Welfare implications of housing subsidies in the Netherlands

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Abstract

The Dutch housing market is strongly subsidized: owner-occupiers may subtract mortgage interest payments fully from income tax and may benefit from tax exempt price appreciation, in the rental sector rents are heavily regulated and an income-related subsidy is available to low-income households. The total amount of annual subsidization is reported to be 29 billion euro annually in 2006, approximately equally distributed over both sectors. In this paper we study how social welfare is affected by the elaborate subsidization schemes. We find that the welfare costs of subsidization amount to roughly 2 billion euro annually.

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1. Introduction

The Dutch housing market is a puzzling outcome of all kinds of subsidies and regulations. The main result of the maze of governmental intervention is that the housing market is strongly dysfunctional (e.g. Conijn, 2006). The dysfunctionality of the housing market results in, among other things, decreased residential mobility (Schilder & Conijn, 2009), strongly increased government spending on fiscal support of owner-occupiers (Boelhouwer & Hoekstra, 2009), a strong divide between the rental and the owner-occupied sector (Conijn & Marsman, 2004), and significant welfare losses (e.g. Donders *et al.*, 2010). The latter is the focus of this paper. Before describing our model and contribution to current literature, we shortly summarize some key characteristics of the Dutch housing market.

1.1 Housing market: ownership structure

The Dutch housing market is characterized by a large social rental sector from an international perspective (Scanlon & Whitehead, 2007). The size of the owner-occupied sector, however, is not especially low. This is the result of the fact that the non-social housing sector is virtually non-existent in the Netherlands. Table 1 summarizes the distribution of households over sectors in 2006:

Table 1: Distribution of housing according to tenure
Absolute numbers presented in millions of dwellings.

	Owner	Renter
Absolute	3.83	3.30
Relative	54	46

Conijn and Schilder (2009) attribute the small private rental sector to the rent regulation that obstructs landlords from obtaining rents that make renting out feasible. This also explains the dominant position of the housing associations in the Dutch housing market: housing associations are private entities with a social objective which forces them to provide sufficient housing for needing households. Housing associations are, in contrast to regular landlords, able to incur below-market level rents. They are able to do so because they have large financial buffers built up in their portfolio of dwellings (from which they occasionally sell in order to cover new (social) investments). This capital, however, is built up largely with subsidies. Moreover, housing associations can obtain cheaper finance, because they are backed by the government. Essentially housing associations cannot go bankrupt: bankruptcy would result in replacement of / removing current management and financial aid from the government. Investment regulation for housing associations and governmental supervision prevents the obvious moral hazard from taking place in almost all cases.

All in all, the strong governmental regulation of rents in combination with strong subsidization of housing associations has lead to the following ownership structure in the rental sector:

Table 2: Number of dwellings in the rental sector by type of landlord

Numbers are in millions of dwellings; "Other" includes governmentally owned rental housing, housing owned by private persons, housing owned by family.

	Housing association	Private landlord	Other	Total
Regulated	2.4	0.3	0.3	2.7
Non-regulated	0.1	0.1	0.0	0.2
Total	2.4	0.4	0.4	2.9

Table 2 clearly shows that the large majority of rental housing is owned by housing associations. It is important to note that also the majority of privately owned rental housing is actually regulated. Almost all rental housing in the Netherlands is regulated[1]. The large majority, in excess of 80 percent, of this regulated housing sector is so-called social rental housing. As a rule, regulated rents are not feasible rents for private landlords in order to continue operations: this explains the large-scale arbitrage that can be seen among private landlords that are selling off their rental dwellings as soon as becoming vacant. This process, as well as the estimation of feasible rent levels, is described in more detail in Conijn and Schilder (2009).

1.2 Housing market: subsidies

There are several types of subsidies to both owner-occupiers and renters. Here we briefly summarize the main subsidies to both groups of households. These subsidies include the tax benefit to owner-occupiers and the benefits of rent regulation and housing allowances for renters.

Owner-occupiers have two important tax benefits resulting from owning their property. On the other hand, owner-occupiers are also taxed over their properties. The subsidies for owner-occupiers exist of two main tax benefits: the deductibility of mortgage interest paid over the property of residence and the tax exemption of home equity.

Home owners are allowed to deduct mortgage interest payments fully from their income tax. This may be done at marginal tax rate. High-income households therefore have an increased incentive to own their properties. A second benefit for owner-occupiers is the tax exemption of home equity. Home equity is not taxed; other equity, however, is taxed at 30% assuming a return of 4%. Effectively the benefit over home equity is thus 1.2%.

Owner-occupiers are also taxed over their properties. Here we need to distinguish two types of taxes: taxes levied by municipalities and other non-central governmental institutions and taxes levied by the central government. The taxes levied by non-central governmental institutions we regard as payments for services: examples of such taxes are the taxes paid for clearing waste, using the sewer *et cetera*. In assuming these taxes as payments for services we follow Koning *et al.* (2006). Home owners are also taxed by the central government for their properties. Owner-occupiers are required to pay an implied rental income over their property. This tax, however, is only 0.55 % of the property value and never exceeds the amount of interest deducted from income tax. Furthermore a tax is levied upon every housing transaction. This

[1] A short description of how rent regulation is organized in the Netherlands is given in the next section on housing subsidies.

stamp duty is a payment of 6 percent of property. The stamp duty is due by the buyer of the property.

Renters benefit from both implicit and explicit subsidies as made clear by e.g. Romijn and Besseling (2008) and Schilder and Conijn (2009). The implicit subsidy to renters is the below-market rent following rent regulation. The explicit subsidy is an income-related housing allowance. Especially the implicit subsidy has large effects on the housing market, as pointed out in Schilder and Conijn (2009).

The explicit subsidy as mentioned is simply an income-fixed housing allowance. Explaining exactly how the amount of subsidy is determined is rather complicated and for this paper it suffices to know that income and rent level are the main drivers of this subsidy. Housing allowances decrease strongly with income and in order to qualify for housing allowance the rent level must be within a certain price range (where the range again depends on income and household composition).

The implicit subsidy to renters is the difference between market level rents and actual rents. Due to the regulation of rents in the Netherlands virtually all rents are below what would be market level rents (i.e. rent levels that a landlord would need to make a reasonable return on investment). Renting is therefore cheap. Renting becomes even cheaper over time: the annual rent adjustment is maximized by the government and usually tracks inflation. The only way rents can be adjusted to higher levels is when the dwelling is vacated. Tenants who stay in their dwellings for a long period of time therefore enjoy very low rents. This subsidy is independent of the renter and is tied to the object (the dwelling): landlords are not allowed to change rents beyond the set boundaries, not even when income has risen considerably. The market distorting effects have been analyzed before in e.g. Romijn and Besseling (2008) and Schilder and Conijn (2009); detailed analysis of the distorting effects of the implicit subsidy goes beyond the scope of this paper.

In table 3 we summarize average subsidies per household per income decile. The subsidies are defined as the difference between the tax-neutral market price and the current actual price of housing services multiplied by the consumed number of housing services (see detailed description in the section describing the model). In the estimation of subsidies we do not account for a potential decrease in the value of housing following abolishing housing subsidies (as is done in e.g. Conijn & Schilder (2009) for the rental sector). The figures presented here are therefore more in line with the figures presented by Koning *et al.* (2006), Romijn and Besseling (2008) and Donders *et al.* (2010).

Table 3: Housing subsidies in the Netherlands

	Owner	Renter
Average	3211	5260
Total (bln euro)	12.1	17.4

Subsidies in the owner-occupied sector are thus estimated as the fiscal benefit (net of attributed rental value of the property) plus the tax exemption of home equity minus the transfer tax (attributed over the average life span of 14.5 years). In the rental sector subsidies are estimated as the difference between the market price of user cost minus the actual user cost and then adding housing allowances.

