housing would still be tax-favoured compared to other assets. In this study, we examine the case (a) where homeowners are treated the same way as landlords (or other capital investors) under the current tax system. Thus, in the benchmark tax system, imputed rental income is taxed and homeowners are allowed to deduct expenses that are accrued from producing this income, i.e. mortgage interests, maintenance costs etc. Because the current Finnish income tax system is based on nominal income we will also deal with nominal measures.[84]

2.2 Deductible items and size of the tax subsidy

The Finnish income tax system is based on the notion that net income is taxable, i.e. costs from producing income are fully deductible from gross income. Thus, it is important to be precise on what these deductible items are. There are basically two kinds of homeowners in Finland. First, there are homeowners who own single family detached houses, i.e. they own the property they occupy. Apartment buildings (row houses and multi-storey blocks), on the other hand, are set up as housing companies and the homeowners who occupy the dwellings own shares from the company. The company owns the property and the shares give the owner the right to occupy (or rent out) the dwelling. This distinction is important when considering

[84] The tax system considered here is tenure neutral. It is not necessarily optimal. For research on optimal taxation of housing capital, see e.g. Rosen (1985), Englund (2003) and Cremer & Gahvari (1998).

new tax rules for homeowners because there are currently different deduction rules for landlords who own a property compared to landlords who own housing company shares.[85]

Currently, landlords are allowed to deduct the following items from the gross rental income they receive: interest expenses on debt, municipal property tax, maintenance charge, appliance costs, insurance costs, water and electric costs if paid by the landlord, and repair costs that maintain the dwelling. In addition, if a landlord owns the whole property (e.g. a single family detached house) she is eligible for a depreciation allowance from her rental income. The depreciation allowance for landlords is currently 4 percent of the acquisition cost. For example, if a landlord initially paid 100,000 euros for the house, she would be allowed to deduct from gross rental income 0.04*100,000 = 4,000 euros in the first year, 0.04*96,000 = 3,840 in the second year and so on. Of course this means that as the acquisition cost goes down, the future capital gain rises because for tax purposes capital gain is defined as the difference between acquisition cost and the selling price. So in effect, a landlord owning a property is able to defer some tax payments until she sells the property. A landlord owning shares of a housing company, on the other hand, is not eligible for the depreciation allowance. The housing company is allowed to write off the value of the building in its balance sheet but this does not benefit the individual landlord. In a perfectly tenure neutral tax system outlined according current tax-treatment of landlords, homeowners residing in single family detached houses would be eligible for a depreciation allowance similar to the one that landlords are eligible now if they own properties. However, this would create an obscure situation where homeowners are treated differently according to whether they own a property or housing company shares. For this reason we do not allow homeowners to make use of the depreciation allowance.

The above discussion is related to the question of how to account for economic depreciation of housing structures for tax purposes. In principle, this can be done in two ways. First, one could simply allow homeowners to deduct annual maintenance costs from imputed rental income and any excess depreciation could be handled when capital gains are taxed because the capital gains or losses depend on house quality. Alternatively, one could assume that all houses depreciate roughly at the same rate and simply impute some rate of depreciation on

[85] Also corporations own apartment buildings. However, since this paper is concerned with personal income taxation this aspect is not pursued further.

house value. Unfortunately estimates of the depreciation rate of Finnish housing stock do not exist.[86] The household level data set used in the empirical part of this paper includes the repair and maintenance costs stated by the owner. The problem with this measure is that some homeowners choose not to make repairs during a particular year. Instead, homeowners seem to make bigger repairs every now and then. According to our data, in 2004 roughly 41 percent of homeowners reported positive maintenance costs and the average amount that all homeowners spent on maintenance was 0.8 percent of house value. The average for those who did some maintenance was 2.2 percent of house value. In both calculations, house value is estimated by the owner. Although this choice is rather *ad hoc*, we assume that on average a homeowner spends on maintenance 1 percent of house value and allow this amount to be deducted from gross imputed rents for tax purposes. The house value we use for this purpose estimated by the owner. An alternative would be to simply deduct the actual maintenance costs. However, since the main focus of the paper is to study distributional aspects accounting for depreciation through this measure is problematic. The figure of 1 percent is consistent with the findings by Harding et al. (2007) from the U.S. Any depreciation in excess of this could be taken into account when calculating the capital gain or loss once the dwelling is sold. However, we will not deal with capital gains taxation in this paper.

In addition to mortgage interest and depreciation, we allow homeowners to deduct municipal property tax payments, maintenance charge if the homeowner owns the dwelling through a housing company, waste management and insurance costs. In the case of a housing company, the company is liable for the property tax. The tax is passed on to share owners according to the floor area of the dwelling. In practise, the property tax is included in the maintenance charge that the share owners pay to the company. Usually the maintenance charge also includes items such as waste management, maintenance costs of common facilities and so on. These choices follow the current tax treatment of landlords. In addition to these items, some costs such as real estate agent costs should also be deductible. However, since we do not have data on these costs they are left out of the empirical analysis. Now, abstracting from capital gains the net imputed rental income for a homeowner can be written as

[86] In a recent paper, Harding et al. (2007) find that in the absence of maintenance a typical home in the U.S. depreciates at a real annual rate of 3 percent. They also find that a typical homeowner spends on maintenance an amount that adds roughly 1 percent per year to the value of the home. Thus, the depreciation rate net of maintenance is estimated to be roughly 2 percent.

(4) $$NIR = R - \tau - d - iM,$$

where τ, i and M are defined above, and d includes all other deductible items discussed above. The tax subsidy associated with net imputed rental income equals

(5) $$\text{tax subsidy} = t * NIR = t\left(R - \tau - d - iM\right),$$

where t is the capital income tax rate. From 5 it's clear that although the deductibility of mortgage interest does not constitute a subsidy to homeowners when compared to landlords, the amount of mortgage interest payments does affect the amount of taxes paid if net imputed rental income is taxed.

3 Estimating imputed rental income from owner-occupied housing

In order to operationalise equations (4) and (5), we need to estimate the rental value, *R*, of the house a homeowner resides in. There are basically two ways to measure imputed rental income from owner-occupied housing.[87] First, imputed rental income can be calculated as a rate of return on house value which would be received if this equity would be invested in some other asset (e.g. interest bearing account). The researcher would simply need to know the house value and assign some rate of return on it to get an estimate of the imputed rental income. In the second approach, imputed rental income is assumed to equal the market rental value of an analogous good. In the case of housing, gross imputed rental income is assumed to equal gross market rent received by a landlord from a similar dwelling. The reasoning behind this measure is that the rent an owner-occupier could receive by renting out the dwelling can be seen as the opportunity cost of not renting out the dwelling. Because the owner-occupier is not willing to rent out the dwelling she must value the services at least at the amount of market rent.

