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Working Paper

Shifting the tax burden from labor to property: The case of Germany

Working Papers in Economics, No. 2016-03

Provided in Cooperation with:

Department of Social Sciences and Economics, University of Salzburg

Suggested Citation: Paetzold, Jörg; Tiefenbacher, Markus (2016) : Shifting the tax burden from labor to property: The case of Germany, Working Papers in Economics, No. 2016-03, University of Salzburg, Department of Social Sciences and Economics, Salzburg

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Jörg Paetzold, Markus Tiefenbacher

Shifting the tax burden from labor to property:
The case of Germany

No. 2016-03



WORKING PAPERS
IN ECONOMICS

Shifting the tax burden from labor to property: The case of Germany

Jörg Paetzold* and Markus Tiefenbacher†

July 2016

Contrary to frequent recommendations of the public finance literature and international institutions, a persistently high tax wedge on labor is observed in Europe. At the same time, the scope for shifting taxes from labor to more growth-friendly revenue sources appears underused in many European countries. This motivates our simulation of a revenue-neutral property tax reform for Germany, a country in which tax receipts from land are particularly low. More precisely, we assess by how much social insurance contributions (SIC) can be reduced when Germany switches from its current property tax scheme based on outdated cadastral values to one based on market property values. In order to make such a simulation possible, we match property related information with the input dataset of EUROMOD, the tax-benefit simulation model for the EU. Our results suggest that the implicit tax rate on labor could be reduced from currently 37,2% to 36,5%. Furthermore, we simulate different scenarios of the SIC reduction. Redistributive effects of these different scenarios tend to be modest and depend crucially on the design of the SIC reduction.

Keywords: Statistical Matching, Labor Tax, Property Tax, EUROMOD
JEL code: D31, C15, H12, R28, C83

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Parts of the paper were written during a research visit of Markus Tiefenbacher at the University of Essex and University of Antwerp. We would like to thank Wolfgang Brunauer, Paul Clark, Matthias Dolls, Alari Paulus, Andreas Peichl, Gerlinde Verbist and numerous seminar participants at Essex, Antwerp, Salzburg and WIFO Vienna for helpful comments and discussions. Financial support from the Humer Foundation and the Salzburg Centre for European Union Studies (SCEUS) is gratefully acknowledged. The research leading to these results has also received support from the European Commission's 7th Framework Programme (FP7/2013-2017) under grant agreement n°312691 (In-GRID - Inclusive Growth Research Infrastructure Diffusion).

1. Introduction

An overall high implicit tax rate (ITR) on labor¹ is commonly said to be detrimental to growth and employment (e.g. Arnold et al. 2011, Myles 2009, Lee & Gordon 2005). In general, the literature suggests that taxes levied on consumption or property are less distortionary and growth-harming than those levied on corporate or labor income (Diamond & Mirrlees 1971, Slemrod 1990, Feldstein 2006, Mankiw et al. 2009, OECD 2009). Despite these findings, the scope for shifting taxes to more growth-friendly revenue sources appears underused in many European countries. Germany in particular has been identified as a country which makes only little use of property taxes,² while having a high implicit tax rate on labor (see figure 1). In a similar vein, Germany has been frequently advised by various international institutions (e.g. European Commission and European Council 2015, OECD 2014, IMF 2013) to augment its growth potential through shifting the tax burden away from labor to other tax bases, such as property. More precisely, Germany has been counseled by the European Commission to update its property tax base and, once implemented, to properly monitor its redistributive implications.

The use of outdated rateable values to determine property tax liabilities are often said to be an important reason why revenues from taxing property are low in Germany (Spahn 2004). Indeed, the current valuation of property defining the tax base dates back to 1964 in Western Germany and to 1935 in Eastern Germany. Several attempts to reform property taxation have been made, e.g. an overhaul of the German *Grundsteuer* was part of the national Reform Program 2014 and 2015, but put on hold hitherto. In addition, various scholars have proposed a reassessment of these outdated cadastral values (e.g. Blöchliger 2015, Färber et al. 2014). Similar situations with very outdated cadastral values determining property tax liabilities can be found in other European countries (Andrews et al. 2011).

Our study aims to examine the revenue consequences of a property tax reform that uses market values to determine property tax liability. To assess distributional consequences, we compare pre- and post-reform property tax liabilities as well as disposable incomes across the income distribution of households. Further, we simulate two revenue-neutral scenarios in which the additional revenue is used to lower the tax burden of labor.

Simulating such a proposed policy reform is difficult since there exists no data source which provides information on both current property tax liability and the actual market value of the property.³ However, the HFCS (Household Finance and Consumption Sur-

¹The ITR measures the ratio of taxes and social insurance contributions on labor income to total compensation of employees.

²Please note 'property taxes' in this paper thenceforth describe recurrent levies on immovable property of private households, i.e. excluding transaction taxes and taxes on corporate assets.

³In its survey of 1988, the German Socio-Economic Panel (SOEP) asked respondents about the cadastral and market values of their main household residence. However, three shortcomings make the use of this joint observation impractical. First, the information dates back to 1988, and it is reasonable to assume that property values have changed substantially since then. Second, SOEP only collected rough ordinal estimates. Third and most importantly, joint observation is only available for main household residence and not any other property owned, which amounts to just a third of total real estate values in Germany.

vey) of the ECB provides extensive information regarding the value of properties owned. In addition, the EU-SILC survey (European Union Statistics on Income and Living Conditions) contains information on property taxes currently paid. In order to conduct our simulation analysis, we have to match the two representative survey micro datasets.

We use statistical matching to assign the value of a households' property owned from HFCS to at least one household unit in SILC. Performing a number of validity checks we find that especially on a more aggregate level such as household income deciles, the matched dataset preserves the properties of the original HFCS dataset sufficiently well. The matched dataset is then used to simulate a reform in which the tax base is no more defined by the (outdated) cadastral value but the market value of the property. Thus, we can contrast the new after-reform property tax liability to the current property tax liability. In a first scenario, we assess the potential revenue gain induced by the use of market values. Next, we simulate a revenue-neutral scenario in which the additional revenue is used to lower social insurance contributions (SIC) via a lump sum SIC credit. As a third scenario, we simulate a proportional reduction of social insurance contributions, again under revenue-neutrality. All simulations are carried out using EUROMOD – the tax-benefit microsimulation model for EU member states. It allows to monitor changes in households' disposable income before and after the simulated property tax reform, and under the two revenue-neutral scenarios.

On the macro level our simulations suggest that the revenue from property taxation would raise from currently 10,9 bil. € to 18,9 bil. €. This additional revenue would allow a reduction of the implicit tax rate on labor from currently 37,2 % to 36,5 %. On the micro level, our results first indicate that the percentage increase in the property tax liability is roughly constant across the income distribution of property owners. Hence, the relative size of the property tax liability across the income distribution of homeowners is by and large preserved, which means that the reassessment of cadastral values may not hurt a certain income group of property owners in particular. Second, when examining the effect of the proposed update of cadastral values (again *without* redistributing the additional revenue) across the entire income distribution, we find that the percentage change in disposable income varies little across income deciles. Thus, an update of cadastral values without using the additional revenue to lower the tax burden on labor would render such a reform virtually neutral in terms of redistribution.

Finally, we simulate two revenue-neutral scenarios in which the additional revenue is used to lower the tax burden on labor. We find that the distributional effects of the revenue-neutral scenarios are relatively modest and depend on the way in which the tax reduction on labor is implemented. Specifically, we show that when a lump sum SIC credit is granted, all household deciles would gain in disposable income except of the top three ones. In contrast, when using the additional revenue for a proportional reduction of social insurance contributions, the effect on disposable income is small and relatively constant across the income distribution.

Our results relate to existing literature in a number of ways. First, several proposals have been made for Germany to increase tax revenues from wealth and property (see, e.g., Bach et al. 2014, Färber et al. 2014). Our paper adds to this literature by assessing the

revenue potential of an important policy proposal regarding the German property tax, namely the update of the outdated cadastral values. Furthermore, previous authors have pointed out that the redistributive element of the German property tax in its current form is very limited (Bach & Schratzenstaller 2013). Our results support this view and indicate that this would not be substantially different once cadastral values are updated. In fact, our findings suggest that the potential for redistribution (if desired by the legislator) hinges on the simultaneous reduction of the tax wedge on labor. In sum, we are the first to analyze both potential revenue and distributional effects for Germany when updating its cadastral values.

Furthermore, our study relates to literature using EUROMOD to simulate tax and benefit reforms for EU member states. So far, little empirical work has been dedicated to property related tax simulations using EUROMOD, mostly driven by inherent data limitations of EU-SILC. A notable exception is Moscarola et al. (2015), using a tax shift from labor to property in Italy to assess labor market equilibrium of an increase in tax credits on low incomes. In a similar vein, Figari et al. (2016) investigate the fiscal and distributional consequences of including homeowners' imputed rent in personal taxable income as some kind of property tax for six European countries. Using up-to-date property values to determine property taxes could be regarded as an important complement (and maybe even as a substitute depending on the specific design) to housing income taxation. Finally, Figari et al. (2015) currently create a EUROMOD input database directly from the HFCS dataset. Their approach aims at broadening the scope of EUROMOD by including information on wealth from HFCS, but they do not combine this with EU-SILC data. The novelty of our paper is the creation of a new dataset via statistical matching that allows analyses regarding two variables which have never been jointly observed, namely the current property tax liability and the actual market value of the property. Our approach may potentially be extended to other European countries covered by EUROMOD, providing a fruitful avenue for further research.