Table 3 clearly shows that on average the subsidies in the rental sector are much higher than in the owner-occupied sector. The largest share of the subsidy to renters exists of implicit subsidy due to rent regulation. Also evident from table 3 is the fact that the total amount of subsidization in the rental sector is much higher than in the owner-occupied sector. The way subsidies are distributed over households, however, depends strongly on tenure and income, as is shown in figure 1:

Figure 1: Housing subsidies in the Netherlands

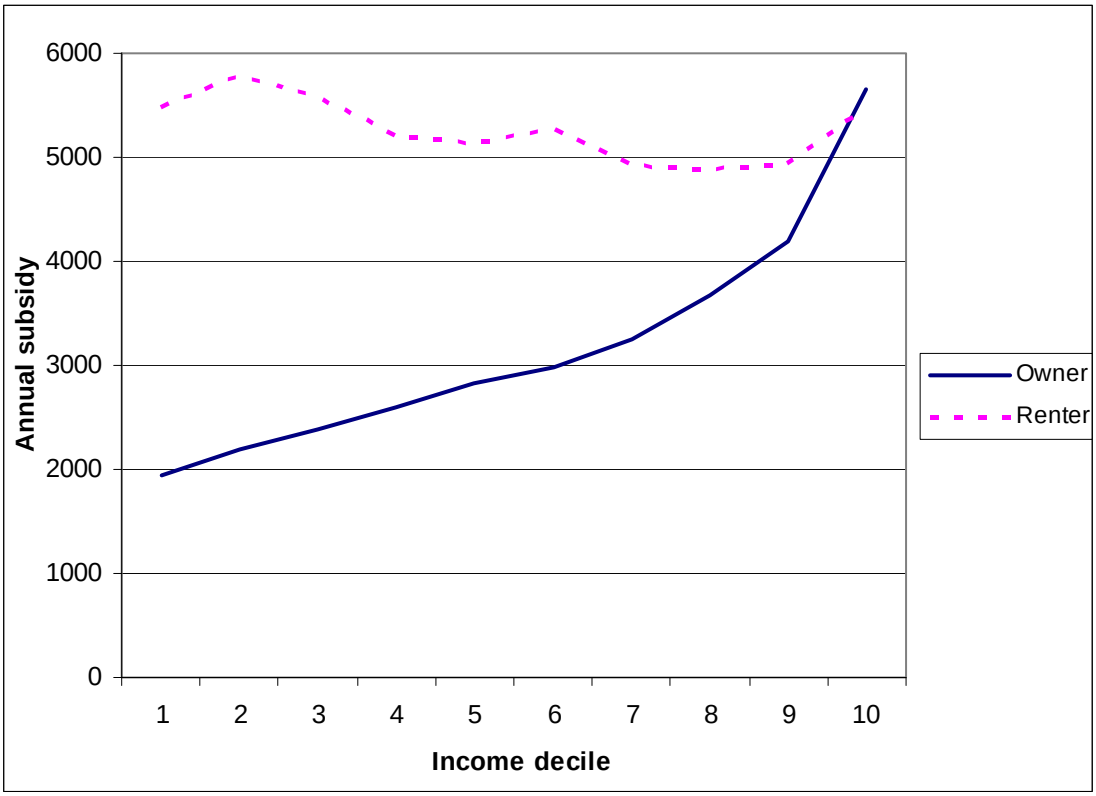


Figure 1 clearly shows that the amount of subsidy received by a household increases strongly with income in the owner-occupied sector. That is the result from the fact that the mortgage interest is deductible at the marginal tax rate, increasing the benefit for high income households. This, with the notion that home equity is tax exempt, creates the incentive to increase housing consumption beyond what would be demanded in equilibrium.

In the rental sector we observe a slightly decreasing subsidy over income: this is the result of the housing allowance diminishing over income. Nonetheless is the income effect far smaller in the rental sector than in the owner-occupied sector. We may expect here that households in the lower income deciles are strongly overconsuming compared to what these households would consume in equilibrium. Welfare losses are therefore likely to be higher in the low-end of the rental market (and the high-end of the owner-occupied market).

1.3 Welfare loss from distorted consumption

Numerous studies in the past have focused on the welfare effects following distorted consumption of goods given demand (or supply) affecting taxes and market regulations. The basic rationale for welfare losses is that households consume different levels of housing services in a subsidized world than they would ceteris paribus in an unsubsidized world. As described the Dutch housing market is heavily subsidized and each subsidy has a different impact on household behavior. The rent regulation in the rental sector, for instance, results in housing services being consumed by households that do not value these housing services the most. Glaeser and Luttmer (2003) prove this fact for the regulated rental market in New York. The inefficient allocation of housing services over households is further increased by the allocation procedure of rental housing, which is based on queuing. In the owner-occupied sector we observe that subsidies increase with income *and* consumption: owners thus have an incentive to increase housing consumption in order to increase total consumption. However, given the (very) limited price elasticity of supply in the Netherlands this increase in demand has lead to an increased price level in the owner-occupied sector (see e.g. Vermeulen & Rouwendal, 2007; Conijn, 2008). In both sectors housing services are strongly subsidized, and housing consumption strongly directed, and thus we may expect inefficiencies in both sectors.

The impact of subsidization on inefficient housing consumption has received a lot of attention in international literature for quite some time. Aaron (1970), for instance, reports significant overconsumption in the US market by home-owners resulting from the tax subsidies. Also Rosen (1979) and Poterba (1992) report a strong demand increase of owner-occupied housing resulting from favorable tax treatment. There are, however, relatively few articles estimating welfare effects of subsidies in the Dutch housing market. For the Dutch housing market a series of papers has been published by the Netherlands Bureau for Economic Policy Analysis (henceforth: CPB). These papers include the analysis of Koning *et al.* (2006) on the owner-occupied market, Romijn and Besseling (2008) on the rental market, and Donders *et al.* (2010) on an integrated housing market model. The economic inefficiencies resulting from subsidization of housing services is enormous. Koning *et al.* (2006) report a welfare loss of 1 billion euro annually in the owner-occupied sector. In the rental sector the welfare loss amounts up to 2.75 billion euro (Romijn & Besseling, 2008). In Donders *et al.* (2010) three policy scenarios are estimated. Their fiscal neutral scenario results in a total welfare gain of 7.4 billion euro.

1.4 Various issues in the Dutch debate

In this study we wish to accommodate several issues that have been keyed in the recent Dutch literature. In the main body of this paper we address our basic model. In this model we make several assumptions and choices that may have an impact on the outcomes of the study. We therefore also estimate a model that is more in line with the work published by the CPB; this is presented in the appendix to this paper.

The main issues that we wish to address concern the assumption of the level of aggregation on which the housing market should be studied and the impact of home equity on demand and the deadweight loss. We end this paragraph by addressing some specific estimation issues that are inherent to working on the Dutch housing market.

1.4.1. The impact of home equity

Increases in wealth have a positive impact on consumption levels according to the permanent income hypothesis. In line with this expectation many authors have reported positive relationships between home equity and consumption patterns. Case *et al.* (2005) report increasing household consumption resulting with home equity in a cross section across 14 countries. Bostic *et al.* (2006) find similar results that home equity has a strong impact on consumption. Greenspan and Kennedy (2008) note that the larger share of capital gains are used for either a new house or home improvement; a smaller, yet significant share, is used for other purposes such as repayment of non-housing debt. Van den End *et al.* (2002) reports that also in the Netherlands increases in home equity have been used for consumption purposes, but also in the Netherlands the majority of capital gains on housing is used for housing.

The majority of home equity gains appear to be reinvested in housing. This explains why Dusansky and Koç (2007) find that price increases (and thus home equity increases) result in an increasing demand for housing. Hoyt and Rosenthal (1992) also report that demand for housing increases with home equity, especially when it is "locked in". The "lock in" refers to the fact that it is fiscally beneficial to roll over the investment into new housing. A similar fiscal incentive is present in the Dutch housing market where mortgage interest is deductible only to the extent to which the mortgage is used for acquiring or improving a dwelling. We therefore expect that home equity might have an important impact on housing demand and take home equity as an explanatory variable in our model.

1.4.2 Housing market: national or regional

The Netherlands is a very small country. Nonetheless both practitioners and academics generally agree that the Dutch housing market should not be regarded as one market, but as several regional submarkets (see e.g. Visser en Van Dam, 2006 – prijs van de plek). In Schilder and Conijn (2009) large price differences between owner-occupied housing can be observed in different regional submarkets. Ras *et al.* (2006) justly put forward that this difference in price level is not necessarily a difference in housing quality. Therefore, using a simple multiple over the national average house price to estimate housing consumption may be wrong. Despite this observation, there has not been a welfare analysis on the Dutch housing market that deals with regional submarkets.

In a series of papers by Ras *et al.* (2005, 2006) and Eggink *et al.* (2007) a correction for regional price level differences, which the authors claim to be the result of regional differences in supply and demand, rather than structural differences in housing quality, is applied. These authors correct for regional submarkets using a constant quality regional price index. The number of housing services produced by any dwelling is thus compared to the national average dwelling at regional prices. This way we are able to make more accurate comparisons of housing services.