The applicability of the above approaches ultimately depends on the type of data available from housing markets. For purposes of estimating imputed rental income from a given dwelling, one either needs an assessed value for it, or price or rent data from similar dwellings

[87] See Katz (1983) for a more thorough presentation of valuing services of consumer durables.

from the same housing market. In the latter cases, an estimate of dwelling value or the value of housing services from the dwelling can be derived using hedonic regression techniques. However, there are clear down-sides to this approach especially for housing units in areas where the number of comparable units is low. In the case where rent data are used, the problems may be even more severe because owner-occupied dwellings are often fundamentally different from rental dwellings. For example, single-family detached houses are rarely available for rent in Finland, and thus, a comparable measure for single-family owner-occupied houses is difficult to find. This problem is emphasised in rural regions where comparable rental and owner-occupied units simply do not exist. Because location is one of the most important attributes in house price determination this is by no means a small problem.

Despite the weaknesses mentioned above, this study uses a hedonic rent regression to estimate a monthly rent for owner-occupied dwellings in our data sample. We prefer rent data over house value data for two reasons. First, the only house value estimates available to us are owner estimated values, and second, house values reflect, in addition to future rents, house price expectations. The tax on imputed rental income should be based on imputed rental income alone, not on price expectations. However, in this case capital gains should also be taxed. This way the tax treatment of homeowners would be close to landlords and stockowners. That is, imputed rental income would correspond to rents received by landlords and to dividends received by stockowners, and capital gains would be taxed when they are realised.

Before we go into the hedonic regression we briefly describe the data. The dataset used in this study is the 2004 household Wealth Survey (WS) produced by Statistics Finland. The WS includes information on various household characteristics such as socio-economic status, demographics, income, taxes, housing and wealth. Most of the information in the survey data is collected from various administrative registers and the rest collected through interviews. The WS is a stratified sample drawn from all private households in Finland where the strata are created according to socio-economic status and income. In order to get reliable information on overall household wealth, entrepreneurs and high-income households are assigned a higher inclusion probability to the final sample. The selected households are given sampling weights so that the sample is representative of the whole population. In the

following calculations sampling weights are used in order to make the results representative of the whole population.

Statistics Finland assigns an estimate of imputed rental income to homeowner households in the WS sample by using information gathered from renter households on their monthly rents through a separate rent survey. Households are stratified according to dwelling characteristics and homeowner households are assigned the average monthly rent of the renter households in the same strata as a measure of monthly gross imputed rent. However, regional aspects are omitted from these estimates altogether, although population density of the municipality is controlled for with two levels, urban and rural.[88] The technique used by Statistics Finland most likely leads to smaller variation in imputed rental income between different regions and households compared to using more accurate imputed rental values.

Often the biggest drawback of using nationwide household level surveys for hedonic analysis is that the precise location of the dwellings is unknown. However, our data allows us to identify the location of a household's dwelling in a more coarse regional setting. First, we can identify Helsinki and the rest of the capital region. Second, we can identify major university cities and other regional centres. Furthermore, Statistics Finland classifies municipalities into three categories according to urbanisation rate as described in footnote 17. A novelty of the 2004 WS data set is that it includes a housing survey supplement where households were asked a number of additional questions concerning their housing choices and needs. For our purposes, the most interesting new information compared to prior household surveys is that household location within an urban area or a municipality can be identified more precisely than before. Namely, the data allows us to identify whether the dwelling is situated in the centre of the city or outside of it.

Using the improved location information and the dwelling characteristics included in the 2004 WS data set, we estimate the imputed rental income of homeowners using a hedonic regression approach. More precisely, a hedonic rent regression for free market rental

[88] Statistics Finland defines a municipality as urban if 90 percent of its population resides in an urban area and the largest urban area has at least 15 000 inhabitants. Semi-urban municipalities are those where more than 60 but less than 90 percent of the population resides in an urban area and the largest urban area has at least 4 000 but not over 15000 inhabitants. Finally, rural municipalities are those where less than 60 percent of the population resides in an urban area and the largest urban area has less than 15 000 inhabitants. When a two-level classification is used urban and semi-urban municipalities are labelled as urban.

dwellings is estimated and the parameter estimates are used to predict the monthly rent for owner-occupied dwellings in the sample.[89] Before we go ahead with the estimation, we present some descriptive statistics on how owner-occupied and rental dwellings differ in order to see what the main concerns are when predicting rental values for owner-occupied homes using rental dwellings. Table 1 presents mean values for dwelling characteristics for different dwelling types in the WS data. From Table 1 it is clear that rental dwellings differ considerably from owner-occupied dwellings. First, they are mostly situated in multi-storey apartment buildings; only about 7.5 percent of rental dwellings are single family detached houses. In addition to differences in dwelling type, the biggest concern for the hedonic model is the fact that single family houses and owned apartments are much larger than rental dwellings in terms of floor area and number of rooms.

Table 1. Descriptive statistics for different dwelling types.

	Owned single family houses	Owned appartments	Free market rental
N	**1572**	**878**	**292**
Floor area (m^2)	139.1 (56.7)	81.2 (34.2)	54.6 (27.6)
Number of rooms	4.83 (1.56)	3.18 (1.33)	2.09 (1.13)
Age (years)	25.9 (22.2)	29.1 (20.0)	35.7 (20.0)
Detached, %	93.8 %	1.4 %	7.5 %
Two-family, %	5.7 %	4.1 %	6.5 %
Terraced, %	0.1 %	37.7 %	9.2 %
Multi-storey block, %	0.0 %	56.7 %	74.0 %

Notes: Mean values for dwelling characteristics for different dwelling types. Standard deviations are in parentheses.
Source: Author's calculations from the 2004 Wealth Survey of Statistics Finland

We take this into account in the hedonic model by allowing only for a constant (presumably positive) marginal effect of floor area on gross rent. We make some comparisons and justifications for this choice below. Furthermore, since the purpose of the regression is to obtain out of sample predictions, finding a functional form that fits the rental dwelling data as closely as possible is of secondary importance. Thus, the hedonic regression model takes the following simple linear form

$$R_{ij} = \alpha + \mathbf{x}_i'\boldsymbol{\beta} + \mathbf{z}_j'\boldsymbol{\delta} + \mathbf{y}_i'\boldsymbol{\gamma} + \varepsilon_{ij}, \tag{6}$$

[89] This method for estimating the gross imputed rental income is used, for example, in the German Socio-Economic Panel dataset. See Frick and Grabka (2003) for details. Also Eurostat recommends this approach for household surveys.

where R_{ij} is the monthly rent of dwelling i in region j, **x** is a vector of dwelling characteristics, **z** a vector dummy variables indicating the regional housing market and location, **y** a vector household characteristics that serve as proxies for neighbourhood quality which is otherwise unavailable to us, and ε is the error term. It's important to emphasise that a household's characteristics do not determine the rent of the dwelling it resides in. They simply serve as proxies for neighbourhood quality.[90] Ideally, one would like to estimate the hedonic model separately for each regional housing market but sample size limitations prevent us from doing so here. Thus, we assume that the (marginal) rents of dwelling characteristics are equal across regional housing markets and allow the housing market specific rents to vary only through the intercept.

