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THE IMPACT OF HOUSING NON-CASH INCOME ON THE UNCONDITIONAL DISTRIBUTION OF HOUSEHOLD INCOME IN AUSTRIA

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HOUSEHOLD FINANCE AND CONSUMPTION NETWORK

Household Finance and Consumption Network

This paper contains research conducted within the Household Finance and Consumption Network (HFCN). The HFCN consists of survey specialists, statisticians and economists from the ECB, the national central banks of the Eurosystem and a number of national statistical institutes.

The HFCN is chaired by Gabriel Fagan (ECB) and Carlos Sánchez Muñoz (ECB). Michael Haliassos (Goethe University Frankfurt), Tullio Jappelli (University of Naples Federico II), Arthur Kennickell (Federal Reserve Board) and Peter Tufano (University of Oxford) act as external consultants, and Sébastien Pérez Duarte (ECB) and Jiri Slacalek (ECB) as Secretaries.

The HFCN collects household-level data on households' finances and consumption in the euro area through a harmonised survey. The HFCN aims at studying in depth the micro-level structural information on euro area households' assets and liabilities. The objectives of the network are:

1) understanding economic behaviour of individual households, developments in aggregate variables and the interactions between the two;

2) evaluating the impact of shocks, policies and institutional changes on household portfolios and other variables;

3) understanding the implications of heterogeneity for aggregate variables;

4) estimating choices of different households and their reaction to economic shocks;

5) building and calibrating realistic economic models incorporating heterogeneous agents;

6) gaining insights into issues such as monetary policy transmission and financial stability.

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The paper is released in order to make the results of HFCN research generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the author's own and do not necessarily reflect those of the ESCB.

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Abstract

We estimate non-cash income from owner occupied housing, subsidized rental housing, or free use of one's main residence and evaluate their impact on the unconditional distribution of household income and selected inequality measures. We confirm the standard finding in the literature that imputed rents accruing to home owners have an equalizing effect on the distribution of income and find similar evidence for non-cash income from subsidized rents. Whereas imputed rents equalize the upper part of the income distribution, subsidized housing has an equalizing effect on the lower part of the income distribution. Overall, the effect of non-cash income from owner occupied housing clearly dominates the distributional effects, which translates into a combined effect of around 15% higher income for the bottom half and around 10% for the upper half of the unconditional income distribution. Our data provide us with the rare opportunity to apply all three commonly used approaches to calculate imputed rents for owner occupiers: capital-, self-assessment and equivalent rent approach. We find that using the equivalent rent approach leads to the strongest reduction in income inequality.

JEL Classification: D12, D14, D31

Key Words: income distribution, household main residence, housing policies, imputed rent, non-cash income, subsidized rent

Non-technical summary

Imputed rent – i.e. the value of housing services that owner occupiers or free users of one's main residence receive from living in a rent-free dwelling – constitutes a significant component of non-cash household income. In fact, such housing services received by owners are generally one of the largest items imputed in the national accounts. Similarly, the non-cash income from subsidized housing is likely to be relevant in countries like Austria where a housing policy is in place which aims to promote sustainable communities and a good social mix by minimizing social segregation. This is achieved in part through comparatively high income thresholds for limited-profit housing and council flats. If unaccounted for, such non-cash income from housing will cause the income of households who own their dwellings or use them rent-free or who live in subsidized housing to be underestimated.

This paper estimates non-cash income from owner occupied housing, subsidized rental housing, or the free use of one's main residence in Austria, based on data compiled with the Household Finance and Consumption Survey (HFCS). The HFCS data contain unique inter-subjective information provided by interviewers on dwelling and building quality, and detailed information on key variables such as mortgages, and the debt of renters in cooperative housing. Furthermore, the HFCS data provide the information necessary for all three approaches commonly used to calculate imputed rents for owner occupiers, namely the capital approach, the self-assessment approach and the equivalent rent approach. The HFCS thus offers us a rare opportunity for comparing estimated rents across methodologies. After all, the method used to estimate imputed rents of owner occupiers matters for both the level and the distribution of gross household income.

Taking such non-cash income into account reduces inquality, because imputed rents are less unequally distributed across household income. They impact different parts of the gross household income distribution. Imputed rents for owner occupied housing and free use mainly equalize the upper part of the income distribution, while subsidized housing has an equalizing (albeit smaller) effect mainly on the lower part of the income distribution. At the same time, we observe that some high income households receive non-cash income from subsidized rents, which is line with the goal of promoting a social mix in subsidized housing communities.

Overall, non-cash incomes in the form of imputed rents for owner occupied housing clearly dominate the distributional effects in absolute terms, reflecting the fact that these income streams generally exceed non-cash incomes from subsidized rental housing. As a consequence, in relative terms the income of the bottom half of the household income distribution increases by around 15% and the upper half closer to about 10% if non-cash incomes are taken into

account. Finally, comparing the three methods for calculating imputed rents of owner occupiers shows that the most commonly used approach, i.e. estimating imputed rents from equivalent rental units, leads to the strongest reduction in income equality. Both the capital approach, estimating the value of the housing investment and calculating a hypothetical return on investment, and the self-assessment approach, in which owner occupiers give subjective estimates of the rent for their housing, generate a more unequal income distribution when non-cash income from imputed rents is accounted for.

1 Introduction

There are two kinds of unobserved housing rents that may impact the level and distribution of household income. First, homeowners benefit from a hypothetical income stream, which should be imputed to generate an appropriate measure of property income (United Nations (1977); International Labour Organisation (2004); Canberra Group (2011); Organization for Economic Cooperation and Development (2013)). Second, rents for subsidized housing may be lower than market rents, which leads to a further underestimation of income (Hills (1991); Olsen (2001)). While the first concept, imputed rents from owner occupied housing, is well established in the empirical economic literature, the income effects of social housing have been discussed less widely. A comparison of these two forms of non-cash income is the main contribution of this paper.

There are three established ways of estimating imputed rents in the literature, all of which are typically based on survey data (Frick and Grabka (2003); Juntto and Reijo (2010); Törmälehto and Sauli (2013)). First, the preferred methodology is the rental equivalence approach (International Labour Organisation (2004); European Commission (2005); Canberra Group (2011)), which calculates the value of housing services received by inhabitants of owner occupied housing. From equivalent units in the private rental market, rents are estimated and housing costs deducted to arrive at a market value for these housing services. The standard estimation method are hedonic regressions using dwelling and household or individual characteristics as covariates. The main drawback of this method is the limited size of unregulated rental markets (Törmälehto and Sauli (2013)). If selection bias resulting from self-selection of households into private versus subsidized markets is a concern, a Heckman selection model can be used as a possible correction (Hulliger and Wiegand (2012)).

The empirical literature typically finds that imputed rents reduce income inequality (Smeeding, Saunders, Coder, Jenkins, Fritzell, Hagenaars, Hauser, and Wolfson (1993); Yates (1994); Frick and Grabka (2003); Garner and Verbrugge (2009); Frick, Grabka, Smeeding, and Tsakloglou (2010); Törmälehto and Sauli (2013)). The reason is that the distribution of imputed rents, while right-skewed, is less unequal than the distribution of other income. However, notable exceptions are Italy (D'Ambrosio and Gigliarano (2007)) and the U.S. (Garner and Short (2009).

The second estimation method, the capital market approach, interprets imputed rents as capital income from an investment in housing. The relevant literature applies an exogenous rate of return to the value of housing equity (Saunders, Smeeding, Coder, Fritzell, Hagenaars, Hauser, and Wolfson (1992)). Conceptually, the use of a nominal interest rate applies com-

pound interest to the inflation rate and thus overstates rental income, while a real interest rate understates rental income (Yates (1994)). Since the housing value is a subjective estimate of respondents in survey-based data, there is a possibility of misestimation of market values (Kiel and Zabel (1999)). Other issues revolve around the volatility of house prices and the fact that housing prices reflect expectations (Saarimaa (2011)).

Empirically, Frick, Grabka, Smeeding, and Tsakloglou (2010) find that using the capital market approach reduces the dampening effect of imputed rent on income inequality. In the case of Germany, it even reverses the effect and exacerbates income inequality; Garner and Short (2009) report similar reversal effects for the U.S.