1.5 Specific estimation issues

We wish to explicitly address three key estimation issues before continuing to describe our model. These issues are relatively specific to the Dutch housing market, but could be relevant to any other housing market that has similar extensive governmental interventions. The issues we wish to address are the estimation of the demand curve for renters, potential non-randomness of the distribution of households over both housing market sectors, and minimal housing consumption levels.

1.5.1 Renters' demand curve

In the institutional set-up of the Dutch rental sector it is hard to claim that any renter is on his demand curve. Rental housing is assigned to households through queuing, households have incentives to not adjust housing to demand (given the object-based implicit subsidy described earlier), and access is constraint because of income requirements. The results that would normally come from the model are therefore not likely to reflect the true preferences of renter households. In line with Romijn and Besseling (2008) we use the outcome from our models of the owner-occupier in order to estimate welfare effects in the rental sector.

1.5.2 Non-random distribution of households

Households are most likely not randomly distributed over both sectors. This is the result from the economic incentive that the mortgage interest deductibility gives to high-income households. Conijn and Marsman (2004) show that low income households have concentrated in the rental sector and the high income households in the owner-occupied sector. Ras *et al.* (2006) also find evidence for the non-random distribution of households over both sectors. Ras *et al.* (2006) apply a Heckman two-stage model in order to correct for the selection bias. We follow them and also model our demand model in a Heckman two-stage.

1.5.3 Minimal housing consumption

Under current regime households are overconsuming housing services: housing is too cheap in the rental sector and owner-occupiers benefit from increasing housing consumption. Clearly, if subsidization were to be abolished, housing demand would decrease. It is, however, the big question to what levels. Koning *et al.* (2006) claim households always have a certain level of housing demand, regardless of price. They thus distinguish between the minimal consumption level and what they call the supernumerary consumption. The estimation of changes in housing demand therefore applies, in this line of reasoning, only to the supernumerary part of housing consumption. Koning *et al.* (2006) assume the minimal level of consumption to be around 50% of the average house; Romijn and Besseling (2008) apply the same methodology, yet refine it according to household equivalence factors to correct for household composition in setting minimum consumption levels. This results in a minimum consumption level of 35% of the average house quality for a single-person household.

Setting a minimum consumption level is a tricky thing. For one thing, it implies that households do not search for alternative housing options (e.g. in case of young households staying home longer). Moreover, setting the level has potentially far reaching consequences. We choose not to set a minimum level of housing consumption; in the appendix the model is estimated in line with the reasoning of Koning *et al.* (2006).

2. Model

In this study we want to estimate the welfare loss on a household level that follows from the subsidization and distorted consumption of housing services. We first apply Heckman's two-step procedure to estimate demand for housing services. Then, given the found elasticities, we estimate the welfare costs of subsidization on a household level. In the following section we first present the basic model for estimating the demand for housing services, and then we present the price variables that are used in the models, and then the quantity variables used for the models. The model for estimation of the welfare loss is presented last.

The first step of the model is a probit model for tenure choice and is defined as follows:

$$T_j = \gamma' z_j + u_j \qquad (1)$$

The variable T_j is the revealed preference (i.e. the actual tenure choice), z_i is a vector of variables affecting tenure choice, and u_j is an error term. The explanatory variables in vector z_i are a number of household characteristics (dummy variable indicating age of the head of household, dummy variable for household composition, tenancy spell, dummy variable for level of education in the household[2]) a regional dummy variable for the housing market where the household lives, and the urbanization degree of the area where the household lives. In international literature the relative price of owning over renting is also included in the selection model. In the Dutch context, however, this is not possible and renders spurious results. We further elaborate on the choice to exclude relative price in the appendices.

Given the first step of the model the inverse Mills' ratio can be estimated. The inverse Mills' ratio can be obtained as follows (Sigelman & Zeng, 1999):

$$\mathrm{M_j} = \lambda_i(\alpha_u) = \varphi(\gamma' z_j / \sigma_u)/\Phi(\gamma' z_j / \sigma_u) \qquad (2)$$

The inverse Mills' ratio is then used in the second stage of the Heckman two-step procedure to correct for the non-random allocation of households over both sectors. The second stage demand models are then given by:

$$Q_j = \beta_1 X_j - \beta_2 M_j + \varepsilon_j \quad if\ L_j^* = 1 \qquad (3)$$
$$Q_j = \beta_3 X_j + \beta_4 M_j + \varepsilon_j \quad if\ L_j^* = 0 \qquad (4)$$

Q_i is a measure for the number of housing services demanded and X_j is a vector of variables influencing demand for housing services. Vector X_j contains a variable for home equity of household j, the price per housing service paid by household j, the disposable income of household j, a dummy variable indicating the level of education in household j, and the age of the head of the household of household j.

[2] We use a dummy variable indicating the highest level of education within the household. We do this because it is not known to us whether the respondent is head of the household or partner.

The coefficients based on the OLS in (3) and (4) gives the conditional effects only if the variables do not also enter the selection model (1) (Sigelman & Zeng, 1999). In order to obtain the marginal effects a correction needs to be made on the coefficients of the variables that appear in both the first and second stage model. This is done according to Sigelman & Zeng (1999):

$$\frac{\partial E(y \mid L > 0)}{\partial x_j} = \beta_j - \gamma_j \rho \sigma_\varepsilon \delta(-\gamma' z) \qquad (5)$$

The price paid per housing service is estimated by dividing the user cost by the number of housing services Q_j. Generally, user costs are estimated as the sum of certain costs, including mortgage interest and maintenance and the like, expected house price development and some estimate for the opportunity costs of invested capital. The latter we have split up into two parts because the tax exemption that affects required return only applies to home equity, while we attribute the risk premium over the entire value of the dwelling. We estimate user cost in line with previous research that specified user cost for the Dutch institutional set-up as follows[3]:

$$UC_o = I + i*(V-M) + r*V + o*V + PT + PI + Tc + (d-a)*V + F \qquad (6)$$
$$UC_r = R - HA \qquad (7)$$

I = mortgage interest paid
i = required rate of return on invested equity
(2.8% : 4 required return - 1.2 tax exemption on income from investments)
r = risk premium (2%)
V = value of the property (as assessed for tax purposes)
M = mortgage
o = percentage value of maintenance (0.9%[4])
PT = property taxes (levied by municipalities; on average 0.1%[5] of V)
PI = property insurance (on average 0.1%[6] of V)
Tc = attributed transaction costs (0.5%: 0.2%[7] + 0.3%[8] attributed transfer tax)
a = (expected) appreciation rate (long term annual average taken; 3%[9])
d = depreciation (1%[10])
F = net fiscal benefit mortgage interest deductibility
R = rent paid
HA = housing allowance

[3] See e.g. Elsinga & Conijn (1998).
[4] In line with Koning *et al.* (2006).
[5] This is the lower bound reported in Van den Noord (2005); ours is estimated using observations of property taxes levied and house values in the database.
[6] This is in line with Koning *et al.* (2006) and is estimated using observations of property insurance paid and house values in the database.
[7] In line with Koning *et al.* (2006): based on average transaction costs and an average tenancy spell.
[8] Based on Koning *et al.* (2006): table 1, p. 10.
[9] In line with Koning *et al.* (2006).
[10] Based on an average of the economic depreciation in the owner-occupied sector reported in Conijn (1995) and for the rental sector reported in Conijn and Schilder (2009); 0.83% and 1.3% respectively.

For all user cost the above mentioned formulas are estimated with actual observations for all households, except for *Tc* and *(a-d)*. In those cases we applied a constant percentage of the property value for all households.

The Dutch housing market is generally described by both professionals as scientists as a number of regional submarkets. There are significant price level differences between these regional submarkets. Ras *et al.* (2006) claim that those price level differences do not reflect differences in quality (or: housing services), but differences in scarcity. We follow Ras *et al.* (2006) in their reasoning that differences in regional scarcity should not be left unconsidered and ought to be corrected for in the model. We follow the same approach as Ras *et al.* (2006), albeit using a different specification. We thus specify a regional constant quality price index to correct for regional price level differences that we cannot attribute to differences in the quality of housing.