The results for the hedonic regressions are presented in Table 2. Even with the drawbacks of the data, the hedonic regression model explains a considerable amount of the variation in rents with an adjusted R^2 measure of 0.61.[91] In the regression we control for major cities[92] and other regional centres[93] and the location (city centre vs. outside) of the dwelling within each area. In addition, we control for smaller urban and semi-urban areas and also distinguish rural areas in four different parts of the country. The coefficients for the dwelling characteristics have the expected sings but because of small sample size the estimates are somewhat imprecise.

[90] See Ioannides and Zabel (2003) and Ioannides (2004) for details. The household characteristics explain roughly 7 percent of the variation in rents.
[91] Household characteristics explain roughly 7 percent of the variation in rents.
[92] These are Helsinki, Jyväskylä, Kuopio, Oulu, Tampere, and Turku.
[93] These are Hämeenlinna, Joensuu, Kotka, Lahti, Lappeenranta, Pori and Vaasa.

Table 2. Results for the hedonic rent regression.

	Coeff.	Standard error		Coeff.	Standard error
constant	207.2**	59.65	*outside of city centre:*		
floor area	2.965**	0.473	Helsinki	245.2**	56.47
age	-4.968**	1.338	other capital region	173.2**	58.17
$(age)^2$	0.045	0.015	Kuopio	51.28	92.58
detached[a]	-66.18	48.26	Jyväskylä	145.0	94.12
two-family house	-75.77	48.10	Oulu	156.8*	73.73
terraced	-32.98	38.41	Tampere	149.3*	65.99
building material wood	-59.79*	31.49	Turku	124.7	72.67
noisy neighborhood	-2.417	31.91	Hämeenlinna	167.1	143.6
small house intensive area	37.46	30.07	Joensuu	110.62	145.5
location dummies:[b]			Kotka	29.74	148.8
city centre:			Lahti	-21.00	93.36
Helsinki	279.0**	57.96	Lappeenranta	no obs.	
Kuopio	113.0	85.35	Pori	69.74	84.12
Jyväskylä	176.5*	84.16	Vaasa	183.5	148.7
Oulu	287.7**	108.65	other urban regions	107.0	59.32
Tampere	203.1**	70.60	semi-urban regions	46.35	55.04
Turku	188.4*	75.94	rural west	24.31	80.36
Hämeenlinna	189.4+	108.18	rural east	7.66	60.16
Joensuu	137.9	93.10	rural north	143.9	88.10
Kotka	no obs.		*household characteristics:*		
Lahti	141.1	84.83	disposable income	0.003**	0.001
Lappeenranta	163.9+	93.90	$(disposable income)^2$	-1.7E-09	1.6E-09
Pori	107.1	84.02	number of children	34.66*	14.82
Vaasa	55.22	84.82	college degree[d]	-3.696	17.24
other urban regions	28.30	40.00			
Number of obs.	292		Adjusted R^2	0.61	
F-test (p-value)	11.37 (0.000)				

Notes: The dependent variable is monthly rent. **, * and + indicate statistical significance at 1, 5 and 10 percent level, respectively.

[a] Dwelling type dummies, reference is multi-storey block

[b] Reference is rural regions in southern Finland.

[d] Dummy indicating that the household head has a college degree or higher.

The parameter estimates in Table 2 are used to predict a monthly imputed rent for homeowner households. The annual gross imputed rental income for homeowners is obtained by multiplying the predicted monthly rent by the number of months the household has resided in the dwelling during the survey year.[94] The net imputed rental income is obtained by making the deductions discussed in the previous section from the gross measures. To obtain the tax subsidy element, the net imputed rental income is then taxed according to a proportional 29 percent capital income tax rate.

[94] This method produces downward biased estimates of imputed rental income if the household has moved during the survey year from an owner-occupied dwelling to another owner-occupied dwelling or to a rental dwelling. Unfortunately, we are unable to identify these households.

In order to get some indication of how well the predicted imputed rents correspond to reality, we compare the predicted rental values to house value estimates made by the owners. These are compared in Figure 1 across house value deciles. Figure 1 also reports predicted imputed rents from a hedonic regression where in addition to variables in Table 2 a square term of floor area was included. In this regression, the square term was negative but was not statistically significant even at 10 percent level. Sampling weights are not used in Figure 1. In addition to our estimates, Figure 1 also includes imputed rental income estimates made by Statistics Finland. The predicted gross rents follow the house value estimates quite well in the lower part of the house value distribution. However, the estimated average gross rents fall clearly behind average house values in the top half even when floor area does not have a diminishing positive effect on imputed rent. Furthermore, our estimates also fall behind the estimates made by Statistics Finland. Perhaps this has something to do with the fact that Statistics Finland constructs its estimates using a separate rent survey which is probably more reliable in terms of covering the whole free-market rental sector.

Figure 1 seems to give some justification for the use of the linear specification of floor area in the hedonic model both when compared to house values and the alternative estimates made by Statistics Finland. However, Figure 1 also suggests a potential problem in using market rents in estimating imputed rents for owner-occupied houses; expensive rental dwellings are rare, and thus, using market rents may not give a very accurate picture of imputed rents for expensive owner-occupied homes. However, it may also be the case that expensive houses are expensive because they include house price expectations. If this is the case, our hedonic estimates of imputed rental income are more reliable than estimates based on house value when the goal is to estimate the value of the housing service stream to a homeowner.