A third approach, the self-assessment method, measures the opportunity cost of renting out owner occupied housing. Owners provide a subjective estimate of rental income from their housing, which is used directly as a proxy for rent. This method leads to the smallest reduction in inequality in a number of European countries (Frick, Grabka, Smeeding, and Tsakloglou (2010)). However, the opposite is true for Belgium (Verbist and Lefebure (2007)) and the U.S. (Garner and Short (2009)), where inequality increases.

Our data allow us to estimate imputed rents from owner occupied housing using all three methods. Following Frick, Grabka, Smeeding, and Tsakloglou (2010) and Garner and Short (2009), we cross-check the market-value approach, which has generally been favoured in the recent literature, with the other two approaches.

Much less work has been directed towards the second effect considered in this paper: the income effects of social housing (Olsen (2001)). A notable exception is Verbist, Förster, and Vaalavuo (2012), who find very small effects of imputed rent for social housing on the income distribution from EU-SILC data. The older literature on the U.S. (Hammond (1987); Olsen and Barton (1983); Murray (1975); Kraft and Olsen (1977); Reeder (1985)) is reviewed by Olsen (2001). This body of work applies linear regressions for samples of housing program recipients, and generally finds an inverse relationship between benefits and income, and a positive correlation between benefits and family size. For the U.K., the available evidence points in the same direction; relative housing benefits are found to decrease with income (Gibbs and Kemp (1993), Le Grand (1982), Kemp (1992)). Gibbs and Kemp (1993) conclude that social housing has equalizing distributive effects. Sanchez Martinez (2005) documents similar, albeit small, effects of social housing policy in Spain. DeBorger (1985), however, does not find a significant relation between housing benefits and income based on a small survey in Belgium.

For Austria, imputed rents are routinely estimated based on two major data sets, the

System of National Accounts (SNA) and the European Union Survey of Income and Living Conditions (EU-SILC). The SNA treats households as unincorporated enterprises which lease the house back to the household (Canberra Group (2011)). Imputed rents enter value added in the household sector and thus increase the gross domestic product. They enter as a component of the household sector's gross operating surplus and thus influence the factor income distribution; and on the expenditure side they are part of private consumption (Gruber and Reich (2009)). While outlays such as interest on mortgages and the maintenance and repair of buildings are considered intermediate inputs and thus deducted from value added, maintenance and repairs of housing units are categorised as consumption. The SNA does not contain information at the household level or information on the distribution of imputed rents.

The EU-SILC data contain estimates of imputed rent for below-market renters and owner-occupiers. For international comparisons, Törmälehto and Sauli (2013) identify issues regarding international comparability, and in some cases a lack of consistency of the variable of tenure structure with imputed rental values. In Austria, the EU-SILC estimation of imputed rents is based on the equivalent rent approach, with regression coefficients generated from the Austrian microcensus (Statistik Austria (2012a)). The estimates are produced in a series of stepwise linear regressions run separately for each type of dwelling (Statistik Austria (2008)). The EU-SILC data for Austria do not distinguish between gross and net imputed rents, but identify interest payments on mortgages with a separate variable. Statistik Austria (2008) and Sauli and Törmälehto (2010) find that inequality in Austria is somewhat reduced when imputed rents net of mortgage interest payments are taken into account using EU-SILC data. Maestri (2012) shows that the gains from re-ranking due to imputed rent are concentrated in the third income quintile in Austria.

In Austria as well as internationally, the comparison of non-cash income, namely that from owner occupied housing on the one hand and that from social housing on the other, has garnered scant attention in the empirical literature, with the exception of the seminal work by Frick, Grabka, Smeeding, and Tsakloglou (2010). This paper thus expands on and updates the existing empirical literature on the income effects of housing tenure by widening its focus to comparing imputed rents from owner occupied with those from social housing in Austria. Furthermore, it deepens existing research through a detailed investigation of the distributive effects of social housing.

Finally it should be noted that, in line with the empirical literature on imputed rents, this paper takes only first-order effects of housing policies into account. It adopts an agnostic stance on second-order effects and behavioural responses that would require general equilibrium modelling, such as labour supply, consumption, welfare and price effects. While micro

simulations of behavioural responses to housing policy changes are a fruitful avenue for future research, it should be kept in mind that empirical estimates of these labour supply changes tend to be small (Murray (1980); Fischer (2000)).

The rest of this paper is structured as follows. Section 2 gives some background information on housing policies in Austria. Section 3 briefly describes the data in the Household Finance and Consumption Survey, the micro dataset we use. Section 4 discusses the estimation strategy we apply to generate the relevant counterfactual income distributions. Section 5 presents the results, and Section 6 concludes.

2 Institutional Background

Kunnert and Baumgartner (2012) compare housing policies in Austria, Sweden, Spain, the United Kingdom, and the United States and found that every country broadly intervenes in the housing market. At the same time, the respective housing policies vary considerably. Austria in particular has a unique housing policy.

Austria's housing policy aims at facilitating the construction of new homes, at helping maintain the stock of existing rental flats, and at regulating rents in the cooperative and parts of the private housing market sector. The overarching goal is to promote sustainable communities and a social mix by avoiding segregation and ghettoization. The housing policy framework put in place to achieve these goals consists of four main instruments.

The construction of new homes is promoted with the Housing Subsidy Programme ("Wohnbauförderung"). Within this programme, provincial governments provide subsidized credit to individuals, cooperatives and corporations. These loans have been designed to cover a particular fraction of total building costs which varies across provinces.
The eligibility for subsidized credit is tied to neediness through income limits for owners (in the case of family homes) and renters (for rental flats constructed by cooperatives or corporations). Subsidized corporations are bound to charge only a cost covering rent as long as the subsidized credit has not been repaid. They can typically start charging market rents after a period of around 30 years – unless they fall under another Austrian housing policy instrument, the Limited Profit Housing Law ("Wohnungsgemeinnützigkeitsgesetz") .
The Housing Subsidy Programme is an object based subsidy which is directly aimed at the supply of new homes. The majority of rental flats and family homes constructed each year are subsidized by the Programme. In this respect, Austrian housing policy differs markedly from approaches in other high income countries, where supply is typically targeted only indirectly through high loan-to-value ratios or tax deductibiliy of mortgage payments. Subject based

subsidies, i.e. housing allowances, play a comparatively minorrole in Austria.

The second instrument is the Limited Profit Housing Law mentioned above. Under this law building companies may charge only a cost covering rent, and costs are capped by limits on employee salaries. Furthermore profits have to be reinvested in Austrian housing projects. Building companies which are subject to this law are mostly cooperatives but there are also limited profit housing corporations. Since the work of limited profit housing cooperatives and corporations is in the public interest, they are exempt from corporate tax. Support of projects of limited profit housing builders under the Housing Subsidy Programme has caused a stock of strictly price controlled flats to emerge over time.

The third policy instrument is the Tenancy Law ("Mietrechtsgesetz"), which targets the private rental market. It imposes de jure rent controls essentially on flats constructed before 1945, which is roughly half the private rental market. In practice, regulated rents match the rents in the unregulated segment of the private rental sector (Kunnert and Baumgartner (2012)).

The fourth instrument of Austria's housing policy is the stock of council flats, which are mainly owned by, and located in, the city of Vienna. The construction of these council flats used to be supported by the Housing Subsidy Programme, but the city of Vienna stopped constructing new flats around a decade ago. For the stock of council flats various rent regulations are in place, even though the municipalities could de jure charge market rents to some extent. In actual fact, the biggest owner of council flats, the city of Vienna, charges rents below the market price.

This comprehensive set of object based instruments has important macroeconomic effects. Recent studies argue that the Housing Subsidy Programme stabilizes building investments and the building cycle, while keeping household debt stable and rendering the Austrian economy less vulnerable to external shocks like higher interest rates (see Czerny and Weingärtler (2007), Kunnert and Baumgartner (2012)). This prevents a housing boom and bust cycle, as suffered in Spain, the United Kingdom, or the United States in the 2000's (Kunnert and Baumgartner (2012)). These indirect effects of Austrian housing policy are not relevant for our estimation here; they might however play a role in a more comprehensive analysis incorporating second or higher order effects.

Furthermore, housing rents in Austria are among the lowest third in the Euro area. At the same time the high income thresholds for limited profit housing and council flats in combination with some subject based subsidies for low income households prevent social segregation

and a stigmatization of public housing (Kunnert and Baumgartner (2012)). This is confirmed by studies using household and personal characteristics to estimate imputed rent, which do not find selection bias (Verbist, Förster, and Vaalavuo (2012)). This outcome might be explained by the inclusive nature of Austrian housing policy resulting from weak eligibility criteria for social housing.