The constant quality price index is estimated as follows:

$$V_{i,k} = c_k + \beta_1 X_{i,k} + \beta_2 S_{i,k} + \varepsilon_{i,k} \qquad (8)$$

$V_{i,j}$ is the value of house i in housing market k , c_k is a constant, $X_{i,k}$ is a vector of housing characteristics of house i in housing market k, and $S_{i,k}$ is a vector of characteristics of the environment of house i in housing market k. Vector $X_{i,k}$ contains a dummy variable indicating whether the house is a single family or a multi family dwelling, a variable indicating floor size, a variable indicating the size of the garden (or balcony if applicable), a dummy variable indicating construction period, a dummy indicating the presence of a garage, and a variable for the (natural logarithm of) number of rooms. Vector $S_{i,k}$ contains a dummy variable indicating the degree of urbanization of the location of the dwelling, a dummy variable indicating satisfaction with the surroundings in the neighborhood of the dwelling, and a dummy variable indicating satisfaction with the built environment in the neighborhood of the dwelling. These regressions are run for each of the 46 housing market areas separately: the value of individual housing on the left-hand side and the before mentioned explanatory variables on the right-hand side. Using the average values of all of these explanatory variables on a national level we obtain the regional price index number given a constant quality house as follows:

$$RPI_k = c_k + \beta_{1,k} X + \beta_{2,k} S \qquad (9)$$

The number of housing services, Q_i , are then estimated as follows:

$$Q_{i,k} = V_{i,k} / RPI_k \qquad (10)$$

The number resulting from (10) is normalized such that the national average number of housing services produced is equal to 100.

In order to estimate the effect of subsidies on housing demand we estimate the level of housing services demanded without subsidization. The predicted level of housing services without subsidization of housing is a linear prediction of (3). We do the predictions for both the current demand and the expected demand. The predicted levels of current demand are estimated for owners and renters separately; the predicted levels of expected demand are predicted only with the coefficients of the owner-occupied sector as renters are expected not to be on their demand curve.

$$Q_j^* = c + \beta_1 X_j - \beta_2 M_j \quad (11)$$

For estimating the expected level of demanded housing services in a market with no subsidies we need market prices. We do not have actual observations for market prices. We are, however, able to estimate the prices of owner-occupied housing without the subsidies (i.e. user cost minus the interest deduction, the tax exemptions, and the stamp duty). This means we estimate (6) again, yet this time fully expressed as a fixed percentage of house value V. There is one important complication, however: we do not know how households would finance their homes in equilibrium: we follow Koning *et al.* (2006) who use a debt quote of 50%. This results in a user cost of 5.3%. This results in the following definition of market price per housing service:

$$p_{m,j} = (0.053 * V_j) / Q_j \quad (12)$$

The shifts in demand that follow from (11) are causing a welfare loss to society. This welfare loss can now be estimated using the elasticities from (3) and (5). We estimate the welfare costs on an individual household level:

$$DWL_j = 0.5*(p_c - p_m)^2 * Q_j * \eta_j \quad (13)$$

DWL_j is the deadweight loss of household resulting from the distorted consumption of household j, p_c is the price per housing service paid under current market conditions by household j, p_m is the price per housing service paid under equilibrium market conditions by household j, Q_i is the number of housing services consumed by household j, and η_i is the compensated price elasticity of demand for household j. The term in brackets is the subsidy to household j; this subsidy is expressed in relative terms as a percentage of the market equilibrium price of housing services.
From (17) p_c follows from dividing the actual user cost of equations (6) and (7) by the number of housing services consumed from (10). Q_j is determined earlier in (10). The market price of housing services is estimated in (12) We further need an estimate for η_j . We can obtain η_j from substituting the estimated uncompensated price elasticity and income elasticity of demand from (3) into the Slutsky equation:

$$\eta = \partial Q^c / \partial p = \partial Q / \partial p - (\partial Q / \partial HHI) * (UC / HHI) \quad (14)$$

Data

All estimations are done using the housing needs survey of the Dutch Ministry of Housing, Spatial planning and the Environment, WoON 2006. The database from the housing needs survey contains information on housing related topics of a representative sample of households (n=64.000). Among the topics dealt with are the characteristics of current and previous housing, prices paid for current and previous housing as well as softer data such as the way in which households experience their neighborhoods et cetera. The tax-assessed value of rental dwellings was added to our database by the Central Planning Bureau.

3. Results

First we present some general results of our analysis, including some summary statistics of key variables in our models. Then we present the model outcomes and the estimated marginal effects. The resulting welfare implications are presented last, where we will focus on the shift in demand first, and then present the estimated deadweight loss.

Summary statistics of used variables

User cost play a central role in our analyses. The user cost have been specified in line with previous specifications of user cost in the Dutch housing market and are summarized in table 1:

Table 4: user cost of owning / renting in the Dutch housing market

	Owner-occupied	Rental
Number of households (million)	3.83	3.30
Value of dwelling (euro)	283429	167857
Disposable income (annual, euro)	38307	20755
User cost (annual, euro)		
current	12747	4265
opposite tenure	6287	5210
current user cost (% of value)	4.50	2.54
Subsidies (annual, euro)		
mortgage interest deductibility	2427	
housing allowance		46
implicit subsidy (market rent - actual rent)		3393

There are numerous important results, although none of these results are very different from existing literature. Many of the results are, although striking from an international perspective, simply the outcome of the extensive governmental intervention. It lies beyond the scope of this paper to extensively follow the arguments through, but we do mention some of the underlying explanations for the most striking results of table 4.

The governmental intervention mentioned often leads, through economic incentives, to large gaps between the owner-occupied and the rental sector. One of these results is the enormous difference between the average value of owner-occupied housing and rental housing. This large gap between owning and renting has been described before in e.g. Conijn and Schilder (2009) and can be attributed mainly to rent regulation. Also in line with Conijn and Schilder (2009) we see little relation between rent and value; the difference in house value between the owner-occupied and rental sector is far larger than the difference in accompanying (attributed) rent levels. Finally, another large gap can be seen in the user cost: owner-occupiers have far higher user cost than renters. This can only partly be explained by the different levels of consumption (i.e. house value): the remainder of the explanation can be found in different ways of subsidizing and the accompanying incentives that these subsidies have (as e.g. described in Schilder & Conijn, 2009).

A striking result from table 4 is to see that both owners and renters would be (or are) better off in the rental sector. Current owner-occupiers would have dramatically lower user cost if they had been able to obtain their current dwelling under the current regime in the rental sector. This is not possible for two reasons: under current regime most owner-occupiers would not qualify for rental housing given their (too high) income, and the rental sector does not supply housing of such high quality. In line with the previous observation it should be noted that the relative additional cost of owning is smaller for renters than for current owner-occupiers. This is caused by the fact that under current regime the cost of debt is lower than the cost of equity. Renters are assumed to obtain 100% debt finance and therefore benefit maximally from the fiscal treatment of mortgage interest. Current owners, however, have significant equity shares built up in their homes causing higher user cost. Despite the economically counterfactual choice of current owners to own their dwellings, this is a stable situation. In fact, the owner-occupied sector has increased proportionally for almost two decades (e.g. Ministry of Housing, Spatial Planning and the Environment, 2006). This is caused primarily by the access constraints to enter the rental sector mentioned earlier and the fact that cost of equity is not an expense: many owners might have higher costs being an owner-occupier, yet have lower expenses being an owner at the same time.

3.1 Model estimates

In order to estimate the demand curve of households in the owner-occupied sector we estimated a Heckman two-stage described in (1) - (5). The first stage of the Heckman, given in (1) is a probit model for tenure choice given a number of control variables. The coefficients are given in table 5:

Table 5: Heckman first-stage: Probit
All level variables are in the log-linear form

	Coeff.	St.err.
Disposable income	1.729	0.017
Tenancy spell	0.057	0.008
Age head of household (ref. = under 25 yrs.)		
25 - 34	0.323	0.056
35 - 44	0.362	0.056
45 - 59	0.139	0.057
> 60	-0.293	0.057
Urbanisation (ref. = strongly urban)		
urban	0.160	0.031
moderately urban	0.377	0.031
little urban	0.475	0.036
rural	0.548	0.041
Housing market area		
45 regional dummies (1/0) for 46 markets	*	*
Constant	-18.300	0.182
n	43372	
Pseudo R-sq	0.332	

* not presented

We described earlier how access constraints affect home-owners to choose the more expensive option of owning. Similarly, for renters access constraints have impact on their tenure choice as well: renters often do not meet the minimum income requirements set by banks in order to qualify for a mortgage. The relative price of owning over renting therefore heavily influenced by access constraints. We therefore do not take into account relative price in our model, although in an international setting this is standard: as argued, given the Dutch housing market set-up the relative price is not a usable concept[11].

