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Documentation IZAΨMOD v3.0: The IZA Policy Simulation Model

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Institute for the Study
of Labor

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ABSTRACT

Documentation IZAΨMOD v3.0: The IZA Policy Simulation Model

This paper describes IZAΨMOD, the policy microsimulation model of the Institute for the Study of Labor (IZA). The model uses household microdata from the German Socio-Economic Panel Study and firm data from the German linked employer-employee dataset LIAB. IZAΨMOD consists of three components: First, a static module simulates the effects of a tax-benefit reform on the budget of the individual household. This includes taxes on income and consumption, social security contributions, public transfers. Secondly, behavioral labor supply responses are estimated. The third component distinguishes our model from most other microsimulation tools. A demand module takes into account possible restrictions of labor demand and identifies the partial equilibrium of the labor market after the supply reactions.

JEL Classification: D58, H20, J22, J23

Keywords: microsimulation, tax and benefit systems, labor supply, labor demand, Germany

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1 Introduction

This paper describes the current version of the behavioral microsimulation model IZAΨMOD v3.0, which is developed at the Institute for the Study of Labor (IZA).[1] There were several major improvements since the initial version, developed in 2002. In 2010, IZAΨMOD was extended to account for labor demand responses and calculate partial equilibrium effects on the labor market. Moreover, this version allowed an extensive study of the distributional effects of policy reforms. We revised large parts of the code and improved the speed and the accuracy of the model for version 3. In addition, we implemented a detailed simulation of household's expenditure behavior, a graphical module that illustrates policy reforms and their effects on budget sets, and a completely rewritten labor supply module that now includes a wide range of state-of-the-art model specifications. This documentation provides a largely technical description of IZAΨMOD v3.0 and its different modules. However, as the basic structure of the model has been maintained, it draws heavily from Peichl, Schneider and Siegloch (2010).

Microsimulation Models (MSM) have become one of the standard analytical tools in the field of applied welfare and distributional analysis. The main feature of a microsimulation approach is the partial equilibrium analysis that simulates the effects of a policy reform (i.e. tax or benefit change) on one side of the market (i.e. households, firms, individuals). The simulation basically consists of evaluating effects of a change in the economic environment of individual agents in terms of welfare or activity (Bourguignon and Spadaro, 2006). MSM are based on microdata and therefore account for heterogeneity of economic agents within the population. Hence, the advantage of MSM consists in the precise identification of winners and losers of a reform, which allows for the overall evaluation of welfare effects as well as political economy factors that may obstruct the implementation.

Within the MSM category, many models are applied to redistribution policies. Tax models, for example, are widely used to simulate the distributional consequences of a tax or benefit change among heterogeneous groups of families and to predict the likely costs to the government of a proposed or hypothetical policy reform (Creedy and Duncan, 2002).

As far as the distributional analysis is concerned, there is a variety of different approaches. Non-behavioral models, also referred to as arithmetic models, simulate changes in the real disposable income of individuals or households due to a tax or

[1] The authors would like to thank everybody who has been helping developing IZAΨMOD over the past years. Especially, we want to give credit to Hilmar Schneider and Holger Bonin for giving birth to the model. Furthermore, we want to thank Mathias Dolls, Vanessa Dräger, Johannes Hermle, Jens Hogenacker, Dirk Neumann, Ulf Rinne and Caroline Wehner for valuable contributions.