Finally, for the purposes of this paper it is important to note that since there is no siginificant empirical difference between rents in the regulated and unregulated private sector, private market renters can be treated as a single group. For the analysis of housing policies and outcomes in Austria, the relevant groups are thus owner occupiers (outright and mortgaged owners), private market renters, renters in cooperative housing, renters in council housing, and rent-free dwellers (free users).

3 Data

This paper uses data generated in the first wave of the Household Finance and Consumption Survey (HFCS) in Austria 2010 (Fessler, Mooslechner, and Schürz (2012)).[1] This micro dataset contains the complete household balance sheet as well as flow variables.

The Austrian HFCS used regional multistage clustered probability sampling. The net sample size is 2,380 households with a response rate of around 56%. Non-response weighting was made on the basis of detailed information on non-participant households as well as interviewer characteristics. Item non-response was (partly) corrected for with multiple imputations using a Bayesian chained equations approach.[2] All our estimates take multiple imputations into account using Rubin's Rule.[3]

For the purpose of this paper, income, real assets, and debt are of particular interest. The dataset provides extensive information on the household's main residence, including household size, tenure status, market value, location, and measures of the house/apartment quality, and neighbourhood quality. Depending on tenure status, the data contain information on how the

[1] We restrict our analysis to the Autrian HFCS data because the 15 country Euro area dataset does not contain all the variables used here.

[2] See www.hfcs.at for detailed documentation of the Austrian HFCS, and ECB (2013a) and ECB (2013b) for documentation of the full Eurosystem HFCS.

[3] Whereas the main goal of multiple imputation is variance estimation including uncertainty resulting from the imputation procedure, many measures, such as medians, also differ in their point estimates when estimated as an average of the respective measures over all multiple imputed implicates versus only using one implicate or all implicates but ignoring Rubin's Rule. That is why we still use all implicates and apply Rubin's Rule to calculate our point estimates. Given the ad hoc assumptions required in the estimation of imputed rents, such as interest rates or costs for upkeep, resulting in unclear uncertainty, we refrain from reporting variance estimations. Instead, we extensively check the robustness of our estimates.

dwelling was financed as well as rent and hypothetical rent. Both the value of the dwelling and the hypothetical rents are subjective estimates by respondents, i.e. the financially most knowledgeable person in the household. Furthermore, the data include the cooperative share value ("Finanzierungsbeitrag") for all cooperative renters and the values of mortgages for all owner occupiers other than outright owners. Both are crucial for calculating non-cash income of those groups.

The data allow us to sort households by tenure status into the six groups named in Section 2 (see Table 1). Almost half of the households are owner occupiers, with about 30% outright ownership and 17% mortgaged housing. Less than half of the households rent their main residence and around 19% do so on the private market. The majority of renters are thus subsidized, living either in cooperative housing (around 16% of all households) or in council housing (around 12% of all households). Almost 6% of households use their main residence for free, i.e. they neither own the dwelling nor pay any rent for it. The share of private market renters in Austria is thus safely above the 10% cutoff level recommended by Eurostat (Törmälehto and Sauli (2013)), below which rental equivalence estimations might be based on too small a share of households.

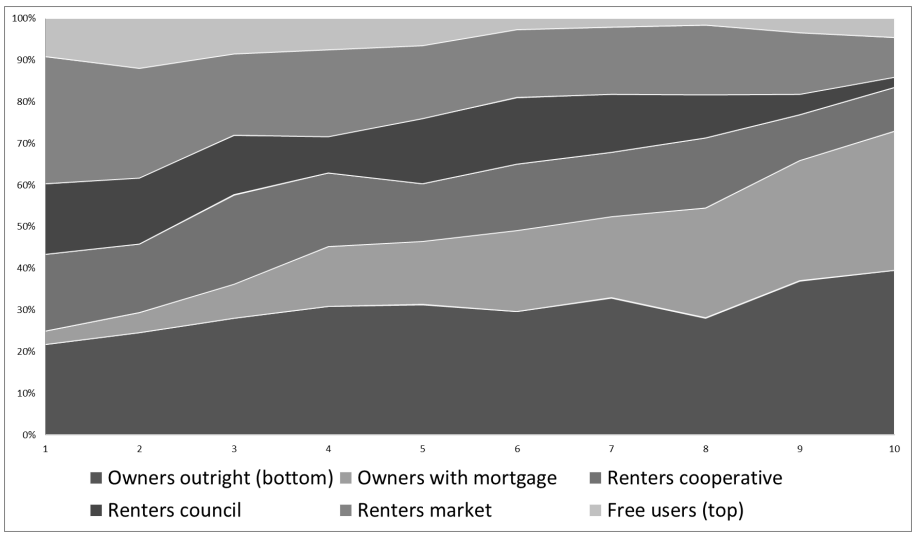
Table 1: Household Tenure Status

	Housing status	Percent
Owners	Outright	30.4
	Mortgaged	17.3
Renters	Cooperative	15.7
	Council	11.9
	Market	18.8
Free Users		5.8

Notes:
(i) *Source:* HFCS Austria 2010.

Figure 1 gives an overview of the composition of household tenure status by income. The share of owners increases with income at the expense of the other tenure forms; owners make up roughly 25% of households in the lowest and about 70% in the highest, gross household income decile. The incidence of mortgaged homes rises over gross household income percentiles, while the share of renters in market, cooperative, and especially in council housing generally broadly decreases with income.

Figure 1: Housing Status by Household Income deciles



Notes:
(i) This graph shows the composition of the household population by housing status over household gross income deciles.
(ii) *Source:* HFCS 2010.

4 Estimation Strategy

Our data contain a cross-section with draws from the country-distribution P of the vector (Y, X, M), which consists of gross income Y, household characteristics X and a set of characteristics of the households' main residence M, including inter-subjective information, meaning additional information about the dwelling not given by the respondent but gathered by the interviewer. Besides the mortgage value and the cooperative share value, X includes household types with regard to the housing tenure status respondents indicated for their main residence $s_i = \{1, 2, 3, 4, 5, 6\}$, where 1 signifies outright owners, 2 are owners with a mortgage, 3 are tenants in subsidized cooperative housing, 4 are tenants in subsidized council housing, 5 are tenants on the private (non-subsidized) market and 6 are free users (see Table 1).

Our first empirical aim is to estimate how the distribution of income $P(Y)$, or statistics with regard to the distribution of income $\nu(P(Y))$, changes once non-cash income from housing is accounted for. That is, non-cash income is added to the observed cash incomes of owner occupiers, tenants with subsidized rents, as well as free users. With regard to distributional statistics ν, this paper focuses on the Gini coefficient, percentiles and selected percentile ratios.

Following the literature and international statistics guidelines discussed in section 1, our

preferred estimation method is the "rental equivalence approach". The method is based on hedonic regression techniques, which estimate the price of the constituent elements of housing, under the assumption that private market housing does not differ from other housing with regard to unobserved housing characteristics.

The literature typically uses dwelling- as well as household- and personal-level characteristics to estimate hedonic regressions. Selection bias arises from the criteria for eligibiilty and other factors like social segregation. Variables indicating possible segregation can be household income, the capacity to face unexpected expenditures, family size, household structure, and migration background. If selection bias is detected, then two-step Heckman correction procedures are usually applied as a correction (Verbist, Förster, and Vaalavuo (2012)).

Our approach is unlikely to be affected by selection bias. First, our data on dwelling quality is inter-subjective, i.e. based on the perceptions of trained interviewers rather than the survey subjects. Interviewer-based information (see Table 2), which is partly recorded before meeting the respondent (e.g., the outside appearance of the building), is thus strictly independent from possible measurement errors or interviewer bias related to the respondent. Second, the size of the private rental market in our sample is sufficiently large at 19% of all housing to comfortably pass the Eurostat (2009) (cited by Törmälehto/Sauli 2013) 10% threshold for suggested use of Heckman correction models. Third, Verbist, Förster, and Vaalavuo (2012) analyze the presence of selection bias, and do not find evidence for it in Austria using EU-SILC data. A reason might be the Austrian housing policies discussed in section 2, which seem to prevent strong segregation.