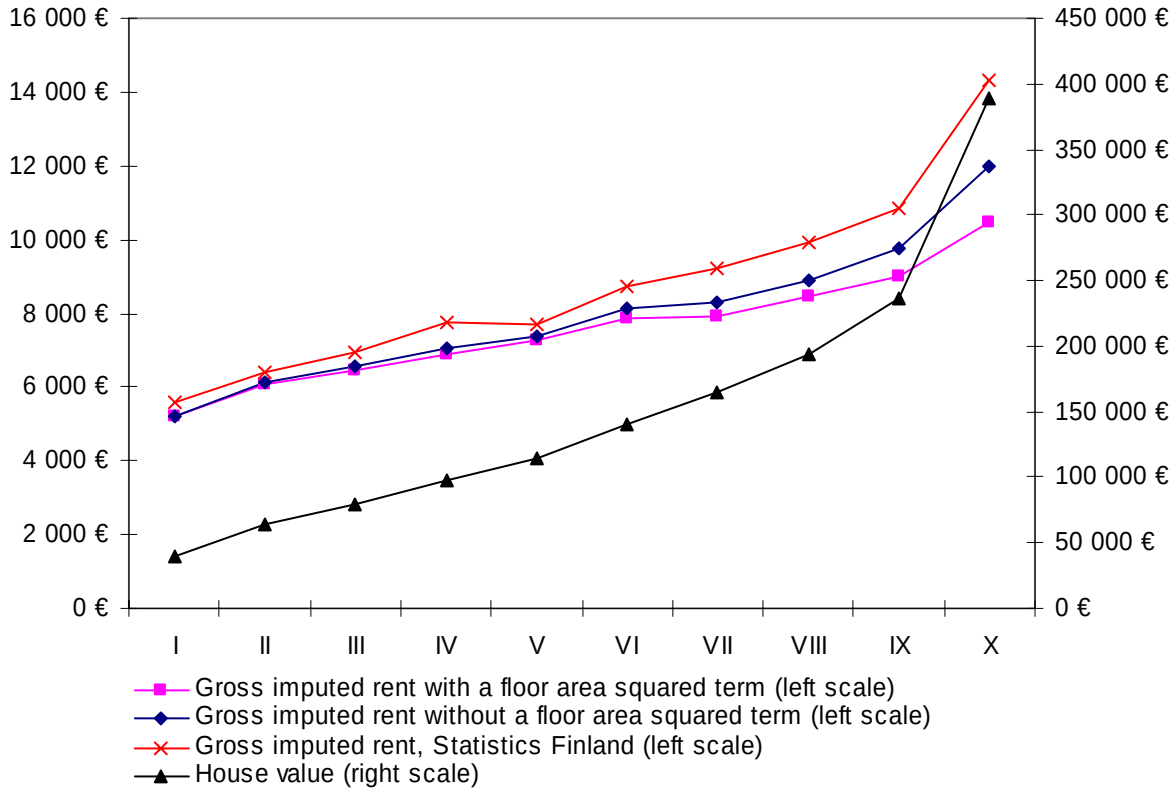

Figure 1. Predicted gross imputed rents and house value estimates according to house value deciles.

4 Distributional analysis

4.1 Overall measures

According to our estimates the overall value of net imputed rental income was about 6.6 billion euros in 2004. This is a little lower than the estimate of 6.7 billion obtained using the approach by Statistics Finland. In Finland imputed rental income makes up about 10.7 percent of homeowner households' and 8.5 percent of all households' total annual disposable income.[95] Imputed rental income is even more important for outright owners with no mortgage debt. For them imputed rental income made up almost 13 percent of total disposable income. The magnitudes of these figures are similar to those reported by Frick and Grabka (2003) for other western countries. They report that imputed rental income makes up about 9 percent of total income in Great Britain, about 7 percent in the U.S., and about 4 percent in

[95] Disposable income includes wages and entrepreneur income, capital income, transfers received and transfers paid (excluding indirect taxes). Estimates of other sources of non-monetary income, such as benefit from a company car, are also included in disposable income.

former West Germany. The low figure of former West Germany is explained by the low rate of homeownership in Germany compared to these other countries.

The estimated tax revenue forgone in 2004 due to non-taxation of imputed rental income was 1.9 billion euros. This is roughly the same as an official estimate for 2004 reported in the tax expenditure report by Government Institute for Economic Research (2007). To give these figures some perspective, the overall government tax revenue collected through income and wealth taxes in the same year was 12.9 billion euros. On the other hand, housing allowances added up to a total of 900 million euros in 2004 and the amount of tax revenue lost because of the mortgage interest deduction was about 370 million euros. So the non-taxation of imputed rental income is by far the largest individual housing subsidy. However, it must be emphasised that the amounts of the tax subsidies reported here are calculated at given housing tenure, house price and housing consumption levels and as such ignore any behavioural responses.

4.2 Incidence across income deciles

The benchmark income concept used in the distributional analysis is household disposable income as defined in footnote 95. In order to account for differences in household size and composition, and scale benefits in consumption, all income concepts used in the paper are scaled using the so-called modified OECD equivalence scale. The scaling gives the first adult in the household a weight of 1. Remaining adults in the household (defined as household members who are 14 years old or older) get a weight of 0.5 and children (members under the age of 14) get a weight of 0.3.

Because the impact of imputed rental income on income distribution is largely driven by the position of homeowners (especially those who own outright) in the income distribution, we start the distributional analysis by looking at the composition of income deciles according to household's housing tenure and financing choice. Overall in 2004, 66 percent of Finnish households were homeowners and of these 56 percent owned outright. Figure 2 presents the tenure composition of income deciles which are constructed based on equivalence scaled household disposable income including imputed rents.

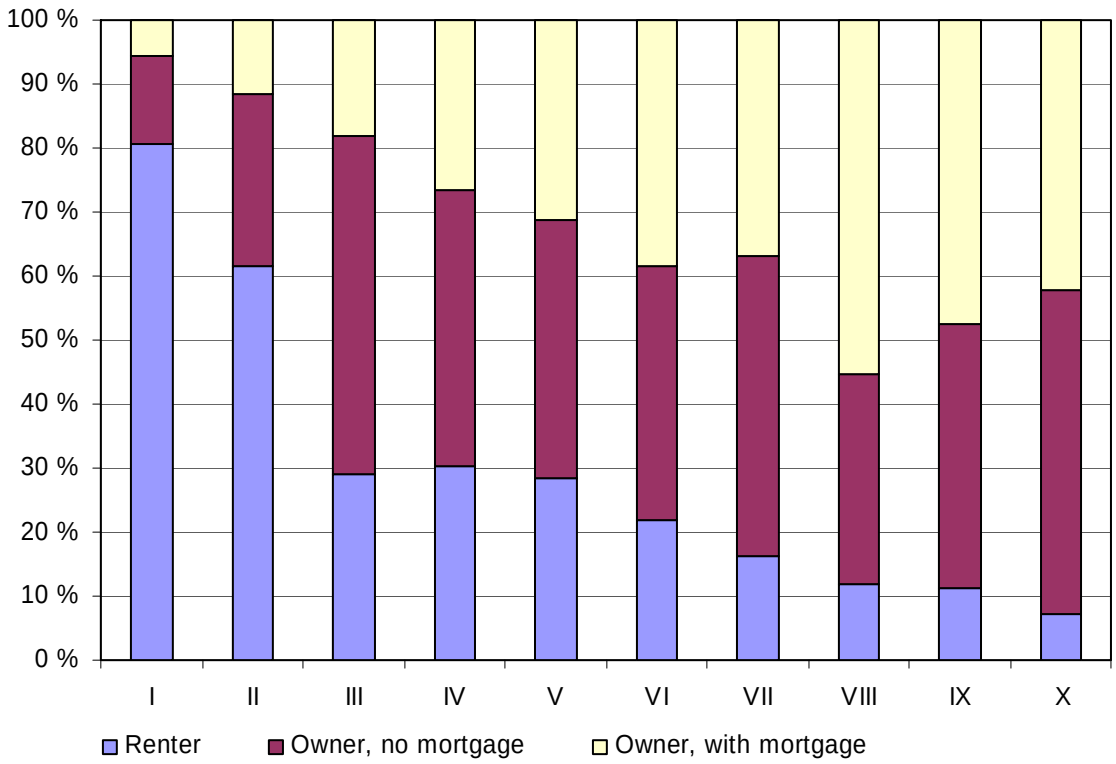

Figure 2. Composition of income deciles according tenure type and financing.