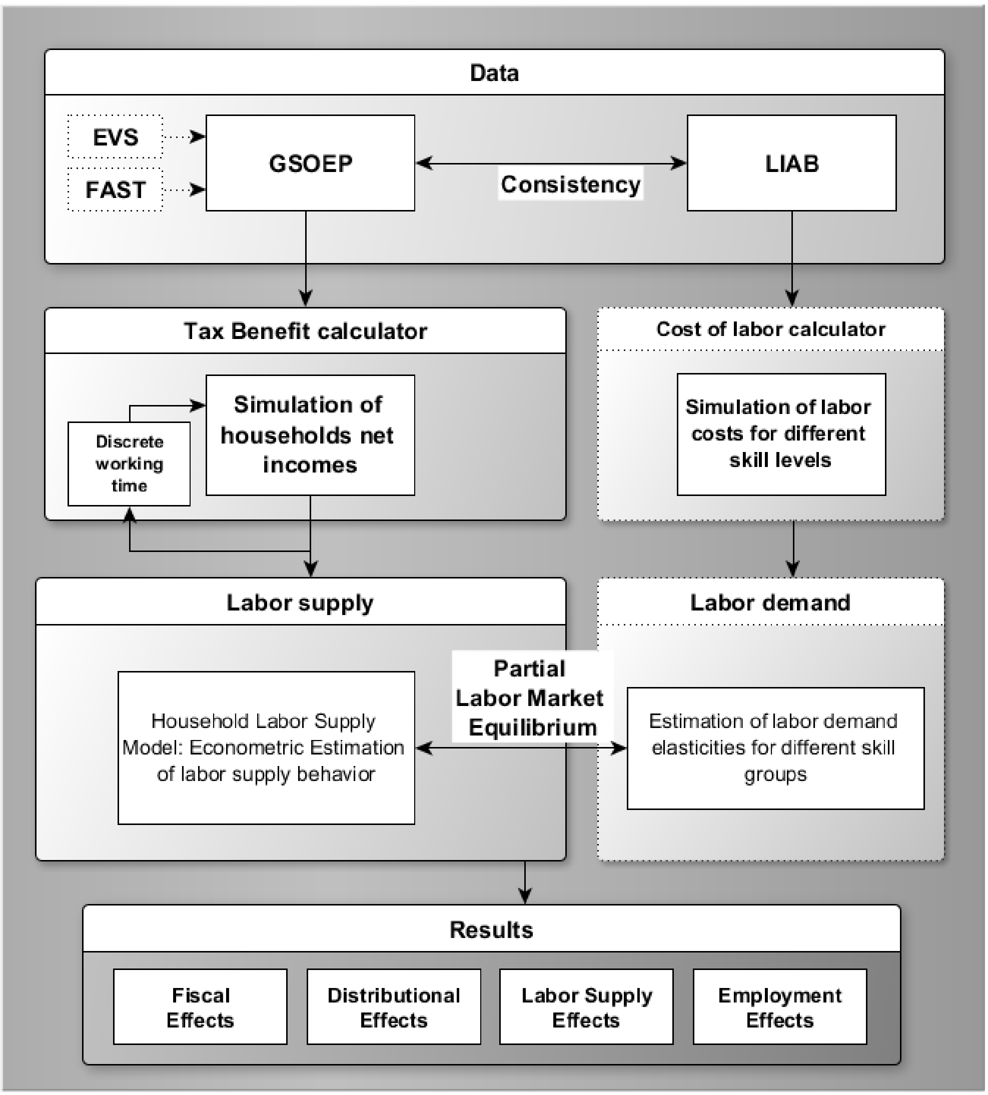
benefit reform under the assumption that behavior is exogenous to the tax and benefit system (Bourguignon and Spadaro, 2006). Hence, individuals are not allowed to change their behavior and the models only simulate first-round effects, which comprise immediate fiscal and distributional changes.

In contrast to arithmetic models, behavioral models take some kind of behavioral response, usually based on the rationale of utility maximization, of individuals or households into account. Within this approach, labor supply and consumption are among the types of behavior most frequently included in the analysis. Microeconometric labor supply models incorporate a theoretical grounding of the behavioral response and allow for the modeling of labor supply decisions along the extensive (labor market participation) as well as the intensive (hours worked) margin (Peichl, 2009). Usually, a labor supply module is either integrated into the microsimulation model or can be linked to it as an external module.

IZAΨMOD consists of four core components. The basis is a static microsimulation model that incorporates the complex German tax and benefit system for the years 1984 to 2014. The second module is an micro-econometrically estimated labor supply model, which takes into account behavioral reactions to reforms of the tax-benefit system. The third component is a labor demand module, which completes the analysis of the labor market and allows a global assessment of the effects of policy measures. Finally, IZAΨMOD incorporates a comprehensive output module that allows to analyze the likely effects of policy reforms in various illustrative ways. Figure 1 shows the basic setup of IZAΨMOD. Components one and two are based on data from the German Socio-Economic Panel Study (SOEP), a representative panel study of private households in Germany. Supplementary information is drawn from the German Income and Expenditure Survey (EVS) and the Income Tax Return Data (FAST). The demand module uses German Linked Employer-Employee Data from the IAB (LIAB).