The remaining variables all have the appropriate signs and are generally statistically significant (only exceptions are some of the 46 regional housing market dummies). Income is the strongest predictor for tenure choice. As income increases the probability of owning increases as well. This is in line with expectations given the fact that mortgage interest deductibility becomes more profitable with increasing income and the fact that access to the rental sector is constraint. Households with older heads of household tend to be more often owners, except for elderly who tend to return to the rental sector. The rental sector is mostly concentrated in urban areas, which is reflected in the coefficients reported on the dummies for urbanization.

[11] In the appendix we estimate our models including an estimate for relative price.

Based on the first stage regression the inverse Mills' ratio is estimated and plugged into the second stage regression. The coefficients from the second stage regression are presented in table 6:

Table 6: Heckman second-stage: OLS[12]
All level variables are in the log-linear form

	Coeff.	St.err.
User cost per housing service	-0.496	0.016
Home equity	0.042	0.001
Disposable income	0.714	0.016
Tenancy spell	-0.052	0.003
Household composition (ref. = 1 person)		
Couple	0.040	0.009
Couple with child(ren)	0.072	0.009
Single parent with child(ren)	0.070	0.016
Other	0.148	0.025
Urbanisation (ref. = strongly urban)		
urban	0.136	0.010
moderately urban	0.275	0.011
little urban	0.322	0.012
rural	0.360	0.014
Selection effect (Mills' ratio)	0.388	0.016
Constant	-1.273	0.186
n	43372	
R-sq	0.545	

In table 6 we find all the appropriate signs and statistically significant coefficients again: demand decreases with price, increases with home equity and income, increases with children. We also find that in rural areas demand for housing services is larger than in urban areas. The Mills' ratio is significant indicating that indeed households are not randomly distributed over the owner-occupied and rental sector. The coefficients presented in table 3 must be interpreted as conditional elasticities. We need the unconditional elasticities in order to estimate the welfare effects of subsidization. This is done by correcting the presented elasticities in table 6 according to (5). The results are show in table 7:

[12] Mind that we only present the results of the OLS on owner-occupiers: the estimation of the demand curve for renters is problematic as discussed earlier consumption is constraint by regulation.

Table 7: Marginal effects after Heckman

	Mfx
User cost per housing service	-0.496
Home equity	0.042
Disposable income	0.249
Tenancy spell	-0.068
Household composition (ref. = 1 person)	
Couple	0.040
Couple with child(ren)	0.072
Single parent with child(ren)	0.070
Other	0.148
Urbanisation (ref. = strongly urban)	
urban	0.093
moderately urban	0.177
little urban	0.201
rural	0.223
Selection effect (Mills' ratio)	0.388
Constant	-18.300

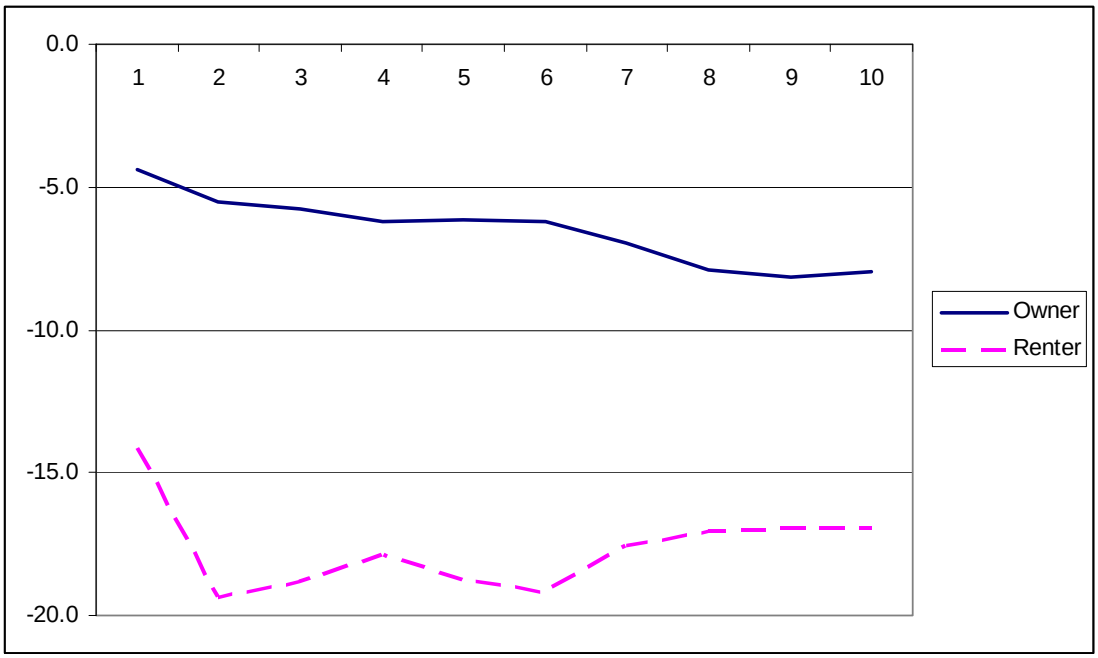
The coefficients presented in table 6 are the unconditional elasticities. The elasticities we find are reasonably in line with international literature. We do find that our estimate for the income elasticity is somewhat lower than usually reported. We have run our model also excluding home equity in which case the income elasticity increases to 0.264.

3.2 Welfare implications

3.2.1 Shift in demand

In order to estimate how households' demand would shift if prices would change in case of a market situation without subsidization we make a linear prediction using (11) for each household with respect to their housing consumption. This is done for the current consumption as well as the expected consumption at market prices (which are specified according to (12)). The resulting percentage changes are summarized in figure 2:

Figure 2: decrease in demand at market prices

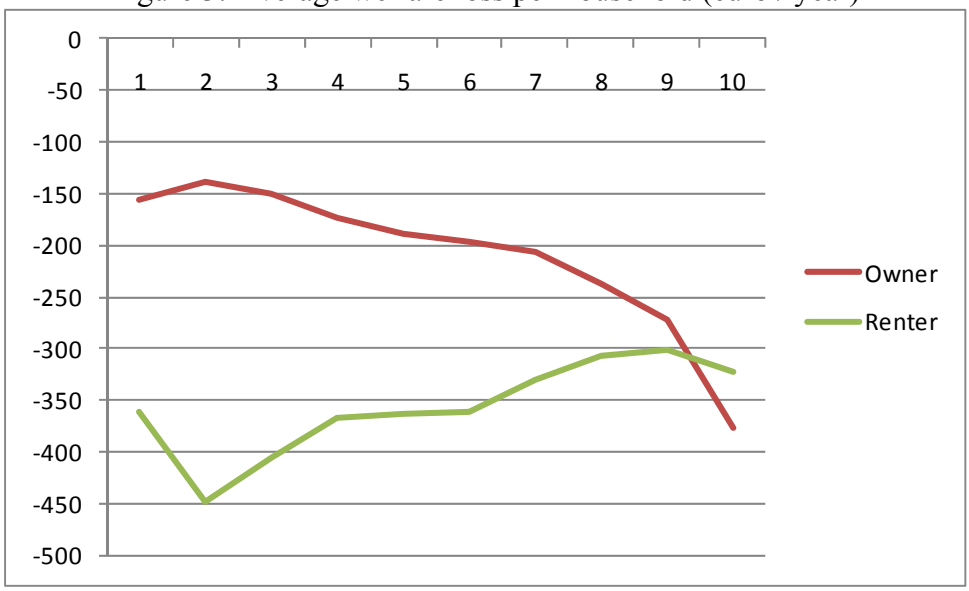


The pattern in the owner-occupied sector shows what can be expected: gradually decreasing demand as the impact of abolishing subsidies increases. In the rental sector the opposite pattern could be expected a priori: subsidies decrease with income, so the impact of abolishing subsidies should be less in higher income deciles. This is reasonably in line with what we find, with one very significant exception in the lowest income decile. This can be explained by the relatively high user cost per housing service paid by renters: renters in the lowest income decile pay more per housing service consumed than renters in the second and third income decile. The price these households pay is thus closer to the market price of housing services and therefore their demand is not as much affected by abolishing subsidies.