Our data allow us to use dwelling characteristics as well as inter-subjective information directly on the dwelling and building quality instead of household- or personal level information. We are thus able to use (i) information to estimate hedonic regressions which should – once controlled for intersubjective dwelling information – not be exposed to selection bias due to eligibility criteria or social segregation and (ii) use the capital market approach as well as the self-assessment approach as robustness checks for the estimation of imputed rents of owner occupiers.

The rental equivalence approach allows us to use a single methodology for all types of households under investigation. We estimate the conditional expectation function (CEF) of rent for the subsample of tenants in the private (non-subsidized) rental market:

$$r_i^{msq} = \alpha + M'\beta + \varepsilon_i \quad \forall \quad s_i = 5. \tag{1}$$

Here r_i^{msq} is the monthly rent per square meter (net of all operating expenses and maintenance) of household i, α is a constant, M includes characteristics of the household's main residence, and ε is a zero mean error term with variance σ^2. The characteristics of the household's main residence used are the province in which the household is located (9 categories), municipality size (8 categories), and a building rating (4 categories) as well as a dwelling rating (5 categories) given by the interviewer. Descriptive statistics for the variables are shown in Table 2.

Table 2: Descriptive Statistics

		Share (%)	Mean HMR size (m^2)
Province	Vorarlberg	4.1	101.1
	Tyrol	8.4	96.8
	Salzburg	6.6	86.0
	Upper Austria	15.3	121.6
	Carinthia	6.8	117.7
	Styria	15.4	111.3
	Burgenland	4.1	120.1
	Lower Austria	16.0	115.0
	Vienna	23.3	81.2
Municipality Size	Up to 2000	17.4	127.5
	2000 to 3000	10.9	123.1
	3000 to 5000	10.8	114.8
	5000 to 10000	11.8	113.7
	10000 to 20000	7.7	96.1
	20000 to 50000	5.8	94.1
	50000 to 1mio	12.3	87.3
	More than 1mio	23.3	81.2
Building Rating	Generally clean and sound	66.9	110.1
	Some peeling paint or cracks	26.5	92.9
	Needs substantial painting or refilling	6.3	86.0
	Dilapidated	0.3	80.9
Appartment Rating	Luxury	5.3	139.7
	Upscale	48.2	113.9
	Mid-range	35.3	91.7
	Modest	8.6	84.1
	Low-income	2.6	78.4

Notes:

(i) *Source:* HFCS Austria 2010.

Furthermore, we use a weighted regression which yields design consistent estimates of the conditional expectation function, even though our model might not reflect the data generating process (see Faiella (2010)). In the case of the HFCS these weights also tackle selective non-response by including information gathered for all - not only the participating - households in the gross sample.

If the population CEF is linear, a multivariate linear ordinary least squares regression (OLS) is the best predictor for this statistical object. Even in the likely case that the population CEF is not linear, an OLS regression remains the best linear approximation of the CEF. However, the regression is only descriptive in the sense that we just use it to deliver the conditional expectations of rent per square meter for the covariate combinations of our household types of interest. We do not interpret the coefficients causally.

The coefficients resulting from estimating equation (1) via weighted OLS (adjusting for survey design as well as multiple imputations via Rubin's Rule) are used to estimate fictitious yearly market rents for free users ($s_i = 6$), owner occupiers ($s_i = 1, 2$) and subsidized tenants ($s_i = 3, 4$), $\hat{r}_i^{ym} = \left(\hat{\alpha} + M'\hat{\beta}\right)_i \times dsize_i \times 12$. Note that $dsize_i$ denotes the dwelling size of household i.

Owner occupiers. In the case of owner occupiers we follow the consensual definition (United Nations (1977); International Labour Organisation (2004); Canberra Group (2011); Organization for Economic Cooperation and Development (2013)), which calls for the deduction of current maintenance, upkeep and finance costs in calculating imputed rents. The private sector rents on which our estimates are based already exclude current maintenance. We approximate investments into upkeep with the "maintenance and improvement contribution", which is legally mandated for cooperative housing and amounts to 1.47 Euro per month per square meter on average over the depreciation span of a building. As financing costs we deduct 2% interest on the households' outstanding mortgage amount denoted as $mval_i$ (zero in the case of outright owners).[4] The income from housing y_i^h of outright owners and owners with a mortgage is thus

$$y_i^h := \hat{r}_i^{ym} - \underbrace{1.47 \times dsize_i \times 12}_{upkeep} - \underbrace{0.02 \times mval_i}_{financing} \quad \forall \quad s_i = 1, 2. \tag{2}$$

[4] In general interest rate data is available in the survey. However there are up to three possible mortgages with different variable or fixed interest rates possible. Missing data as well as measurement problems are also an issue. For the sake of transparency we therefore assume a fixed realistic interest rate.

Subsidized cooperative housing. For tenants in subsidized cooperative housing we deduct 1% of their cooperative share value[5] ($cval_i$) from their estimated yearly market rent and use the difference to the observed subsidized yearly rent as non-cash income from housing,

$$y_i^h := \hat{r}_i^{ym} - \underbrace{0.01 \times cval_i}_{1\% \; of \; cooperative \; value} - \underbrace{r_i^y}_{observed \; subsidized \; rent} \quad \forall \quad s_i = 3. \tag{3}$$

Subsidized council housing. For tenants in subsidized council housing, the difference between estimated yearly market rent and actual subsidized yearly rent r_i^y is used as non-cash income from housing,

$$y_i^h := \hat{r}_i^{ym} - \underbrace{r_i^y}_{observed \; subsidized \; rent} \quad \forall \quad s_i = 4. \tag{4}$$

Free users. In the case of free users, yearly non-cash income from housing denoted by y_i^h is defined directly as the imputed yearly market rent. We assume that free users do not have any expenses for current maintenance, upkeep or financing, as they do not own their main residence and do not to pay any rent, either.

$$y_i^h := \hat{r}_i^{ym} \quad \forall \quad s_i = 6. \tag{5}$$

For completeness we define the non-cash income from private market renters to be zero, $y_i^h := 0 \; \forall \quad s_i = 5$. As a last step we replace, as Verbist, Förster, and Vaalavuo (2012), all negative values of y_i^h with zero (this affects 1.1% of owner occupiers; 4.1% of council renters; 7.0% of cooperative renters) and add this component of housing non-cash income to household gross income to calculate household total income, $y_i^t = y_i + y_i^h$. Differences in any statistics ν, defined as $\nu(P(Y)) - \nu(P(Y^t))$, are due to household non-cash income. For purposes of interpretation we compute income vectors which only include the changes in the unconditional income distribution that are due to non-cash income for owner occupiers (Y^{ir}) and to subsidized rents (Y^s).

Our dataset offers us the rare possibility to calculate also the other two approaches for imputing rent described in the literature as robustness checks, the "capital approach" for owner occupied housing and the "self-assessment approach" for both owner occupied housing and main residences used for free. For the capital approach, we use the market value of the main residence as reported by owners and free users, and apply a 2%[6], 3%, and 5% yearly rate of return on the value of the main residence as further robustness checks. For the self-

[5] This is the standard rate at which cooperative share values depreciate in Austria.

[6] This was about the rate of return on a 10 year treasury bond at the time of the survey.

assessment approach, we use self-reported hypothetical gross income from renting out the main residence (again net of all operating expenses and maintenance). See Appendix A for results based on these approaches.