The simulation steps of IZAΨMOD can broadly be described as follows: First, the database is generated for the year of interest. Following common practice, we impute non-observed wages with a Heckman procedure (Heckman, 1979). Secondly, the current tax and benefit system is simulated using the modified data. IZAΨMOD computes individual tax payments for each case in the sample considering gross incomes and deductions in detail. This way, we obtain disposable income for every household in the sample. Thirdly, a discrete choice household labor supply model is applied to estimate consumption/leisure preferences of each household using the calculated net incomes and information on working hours. Fourthly, the effects of tax and benefit reforms are analyzed. The reform will alter net incomes of households (first-round effect), which in a second step will induce labor supply reactions following the previously estimated consumption/leisure preferences which are assumed to be fix. Fifth,

Figure 1: Basic Setup



the labor demand module is employed to estimate how the labor supply reactions translate into employment effects. This sets the ground for a detailed analysis of distributional and employment effects of the welfare reform. As the household sample includes sample weights, our results can be generalized to the whole population.

The setup of the rest of this paper is as follows. Section 2 describes the data used for the different modules. Section 3 sets up the tax benefit module, in section 4 the labor supply module is presented and section 5 describes the labor demand module. Section 6 validates the model by comparing simulated outcomes to official data. Section 7 concludes by presenting selected applications of IZAΨMOD.

2 Data

2.1 The German Socio-Economic Panel Study (SOEP)

Both the tax benefit and the labor supply module of IZAΨMOD are based on the German Socio-Economic Panel Study, which is a microdata household panel study. GSOEP was launched in 1984 as a representative cross-section of the adult population living in private households in (Western) Germany and dealt with the expansion of its "survey territory" due to the fall of the Berlin wall in late 1989 by introducing the East German sample in June 1990 (Wagner et al., 2007). The number of cases was enlarged over time by additional samples that represent the entire German population. Moreover, the representativeness of the sample was improved by oversampling certain groups such as high income households or foreigners. Thanks to a refresher sample in 2006 the cross-sectional number of cases is at the level of about 21,000 individuals living in 12,000 households.

GSOEP provides a very rich data on all aspects of life, including personal economic circumstances, personal well-being, employment and personal background. The major dimension of information exploited by IZAΨMOD are employment and income. Among others we draw the following data from the GSOEP: gross wage, job type, government transfers, working time, household composition, age and education of household members and housing costs. IZAΨMOD is constantly updated to the newest GSOEP wave, but it is also possible to employ older waves (back to the year 1984) to analyze potential effects of changes in the German population, e.g. in the household composition.

We alter the traditional household concept and instead define *labor supply units* within each household. As an example, the labor supply of a grown-up child with completed education can be regarded in isolation of his parents' behavior and vice versa. Similarly, an adult who happens to live in the same flat as a couple has to be considered as a separate labor supply unit. This decomposition of households leaves us with labor supply units with one or two adults only.

IZAΨMOD differentiates between several types of households: (A) single households, (B) single parents, (C) couple households where only one spouse is flexible as far as working hours are concerned and (D) couples with two flexible spouses.[2] Additionally there are households that are inflexible as far as their labor supply decision is concerned. It is assumed that the labor supply reaction of those inflexible households is based on a different consumption/leisure decision (or at least with a different

[2] This notation will be kept during the rest of the documentation.

weighting of the relevant determinants) than that of those working full time.[3] We assume that a person is not flexible in his/her labor supply, meaning he or she has an inelastic labor supply, if a person is either

- younger than 16 years of age,
- older than 65 years and out of employment[4],
- in education or military service,
- receiving old-age or disability pensions
- self employed or civil servant.

Every other employed or unemployed person is assumed to have an elastic labor supply.

Another important differentiation is the assignment of individuals to three skill levels. The high-skilled hold a university, polytechnical or college degree. Medium-skilled workers have either completed a vocational training or obtained the German highest high school diploma, called "Abitur". Unskilled workers have neither finished vocational training nor obtained Abitur.