The decrease in demand for housing services is significant in both sectors. The overall average in the owner-occupied sector is 6.6 percent; in the rental sector the overall average decrease in demand for housing services is 17.8 percent. These results are in line with regular economic reasoning; subsidies are relatively large in the rental sector, so abolishing them affects the rental sector more. Also, within each sector, if subsidies tend to grow, the decrease in demand increases. Finally, the change in demand within each sector is relatively large in the owner-occupied sector compared to the change within the rental sector: the decrease in demand changes from about -4 percent to -8 percent in the owner-occupied sector, while in the rental sector the changes are, even in absolute terms, smaller (ignoringe the outlying first decile). This follows from the fact that the difference in subsidies is smaller in the rental sector than in the owner-occupied sector (see figure 1).

The effect of subsidies on expected demand shifts as shown earlier indicates that there might be a significant welfare effect resulting from the subsidization of housing services. The estimation of the welfare effect is done on an individual household level as described in (13) – (14). The outcome of the estimation is given in figure 3 and table 8:

Figure 3: Average welfare loss per household (euro / year)



In figure 3 we see roughly the same pattern as earlier in figure 2: in the rental sector welfare loss is relatively small in the lowest income decile, since these households are already paying a relatively high price for their current dwelling. Furthermore, we see that welfare effects decrease with income. This is the result from the set-up of the subsidization in the rental market: the majority of households receive implicit subsidies through low rents. This is reflected in the high overall level of welfare loss. The effect decreases with income, as housing allowances are decreasing with income. In the owner-occupied sector it becomes very evident that the welfare loss increases strongly with income: this is a direct effect of the mortgage interest deductibility.

Table 8: Welfare effects from subsidization

All numbers are averages of euro per year, except the total figure (in billions of euro per year).

	Owner		Renter	
Income	Average	Total	Average	Total
1	-156	-0.06	-362	-0.12
2	-138	-0.05	-448	-0.15
3	-151	-0.06	-405	-0.13
4	-174	-0.07	-368	-0.12
5	-190	-0.07	-363	-0.12
6	-197	-0.08	-362	-0.12
7	-207	-0.08	-331	-0.11
8	-237	-0.09	-308	-0.10
9	-273	-0.10	-301	-0.10
10	-377	-0.14	-322	-0.11
Total	-212	-0.80	-354	-1.18

The figures we report on an annual basis are reasonably in line with previous literature on this topic in the Netherlands for the owner-occupied sector. In the rental sector, however, we find a significant lower deadweight loss than reported thus far. This is in line with our findings that we also could not reproduce the previous findings of increased demand (at market prices) in the high-end of the rental market. The total net welfare effect of abolishing housing subsidies is again in line with the figures reported by Donders *et al.* (2010). The figures we report are consistent with one another and with one may expect based on standard economic theory. In total the welfare loss resulting from subsidizing housing services is roughly 2 billion euro annually. This is equivalent to 0.4% of GDP.

4. Conclusion

We have shown, based on a Heckman-based model, significant distorting effects of government intervention. This study does not focus on access constraints and alike, yet the results of such barriers become clear in this study. We have focused, in a very traditional way, on welfare implications that result from distorted consumption patterns of subsidized housing services. We report an annual welfare loss to society resulting from distorted consumption of housing services of 2 billion euro annually: this is roughly equal to 0.4% of the Dutch GDP.

Our analyses have contributed to the current literature by addressing regional housing markets in a welfare analysis and by explicitly modeling the impact of home equity. Addressing regional housing markets as we have done in line with Ras *et al.* (2006) has not been done in a welfare analysis yet, but has proven to be of significant importance. We further find that explicitly modeling home equity does matter. Given our models, we find, as expected, that the welfare losses presented earlier in the Netherlands are probably overestimating the deadweight loss from subsidization, especially so in the rental sector.

The main results from this paper are fairly much in line with international literature. That is despite the fact that we the Dutch institutional make-up of the housing market does not allow for the standard approach using relative price. Robustness checks have shown that actually following previous research by applying a relative price measure results in seriously flawed analyses.

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Appendices
Appendix 1: Relative price

The relative price of owning over renting is, in international literature, often used in tenure choice models. This variable, however, implies a free choice between both tenures: the relative price then results in households picking the tenure mode that is most attractive. In the Dutch housing market there is no choice between owning and renting in this sense: entrance into the rental sector is, at least for the large majority of the rental stock, restricted to (maximum) income levels. Furthermore is the quality of housing in the rental stock a lot smaller than in the owner-occupied sector: households that wish to consume a larger amount of housing simply cannot choose to rent because such housing is not offered in the rental sector.

We indicated in the model description that taking relative price into the first stage of the Heckman leads to spurious results. The reason for that can be seen in table 1: it is, given rent control, financially beneficial for every household to be renter. This is even more so for owner-occupiers than for renters; i.e. home owners would benefit more from renting their dwelling, than renters would loose from owning theirs. In order to illustrate the effect of taking a relative price measure up in the model, we estimate our models described earlier with an estimate of the relative price. This is done as follows:

For current renters we fill out (6) using the values applicable to renters. Mind here that for the renters all terms of the user cost formula are constant percentages of property value, based on the mean values of those percentages observed with owner-occupiers. This means that we assume a mortgage interest rate of 5.5%. Furthermore we assume the house to be fully debt financed. For current owner-occupiers we estimate the "would-be" rent using an OLS on actual rents of renters. We run two separate regressions: one for rents of social landlords and one for non-social landlords. The regression is for both types of landlords as given in (18):

$$R_j = c_1 + \beta_1 X_j + \beta_2 Ts_j + e_1 \qquad (15)$$

We then use the coefficients from (18) in order to predict a rent for each owner-occupier household. This is done as follows:

$$WR_j = c_1 + \beta_1 X_j + \beta_2 Ts_j \qquad if\ E_j = 1 \qquad (16)$$
$$WR_j = c_2 + \beta_3 X_j + \beta_4 Ts_j \qquad if\ E_j = 0 \qquad (17)$$

WR_j is the estimated rent for household j, c is a constant, X_j is a vector of dwelling characteristics, and Ts_j is the tenancy spell of household j. E_j is an indicator variable that indicates whether the household would qualify for any level of housing allowance[13]. Vector X_j contains a dummy variable indicating whether the house is a single family or a multi family dwelling, a variable indicating floor size, a variable indicating the size of the garden (or balcony if applicable), a dummy variable indicating construction period, a dummy indicating the presence of a garage, a variable for the (natural logarithm of) number of rooms, and a dummy variable indicating the housing market area.

[13] This is determined based on a combination of household composition and household income. The majority of owner-occupied households do not qualify for any level of housing allowance and their rents are thus estimated using (5).

We thus have two different rents: a lower estimate for households that would qualify for housing allowance and a higher estimate for households whose income is too high to qualify for housing allowance. By making two estimates for the rent we wish to account for the fact that the social rental market is not accessible to every household. In addition to the attributed rent level we estimate the amount of rental subsidy the household would qualify for. This is again based on a regression of actual observations from renters:

$$HA_j = c + \beta_1 R_j + \beta_2 HHI_j + \beta_3 HHC_j \quad (18)$$

HA_j is the housing allowance of household j, R_j is the rent paid by household j, HHI_j is the income of household j and HHC_j is a dummy variable for the household composition.

The would-be housing allowance for an owner-occupiers household is then estimated as follows:

$$WHA_j = c + \beta_1 WR_j + \beta_2 HHI_j + \beta_3 HHC_j \quad (19)$$

HHI_j is the income of household j and HHC_j is a dummy variable indicating the household composition of household j.

Thus all elements of the user cost formulas (6) and (7) are known or estimated for all observations in both tenures. The relative price of owning over renting then becomes:

$$RP_j = UC_{o,j} / UC_{R,j} \quad (20)$$

We then plug in the relative price ratio from (20) as an explanatory variable in (1). Here we report tables (5) through (7) again, yet with the relative price variable included in the model.