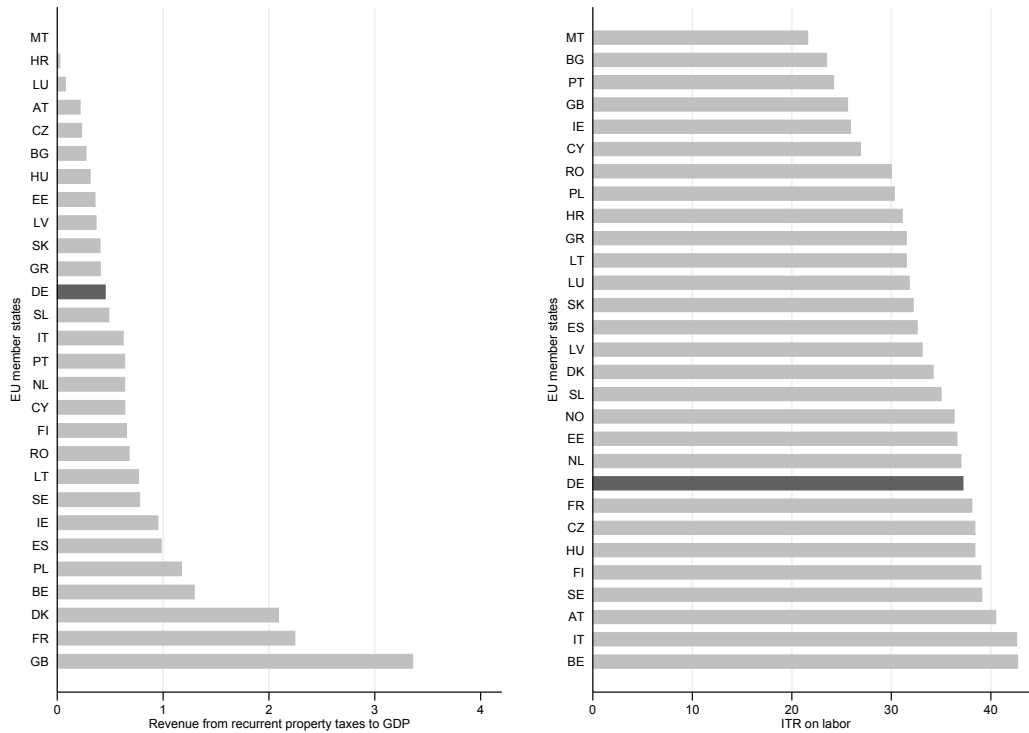
The remainder of this paper is organized as followed. Section 2 illustrates the institutional background of property taxes in Germany. Section 3 describes the applied merge of two never jointly observed household characteristics - current property tax liabilities and the market value of the underlying property - via statistical matching. An analysis of the yield matching results is provided in section 4. The modeled property tax function and the distributional effects of a property tax reform are described in section 5. The final section contains a conclusive discussion of our results.

2. Motivation and institutional background

As stressed above, Germany seems to have considerable scope to reform the valuation of property used for property taxation. Basic cross-country comparable descriptives underpin this view. Figure 1 illustrates large disparities across EU-28's member states with regard to revenue of property taxes and the implicit tax rate on labor. Revenues from property taxes remain comparatively low in Germany (0.44% of GDP vs. 1.5% in EU-28). At the same time, the ITR on labor in Germany is above average (37,2% vs.

36.1% in EU-28).

Figure 1: Revenue from property taxation to GDP & implicit tax rate on labor, EU-28 member states 2010



Notes: The left bar chart shows in descending order the percentage of national revenues collected from recurrent property taxes (as % of GDP). The right bar chart compares percentage points of implicit tax rate (ITR) on labor. The ITR is defined as the ratio of all direct and indirect taxes including social security contributions levied on employed labor income to total compensation of employees.

Source: European Commission (2014)

So far, several attempts to reform German property taxation have been made, e.g. an overhaul of the *Grundsteuer* was part of the national Reform Program 2014 and 2015 but put on hold hitherto. As a consequence, the current valuation of property continues to date back to 1964 in Western Germany and to 1935 in Eastern Germany. Back then, rateable values⁴ were assessed on the basis of capitalized gross returns (i.e. rental income) or, in the case of owner occupied dwellings, on the basis of construction costs (for details see Spahn 2004). The original intention of the legislator was to update the property value on a regular basis, but this was never put into practice.⁵ To make cadas-

⁴Please note that we use the term cadastral and rateable value interchangeably.

⁵To at least partly offset the nominally fixed cadastral values, municipalities use local tax multipliers to the federal rate. However, the multipliers are set on municipality level only and hence, do not account for heterogenous developments of property values within a given municipality. In addition,

tral values comparable and fair, even new buildings, sales or improvements to existing buildings are rated to market values of 1964. Hence, the valuation of German properties dates back to market values decades ago, resulting in cadastral values which differ substantially from current market values.⁶ In sum, the link between the property tax liability based on outdated cadastral values and the actual market value became very weak (Wissenschaftlicher Beirat BMF 2010).

From a policy perspective, two reasons render a reform of the current property tax system in Germany important and hence, our simulation relevant. First, a sunset clause in the German Finanzausgleich - an equalization payment in the German multi-level government - makes its reorganization inevitable by the end of 2018. Since it is often argued that reforms of property tax regimes should be linked to reforms of intergovernmental fiscal frameworks (e.g. Devereux et al. 2007), we consider the sunset clause as a window of opportunity for an overhaul of property taxation in Germany. Second, two pertinent constitutional complaints (BvR 639/11 and 1 BvR 889/12) are currently pending before the Federal Constitutional Court. It is generally assumed the court will hold the continued failure to conduct a general reassessment of property values to violate the equality-of-treatment clause of the constitution.

3. Description of Data used for the Simulation

This paper uses matching of the HFCS and EU-SILC data to simulate revenue and distributional effects of an update of cadastral values in Germany. As mentioned above, matching the two datasets is necessary since the two most important variables for such a simulation - current property tax liability and value of properties owned - are never jointly observed. Table 1 illustrates the idea of combining the two datasets in order to jointly observe these two variables.

Table 1: Illustration of missing information problem

| | SILC | HFCS | matched dataset |
|----------------------|-------------|-------------|------------------------|
| property value Y | ✗ | ✓ | ✓ |
| tax liability X | ✓ | ✗ | ✓ |
| matching variables Z | ✓ | ✓ | ✓ |

Information regarding the current property tax liability can be obtained from EU-SILC. The European Union Statistics on Income and Living Conditions (SILC) is a representative survey coordinated by Eurostat that encompasses detailed information on

the increase in weighted average multipliers since 1974 only accounts for 58% of inflation adjustment (source: own calculations based on data from the Federal Statistical Office). Further details provided in section 5.1.

⁶Already in 1992, German fiscal authorities executed a comparison of selling prices with underlying cadastral values and found a ratio between 5 and 10 to 1 (Bach et al. 2012).

income, benefits, taxes and certain demographic characteristics. Its main limitation is the lack of information on household wealth. In contrast, the Eurosystem Household Finance and Consumption Survey (HFCS) provides household- and individual-level data on assets and liabilities, income and indicators of consumption and credit constraints. For Germany, the *Bundesbank* conducted this detailed survey to collect for the first time rich micro data on households' wealth and debt.⁷ Hence, the HFCS allows to observe the characteristics of properties a household owns, especially the value of these estates.

Table 2: Summary Statistics of SILC and HFCS

| | SILC | | | HFCS | | |
|----------------|--------|-----------|--------|-----------|-----------|-----------|
| | mean | std. dev. | median | mean | std. dev. | median |
| household obs. | 13.079 | | | 3.565 | | |
| tax_liability | 345 € | 494 € | 250 € | | | |
| main_resid | | | | 220.432 € | 190.058 € | 180.000 € |
| other_prop | | | | 264.924 € | 678.954 € | 115.000 € |

Notes: tax_liability: Recurrent property tax liability yearly paid for all owned immovable properties. main_resid: (self-assessed) value of main household residence - dwelling where members of the household live. other_prop: (self-assessed) value of the total number of owned properties other than main residence. *Source:* Own calculations based on sample of property owners in German HFCS and SILC, respectively.

Finally, both surveys contain a number of overlapping variables we will use for the matching procedure. In sum, we receive two representative datasets for Germany, with the EU-SILC sample being considerably larger, including 13,079 households compared to 3,565 households in the HFCS. Summary statistics on the core variables of interest in the two datasets used are presented in table 2. Conditional on owning other properties, dwellings other than the main residence counts for 57% of real estate wealth (though this condition only applies to 41% of all proprietors). Please note, for the aggregate property tax revenue this means that two thirds stems from owner-occupied housing and one third from other property. In line with Lindner (2015) and Zhan (2015), we find owner-occupied property and other real estate as the quantitatively most important wealth components.

3.1. Coherence check of datasets

Before applying statistical matching it is important to make sure that data collection and survey design of HFCS and SILC are comparable. As a matter of fact, HFCS and EU-SILC have the same target reference population, namely all private households in Germany. Both surveys exclude all institutionalized population, i.e. people living in retirement homes, health care -, religious -, correctional and penal institutions. The ref-

⁷For a comprehensive methodological and descriptive report of the HFCS data we refer to Eurosystem Household Finance and Consumption Network (2013).

reference units are defined as all age 16+ members currently living in the same household. Reference point of time for balance sheet items is in both surveys the date of interview. Interviews for EU-SILC were held between 05/2010 – 11/2010. The field work for HFCS data was conducted from 09/2010 – 07/2011. Both surveys use the same income reference period, which is 2009. Finally, due to the potential non-response bias, HFCS tries to oversample wealthier households. In contrast, SILC does not apply such oversampling. However, it is important to note that for Germany, we find one of the best data coherence between HFCS and EU-SILC among the 15 euro area countries regarding potential matching variables. For instance, the median annual gross income differs by less than 100 €. In sum, we conclude that regarding target population, household definition as well as reference period, the two survey designs appear to be sufficiently coherent to allow statistical matching.

3.2. Methodology of Statistical Matching

How can two household characteristics which are never jointly observed - current property tax liability (X) and property value (Y) - be jointly used? Statistical matching (also known as data fusion) aims to create a complete data file from different sources which do not contain the same units. The difference to record linkage which deals with *identical* units, like e.g. individual names or social security numbers, is that statistical matching deals with *similar* ones (Rässler 2002). Statistical matching in our context allows for imputing the property value Y from HFCS (donor) to SILC (recipient) via a number of appropriate matching variables (Z)(see table 1). These matching variables should be strongly correlated with the merger variable Y and be jointly observed with (Y) as well as (X), i.e. appear in both datasets .