According to Figure 2 homeowner households are situated in the top half of the income distribution. Furthermore, the share of outright owners of all households tends to increase as we move to higher income deciles. However, also some low income households are homeowners. Further calculations show that 60 percent of outright owners in the three lowest income deciles, in fact, are households where the household head was retired. Typically, these households have low current income but may be wealthy with a large part of their wealth invested in housing.

This is illustrated more clearly in Figure 3 where we can see how much net imputed rental income makes up of homeowner households' disposable income in different income deciles (bar on the right). The shares are calculated conditional on homeownership. For homeowners situated in the lowest decile, imputed rental income makes up over 30 percent of their annual disposable income. Clearly, these households would find it difficult to cope with a tax on imputed rental income. Figure 3 also illustrates the way the tax subsidy, as defined in equation (5), is spread out across income deciles. Naturally, as the share of homeowners rise with income, also the share of the subsidy that goes to the homeowners rises. However, the

homeowners in the top two income deciles receive clearly more than their proportionate share of the subsidy. Especially the highest decile stands out in this respect. Overall, 65 percent of the subsidy goes to the top half of the income distribution.

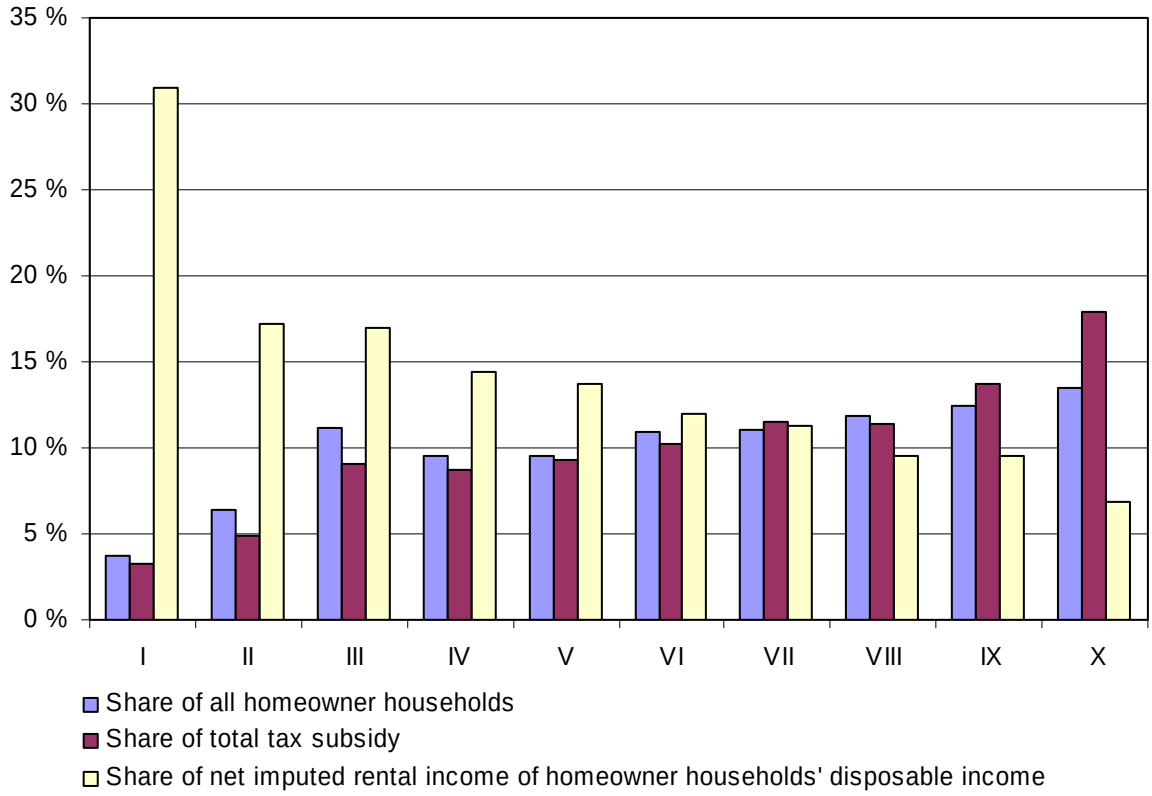

Figure 3. Distribution of homeowners and the tax subsidy according to income deciles.

Figure 4 reports mean values of imputed rental income and the tax subsidy across income deciles. The mean values are calculated conditional on homeownership. Mean values for owner's estimated house value and housing equity (house value minus mortgage debt) are also reported for reference. Homeowners situated in higher income deciles clearly have more expensive houses and also higher housing equity. Relatively high house values and housing equity in the lower deciles is again probably explained by retired households who own outright and have low current income. On average, homeowners' annual tax subsidy was 1206 euros. Somewhat surprisingly the differences in imputed rental income and the tax subsidy are quite small across income deciles. The information in Figures 2, 3 and 4 indicates that homeowners situated in the top income deciles benefit most from the tax subsidy mainly because they live in expensive houses and are more likely to own outright, which means that they have less deductible interest expenses.