5 Results

5.1 Estimated rental equivalents

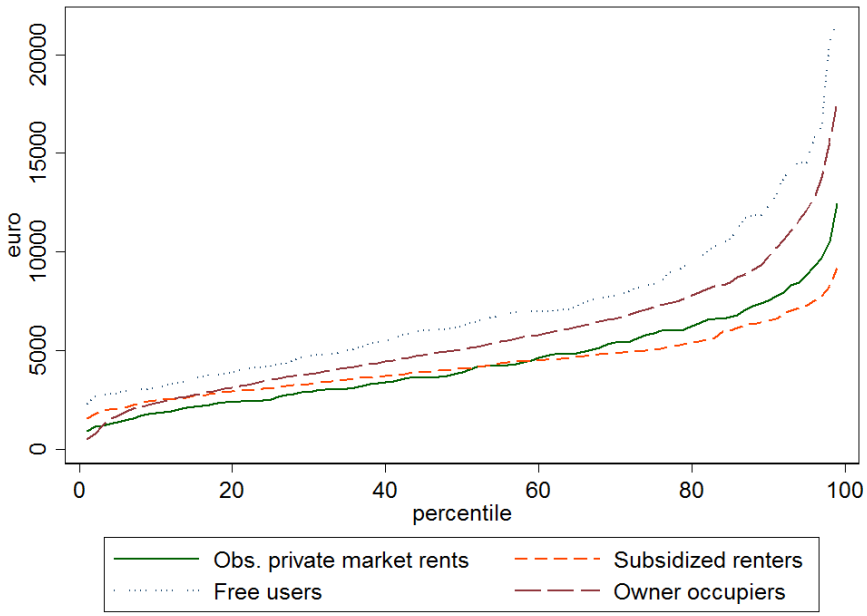
Figure 2 shows the results of the estimations of rental equivalence. That is, it includes the quantile functions of the conditional distributions of imputed market rents estimated from private market tenants $P(\hat{r}_i^{ym}|s_i = j)$ for all other tenure forms j, including owner occupiers (outright and with mortgage, $s_i = 1, 2$), subsidized renters (council and cooperative housing, $s_i = 3, 4$) and free users ($s_i = 6$), as well as the observed rents of tenants in the private market.

The rental equivalents of free users are strictly higher than the rents of all other forms of tenure. Free users tend to be a heterogenous group, including older owner occupiers who might have already transferred their house as a gift to their children but still use it as a main residence as well as young adults who could be living in apartments owned by family members. The imputed rent of owner occupiers is higher than private market and subsidized rents over large parts of the unconditional income distribution. This lower value of imputed rents compared to free users is due to the deduction of housing costs incurred by owner occupiers in their capacity as landlords. Note that here we are interested in a comparison comparison of dwellings and therefore for subsidized renters graphs 2 and 3 contain the equivalent private market rents, instead of non-cash income, which is defined as difference between observed rent and estimated rental equivalent (minus 1% of the cooperative value in case of cooperative renters).

The rental equivalents for subsidized renters are higher than private market rents in the lower half of the distribution, and lower than private market rents at the top. They cross over between the 50th and 60th percentile. As the CEF estimated in (1) is used to generate the rental equivalents, by definition the conditional expectation of a certain private market rent (observed or estimated equivalent rent) is the same given the characteristics of the residence M.

Figure 3 shows the observed distribution of private market rents and rental equivalents in subsidized housing, and adds the observed distribution of subsidized rents. A household at the 20th percentile of the distribution of observed subsidized rents pays less than a household at the 20th percentile of the market rent distribution, even though the captured characteristics

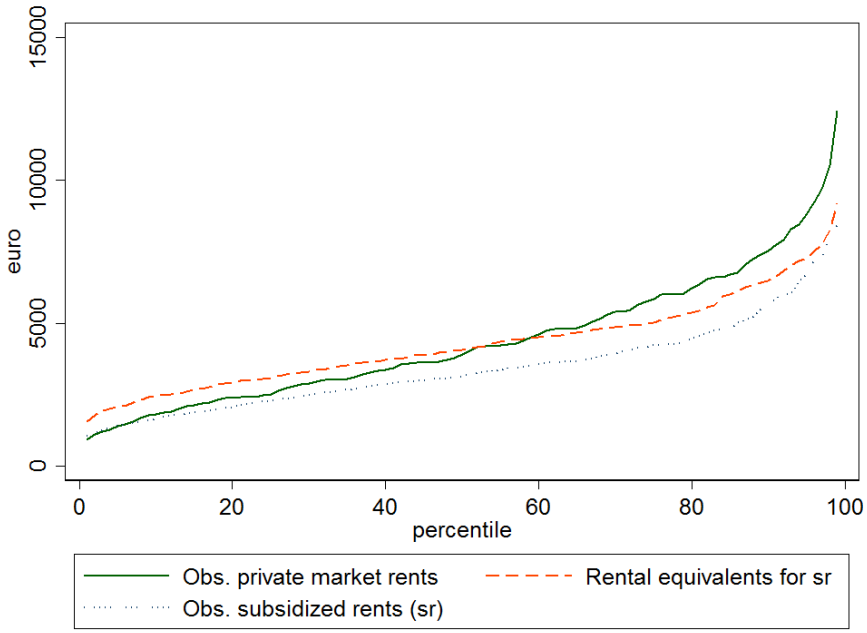
Figure 2: Observed private market rents and rental equivalents



Notes:
(i) This graph shows observed private market and estimated rental equivalents for subsidized renters, free users and owner occupiers.
(ii) *Source:* HFCS 2010.

of the residence regarding its quality rating and location would place it well above the 30th percentile of the market rent distribution. We thus find that subsidized housing rents in Austria are lower than comparable housing on the private market.

Figure 3: Observed private market rent, and observed and rental equivalents for subsidized renters



Notes:
(i) This graph shows observed free market and observed and estimated rental equivalents for subsidized renters.
(ii) *Source:* HFCS 2010.

5.2 Conditional income effect

Table 3 shows the conditional medians and means of income y_i, the non-cash income from housing (y_i^h) and resulting total income (y_i^t) across the different household types s_i. Owners have the highest median and mean incomes as well as the largest estimated non-cash incomes and resulting total incomes. Owners with a mortgage have slightly higher observed (especially with regard to the median) and total incomes, but slightly lower non-cash incomes than outright owners. This finding results from the fact that outright owners have a higher likelihood of already being retired and are therefore a more heterogenous group regarding income, while at the same time not paying financing costs for their housing.

Among the group of renters, subsidized renters in council apartments have somewhat

lower mean and median income than cooperative renters but somewhat higher housing non-cash income resulting from subsidies. The small group of free users has relatively low and heterogenous incomes, but the highest non-cash income at the same time.

On average non-cash incomes of owners and free users are substantially higher than those of subsidized renters. This holds in absolute terms as well as relative to household income. Once non-cash income is accounted for, average free users turn out to be considerably better off than subsidized renters.

Table 3: Household Income, Estimated Non-Cash Income and Resulting Total Income

	Obs. income (y_i)		+ Non-cash income (y_i^h)		= Total income (y_i^t)	
	median	mean	median	mean	median	mean
Outright Owners	35.9	51.0	5.3	5.9	41.7	56.9
Mortgaged Owners	49.0	60.2	4.7	5.4	54.5	65.6
Cooperative Renters	28.0	36.0	0.2	0.8	29.1	36.8
Council Renters	27.4	32.6	0.6	0.9	28.3	33.5
Market Renters	25.6	34.6	0.0	0.0	25.6	34.6
Free Users	21.3	33.4	6.2	7.1	28.3	40.5
Total	32.3	43.9	2.5	3.4	35.6	47.3

Notes:
(i) This table shows yearly observed gross household income, estimated non-cash income from housing as described in section 4 as well as total household income in EUR thousand.
(ii) *Source:* HFCS Austria 2010.

5.3 Effect on the unconditional distribution of income

As a next step we investigate the effects of the estimated non-cash incomes on the full unconditional income distribution of all households. Figures 4a to 4f plot the absolute and relative differences (for percentiles 1-99) between the observed unconditional income distribution (Y) and the income distributions including non-cash income for subsidized renters (Y^s) (Figures 4a and 4b), owners (Y^{ir}) (Figures 4c and 4d), and the total income distribution including the non-cash income of subsidized renters and owners (Y^t) (Figures 4e and 4f).

The effect of non-cash income for subsidized renters is small, at 0 to 600 Euro, and spread across the income distribution in absolute terms. It decreases with income in relative terms, from roughly 4% to 0%. This finding illustrates the fact that the beneficiaries of rent subsidies include not only low income households, but also, households across the full income distribution including those in the top deciles. This finding is related to the fact that as in

Verbist, Förster, and Vaalavuo (2012), no significant selection bias can be found with regard to private versus social housing and can be interpreted as an indication that the Austrian housing policy meets its objective of ensuring a social mix.

In the case of owner occupiers, on the other hand, Figures 4c and 4d show a pattern of increasing non-cash income with household income in absolute terms, ranging roughly from 0 to 8,000 Euro. This illustrates the higher likelihood of being an owner occupier for higher income households as well as the fact that housing size and quality (with regard to location and rating) increase with household income. In relative terms, however, non-cash income increases as a proportion of income (despite very low incomes) up to the middle of the income distribution and then slightly decreases with a sharp drop at the right end of the distribution.