Statistical matching has received increasing attention in the last years. For instance, Eurostat recently started feasibility studies to evaluate how statistical matching can be used as a tool to integrate information from several existing data sources (e.g., Eurostat 2013, Webber & Tonkin 2013). This highlights an important reason that makes statistical matching an attractive technique: When the joint collection of several relevant household's aspects comes at very high costs or is not feasible, alternative methods such as statistical matching can be advisable (Leulescu & Agafitei 2013).

Statistical matching is often described as a non-response phenomenon (Rässler 2002). Hence, one can think of a 100 % non-response rate of the question on value of properties owned in the EU-SILC survey. However, EU-SILC does provide information on who owns property and how much property tax they pay. In the following section we will present a careful selection of matching variables in order to assign respondents of EU-SILC (who do own property) the corresponding market value of the property.

3.3. Identification of matching variables

As mentioned above, the careful selection of the matching variables is crucial when using statistical matching. Little & Rubin (2014) state that the choice of suitable matching variables present in both datasets has a greater impact on the validity of the matching

implementation than the matching technique effectively used. In the spirit of the stepwise approach of Leulescu & Agafitei (2013), we apply the following three key steps to choose appropriate matching variables:

First, we carry out a data reconciliation process to correct variables discrepancies of HFCS and SILC due to the use of different technical definitions or variable concepts. For instance, we harmonize potential matching variables when their scale of measure differed. Sometimes such harmonization is not possible when the level of detail and accuracy lie far apart.⁸ In such cases, we decided not to consider these variables for the matching procedure. Appendix A.1 provides a comprehensive summary of the reconciliation process and a list of the common set of variables from both surveys.

Second, it is important that the common set of variables (i.e. our potential matching variables), which appear both in HFCS and SILC, show similar distributions. We apply Hellinger Distance (HD), a measure to evaluate similarity of variable distribution of two different datasets (Webber & Tonkin 2013, Eurostat 2013). Equation (1) assesses the similarity /dissimilarity between donor HFCS and recipient SILC for each potential matching variable. A HD value of 0 can be interpreted as perfect similar and a value of 1 as perfect discrepancy. As commonly stated in the literature, an HD of over 5% raises concerns about the similarity in marginal distributions (e.g., Leulescu & Agafitei 2013).

$$HD(V, V') = \sqrt{\sum_n^K \left(\sqrt{\frac{n_{Di}}{N_D}} - \sqrt{\frac{n_{Ri}}{N_R}} \right)^2} \quad (1)$$

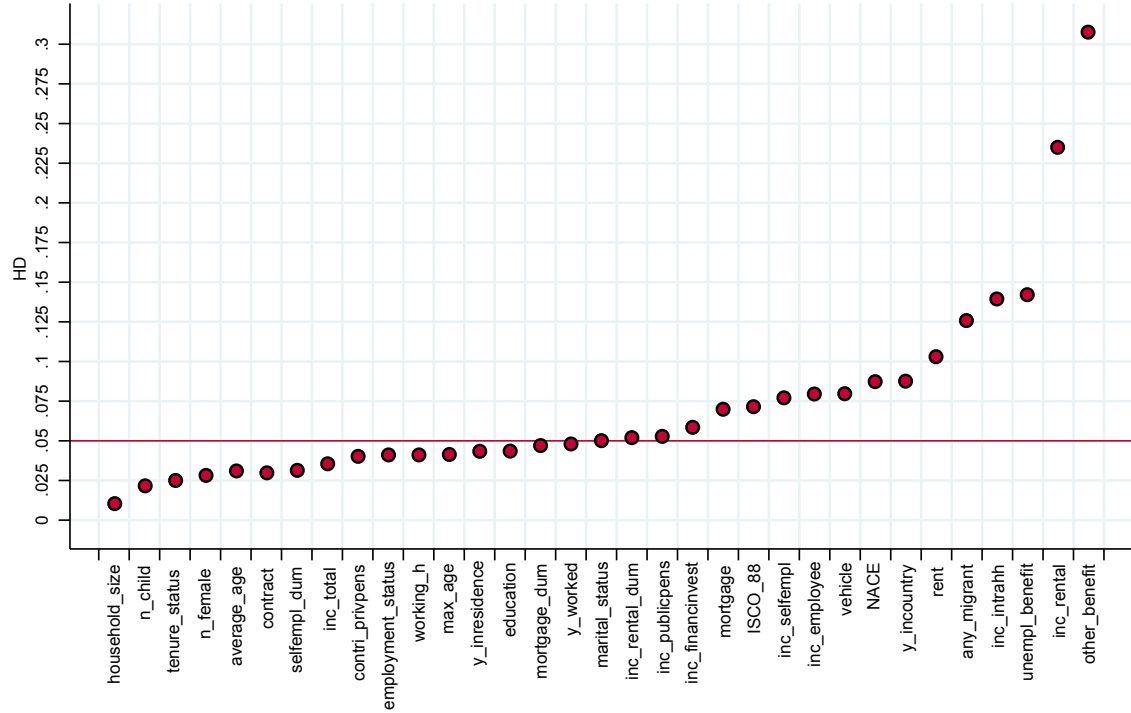
Let V be the donor dataset (HFCS) and V' the recipient dataset (SILC), K is the total number of cells in a contingency table, n_{Di} is the frequency of cell i in donor data D , n_{Ri} denotes the frequency of cell i in recipient data R and N be the total size of the specific contingency table.

We calculate HD metrics on a truncated dataset. To be more precise, only HFCS units that own property are taken into account as only this subsample is liable to property taxation. This restriction reduces noise as it prevents the matching of property values to households not liable for property taxation. In a similar vein, we also restrict the recipient file to observations liable to property taxes.

Figure 2 indicates that for quite some variables, the HD metric is below 5%. For instance, most of the demographic variables from both surveys show a strong degree of similarity regarding their distributions. Furthermore, total household (gross) income and contributions to private pension plans are very similar across both surveys. More importantly, variables capturing whether a person has rental income or its tenure status are very evenly distributed in both survey. Unsurprisingly, relatively low similarity is found for variables measuring welfare transfers. All other variables exceeding the 5%

⁸To give an example, HFCS inquired total welfare benefit transfers on household level, whereas SILC collected at an individual level old-age benefits, survivor' benefits sickness benefits, disability benefits and education-related allowances separately. As a consequence we had to eliminate gross cash income from regular social transfer from the potential set of matching variables.

Figure 2: Comparing extensive margins of common variables



Notes: Hellinger Distance metrics for common coherent variables with reference line at 0,05. For further information on variables abbreviations, we refer to appendix A.1.

Source: Own calculations based on sample of property owners in German HFCS and SILC, respectively

threshold are not used for the matching, as this would introduce noise to our analysis. Additional tests comparing weighted means by using simple t-tests confirm our selection of suitable variables based on the HD metrics.

As a third step, we want to test the explanatory power of the set of common variables which fulfill the condition of coherence and similarity of distributions (i.e. all variables not exceeding the 5% threshold in figure 2). According to D’Orazio et al. (2006), common variables for matching should be selected on the basis that they significantly explain the variation in the merger variable Y , that is the value of properties owned. As standard in the literature, the null hypothesis of no association between common variables and market value of property is tested. We run Rao-Scott tests, a correction of Chi-squared tests for contingency tables when the estimated cell proportions are derived from survey data (Rao & Scott 1981). In order to provide also a measure of strength of association between two variables, the Pearson correlation coefficients are calculated. Appendix A.2 shows results for the Rao-Scott test and Pearson correlation coefficient.⁹ As depicted in

⁹Our results stay qualitative the same when applying multivariate statistics such as stepwise regressions (results available upon request).

table A2, 13 of the 19 variables that have been found to be similarly distributed across both surveys are also significantly correlated with our merger variable Y. Hence, based on overall coherence, similar distributions and sufficient predictive power, we select a set of 13 variables suitable for statistical matching. Table 3 provides an overview of all variables considered for statistical matching, with the 13 variables eventually used for statistical matching shaded in gray.

Table 3: Summary of matching variables

| Variable Name | Coherence | Distributional Similarity | Explanatory Power |
|-----------------------------|-----------|---------------------------|-------------------|
| max_age | ✓ | ✓ | ✓ |
| average_age | ✓ | ✓ | ✗ |
| n_female | ✓ | ✓ | ✗ |
| n_child | ✓ | ✓ | ✗ |
| household_size | ✓ | ✓ | ✓ |
| marital_status | ✓ | ✓ | ✗ |
| any_migrant | ✓ | ✗ | |
| y_incountry | ✓ | ✗ | |
| employment_status | ✓ | ✓ | ✗ |
| education | ✓ | ✓ | ✓ |
| ISCO_88 | ✓ | ✗ | |
| NACE | ✓ | ✗ | |
| contract | ✓ | ✓ | ✗ |
| y_worked | ✓ | ✓ | ✓ |
| working_h | ✓ | ✓ | ✓ |
| inc-employee | ✓ | ✗ | |
| inc_selfemployed | ✓ | ✗ | |
| inc-selfemployed_dum | ✓ | ✓ | ✓ |
| inc_publicpens | ✓ | ✓ | ✓ |
| unempl_benefit | ✓ | ✗ | |
| inc_financeinvest | ✓ | ✗ | |
| other_benefit | ✓ | ✗ | |
| contri_privpens | ✓ | ✓ | ✓ |
| mortgage | ✓ | ✗ | |
| mortgage_dum | ✓ | ✓ | ✓ |
| inc_rental | ✓ | ✗ | |
| inc_rental_dum | ✓ | ✓ | ✓ |
| inc_intrahh | ✓ | ✗ | |
| inc_total | ✓ | ✓ | ✓ |
| tenure_status | ✓ | ✓ | ✓ |
| rent | ✓ | ✗ | |
| y_inresidence | ✓ | ✓ | ✓ |
| vehicle | ✓ | ✗ | |

3.4. Matching procedure

To construct the link between the HFCS and SILC dataset, we use a so-called hot deck matching procedure. This non-parametric matching technique assigns each observation in HFCS to at least one “nearest neighbor unit” in SILC that is most similar with respect

to the matching variables. “Nearest” is defined as the associated observational unit that shows the smallest distance metric based on our set of matching variables.