Table 9: Heckman first-stage: Probit

All level variables are in the log-linear form

	Coeff.	St.err.
Relative price	1.736	0.020
Disposable income	2.169	0.022
Tenancy spell	-0.048	0.010
Age head of household (ref. = under 25 yrs)		
25 - 34	0.408	0.064
35 - 44	0.296	0.064
45 - 59	0.056	0.064
> 60	-0.521	0.065
Urbanisation (ref. = strongly urban)		
urban	-0.040	0.035
moderately urban	0.018	0.036
little urban	0.027	0.041
rural	0.015	0.048
Housing market area		
45 regional dummies (1/0) for 46 markets	*	*
Constant	-22.914	0.234
n	41730	
Pseudo R-sq	0.492	

Table 10: Heckman second-stage: OLS

All level variables are in the log-linear form

	Coeff.	St.err.
User cost per housing service	-0.306	0.005
Home equity	0.036	0.000
Disposable income	0.255	0.006
Tenancy spell	-0.003	0.002
Household composition (ref. = 1 person)		
Couple	-0.013	0.005
Couple with child(ren)	-0.037	0.005
Single parent with child(ren)	-0.072	0.007
Other	0.119	0.011
Urbanisation (ref. = strongly urban)		
urban	0.078	0.004
moderately urban	0.145	0.005
little urban	0.164	0.005
rural	0.179	0.006
Selection effect (Mills' ratio)	-0.097	0.004
Constant	3.058	0.055
n	41729	
R-sq	0.548	

Table 11: Marginal effects after Heckman

	Mfx
User cost per housing service	-0.316
Home equity	0.035
Disposable income	0.040
Tenancy spell	-0.032
Household composition (ref. = 1 person)	
Couple	-0.099
Couple with child(ren)	-0.162
Single parent with child(ren)	-0.117
Other	0.034
Urbanisation (ref. = strongly urban)	
urban	0.034
moderately urban	0.092
little urban	0.106
rural	0.100
Selection effect (Mills' ratio)	-0.097
Constant	3.058

The reported coefficients for user cost per housing service and disposable income have the appropriate signs. We have, however, noticed that by splitting up the sample the signs switch. Below we present the OLS results from table 10 once more, yet only for the lowest 5 income deciles. The income elasticity of demand switches sign and becomes negative. In the base case presented in the main text this is not the case.

Table 12: Heckman second-stage: OLS

All level variables are in the log-linear form

	Coeff.	St.err.
User cost per housing service	-0.129	0.008
Home equity	0.027	0.001
Disposable income	-0.169	0.013
Tenancy spell	0.031	0.002
Household composition (ref. = 1 person)		
Couple	0.032	0.006
Couple with child(ren)	0.035	0.007
Single parent with child(ren)	-0.049	0.009
Other	0.176	0.013
Urbanisation (ref. = strongly urban)		
urban	0.085	0.006
moderately urban	0.147	0.007
little urban	0.171	0.007
rural	0.194	0.008
Selection effect (Mills' ratio)	-0.210	0.005
Constant	6.561	0.111
n	19204	
R-sq	0.5163	

Appendix 2: Minimal consumption level

In the introduction of this paper we mentioned that the CPB uses a minimal consumption level for households. The change in price, as a result, affects the above minimal housing consumption only. This potentially has far reaching effects. We therefore model both the estimated impact of subsidies on demand according to our models, as well as using the set-up of the models in the CPB.

The described procedure for estimating the shift in demand of housing services at market prices allows for very low demand levels. To some extent this might be true: households might choose for other forms of living (e.g. leaving parental house later in life, forming other cooperative forms of living). The recent papers by Koning *et al.* (2006) and Romijn and Besseling (2008), however, assume a minimal and a supernumerary expenditure on housing. They claim that households always require a minimum level of housing services. In order to check the robustness of our results we also estimate (11) with a minimum consumption level. We do, however, believe that the levels Koning *et al.* (2006) use are unrealistically high: they set the minimum level just above 50%. This means that every household would at least consume more than half of the *average* house, or put differently, that a single-person household would require a house of *at least* 135.000 euro. We set the minimum consumption level at several lower levels and then predict demand.

Setting minimum housing consumption levels raises the issue that not all households can be expected to have equal minimum housing needs: single-person households are likely to need less space than families with a few children. We therefore need to correct for the household composition. Statistics Netherlands has calculated so-called equivalence factors that can be interpreted as ratios to standardize welfare. We will use these ratios to determine the level of minimum housing consumption. Siermann *et al.* (2004) provide the formula used for estimating these equivalence factors:

$$E_j = (A_j + 0.8*C_j)^{1/2} \qquad (21)$$

Where E is the equivalence factor, A is the number of adults in the household and C is the number of children in the household. The total minimum demand level of housing services is then given by multiplying the set minimal consumption level with the equivalence factor, E:

$$Q_{j,\,mc} = w * E_j \qquad (22)$$

Total demand is then estimated using the minimum consumption level from (22) plus an estimated number of housing services for which we run (3) on all housing services in surplus of the minimum level $Q_{j,\,mc}$. The supernumerary consumption is estimated as follows:

$$Q_{j,\,snc} = c + \beta_1 X_j - \beta_2 M_j \qquad (23)$$

Total demand is then estimated as the sum of (22) and (23):

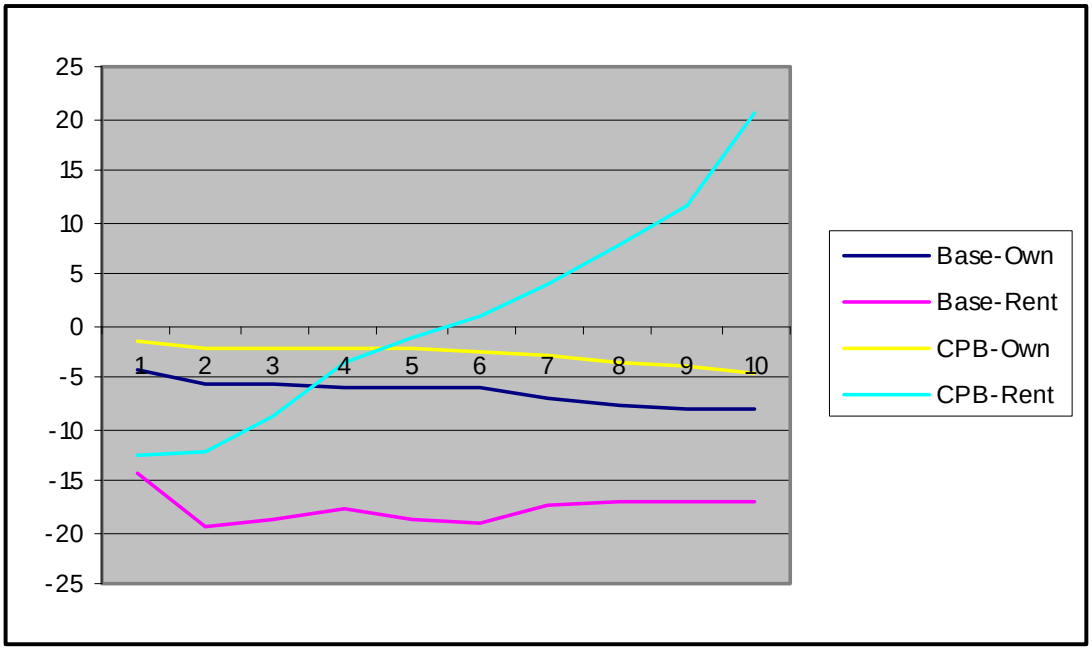
$$Q_{j,\,T} = Q_{j,\,mc} + Q_{j,\,snc} \qquad (24)$$

The results in the main text show very different results than the results from the CPB. Especially in the rental sector we find importantly different outcomes. Our estimates show a decrease of demand for housing services in the rental sector, whereas Romijn and Besseling (2008) show that households with higher incomes would actually have an increase in demand.

We use (11) and the minimal consumption adjustments from (21) through (24) to estimate the change in demand between the current level of consumption and the expected level of consumption at market prices. We do so using our (baseline) assumptions including a Heckman-procedure, a regional housing market specification, explicitly modeling home equity, and no minimal consumption level. We also estimate a model using assumptions in line with the CPB papers; this includes no Heckman procedure, a national housing market specification, home equity modeled as an additional income stream to disposable income, and a minimal consumption level. The results are presented in figure 4:

Figure 4: Shift in demand after changing to market prices

- Base-case = regional market specification, home equity separately modeled, Heckman-correction, no minimal consumption level
- CPB-case = national market specification, home equity modeled in income, no Heckman-correction, minimal consumption level



In order to understand the difference between the outcomes of both models we ran the same estimation models with different assumptions. The results of these models are presented below. The figures show that the minimal consumption requirement strongly increases the expected demand under market prices (because a fair share of housing services is consumed regardless of the price change). Furthermore, it can be seen that the Heckman procedure “tilts” the results towards a more leveled outcome.