In the graphs showing the effects of both forms of non-cash housing incomes (Figures 4e and 4f), the stronger effect of non-cash incomes for owner occupiers clearly dominates the smaller income effect from subsidized housing. The relative effect shows a falling pattern, which points to a possible equalizing effect of imputed rent on inequality measures. [7]

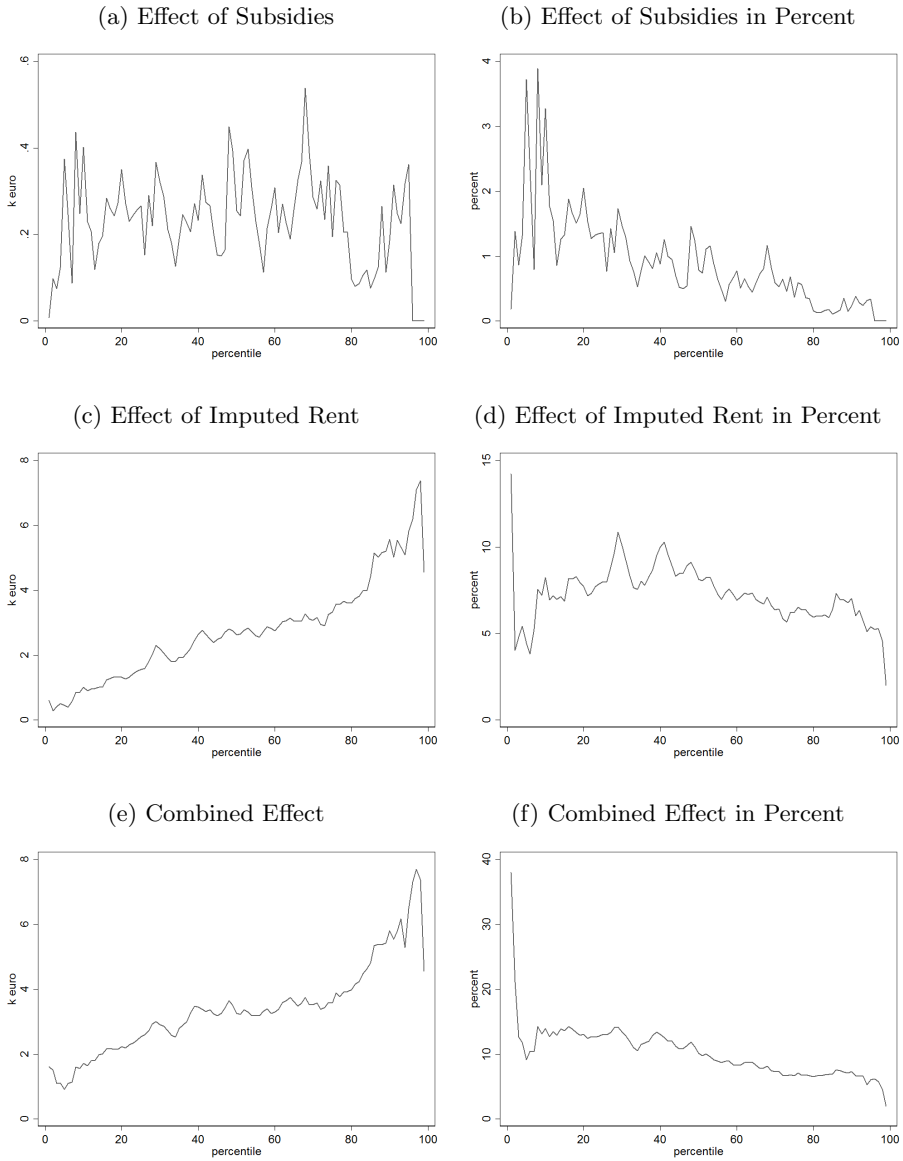
5.4 Effect on inequality measures

Table 4 shows the effects of the distribution of income on selected inequality measures $\nu(P(\cdot))$. The Gini-coefficient for household income in our data is 0.42; the percentile ratio $P75/P25$ is 2.74, the $P90/P50$ ratio is 2.46 and the $P90/P10$ ratio is 6.48. The second column shows the respective measure of inequality when only non-cash income from subsidized rents (council and cooperative housing) is taken into account, and the third column shows the inequality measures when only non-cash income for owner occupiers is included. The overall measure is shown in column four.

While both steps reduce inequality, there is a difference in the groups that are affected by the estimated non-cash incomes. The rents imputed for owner occupied housing have a stronger impact on the upper part of the distribution, whereas those for the subsidized rental market have a more pronounced impact on the lower part of the income distribution. Analogous tables to Table 4, but based on the capital- and self assessment approach for imputed rent can be found in Appendix A.

[7] For results from the capital- and self-assessment approach, see section 5.5.1 and Appendix A

Figure 4: Effects on the unconditional income distribution



Notes:

(i) Graph (a) shows the effect of subsidized rents on the full distribution of household income.

(ii) Graph (b) shows the effect of subsidized rents on the full distribution of household income in percent.

(iii) Graph (c) shows the effect of imputed rents on the full distribution of household income.

(iv) Graph (d) shows the effect of imputed rents on the full distribution of household income in percent.

(v) Graph (e) shows the combined effect of subsidized rents and imputed rents on the full distribution of household income.

(vi) Graph (f) shows the combined effect of subsidized rents and imputed rents on the full distribution of household income in percent.

(vii) *Source:* HFCS 2010.

Table 4: Counterfactual Inequality Measures

	$\nu(P(Y))$	$\nu(P(Y^s))$	$\nu(P(Y^{ir}))$	$\nu(P(Y^t))$
Gini	0.42	0.42	0.41	0.41
P75/P25	2.74	2.72	2.70	2.59
P90/P50	2.46	2.45	2.43	2.40
P90/P10	6.48	6.28	6.40	6.10

Notes:
(i) *Source:* HFCS Austria 2010.

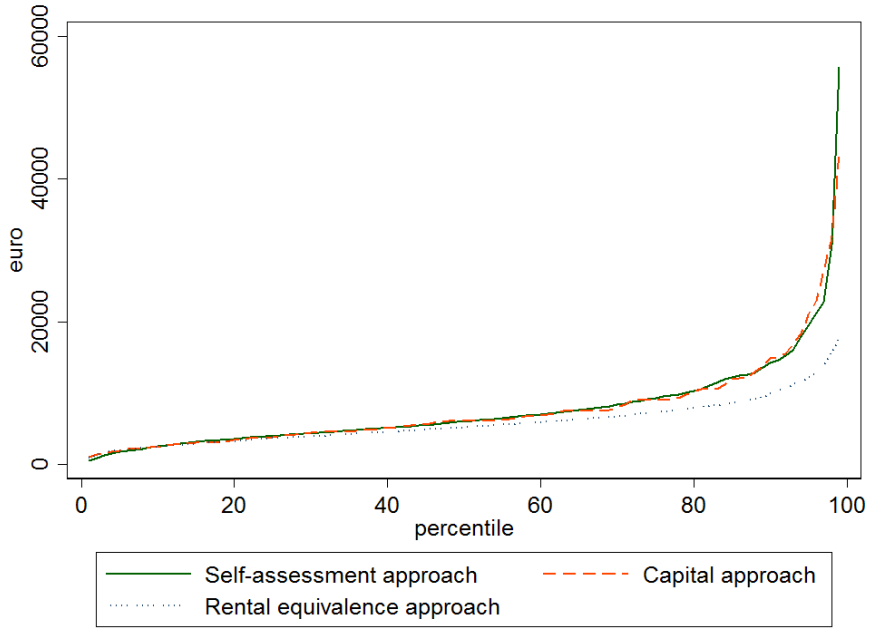
5.5 Robustness Checks

This section puts the results described in sections 5.1-5.4 in perspective by estimating imputed rents using two alternative approaches common in the literature (section 5.5.1), by providing an instrumental variable approach for income to account for measurement error (section 5.5.2), and by comparing our results with available aggregates from other data sources (section 5.5.3).