Two drawbacks would make the use of the most common (Euclidian) distance metric in our context questionable. First, Euclidian distance is extremely sensitive towards the measurement scale of covariates (Maesschalck et al. 2000). Second, strongly correlated covariates like years in main household residence and age of oldest household member would be overestimated, as Euclidian distance is sensitive to multicollinearity. Hence, we decided to use the unitless and scale-invariant Mahalanobis distance metric, which accounts for the above mentioned issues of scale and multicollinearity. By standardizing the distribution it accounts for the fact that the dimension of our matching variables do not have the same units. The covariance matrix C accounts for correlations between matching variables. Intuitively, Mahalanobis distance transforms the data into uncorrelated, standardized variables with variance equals to 1 and then computes for the transformed data the ordinary Euclidean distance between two vectors \underline{x} and \underline{y} (McLachlan 2004). Let the superscript T denote the matrix transpose, Mahalanobis distance between a HFCS observation $\underline{x} = (x_1, x_2, x_3, \dots, x_N)^T$ and a SILC observation $\underline{y} = (y_1, y_2, y_3, \dots, y_N)^T$ is then defined as:

$$d(\underline{x}, \underline{y}) = \sqrt{(\underline{x} - \underline{y})^T C^{-1} (\underline{x} - \underline{y})} \quad (2)$$

As already stated, our recipient dataset (EU-SILC) is more than three times larger than the donor dataset. This disproportionateness is not necessarily a drawback but entails a further implication. Donor units may be used for different recipient units repeatedly. Such a marriage algorithm is known as polygamy (Rässler 2002). If the marriage is restricted to a single spouse (monogamy) we would lose almost three quarters of our SILC observations. Hence, we opted for a $n > 1$ nearest neighbor match based on minimum distance with multiple use of donor units (from HFCS) but put a limitation to the number of matches $n = 1$ made per SILC observation. The final matched dataset we generate consists of 13,079 household observations among which the 6,629 households eligible to property taxes are actually enriched by the market value of their properties. In the next section we will compare its properties and marginal as well as joint distributions to the original HFCS dataset.¹⁰

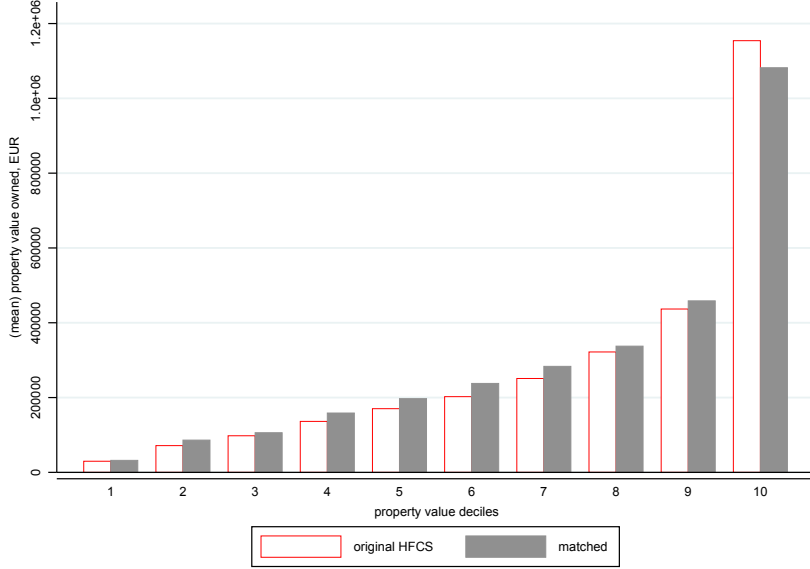
4. Assessment of the Matching Result

In order to assess the validity of our matching procedure, we start with analyzing the consistency of the overall marginal distribution. Therefore, we follow established literature and compare the mean value of property owned per property decile between the matched dataset and the original HFCS dataset (Rässler 2002). Visual inspection of figure 3 shows quite similar distributions of our matched property values. More formally, we

¹⁰We also applied two other matching procedures for the data fusion, namely a mixed method regression-based approach and a propensity score matching approach. Using these two matching procedures, we receive qualitatively similar results (available upon request).

perform a two-sample Kolmogorov-Smirnov test comparing the equality of the weighted distributions. Using this test, we cannot reject the null hypothesis that the distribution of property values in the HFCS and the matched dataset are equal. In addition, we again use the HD-test as a measure for similarity of distributions and find that the marginal distribution of property values in HFCS is preserved in the matched dataset.

Figure 3: Marginal distribution of original HFCS values and matched data



Notes: The figure displays mean property values per property deciles from the original HFCS as well as the matched dataset. The figure is restricted to survey respondents who own property. The red bars represent the distribution of the original HFCS property values. The grey-shaded bars display the distribution of property values in the matched dataset.

As a next step, we analyze the joint distributions of the matching variables and the merger variable in the original HFCS dataset and the matched dataset. Appendix A.3 separately depicts the joint distribution of our merger variable - property value - with each matching variable. Simple eye-balling of appendix A.3 indicates quite similar joint distributions in both datasets. Furthermore, we perform parametric tests to detect significant differences in the joint distributions of the matching variables and the merger variable. First, we run two separate univariate regressions of property value (=the dependent variable) on each matching variable (=the independent variable): One regression using the original HFCS dataset and the other regression using the matched dataset. We then perform a Wald test on the equality of the two estimated coefficients from both datasets, testing the hypotheses:

$$H_0 : coefficient_{HFCS} - coefficient_{matched} = 0$$

In order to not only compare means but get a deeper understanding whether the joint distribution is preserved in the matched dataset, the same procedure is conducted

using quantile regression. We estimate quantile regressions with coefficients for the 75th quantile.¹¹ The first column of table 4 shows that for the mean regression, the H_0 cannot be rejected across all matching variables. Looking at the results based on quantile regressions (the second column), we continue to find no significant differences in the distribution for most of the matching variables. In sum, our results suggest that both the marginal and joint distributions in the original HFCS are sufficiently preserved in the matched dataset.

Table 4: Assessing preservation of joint distribution

| matching variables | Wald Test | |
|--------------------|-----------------|-------------------------|
| | mean regression | .75 quantile regression |
| | Prob > chi2 | Prob > chi2 |
| household_size | 0.6824 | 0.6129 |
| tenure_status | 0.6037 | 0.1551 |
| selfemployed_dum | 0.9039 | 0.1218 |
| inc_total | 0.8655 | 0.2747 |
| contri_privpens | 0.3472 | 0.0742 |
| working_h | 0.2727 | 0.0345 |
| maxage | 0.6854 | 0.5948 |
| y_inresidence | 0.7232 | 0.3726 |
| education | 0.3201 | 0.7101 |
| mortgage_dum | 0.3547 | 0.0520 |
| y_worked | 0.4526 | 0.1632 |
| inc_rental_dum | 0.9839 | 0.8015 |
| inc_publicpens | 0.8475 | 0.1050 |

Notes: For each matching variable we separately carry out a Wald test adjusted for survey data. The null hypothesis tests whether the univariate regression coefficients on property values do not differ between the original HFCS dataset and the matched dataset.

As a final step, we make use of auxiliary information to assess the quality and validity of the matched dataset. We do this by employing a so-called “hook variable” of the donor set (HFCS) which can be used as a proxy for the X variable of interest (i.e. current property tax liability in SILC). Specifically, we use the variable *property value at time of acquisition* (which we only observe in HFCS) as an instrument for the current property tax liability (which we only observe in SILC). The idea is that for survey respondents who acquired their property around the year of the last general assessment in 1964, the variable *property value at time of acquisition* should be highly correlated with the cadastral value of this property and thus, with the current property tax liability. Put differently, for property bought around 1964 the link between the property value at time of acquisition and its cadastral value should be much stronger than for property acquired

¹¹Using quantile regressions on .50 and .95 quantile we receive similar results.

in more recent years and hence, represents a viable predictor of the current property tax liability. Thus, we can use survey respondents who acquired their property around 1964 to assess the quality of our matched dataset by comparing the post-match rank position of their property value at time of acquisition with the rank position of their current property tax liability.¹² To ensure validity of the hook variable, we have to put restrictions on our sample conditional on two household characteristics:

- the property was acquired around the year of the last assessment of the cadastral value, i.e. 1964 (we set an interval of ± 5 years)
- the household owns no other property than its main residence

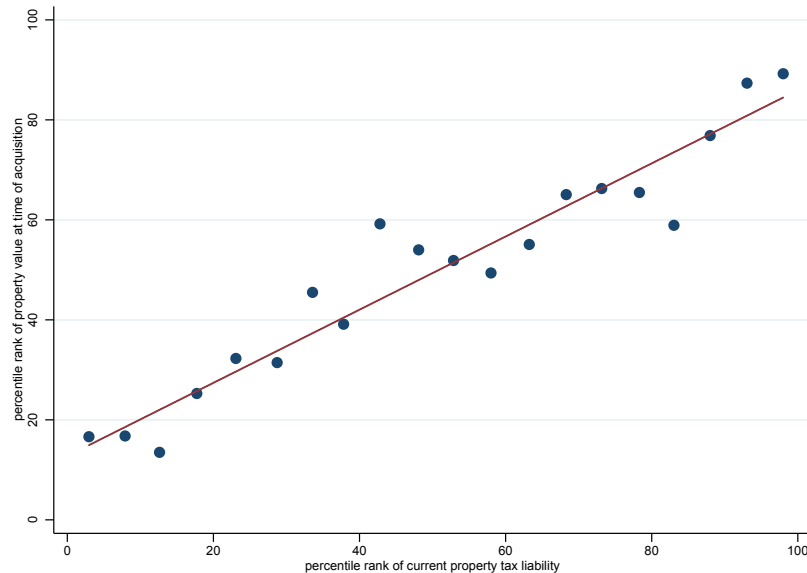
The imposed limitation to households whose only property is their main residence stems from the fact that the information *properties value at time of acquisition* is only inquired for the dwelling the household is living in. Furthermore, SILC does not distinguish between the property tax liability of the main residence or of other properties. Hence, we focus on households whose only property is their main residence. The second requirement concerns the time of acquisition. If the property was acquired around the year of the last assessment of the cadastral values, its (market) value at time of acquisition should come very close to the cadastral value of the property.¹³ Since current property tax liability is a function of the cadastral value, the value of property acquired around 1964 gives a viable predictor for the current property tax liability. In addition, we choose an 5-year interval around the last update to receive a sufficient sample size. Finally, we obtain a subsample of 9 % of households who are eligible to property taxation and fulfill the above mentioned conditions.