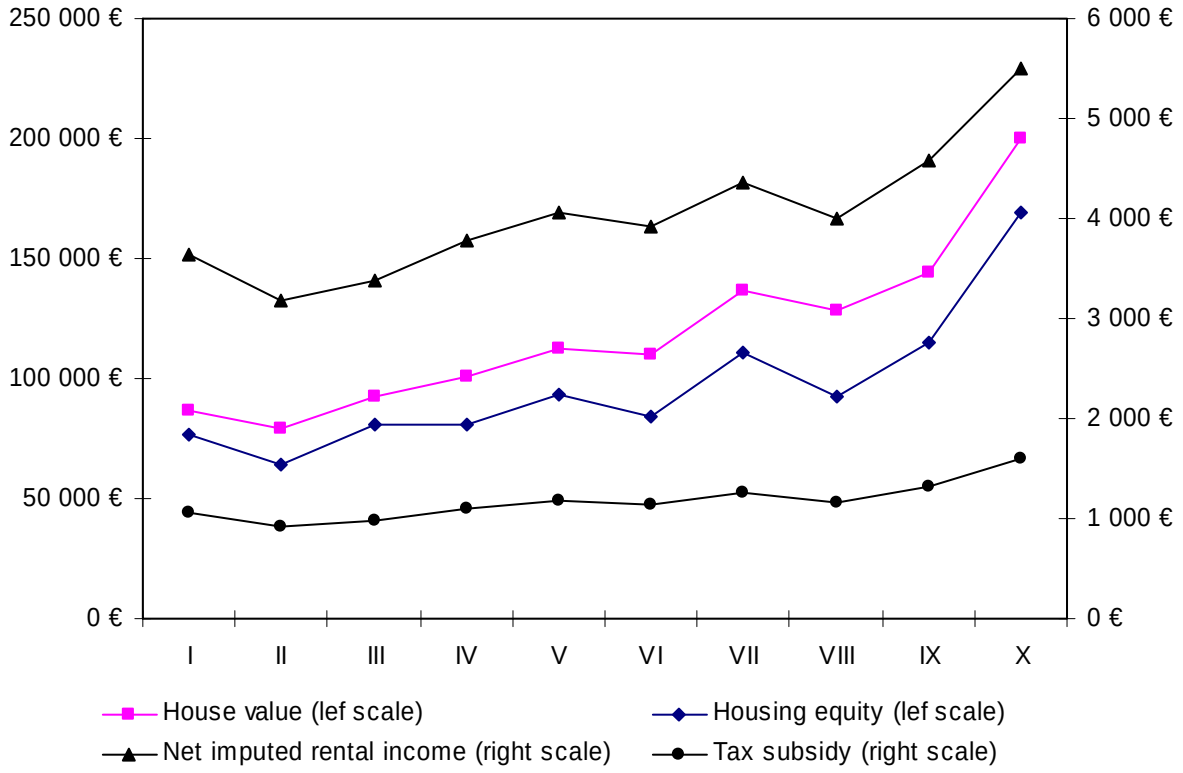

Figure 4. Mean imputed rental income and tax subsidy according to income deciles.

4.3. Impact on overall inequality and re-ranking effects

Next, we turn our attention to the impact of imputed rental income and its taxation on overall inequality. The analysis is based on the following income concepts:

1. Disposable income without imputed rental income
2. Disposable income + net imputed rental income
3. Disposable income + net imputed rental income – a tax on imputed rental income
4. Disposable income + net imputed rental income – a tax on imputed rental income + a tax revenue neutral lump-sum transfer
5. As 4, but tax revenue neutrality is achieved through a lower capital income tax rate.

The idea behind the concepts 4 and 5 is that the increased tax revenue from taxing imputed rental income is transferred back to the households so that overall tax burden in the economy stays constant. In the lump-sum transfer scheme, the increased tax revenue is returned to all

adults as an equal size transfer. This of course treats differently households with and without children. However, this way we try to mimic a change in the income tax system, and not confuse this with a change in means tested allowances, such as child allowances. In the capital income tax scheme, imputed rental income is included in the capital income tax base and the capital income tax rate is lowered so that the overall revenue from the capital income tax stays constant. Alternatively, one could lower labour income tax rates. However, Finnish income taxation is based on individual not on household income, and since the data is at household level a lower labour income tax cannot be taken into consideration in this study. The two schemes considered here can be seen as extreme cases and the alternative of cutting labour income taxes would probably be somewhere in the middle depending on how the tax rate cuts are targeted.

Table 3 presents quantile ratios, Gini indices and differences in Gini indices for the five income concepts presented earlier. The measures are calculated using the Distributive Analysis Stata Package (DASP) developed by Araar and Duclos (2007a and 2007b).[96] Table 3 also includes basic distributional statistics for the different income concepts.

Table 3. Income inequality and imputed rental income.

	1 Disposable income	2 plus imputed rental income	3 minus tax on imputed rents	4 plus lump-sum transfer	5 lower capital income tax rate
Mean	29 500	32 251	31 319	32 118	32 242
Median	16 344	18 113	17 576	18 112	19 616
P10	8 702	9 476	9 281	9 831	9 613
P90	30 376	32 989	32 173	32 803	37 041
Quantile ratios:					
90/10	3.49	3.48	3.47	3.34	3.85
90/50	1.86	1.82	1.83	1.81	1.89
50/10	1.88	1.91	1.89	1.84	2.04
Gini	28.79	28.04	28.08	27.48	28.88
Differences in Gini	**1 vs. 2**	**2 vs. 3**	**3 vs. 4**	**2 vs. 4**	**2 v.s 5**
	0.75*	-0.05	0.61*	0.56*	-0.84*

Notes: All income concepts are adjusted by the modified OECD equivalence scale. * indicates that the difference is statistically significant at 5 percent risk level.
Source: Author's calculations from the 2004 Wealth Survey of Statistics Finland.

[96] Araar Abdelkrim and Jean-Yves Duclos (2007a): DASP: Distributive Analysis Stata Package. PEP, CIRPÉE and World Bank, Université Laval.

A positive (negative) difference between the Ginis for different income concepts means that overall inequality decreases (increases) when moving from one income concept to the next. From Table 3 we see that adding imputed rental income to disposable income clearly decreases overall inequality measured by the Gini index.[97] This is rather surprising given the fact that homeowners are situated mostly in the top half of the income distribution. However, some low and especially middle-income households also benefit from imputed rental income, and for them the share of imputed rental income of overall income is much larger. The results differ somewhat from the ones found from other countries. For example, Frick and Grabka (2003) find that including imputed rental income to disposable income slightly increases inequality in Great Britain and in the U.S. They do not report statistical significance of their results but the differences are smaller than reported in Table 3. The decrease in inequality in Finland is statistically significant at 5 percent risk level.

Taxing imputed rental income slightly increases inequality (2 vs. 3) but the change is not statistically significant. Perhaps the most interesting comparison in Table 3 is the one where income concept 2 is compared to concepts 4 and 5. These comparisons compare the current tax system (2) to two alternative tax systems where imputed rental income is taxed in a revenue neutral way (4 and 5). Under the lump-sum transfer scheme all adults receive a transfer of 476 euros, whereas the capital income tax scheme allows for a reduction of the capital income tax rate from the then current rate of 29 to 17 percent. That is, under the latter scheme the tax rate on all capital income including imputed rental income is 17 percent. The results are markedly different depending on the way the accrued tax revenue is transferred back to the households. Compared to the current system, overall inequality is smaller in a system where imputed rental income is taxed with the then current tax rate of 29 percent and the accrued tax revenue is transferred back to the households as lump-sum transfers (2 vs. 4). However, when the accrued tax revenue is used to lower the capital income tax rate on all capital income, inequality clearly increases compared to the current system (2 vs. 5). According to quantile ratios, under the system with a lower capital income tax rate the lowest decile is clearly left back compared to the median and the highest decile. Under the lump-sum scheme, the lowest decile actually moves slightly closer to both the median and the highest decile.

[97] There were no Lorenz dominating relationships between the income concepts.