5.5.1 Alternative approaches to imputed rents for owner occupiers

As discussed in section 1, non-cash income for owner occupied housing can be estimated using the equivalent rent approach, the capital approach, and the self-assessment approach. Since our data allow us to apply all of them, we check the robustness of our preferred equivalent rent approach with the other two. Figure 5 shows the three estimates for the conditional distributions of non-cash income for owner occupiers. All three approaches result in similar conditional distributions of imputed rent for a large part of the distribution. The only exception is that both the capital approach and the self-assessment approach suggest higher imputed rent of owner occupiers towards the right tail of the distribution. Our estimates for housing non-cash income of owner occupiers from the equivalent rent approach are therefore likely to be conservative. Since housing wealth and income are positively correlated, a stronger equalizing effect on the unconditional income distribution tends to be found from the regression based equivalent rent approach. Appendix A shows the resulting effects on the unconditional income distribution as well as its mappings to inequality measures using the alternative approaches to estimate imputed rents. As expected, due to the higher concentration of imputed rents in these two approaches compared to the equivalent rent method, the dampening effect on income inequality is generally much weaker and even reversed for some inequality measures. These findings conform to the typical results found by the international literature on imputed rents from various data sources, as discussed in section 1.

Figure 5: Three estimates of non-cash income from owner occupied housing



Notes:
(i) This graph shows imputed rents.
(ii) *Source:* HFCS 2010.

5.5.2 Measurement error

Next we use an instrumental variable approach to check for measurement error. Note that the pattern of increasing absolute and decreasing relative housing non-cash income translates to a slope between zero and one for a regression of housing non-cash income on observed household income. However, this slope might be underestimated due to income measurement error and resulting attenuation bias, which might also affect the relationships between Y and Y^{ir}, Y^{s}, and Y^{t} and consequently lead to an overestimation of inequality reduction.

Assume that observed income is the sum of true income and a random measurement error, $y_i = y_i^{true} + e_i$, where y_i^{true} denotes true income and e_i measurement error with a mean of zero. In this case the slope of a regression $y^h = \alpha + \beta y + \varepsilon$ will be biased downwards, implying an overestimation of a possible inequality reducing effect of non-cash incomes y_i^h. Using an instrument z which is correlated with y but not with the measurement error e, i.e. $cov(z, e) = 0$, should prevent measurement error leading to attenuation bias and provide an unbiased slope.

In the case of the HFCS, two options for instrumenting observed income are gross wealth and total consumption expenditure. In the OLS regression the slope is estimated at .019 (SE : .004). When we use 2SLS with gross wealth and total consumption expenditure as instruments for observed income, this estimate increases to .041 (SE : .013) and .053 (SE : .008), respectively. The slope remains lower than 1, and thus confirms the robustness of our finding that non-cash income has an equalizing effect on household income. However, the fact that the estimate of the coefficient increases in both cases points to the overestimation of the equalizing effect of non-cash income, which is due to attenuation bias resulting from measurement error with regard to income. We can thus confirm the finding from the previous subsection based on alternative estimation methods of imputed rent that the estimates of the equalizing effect of imputed rent from the equivalent rent approach are likely to be overestimated.

5.5.3 Aggregates

Our estimates for the aggregate of non-cash income (net imputed rent) of owner occupiers amount to roughly 10.3 billion Euro (6.8 billion Euro of outright owners and 3.5 billion Euro of mortgaged owners). This is broadly in line with estimates from other data sources for Austria. EU-SILC calculations for imputed rents of owner occupied housing in Austria amount to roughly 10.2 billion Euro and 11 billion Euro in 2009 and 2010, respectively. The Household Budget Survey 2009/2010 ("Konsumerhebung") estimated imputed rents at about 11.2 billion Euro (Statistik Austria (2012b)). The gross imputed rents in the SNA for the private household sector 2009 and 2010 amounted to roughly 13.6 and 14 billion Euro respectively. Net imputed rents, i.e. after the deduction of depreciation, were about 7.7 and

8 billion Euro in 2009 and 2010.[8]

Our results furthermore imply that the non-cash income of free users sums up to another 1.6 billion Euro per year. EU-SILC data provides an estimate of about 1.04 billion Euro in 2009 and 1.21 billion Euro in 2010 for free users. In our data, non-cash income for tenants in cooperative housing amount to roughly 500 million Euro, and council tenants' non-cash income to roughly 400 million Euro. EU-SILC estimates for imputed rent of renters (including council housing, cooperative housing, "other" renters, and subletters) sum to a total of about 535 million Euro. Comparable data for these are not available from other sources.

6 Conclusions

In this paper we used the Household Finance and Consumption Survey to estimate non-cash income from owner occupied housing, subsidized rental housing, and free use of the main residence. The HFCS provides detailed information on mortgages, debt of renters in cooperative housing and unique inter-subjective information provided by interviewers on the dwellings and building quality.

We evaluate the impact of non-cash income from housing on the full unconditional household income distribution as well as selected inequality measures. The effect of non-cash income from owner occupied housing increases with income in absolute numbers, but decreases in relative terms. For the subsidized rental market, the effect is substantially smaller and its pattern is less pronounced along the distribution of income in absolute terms. Relative to income, subsidies also show a falling tendency as income increases.

We thus confirm the standard finding in the literature that imputed rents have an equalizing effect on the distribution of income and find similar evidence for non-cash income from subsidized rents. However, their effects differ across the income distribution differ. Whereas imputed rents from owner occupied housing equalize the upper part of the income distribution, subsidized housing has an (albeit smaller) equalizing effect for the lower part of the income distribution. Overall, the effect of non-cash income from owner occupied housing clearly dominates the distributional effects, which translates into a combined effect of around 15% higher income for the bottom half and around 10% for the upper half of the unconditional income distribution.

The data allowed us to conduct extensive robustness checks using different approaches of estimating imputed rents of owner-occupied housing. They also made it possible to check for measurement error using an instrumental variable approach. Both suggest that our estimates

[8] Not published, from private correspondence.

for imputed rent are conservative and that, while the inequality reducing effects of imputed rents are robust, they might be overestimated in the literature. Finally, our results are in line with available aggregate estimates of imputed rent for owner occupied housing from other data sources for Austria.

Future work include the extension of this analysis to other European countries, as far as data availability permits. A more detailed analysis of the distributional impact of imputed rents on subgroups by socioeconomic characteristics might also yield interesting results. Finally, the distributional aspects of the taxation of imputed rents (or lack thereof) might prove a fruitful and little explored avenue of future research.

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Appendix A Alternative Imputed Rents

Appendix A.1 Results using the Capital Approach

Analogous to graphs 4c to 4f, graphs Appendix A.6a to Appendix A.6d show the effects of imputed rents as well as the combined effects of imputed and subsidized rents on the unconditional income distribution. Instead of the rental equivalence approach discussed in section 4, here the capital approach is used. Imputed rent is defined using a 3% rate of return on the value of the household main residence of owner occupiers.

The absolute effect of imputed rent shown in graph Appendix A.6a reflects the somewhat higher imputed rents using the capital approach. The relative effect rises up to the middle of the income distribution and decreases from the middle upwards while it shows somewhat higher relative effects in the upper part of the distribution before decreasing sharply again similarly to the equivalent rent approach.

Analogous to table 4, table Appendix A.5 shows the effects on selected inequality measures using the capital approach to estimate imputed rents. Additionally as a further robustness check, tables Appendix A.6 and Appendix A.7 show the results under assumptions of a rate of return of 2% and 5% respectively.

Whereas the effect of imputed rent using the capital approach is a little less equalizing for the gini coefficient as well as the $P75/P25$ and $P90/P50$ ratios than in the case of the equivalent rent approach it even has an opposite effect towards more inequality for the $P90/P10$ measure. This results from the likely underestimation of higher imputed rents resulting from the regression based equivalent rent approach. Using a higher rate of return (see Appendix A.7) amplifies this result while using a lower one dampens it a little closer to the equivalent rent results (see Appendix A.6). Overall the results are relatively robust but point towards a possible overestimation of the equalizing effect using equivalent rent approaches.