In the following we examine whether the post-match rank distribution of the property tax liability equals the post-match rank distribution of the property value at time of acquisition. Figure 4 presents a binned scatter plot of the mean rank position of the property value at time of acquisition vs. the rank position of the current property tax liability. The rank-rank relationship is almost perfectly linear, suggesting that our matching procedure assigns current tax liability to the underlying property value reasonably well. The relationship between the two ranks is measured via a Spearman’s rho and yields $\rho = 0.74$. Given that we have no information about improvements made to the property since 1964 (which would change the cadastral value of the respective property and hence, its property tax liability), we consider this a sufficiently high degree of similarity. In sum, we conclude that our matched dataset should allow for valid inferences, especially on a more aggregated level such as income deciles. In the next section 5 EUROMOD simulations are run on this matched dataset.

¹²In contrast, for property bought in more recent years, the link between the property value at time of acquisition and its cadastral value is weaker.

¹³Please note that in 1964 the legislator defined cadastral values as “the price that could be realized [...] in the case of a sale” (see Spahn 2004)

Figure 4: Post-match relationship between current property tax liability and property value at time of acquisition for a subsample of households



Notes: This figure presents a binned scatterplot of the relationship between a household’s rank position of the property value at time of acquisition and a household’s rank position of the current property tax liability using our matched dataset. To construct the figure, we split observations into 20 equal-sized bins based on the rank position of the current property tax liability and plot the mean rank position of the property value at time of acquisition within each bin (the y -axis). The figure is based on a subsample of households which acquired the property around the year of the last assessment of cadastral values (1964). See text for details.

5. EUROMOD simulation

EUROMOD is a comprehensive tax-benefit microsimulation model that enables researchers and policy analysts to run counterfactual simulations and assess the effects of tax (or benefit) reforms on household disposable incomes and tax revenues. It applies tax-benefit policy rules to harmonized micro-data and calculates the effects of these rules on household disposable income (Sutherland et al. 2013). The German component of EUROMOD reproducing the 2010 German tax-benefit system has been validated through comparison with aggregate statistics provided by the fiscal authorities (Ochmann & Granados 2011). We run all tax-benefit policy rules at their 2010 setting and then augment the model with a simulated change in property and labor taxation. Hence, our static simulation model calculates household disposable income under the current as well as the reformed tax-benefit rules to evaluate the distributive effects of the proposed reform.¹⁴

¹⁴The model is static in a way that it abstracts from behavioral changes such as labor supply, avoidance or the tax incidence. For Germany, relatively modest labor supply responses have been found by existing literature (for an overview, see Bargain & Peichl (2013)). Furthermore, Löffler & Siegloch (2015) using German data find that in the short run, the incidence of the property tax is borne by landlords. Other scholars argue that this might also be the case in the long-run (Broer 2013).

5.1. Current property taxation and proposed reform

This section provides some (institutional) details regarding property taxation in Germany and our proposed policy reform. We focus on the property tax levied on land, buildings and improvement (*Grundsteuer B*), leveraged by municipalities. They collect it and appropriate its proceeds. However, all legal regulations of the German property tax, i.e., the definition of the tax base, federal tax rates as well as legal norms regarding the property assessment are set at the federal level. In its current version, the German property tax is calculated as the product of three components: The cadastral value of the property, the federal tax rate and the municipality tax multiplier. Equation (3) formally shows the calculation of the property tax liability:

$$prop_tax = tax_multiplier_{local} * tax_rat_{federal} * rateable_value \quad (3)$$

The tax multiplier is set by the local municipality and has been raised by most German municipalities over time (Löffler & Siegloch 2015). This reflects the attempt by municipalities to at least partly offset the nominally fixed cadastral values.¹⁵ In contrast, federal tax rates have rarely been changed over the last decades and range from 0.26 to 1.0 %. Table 5 displays the federal property tax schedule. The main reason why the federal tax rate differs between West - and East Germany lies in the different reference year regarding the assessment of rateable values in the two parts of the country (1964 for West - and 1933 for East Germany, respectively).

Three Alternative Reform Scenarios. We simulate three different scenarios in conjunction with the proposed property tax reform. While the first simulation updates the cadastral values without changing any other taxes, the other two scenarios seek to shift part of the tax burden from labor to property:

- **(1)** The update of cadastral values is non-revenue neutral: In this first scenario we estimate the additional tax revenue collected from the update of property values irrespective of budget neutrality.
- **(2)** Revenue neutrality through a lump sum SIC credit: The extra revenue from the update of cadastral values is offset by a non-refundable lump sum SIC credit granted to all employees (all employees with positive SIC). This means that the extra tax revenue is given back as an equal SIC credit to all employees paying SIC.
- **(3)** Revenue neutrality through a proportional reduction of employees' SIC: Under this scenario, the additional revenue is used to grant a rebate that is proportional

Moreover, it has been proposed that a reformed property tax should use legal requirements to prevent shifting of the tax to tenants (Fuest 2016). Finally, we abstract from administrative costs associated with the proposed policy reform. Bach et al. (2014) estimate the total costs of tax assessment with regard to an one-time capital levy on net wealth for Germany to be modest with around 5%.

¹⁵Please note that using the local tax multiplier to offset nominally fixed cadastral values does not provide a comprehensive remedy against outdated rateable values. For instance, any adjustment of the tax multiplier occurs on municipality level only and hence, does not account for heterogenous developments of property values within a given municipality. In addition, the increase in weighted average multipliers since 1974 only accounts for 58% of inflation adjustment (Source: Own calculations based on data from the Federal Statistical Office of Germany).

to the SIC payment of an employee.¹⁶

Table 5: Design of federal tax rate *Grundsteuer B*

| Western <i>Länder</i> | | Eastern <i>Länder</i> | | | |
|---|----------|---|------------------------|--------------|--------|
| cadastral values updated in 1964 | | cadastral values updated in 1933 | | | |
| building type | tax rate | building type | tax rate by population | | |
| | | | <25k | 25k - 1.000k | >1000k |
| | | | built before 1924 | | |
| one-family-house | | one-family-house | | | |
| first 38,347 € | 0,26 | first 15.339 € | 1,0 | 0,8 | 0,6 |
| additional value | 0,35 | additional value | 1,0 | 1,0 | 1,0 |
| two-family-house | 0,31 | other houses | 1,0 | 1,0 | 1,0 |
| | | | built after 1924 | | |
| | | one family house | | | |
| | | first 15.339 € | 0,8 | 0,6 | 0,5 |
| | | additional value | 0,8 | 0,7 | 0,6 |
| | | other houses | 0,8 | 0,7 | 0,6 |
| | | | vacant lots | | |
| | | business purpose | 1,0 | 1,0 | 1,0 |
| other / vacant lots | 0,35 | other | 0,5 | 0,5 | 0,5 |

Proposed Property Tax Reform. We simulate a property tax reform in which the taxable base - the rateable value - is no more defined by the cadastral value of the property but by its current market value. Since the rise of the municipality multiplier since 1964 mostly reflects the fact that the cadastral values were not adjusted to inflation, we do not apply them when calculating the new property tax liability. This is consistent with the idea to simulate a situation in which current market values (instead of cadastral values) determine property taxes due, which makes the use of inflation-offsetting multipliers redundant. Using current multipliers *and* current market values would lead to extremely inflated estimates of the new property tax liability. In contrast, not using multipliers when calculating the new property tax liability means that our simulation presents a more conservative estimate of the potential revenue effects of such a reform.¹⁷ Please note that we apply federal tax rates for West Germany to our entire sample, since the reason for the higher federal rate in East Germany is based on the different reference year regarding the last assessment (1933 instead of 1964), which becomes redundant when using current market values for all German properties.

¹⁶In the case of joint filers, the simulated tax reduction (i.e. the lump sum SIC credit and SIC rate reduction, respectively) is granted on household level.

¹⁷We also run our simulation using the corresponding municipality multipliers at the time of the last value assessment of 1964. The results from this simulation can be seen as an upper bound of the magnitude of the proposed reform. Using these multipliers, the increase in property tax liability would be large with more than 600% for the average property owner (results available upon request).

6. Simulation Results

6.1. Macro Effects

Table 6 displays the results of our simulations on the macro level. The pre-reform property tax liability (conditional on being property owner) for 2010 equals 345 €, on average. The proposed property tax reform updating the cadastral values to market values will result in a new mean property tax liability of 967 €. For the scenario **(1)**, where the update of cadastral values is non-revenue neutral, this will generate additional revenues of 8 bil €. In our second scenario **(2)**, we use the additional revenue to grant a credit on employee-SIC (where the credit cannot exceed paid contributions) in the amount of maximum 233 € per worker. This would reduce the annual employee-SIC of the average household from 6,245 € to 5,920 €. In our third scenario **(3)**, we use the additional revenue to grant a 5,2 % rebate on the employee-SIC payment of every taxable individual liable to pay employee-SIC.

From a macro perspective, these results correspond to a reduction of the implicit tax rate (ITR) on labor from currently 37,2% to 36,5%. The ITR on labor is defined as the sum of all direct and indirect taxes and employees' and employers' social contributions levied on employed labor income divided by the total compensation of all employees. It is calculated for employed labor only, so we abstract from the tax burden falling on self-employed income and pensions.