The results indicate that from a distributional point of view it is vital how the new tax revenue is transferred back to the households. This aspect is important also from a political economy point view when considering what type of tax reforms are actually politically feasible under current tenure shares and housing consumption choices.[98]

In order to look deeper into what is happening to the income distribution a decomposition analysis is performed based on subgroups of households. Here the measure of inequality is the generalised entropy index which can be naturally decomposed to within and between variations among different subgroups.[99] Again the estimations are done using DASP. The population is divided into subgroups based on housing tenure type and age. Housing tenure is divided into three groups; outright owners, owners with a mortgage and renters. The decomposition results are presented in Table 4.

Table 4. Decomposition of inequality by tenure type and age, generalised entropy index.

	1 Disposable income	2 plus imputed rental income	3 minus tax on imputed rents	4 plus lump-sum transfer	5 lower capital income tax rate
Total population	14.67	13.90	13.93	13.58	14.79
Tenure:					
Owner outrigth	19.50	15.99	16.74	16.00	17.96
Owner, mortgage	8.81	7.63	7.87	7.60	8.10
Renter	12.33	12.33	12.33	12.48	12.77
Percentage of total:					
Within-group	91.18	84.49	86.75	86.74	85.92
Between-group	8.82	15.51	13.25	13.26	14.08
Age group:					
<25	14.01	14.19	13.81	12.65	14.03
26–35	9.27	9.18	9.13	9.08	9.37
36–45	10.09	9.77	9.76	9.53	10.24
46–55	12.14	11.11	11.19	10.68	11.77
56–65	24.23	21.59	22.13	21.74	24.06
66–75	11.29	10.13	10.24	9.71	11.08
>75	7.17	6.60	6.61	7.98	6.98
Percentage of total:					
Within-group	87.32	86.04	86.38	86.63	86.12
Between-group	12.77	13.96	13.62	13.37	13.88

Notes: All income concepts are adjusted by the modified OECD equivalence scale.
Source: Author's calculations from the 2004 Wealth Survey of Statistics Finland.

[98] See e.g. Eerola and Määttänen (2006).
[99] See the Appendix for details on the index and decomposition.

The results using the generalised entropy index are very similar to the ones obtained using the Gini index when it comes to inequality in the population as a whole. We consider first the subgroups based on housing tenure. According to the results in Table 4 the degree of inequality is lowest within the group of owners who have a mortgage. This is not surprising because these households are probably in a similar stage of their life-cycle and are at least so well off that they can cope with mortgage payments. On the other hand, income inequality is largest within the group of outright owners. Including imputed rental income to disposable income clearly decreases inequality among both owner types, but the decrease is much larger among owners who own outright. Again this is to be expected because for outright owners imputed rental income makes up a larger fraction of their disposable income. By definition, inequality among renters does not change because they do not receive imputed rental income. However, between-group inequality naturally rises after including imputed rental income.

What happens to inequality in the subgroups under the alternative tax systems? Under the lump-sum transfer scheme, inequality within the two owner groups stays almost constant and is slightly increased among renters compared to the current system.[100] Because there is a clear decrease in inequality at the level of total population, the results indicate that the decrease in overall inequality is mostly due to a decrease in between-group variation. This can also be seen from the fact that the relative contribution of between-group variation to total inequality clearly decreases. This means that under the lump-sum redistribution scheme renters catch-up to owners, although among renters inequality increases compared to the current system. Under the system with a lower capital income tax rate, inequality rises within each tenure subgroup. However, also here the contribution of between-group variation to total variation decreases. Interestingly, under both alternative tax systems, inequality increases within the renter group.

The lower part of Table 4 includes the results for age group decomposition, where age refers to the age of household head. During the life-cycle income inequality is relatively high among young households (under the age of 25), clearly decreases among the next group (26 to 35), and then follows a hump-shaped age pattern peaking among households whose head is between 56 and 65 years of age. When imputed rents are added to disposable income,

[100] The reason that inequality changes among renters is that the lump-sum transfers are made according to number of adults in the households whereas we weight household members according to the OECD equivalence scale.

inequality decreases among all age groups except among the households whose head was under 25. The alternative tax systems differ also in the way they affect inequality among different age groups. Under the lump-sum transfer scheme, inequality decreases among all groups except among the very oldest. On the other hand, under a lower capital income tax rate, inequality rises across all groups except the youngest. The rise in inequality under this scheme is greatest among the group where household head was between the ages of 56 to 65. Again between-group inequality decreases but the decrease is not as large as it was when the group division was based on tenure.

Finally, we look at re-ranking effects. Table 5 presents transition matrices that illustrate the extent to which households' income rankings change as a result of including imputed rents to disposable income and under the alternative tax systems considered in the paper. The uppermost transition matrix compares the income positions of households with and without imputed rental income. The two lower matrices compare the income positions of the current tax system to the two alternative tax systems. If all the households remain in the same income decile under both income concepts all diagonal elements of the matrices in Table 5 should equal 100 percent.

Table 5. Transition matrices for re-ranking effects.

		Initial income = 1										
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**All**
	I	**82.1**	17.9									100
	II	13.9	**50.5**	35.9								100
	III	3.0	22.3	**35.8**	39.1							100
Final	**IV**		8.6	24.7	**32.4**	34.2						100
income = 2	**V**	0.42	0.84	3.0	25.3	**38.3**	31.8					100
	VI				3.7	26.1	**46.0**	24.8				101
	VII					1.1	20.6	**56.8**	20.9			99
	VIII	1.1					1.8	18.1	**66.8**	12.5		100
	IX								12.4	**79.6**	7.8	100
	X									7.8	**92.1**	100
	All	101	100	99	101	100	100	100	100	100	100	

		Initial income = 2										
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**All**
	I	**95.4**	3.9	0.13	0.06	0.42						100
	II	4.6	**88.2**	7.0	0.39							100
	III		8.1	**79.6**	12.2	0.28						100
Final	**IV**			13.5	**75.7**	9.6			1.1			100
income = 4	**V**				11.5	**77.4**	10.9					100
	VI					12.0	**80.9**	7.1	0.22			100
	VII						8.8	**84.0**	7.1			100
	VIII							8.3	**87.0**	5.0		100
	IX								4.8	**92.0**	3.1	100
	X									2.8	**96.8**	100
	All	100	100	100	100	100	101	99	100	100	100	

		Initial income = 2										
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**All**
	I	**96.4**	3.9									100
	II	3.6	**93.6**	3.1								100
	III		2.7	**90.1**	6.7							100
Final	**IV**			7.0	**87.9**	5.1						100
income = 5	**V**				5.3	**86.8**	7.8					100
	VI					7.7	**88.0**	4.3				100
	VII						4.8	**91.3**	4.1			100
	VIII							3.8	**92.8**	3.1		100
	IX								3.3	**92.2**	5.1	101
	X									4.6	**94.9**	100
	All	100	100	100	100	100	101	99	100	100	100	

The extent of re-ranking due to imputed rental income is surprisingly large. Especially the households in the middle income deciles are extensively re-ranked as clearly less than half of the households remain in their original income decile. On the other hand, most of the shifts from one decile to another are shifts to the very next decile. In every case, about 85 percent of households remain in the same decile or are shifted to the very next, either up or down. Lowest and highest deciles stand out as cases where households mostly remain in their

original income decile. However, nearly 18 percent of the households in the lowest income decile improve their relative income position, which means that imputed rental income is an important item for some low-income households and may be an important factor in poverty reduction.[101] Again the flip side to this is that these households would probably find it hard to cope with a tax on imputed rental income.