Table Appendix A.5: Counterfactual Inequality Measures

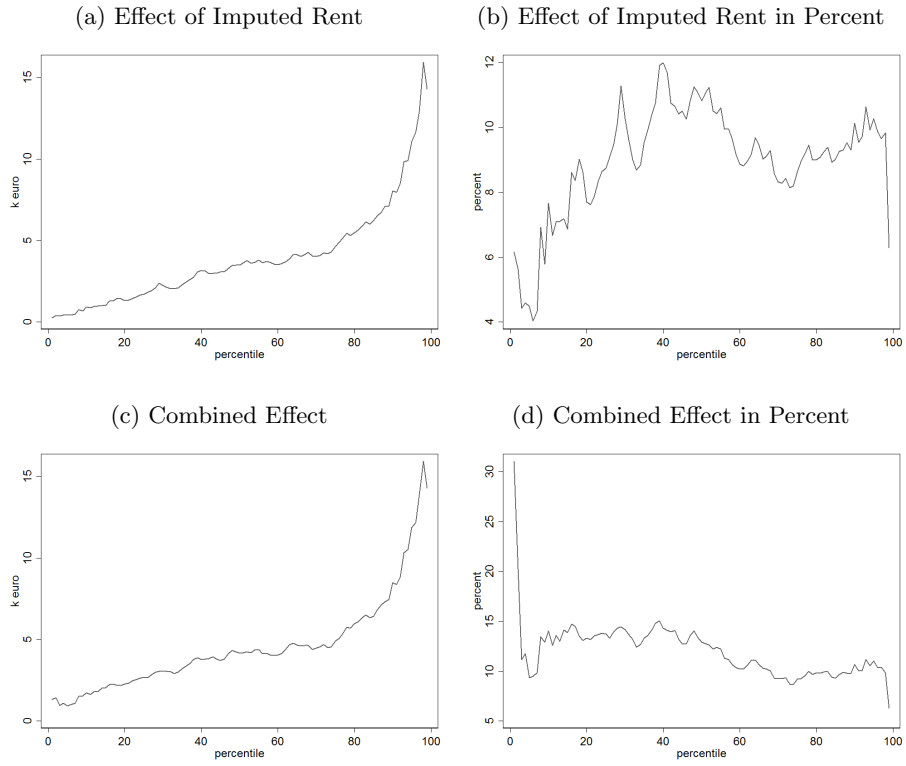
	$\nu(P(Y))$	$\nu(P(Y^s))$	$\nu(P(Y^{ir}))$	$\nu(P(Y^t))$
Gini	0.42	0.42	0.42	0.41
P75/P25	2.74	2.72	2.74	2.64
P90/P50	2.46	2.45	2.44	2.41
P90/P10	6.48	6.28	6.62	6.28

Notes:

(i) Capital approach with 3% rate of return used for imputed rents.

(ii) *Source:* HFCS Austria 2010.

Figure Appendix A.6: Effects on the unconditional income distribution using the capital approach for imputed rents



Notes:
(i) Graph (a) shows the effect of imputed rents on the full distribution of household income.
(ii) Graph (b) shows the effect of imputed rents on the full distribution of household income in percent.
(iii) Graph (c) shows the combined effect of subsidized rents and imputed rents on the full distribution of household income.
(iv) Graph (d) shows the combined effect of subsidized rents and imputed rents on the full distribution of household income in percent.
(v) *Source:* HFCS 2010.

Table Appendix A.6: Counterfactual Inequality Measures

	$\nu(P(Y))$	$\nu(P(Y^s))$	$\nu(P(Y^{ir}))$	$\nu(P(Y^t))$
Gini	0.42	0.42	0.42	0.41
P75/P25	2.74	2.72	2.73	2.64
P90/P50	2.46	2.45	2.45	2.42
P90/P10	6.48	6.28	6.48	6.17

Notes:

(i) Capital approach with 2% rate of return used for imputed rents.

(ii) *Source:* HFCS Austria 2010.

Table Appendix A.7: Counterfactual Inequality Measures

	$\nu(P(Y))$	$\nu(P(Y^s))$	$\nu(P(Y^{ir}))$	$\nu(P(Y^t))$
Gini	0.42	0.42	0.42	0.41
P75/P25	2.74	2.72	2.81	2.68
P90/P50	2.46	2.45	2.44	2.41
P90/P10	6.48	6.28	6.90	6.58

Notes:

(i) Capital approach with 5% rate of return used for imputed rents.

(ii) *Source:* HFCS Austria 2010.

Appendix A.2 Results using the Self-Assessment Approach

Analogous to graphs 4c to 4f, graphs Appendix A.7a to Appendix A.7d show the effects of imputed rents as well as the combined effects of imputed and subsidized rents on the unconditional income distribution. Instead of the rental equivalence approach discussed in section 4, the self-assessment approach is used. For the self-assessment approach, we use self-reported hypothetical gross income from renting out the main residence (again net of all operating expenses and maintenance) as imputed rent.

The absolute effect of imputed rent shown in Appendix A.7a reflects the higher imputed rents implied by the self-assessment approach. The relative effect also increases up to the middle of the income distribution, decreases somewhat less from the middle upwards, shows higher relative effects in the upper part of the distribution, and is not decreasing sharply as in the other approaches.

Analogous to table 4, table Appendix A.8 shows the effects on selected inequality measures using the self-assessment approach to estimate imputed rents.

As with the capital approach, the self-assessment approach has a less equalizing effect, and similar to the capital approach, using higher returns even changes the direction of the effect for some inequality measures as the Gini and the $P90/P10$ ratio in this case. Overall the results are relatively robust but point towards a possible overestimation of the equalizing effect using equivalent rent approaches.

Table Appendix A.8: Counterfactual Inequality Measures

	$\nu(P(Y))$	$\nu(P(Y^s))$	$\nu(P(Y^{ir}))$	$\nu(P(Y^t))$
Gini	0.42	0.42	0.43	0.42
P75/P25	2.74	2.72	2.73	2.61
P90/P50	2.46	2.45	2.45	2.41
P90/P10	6.48	6.28	6.53	6.23

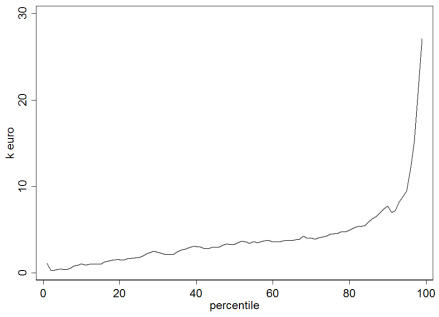
Notes:

(i) Self-assessment approach used for imputed rents.

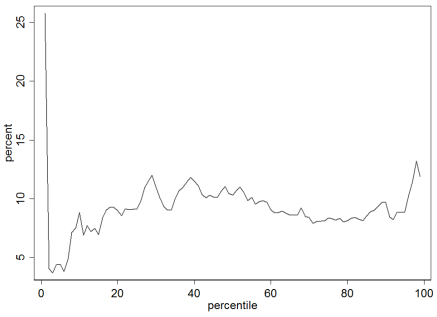
(ii) *Source:* HFCS Austria 2010.

Figure Appendix A.7: Effects on the unconditional income distribution using the self-assessment approach for imputed rents

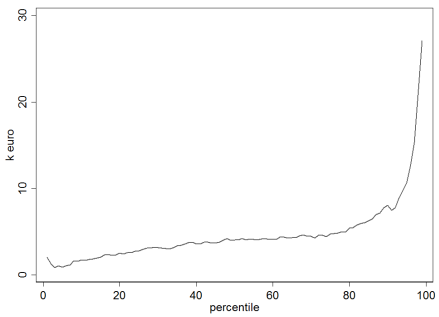
(a) Effect of Imputed Rent



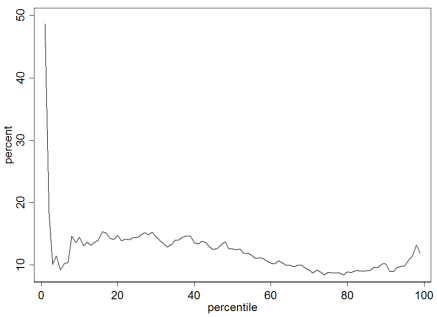
(b) Effect of Imputed Rent in Percent



(c) Combined Effect



(d) Combined Effect in Percent



Notes:
(i) Graph (a) shows the effect of imputed rents on the full distribution of household income.
(ii) Graph (b) shows the effect of imputed rents on the full distribution of household income in percent.
(iii) Graph (c) shows the combined effect of subsidized rents and imputed rents on the full distribution of household income.
(iv) Graph (d) shows the combined effect of subsidized rents and imputed rents on the full distribution of household income in percent.
(v) *Source:* HFCS 2010.