Table 6: Mean core variables under status quo and three alternative scenarios

| | Pre-reform | Post-reform | | |
|---------------|------------|--------------|--------------|--------------|
| | | Scenario (1) | Scenario (2) | Scenario (3) |
| Mean prop_tax | 345 € | 967 € | 967 € | 967 € |
| Mean SIC | 6,245 € | | 5,920 € | 5,920 € |

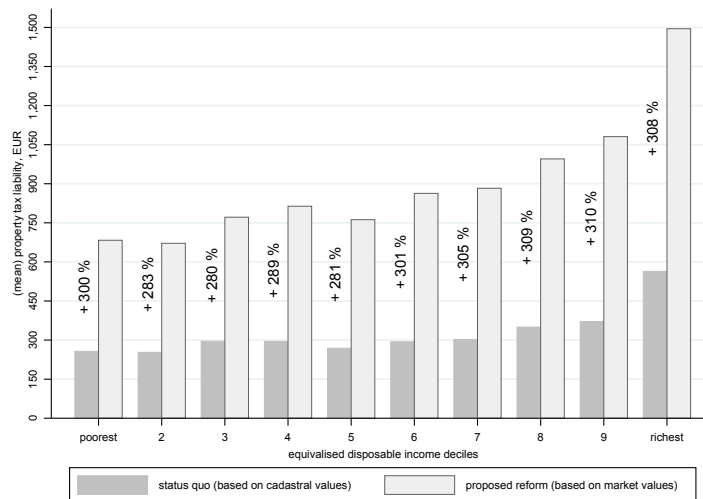
Notes: Mean values are measured at a yearly household level and conditional on being subject to SIC and property tax, respectively. 'prop_tax' comprises the property tax liability of private households. 'SIC' comprises employee social insurance contributions.

6.2. Micro Effects

In this section we seek to analyze how the proposed reform of the property tax would affect different groups of taxpayers differently. Specifically, we want to examine how the burden of the update of cadastral values is distributed across **i) property-owners only** and **ii) the overall population**.

i) First of all, it is obvious that the additional tax revenue generated by the update of cadastral values comes from property-owners. Appendix A.4 shows that ownership rates in Germany increase with disposable income. However, drawing conclusions about who will pay for the proposed reform from this extensive margin only would be premature.

Figure 5: Pre- and post-reform property tax liability across disposable income deciles, conditional on being property owner



Notes: Increase in property tax liability is calculated for property owners only and amounts to approximately 300% across income deciles.

Source: Own calculations based on EUROMOD.

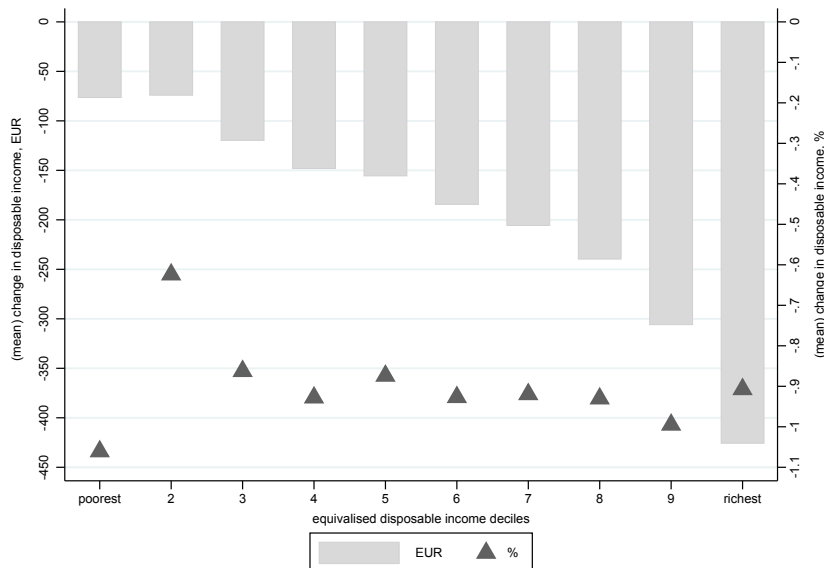
As a next step, we want to examine the change in household budget, i.a. the degree of increase in property tax liability for proprietors. Figure 5 shows pre- and post-reform property tax liabilities across income deciles of property owners only. It is evident from the figure that the increase in the property tax liability is relatively constant across the income distribution of proprietors with a only slightly more pronounced increase for the top five deciles. The increase in property tax liability amounts to approximately 300% for the single household income deciles. Hence, the relative size of the property tax liability across the income distribution of homeowners is by and large preserved under the proposed reform. In other words, an update of cadastral values does not hurt a certain income group of property owners in particular.

ii) Now we want to examine the effect of the proposed update of cadastral values across the entire income distribution (regardless of being homeowner or not). With the median German household not owning any property - the lowest ownership rate in the European Union - this is of particular interest. Please note, in the following analysis we assess equivalized disposable income calculated as market income plus public transfers minus taxes and social insurance contributions. Hereby we check to what extend the incidence of the proposed reform maintains its shape.¹⁸

We start with scenario (1), which is the non-revenue neutral simulation. The bars in figure 6 show the change in equivalized disposable income in absolute monetary values

¹⁸In accordance with established practice we account for differences in household size economies of scale in consumption by applying the modified OECD equivalence scale. For details see OECD (2013).

Figure 6: Overall redistribution (1) across equivalized disposable income deciles for the entire population in % and €



Notes: This figure displays the change in equivalized disposable income on deciles of household income under reform scenario (1), which is the non-revenue neutral simulation. The figure is based on the entire population, regardless of being homeowner or not. Households are put into income deciles according to their pre-reform equivalized disposable income. Bars show the change in equivalized disposable income in monetary values (EUR), triangles display the percentage change in equivalized disposable income.

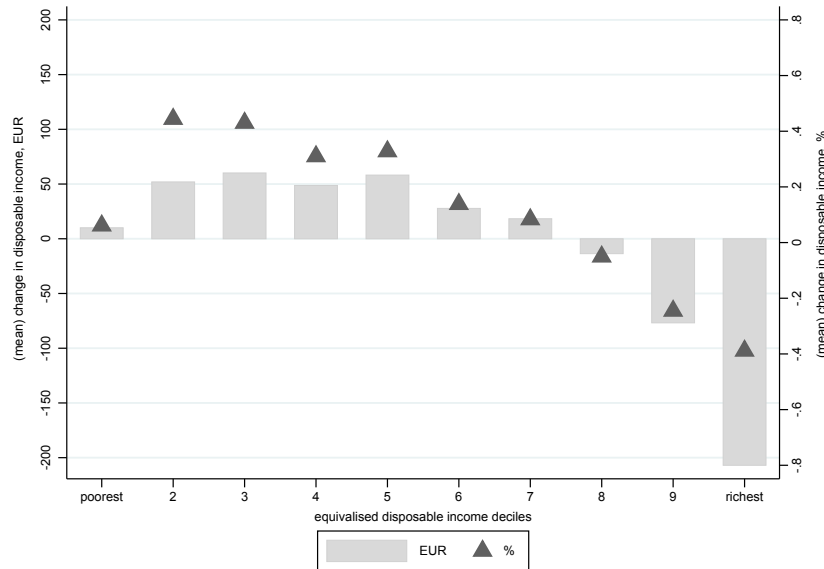
Source: Own calculations based on EUROMOD.

(EUR) on deciles of equivalized disposable income. As expected, the negative change in income becomes bigger with increasing household equivalized disposable income. When displaying the relative income change, a different picture emerges. The triangles in figure 6, representing the percentage change in disposable income under the reform scenario (1), vary little across the distribution.¹⁹ Hence, poorer households are in relative terms as affected by the update of cadastral values as richer ones. Thus, an update of cadastral values without redistributing the additional revenue would render such a reform virtually neutral in terms of redistribution. Previous authors have noted that the redistributive element of the German property tax is limited (e.g. Bach & Schratzenstaller 2013, Broer 2013). Our findings suggest that this would not change when cadastral values are updated. This motivates the analysis of our revenue-neutral reform scenario (2) and (3), where the additional tax revenue is used to lower the tax burden on labor.

Scenario (2) is a simulation in which the additional tax revenue of the proposed update of cadastral values is offset by a non-refundable lump sum SIC credit. More precisely, we grant a credit on individual social insurance contributions (conditional on having positive contributions) in the amount of maximum 233 € per worker.

¹⁹The second decile stands out with a similar absolute increase in tax burden of proprietors and a only slightly higher ownership rate, but a considerable higher income as the first decile.

Figure 7: Overall redistribution (2) across equivalized disposable income deciles for the entire population in % and €



Notes: This figure displays the income change on deciles of household equivalized disposable income under reform scenario (2), which is the lump sum credit simulation. Bars show the change in equivalized disposable income in monetary values (EUR), triangles display the percentage change in equivalized disposable income. Decile groups defined on the basis of household equivalized disposable income.

Source: Own calculations based on EUROMOD.

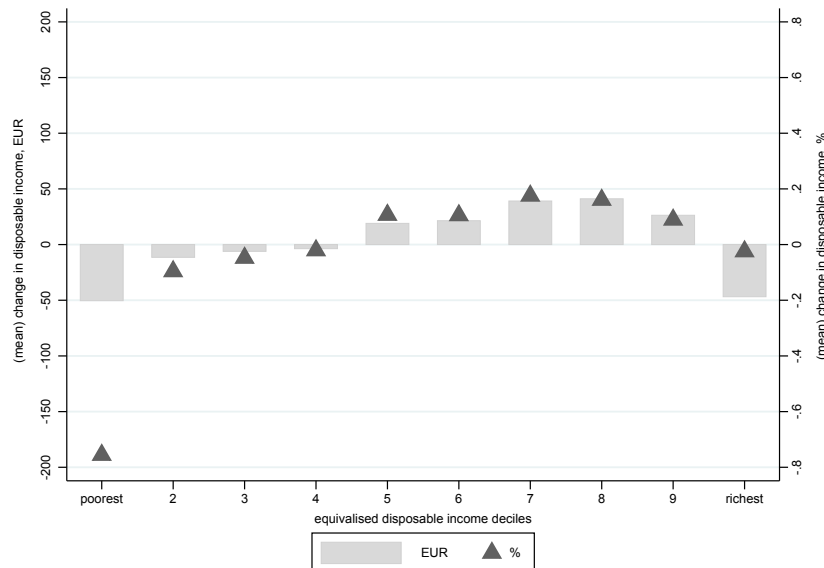
A lump sum SIC credit corresponds with a relative high tax relief for low income earners, whose contribution rate is reduced to a relatively greater extent. Figure 7 displays the income change on deciles of household equivalized disposable income under reform scenario (2). The figure shows that all household deciles would gain in disposable income except of the top three ones.