The re-ranking caused by moving from the current tax system to a system where imputed rental income is taxed can be seen from the two lower matrices in Table 5. More re-ranking takes place when moving to the lump-sum transfer scheme than to the capital income tax scheme. This is to be expected because a lower capital income tax rate affects fewer households than the lump-sum transfer scheme. More precisely, low-income renters clearly benefit from the lump-sum transfer scheme whereas they rarely have capital income, and thus, do not benefit from a lower capital income tax rate. In fact, most renter households are probably totally unaffected by a reform where imputed rental income is taxed and the tax revenue is used to lower the capital income tax rate. On the other hand, some low-income homeowners are made clearly relatively worse off under both alternative tax schemes.

Since the results presented here ignore behavioural responses by households to the proposed reforms some discussion on the likely behavioural effects is in order. In a tenure neutral tax system, households would have a smaller incentive to choose owning versus renting. Furthermore, when imputed rental income is taxed those households who would choose to own would probably want to own smaller houses. This would probably lower house prices at least in the short run. However, this effect is mitigated by an increase in the demand for rental housing because households have to consume housing services in any case. Since taxing imputed rental income would lower other taxes, the decline in housing demand would also be counteracted by a positive income effect due to the fact that housing is a normal good. The exact effect of a tax reform on overall housing demand vitally depends on the way other taxes are changed when the new tax is introduced. There are also reasons why some households would be reluctant to switch from owning to renting. Perhaps the most obvious reason is that single family detached houses are rarely up for rent. Households with a strong preference for

[101] Frick and Grabka (2003) find that imputed rental income yields clear reductions in poverty especially for older households in Great Britain, former West Germany and the U.S.

this type of housing would probably continue to own or pursue homeownership even under a tenure neutral tax system.

5 Conclusions

This study analysed the effects of imputed rental income from owner-occupied housing and its taxation on income distribution in Finland. The results indicate that owner-occupied housing has a significant impact on the well-being of many households. In 2004 imputed rental income constituted on average about 10.7 percent of homeowner households' disposable income. Furthermore, including imputed rental income to household disposable income clearly decreased overall inequality measured by the Gini index. We also found that the government loses significant amounts of tax revenue because of non-taxation of imputed rental income. The estimated tax revenue forgone in 2004 was 1.9 billion euros which amounts to almost 15 percent of the total government income and wealth tax revenue collected that year. Furthermore, the tax subsidy resulting from non-taxation of imputed rental income is skewed toward high-income households who are more likely to be homeowners and also more likely to own outright. More than 65 percent of the total tax subsidy went to the top half of the income distribution. However, we also find that some low-income, mostly retired homeowner households would find it difficult to cope with a new tax on imputed rental income.

The paper also compared the current tax system where imputed rental income is untaxed to two alternative tenure neutral tax systems where imputed rental income is taxed. In both systems, the increased government tax revenue was returned to the households so that the overall amount of government tax revenue stayed constant. In the first scheme, the increased tax revenue was returned to all adult individuals as equal size lump-sum transfers, and in the second scheme, the capital income tax rate was lowered so that the total tax revenue from capital income taxes stayed constant Due to the nature of the data used we were unable to experiment with different tax rate cuts in labour income taxes which would probably be the most realistic alternative compared to the ones considered here.

We find that the effects to overall inequality depend vitally on the way the increased tax revenue is transferred back to the households. Under the lump-sum transfer scheme income

inequality decreased slightly compared to the current system, whereas under the lowered capital income tax scheme inequality clearly increased. These, of course, are short run results that ignore any behavioural responses from the households. On the other hand, Gervais (2002) finds that even in the long run distributional effects of taxing imputed rents may be small. Assuming that the efficiency gains from a tax on imputed rental income are compelling this can be seen as an encouraging result. However, as was shown by Eerola and Määttänen (2006) homeowner households may be reluctant to vote for a reform that aims to tax imputed rental income because the efficiency gains of the reform materialise only in the long run and negative short run effects overweigh the positive ones in current homeowners' decisions.

These results indicate that any attempt to introduce a tax on imputed rental income should be accompanied by a package of tax cuts that mitigate welfare losses to current homeowners, and thus, could be sold to the voters. For example, our results suggest that using the tax revenue to lower the capital income tax rate would probably not be a very popular policy option in a country like Finland where income equality and social cohesion are highly regarded. One option that may prove to be politically feasible is to cut labour income tax rates so that the overall progression in the tax system stays more or less constant. To know the exact way to do this would require individual level tax register data and a sophisticated microsimulation model. This could be a fruitful avenue for future research. In addition, this type of reform could be accompanied by a transition period where the effective tax rate on imputed rental income is raised gradually. However, the purpose of this discussion is not to indorse any particular reform, but instead, to highlight the importance of the way the increased tax revenue is redistributed.

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Appendix. Decomposition of the generalised entropy index by population subgroups.

Sampling weights are used in the calculation of the inequality indices. First, we denote the sampling weight of household *i* as hw_i and household size as hs_i. Now, we define the weight each household gets in the calculations as $w_i = hw_i * hs_i$.[102]

The inequality index used in the decomposition analysis in Table 4 is actually the so-called Theil-L index which is a member of the family of generalised entropy indices.[103] When weighting is used the Theil-L index can be written as

$$T = \frac{1}{\sum_{i=1}^{n} w_i} \sum_{i=1}^{n} w_i \ln\left(\frac{\hat{\mu}}{y_i}\right), \tag{A1}$$

where w is the weight of household i as defined above, n the number of households, y the income of household i, and $\hat{\mu}$ is the mean of household income in the sample. A decomposition analysis for m population subgroups can be carried out in the following way. Letting s_j denote the population share of group j and T_j the Theil-L index within that subgroup, the decomposition of the index can be written as

$$T = \sum_{j=1}^{m} s_j T_j + \overline{T}, \tag{A2}$$

where $\overline{T}$ is Theil-L index for the whole population when each household in subgroup j is given the mean income of subgroup j. That is, the first term measures within group inequality and the latter term measures between group inequality. The weighting in the first term in (A2) can also be done using income shares instead of population shares.

[102] See Araar and Duclos (2007b) for details on how to implement these using the DASP software package.
[103] See Shorrocks (1980) for details.