Figure 5: Shift in demand after changing to market prices – paper's baseline model under CPB-assumptions

- Base-case = regional market specification, home equity separately modeled, Heckman-correction, no minimal consumption level
- B2-case without Heckman = regional market specification, home equity separately modeled, no Heckman-correction, minimal consumption level

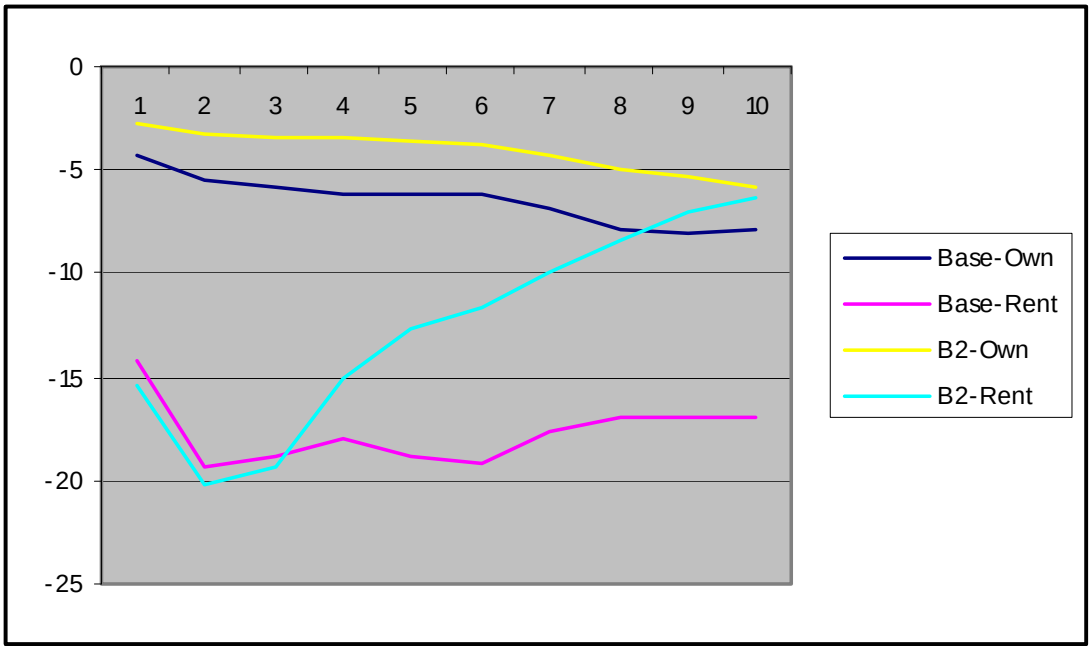


Figure 6: Shift in demand after changing to market prices – CPB model under paper's baseline-assumptions

- CPB-case = national market specification, home equity modeled in income, no Heckman-correction, minimal consumption level
- C2-case without minimal consumption = national market specification, home equity modeled in income, Heckman-correction, no minimal consumption level

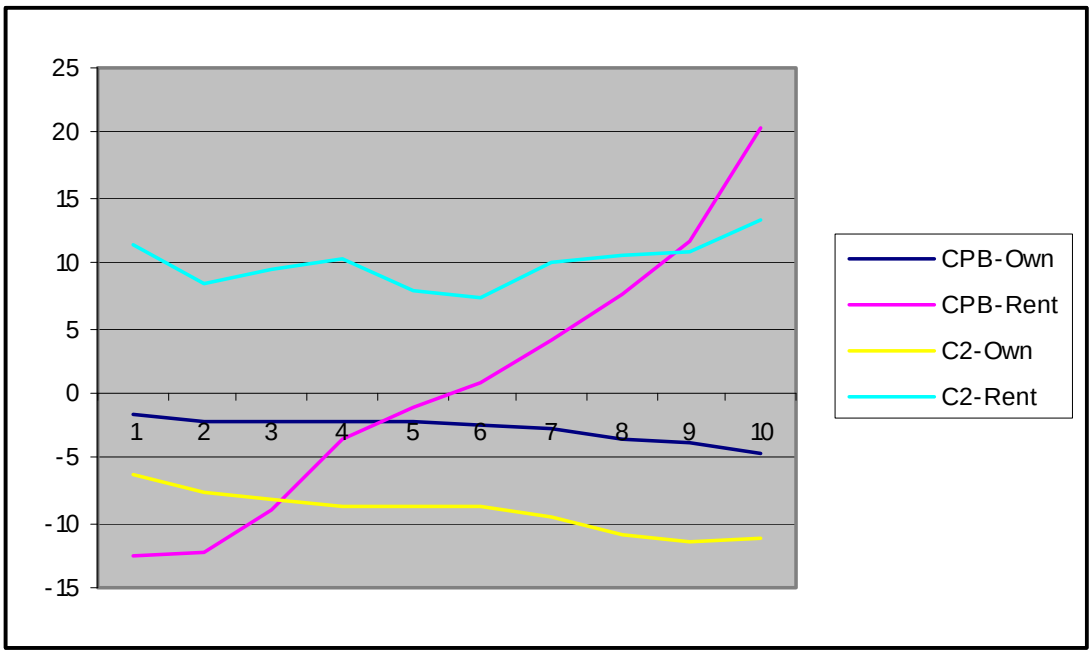


Figure 7: paper's baseline model - effect of minimal consumption

- Base-case = regional market specification, home equity separately modeled, Heckman-correction, no minimal consumption level
- B3-case including minimal consumption = regional market specification, home equity separately modeled, Heckman-correction, minimal consumption level

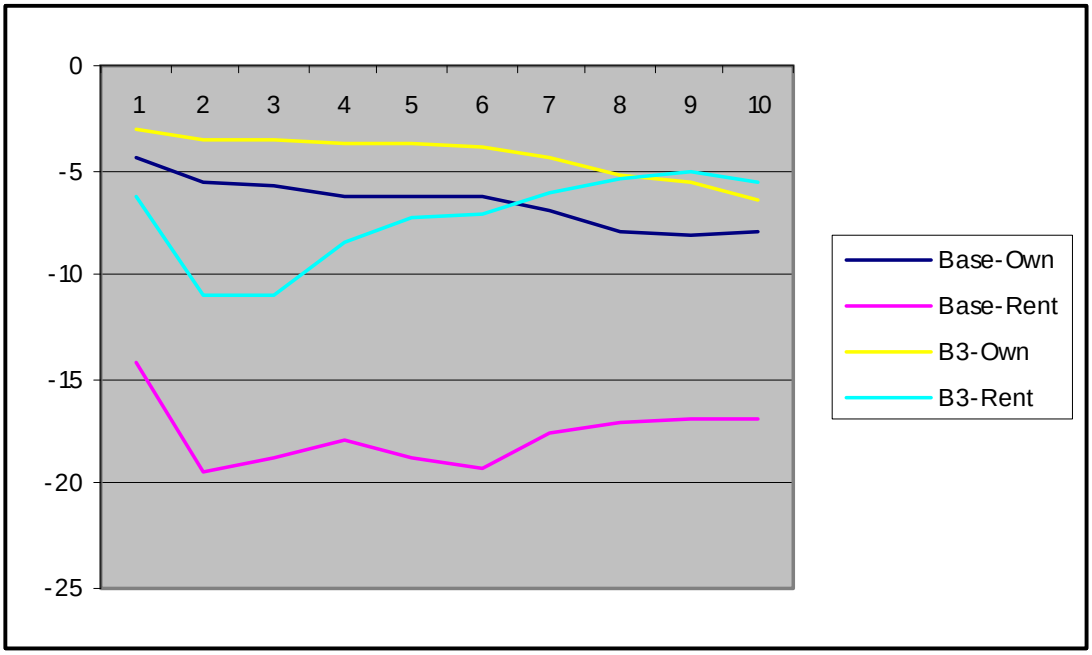


Figure 8: CPB-model – effect of Heckman procedure

- CPB-case = national market specification, home equity modeled in income, no Heckman-correction, minimal consumption level
- C3-case without minimal consumption = national market specification, home equity modeled in income, Heckman-correction, minimal consumption level