The total yearly gains range between 20 € and 60 € on average across the household income deciles, whereas the three top deciles lose between 15 € and 209 € on average. The triangles in figure 7 display the income change relative to equivalized disposable household income, ranging between +0.43 % and -0.40 % for the single deciles.

The underlying redistributive mechanism is mostly driven by the two main sides of proposed reform, easing of employee SIC and increase in property tax liability. The lump sum SIC credit reduces social insurance contributions for low income earners to a relatively larger extent. The update of cadastral values on the contrary does not seem to hurt a certain income group in particular.²⁰

²⁰It arises from the complexity of the German tax-benefit scheme, however, that the particular discrepancies between easing of employee SIC and increase in property tax liability per household are not identically equal to the corresponding change in disposable income. To some extent deductions of old age insurance and special expenses depend on the amount of SIC paid and hence might affect tax allowances for households. More significant is that especially poorer households' eligibility for means

Figure 8: Overall redistribution (3) across equivalized disposable income deciles for the entire population in % and €



Notes: This figure displays the income change on deciles of equivalized disposable household income under reform scenario (3), which is the proportional rebate simulation. Bars show the income change absolute monetary values (EUR), triangles display the percentage change in income.

Source: Own calculations based on EUROMOD.

As a next step we turn to our third reform scenario (3), in which the additional revenue is used to grant a rebate that is proportional to the SIC payment of an employee. Specifically, we simulate a 5.2 % rebate on the social insurance contribution paid by the employee. The impetus for scenario (3) is that employees should enjoy a proportional reduction of their SIC payments. Figure 8 displays the income change relative to deciles of equivalized disposable household income under reform scenario (3). The figure indicates that the proportional rebate would have only small effects in terms of redistribution. With exception of the first decile, which clearly suffers, the average losses and gains per income decile do not exceed 0.2 % of income. Similarly, absolute changes in equivalized disposable income across income deciles do not exceed 50 €. In sum, it seems that middle-income households would profit to some extent from this reform scenario, whereas low- and high-income households slightly suffer.

Table 7 depicts our simulation results of the three reform scenarios in a condensed form.²¹ Revenue effects of a switch from cadastral values to current market values are considerable. Although revenues from property taxes on corporate assets would remain

tested benefits - tests applied on SIC dependent net income - might be affected.

²¹For a numerical summary of the effect on household's budget we refer to appendix A.5. The table in A.5 lists the appropriate mean tax relief in employee SIC and mean increase in property tax burden across non-equivalised income deciles.

Table 7: Impact of three scenarios on the macro- and micro level

| | | Status Quo | Non-revenue neutral (1) | SIC lump sum credit (2) | Proportional SIC rebate (3) |
|-------------|--------------------------|-------------|-------------------------|-------------------------|-----------------------------|
| Macro level | private prop_tax revenue | 4.4 bil. € | 12.4 bil. € | 12.4 bil. € | 12.4 bil. € |
| | total prop_tax revenue | 10,9 bil. € | 18.9 bil. € | 18.9 bil. € | 18.9 bil. € |
| | ITR on labor | 37,2 % | 37,2 % | 36,5 % | 36,5 % |
| Micro level | Gini | 0.2677 | 0.2678 | 0.2665 | 0.2683 |
| | Atkinson (1) | 0.1147 | 0.1148 | 0.1137 | 0.1152 |
| | Poverty threshold | 950 € | 936 € | 950 € | 949 € |
| | worst off 1 % | | | - 13.6 % income | - 14.4 % income |
| | best off 1 % | | | + 4.5 % income | + 2.6 % income |

Notes: 'Staus Quo' is the current property tax- income tax - and SIC scheme. While 'private prop_tax revenue' depicts property tax revenues generated from private households, 'total prop_tax revenue' also includes revenue from property taxes on corporate assets. 'worst/ best off 1 %' depicts the relative greatest loss/ gain in equivalized disposable income.

Source: Own calculations based on EUROMOD.

unchanged, the aggregated total revenue collected from property taxes increases substantially from 10,9 bil.€ to 18,9 bil.€. This additional tax revenue allows a reduction of the implicit tax rate on labor from 37,2% to 36,5%.

Finally, we want to assess overall changes in inequality associated with our three reform scenarios. For this purpose, we employ two widely used inequality indices, namely the Gini and the Atkinson with $A_\varepsilon = 1$. In line with our previous results, we find the non-revenue neutral scenario (1) to barely change the distribution of income. Regarding scenario (2), we observe a small reduction in income inequality. In contrast, scenario (3) would widen the income distribution, though only very slightly. Looking at changes in poverty thresholds (set at 60 % of median equivalized disposable income), we barely find any effect of the three reform scenarios. However, this does not rule out that the proposed tax shift entails significant gainers and losers. In both scenarios (2) and (3), the worst off 1% would be affected by a considerable income shock. Scenarios (2) and (3) could therefore potentially face opposition from asset-rich-income-poor households, which might ask for mitigating measures.

7. Conclusion

The idea of higher taxes on land, capital and wealth to finance mounting public debt has gained ground in several OECD countries. At the same time, the scope for shifting taxes to more growth-friendly revenue sources appears underused in many European countries. This seems to be especially true for Germany, a country which makes only little use of

property taxes while at the same time having a high implicit tax rate on labor. Against this backdrop we simulate a property tax reform for Germany which increases revenues from the taxation of property while simultaneously lowering the tax burden on labor. Changing the current property tax scheme based on outdated cadastral values to one based on market property values, we find substantial revenue effects of the proposed reform. Specifically, tax collection from property would increase from currently 10,9 bil. € to 18,9 bil. €, allowing for an overall reduction of the implicit tax rate on labor from 37,2% to 36,5%.²² Using EU-28 cross-country levels as a comparison, this equates in an improvement of the implicit tax rate on labor by three positions. In contrast, the increase in the ratio of property tax revenue to GDP would change Germany's position by 13 places, with an after-reform level similar to Denmark's (compare figure 1). Examining the distributional effects of the reform on household level, we find the update of cadastral values without using the additional revenue to lower SIC to be virtually neutral in terms of redistribution. As rich and poor households show comparable increases in the (relative) property tax burden, any potential redistribution under the proposed reform depends crucially on the design of the revenue-neutral SIC reduction. While a SIC reduction via a lump-sum tax credit would especially benefit low-income households, a SIC rebate proportional to household's current contributions would barely alter the overall distribution of disposable income. This gives policy-makers considerable scope via the specific design of such a reform.

In light of the controversial nature of the outdated taxation of property in Germany and the apparent reluctance of policy-makers to tackle it, our paper aims to reduce uncertainty about both revenue and distributional effects of such a reform. Depending on the exact design, our results suggest that low- and median income households could be made better off, while reducing the overall tax burden on labor.

We are aware that shifting taxes from labor to property is not easy to implement, especially in a federal system like Germany, where property taxes accrue to local municipalities, and social insurance contributions to federal budgets. From a policy perspective, mass appraisal is both expensive and can be intrusive. However, our analysis aims to inform about the fiscal and distributional effects of such a shift, which can then be mapped against institutional costs and legal constraints. While such an analysis is beyond the scope of our paper, it provides a fruitful avenue for future research.

²²Please note that the total revenue from property covers taxes from private households and corporate assets. Our simulated reform only concerns the first while keeping the latter unchanged.

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A. Appendix

A.1. Reconciliation process of common variables - HFCS 2010 and SILC 2010

| Raw Data | Recoded Household Data | Coarsened | Variabel Name |
|---|--|------------|----------------------|
| Month and year of birth | Average age in household | In SILC | max_age |
| | Age of oldest household member | | average_ag |
| Gender, age | Number of females per household | In SILC | n_female |
| | Number of children per household | | n_child |
| | Absolute household size | | household_size |
| Relationship status | Household's family structure | In HFCS | marital_status |
| Country of birth, citizenship | Dummy=1 if any household member with migration background | In HFCS | any_migrant |
| Duration of stay in host country | Maximum number of years spent in Germany by any household member | In HFCS | y_incountry |
| Self-defined economic status | Dummy=1 if at least two persons are active on labor market (one if single-person -household or lone) | In HFCS | employment_status |
| Highest ISCED level attained | Dummy =1 if any household member has a higher education degree | In SILC | education |
| Occupation (ISCO-88) | Dummy for each ISCO group=1 if any household member' occupation fits to the respective group | In SILC | ISCO_88 |
| Economic activity (NACE) | Dummy for each NACE group=1 if any household member' economic activity fits to the respective group | InSILC | NACE |
| Type of labor contract | Dummy =1 if all active household members have a permanent contract | In SILC | contract |
| Labor force experience | Maximum number of years spent in paid work by any household member | No coarsen | y_worked |
| Number of hours worked per week | Maximum number of hours worked by any household member | No coarsen | working_h |
| Individual gross employee income | Aggregated household's cash employee income | No coarsen | inc_employee |
| Individual gross self-employed income | Aggregated household's cash self- employed income | No coarsen | inc_selfemployed |
| | Dummy=1 if any household member receives self_employed income | | inc_selfemployed_dum |
| Individual income from public pension | Aggregated household's income from public pension scheme | No coarsen | inc_publicpens |
| Individual income from unemployment benefit | Aggregated household's income from unemployment benefit | No coarsen | unempl_benefit |
| Income from financial investment | Originally on household level | - | inc_financeinves |

to be continued

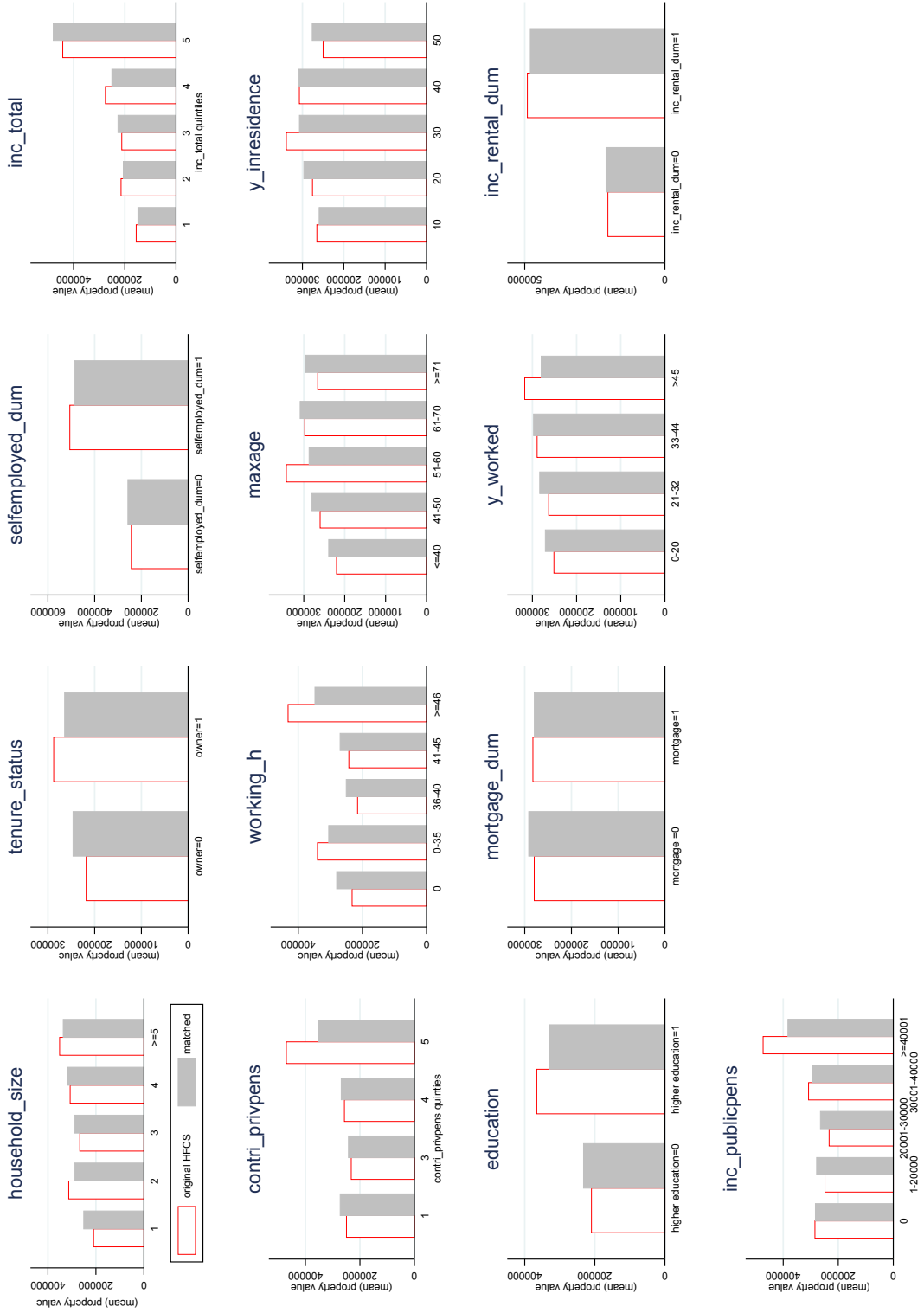
| Raw data | Recoded Household Data | Coarsened | Variabel Name |
|---|---|------------|------------------------------|
| Income from other public transfers | Aggregated household's income from other public transfers | No coarsen | other_-benefit |
| Contribution to private pension plan | Aggregated household's contribution to private pension plans | No coarsen | contri_privpens |
| Household Main residence mortgage principle payment, mortgage interest rate | Originally on household level Dummy=1 if there ar any mortgages using househodl main residence as collateral | in HFCS | mortgage mortgage_dum |
| Rental income | Originally on household level Dummy=1 if any household member receives rental income | - | inc_rental inc_rental_dum |
| Itra household cash transfer | Originally on household level | - | inc_intrahh |
| Total gross income | Originally on household level | - | inc_total |
| Tenure status | Originally on household level | - | tenure_status |
| Rental payment | Originally on household level | - | rent |
| Years living in main household residence | Originally on household level | - | y_inresidence |
| Possession of vehicle | Dummy=1 if any household member owns a car | - | vehicle |
| Income from regular social transfer | - | Incoherent | - |
| Non-collateralized debt | - | Incoherent | - |
| Other self-employed income | - | Incoherent | - |

A.2. Rao Scott Test and Pearson Correlation Coefficients common variables

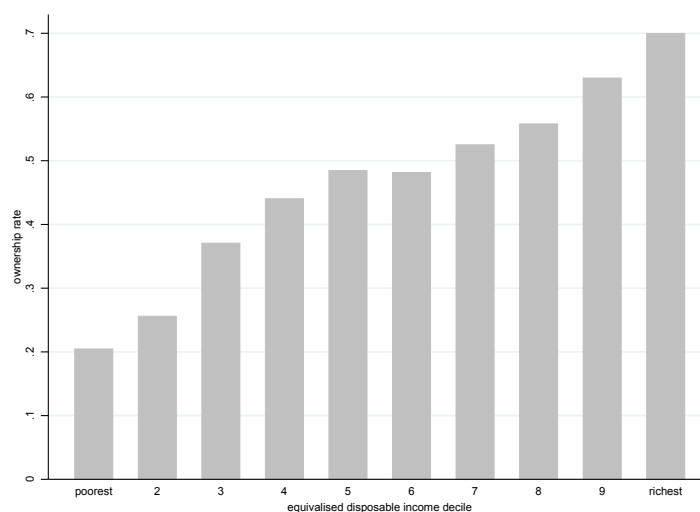
| Common Variables | Test of Independence | | Pairwise Correlation |
|-------------------|----------------------|---------|----------------------|
| | | | |
| max_age | Pearson | 0.0481 | 0.0504* |
| | Likelihood ratio | 0.0451 | |
| average_age | Pearson | 0.0951 | 0.0641 |
| | Likelihood ratio | 0.1093 | |
| n_female | Pearson | 0.0353 | 0.0533 |
| | Likelihood ratio | 0.0224 | |
| n_child | Pearson | 0.2612 | -0.0238 |
| | Likelihood ratio | 0.2859 | |
| household_size | Pearson | 0.0029 | 0.0376* |
| | Likelihood ratio | 0.0016 | |
| marital_status | Pearson | 0.0897 | 0.0308 |
| | Likelihood ratio | 0.08765 | |
| employment_status | Pearson | 0.1281 | 0.0967 |
| | Likelihood ratio | 0.1145 | |
| education | Pearson | 0.2731 | 0.1473** |
| | Likelihood ratio | 0.2659 | |
| contract | Pearson | 0.0000 | 0.1154 |
| | Likelihood ratio | 0.0000 | |
| y_worked | Pearson | 0.0962 | 0.0665* |
| | Likelihood ratio | 0.1496 | |
| working_h | Pearson | 0.0004 | 0.0568* |
| | Likelihood ratio | 0.0000 | |
| selfempl_dum | Pearson | 0.0003 | 0.1545* * |
| | Likelihood ratio | 0.0003 | |
| inc_publicpens | Pearson | 0.04557 | 0.0951* |
| | Likelihood ratio | 0.0180 | |
| contri_privpens | Pearson | 0.0000 | 0.1092* |
| | Likelihood ratio | 0.0000 | |
| mortgage_dum | Pearson | 0.0033 | 0.0513* |
| | Likelihood ratio | 0.0027 | |
| inc_rental_dum | Pearson | 0.0000 | 0.2975** |
| | Likelihood ratio | 0.0000 | |
| inc_total | Pearson | 0.0000 | 0.3296** |
| | Likelihood ratio | 0.0000 | |
| tenure_status | Pearson | 0.0000 | 0.0280* |
| | Likelihood ratio | 0.0000 | |
| y_inresidence | Pearson | 0.0311 | 0.0068* |
| | Likelihood ratio | 0.0304 | |

Notes: Tests of independence - dichotomized for continuous variables - cover Pearson's and likelihood-ratio chi-squared, both corrected for the survey design with the second-order correction of Rao and Scott (1984). Pairwise correlation coefficients are calculated allowing for sample design. Significance levels are based on survey-based variance estimates, with * and ** indicating significance at 5- and 1-percent levels, respectively.

A.3. Joint distribution of merger variable with each matching variable for original HFCS values and matched results from three approaches



A.4. Ownership rates across disposable income deciles



Notes: Ownership rate comprises owning main household residence and/or other properties.
Source: Own calculations based on SILC.

A.5. Non-equivalised mean increase in property tax burden and relief in employee SIC for entire population

| income groups | baseline income | change in prop_tax | change SIC_lin | change in SIC_prop |
|---------------|-----------------|--------------------|----------------|--------------------|
| D1 | 10555 | 89 | -150 | -40 |
| D2 | 16750 | 107 | -246 | -109 |
| D3 | 20698 | 184 | -298 | -172 |
| D4 | 24377 | 231 | -322 | -219 |
| D5 | 27579 | 241 | -350 | -269 |
| D6 | 30075 | 278 | -344 | -314 |
| D7 | 33719 | 303 | -352 | -369 |
| D8 | 38702 | 357 | -356 | -426 |
| D9 | 45568 | 459 | -353 | -497 |
| D10 | 69822 | 639 | -328 | -562 |

Notes: No equivalence scale applied, changes in household budget irrespective of household size. D1 - D10: household equalised disposable income decile groups, 'baseline income' is the mean non-equivalised disposable income, 'change in prop_tax' the mean increase in property tax liability, 'change SIC_lin' the mean relief in employee SIC under scenario (2) and 'change in SIC_prop' the mean relief in employee SIC under scenario (3)
Source: Own calculations based on EUROMOD.

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