2.2 The Linked Employer-Employee Dataset (LIAB)

As the GSOEP is a household survey and does not contain any information on firms, the demand module is based on a different dataset. We employ the linked employer-employee dataset (LIAB) from the Institute of Employment Research (IAB) in Nuremberg, Germany.[5] The LIAB combines data from the employment statistics from the German Federal Employment Agency (Bundesagentur für Arbeit) with the IAB Establishment Panel, which are panel data on plant level. The employment statistics come from official records, namely the German employment register, which covers all employees paying social security taxes or receiving unemployment benefits. Since

[3] For this reason, it is not possible to assume the same econometric relationship for these persons.
[4] For reforms changing the retirement age, this assumption would need to be relaxed.
[5] The advantage of using linked employer-employee data in the context of labor demand estimations is straightforward. When only relying on employee data, it is possible to observe qualification and wages, but generally no information on firms is available. When using datasets on firms, variables like output, labor demand and investments are observed, but in general the individual wages of the employees are missing. Sometimes the sum of wages and the number of workers can be used to calculate an average wage. This procedure, however, has a major disadvantage, since the most important variable determining the labor demand from a theoretical perspective, i.e., the wage, is derived from an aggregate. It is not observed on the micro level which automatically casts doubt on the reliability and accuracy of the results.

1973 all employers have been required to report all employees covered by social security to the social security agencies (Bender and Haas, 2002). This way, about 80 percent of German employees are covered. Civil servants, self-employed and family workers are not included in the statistics. Among others, the employee history provides information on daily wages, age, seniority, schooling, training, occupation, industry and region (Bender et al., 2000). By combining these data with data on received unemployment benefits, the periods of non-employment are filled, completing the (un)employment history of the individuals.

The second source of the LIAB is the IAB Establishment Panel, which contains annual information on establishment structures and personnel decisions in the period from 1993 onwards (Alda et al., 2005). It is a representative stratified random sample from the population of all establishments that only covers establishments with at least one socially insured employee. The name establishment has to be taken literally, since the unit of observation is the individual plant, not the company. The establishment panel covers 16 industries and 10 employment size classes. In 1993 the sample comprised 4265 plants, that is 0.27 percent of all plants in Western Germany. The Eastern German subsample was established in 1996. In 2005 the unified sample was made up of 16,280 establishments.

We use the cross-sectional LIAB, covering the years 1996 to 2007. Each year, it contains 4,000 to 16,000 establishments and 1.8 to 2.5 million employees.

As for qualification we distinguish between three skill levels: unskilled, medium-skilled and high-skilled workers following the classification presented in section 2.1. Since we are interested in the labor demand depending on the skill levels, individuals with missing information on qualification are dropped. Finally, the average deflationized real wages per skill group and per establishment are computed, as well as the number of employees per plant and skill level.

2.3 Income Tax Return Data (FAST)

The German income tax system includes a wide range of deductions that are substracted from taxable income. These deductions can be grouped into two categories: Income-related expenses (*Werbungskosten*) and deductions related to personal circumstances (*Sonderausgaben* and *Außergewöhnliche Belastungen*), see also Section 3.1.2. Most of these items cannot be calculated on the basis of the SOEP data. However, ignoring them would lead to overestimation of the tax base and thus to flawed reform effects on tax revenues. In order to improve the accuracy of the income tax simulation, we additionally exploit administrative tax return data, published by the German Ministry of Finance.[6] It comprises a 10% subsample of all income tax cases from the year 2007, resulting in about 3.5 million observations. These rich data enable us to fit a flexible regression of covariates observed in both GSOEP and FAST on the amounts of these deductions. These encompass income and squared income from various sources, age, number of children and interactions thereof. To be specific, we estimate tobit models separately for *Werbungskosten* and other deductions. In addition, we run different models of singles and married couples. These estimates are then used to predict income-related expenses and other deductions separately on the household level in the GSOEP.[7]

2.4 The survey of income and expenditures (EVS)

An optional feature of IZAΨMOD is the incorporation of consumption expenditures. This allows for extending the scope of the distributional analysis to reforms of indirect taxes, such as Value Added Tax and excise taxes. As the GSOEP is restricted with respect to the coverage of consumption expenditures, we make use of the German survey of income and expenditures (*Einkommens- und Verbrauchsstichprobe (EVS)*.[8] It is a cross-sectional survey conducted by the Federal Statistical Office that started in 1962/1963 and was repeated about every five years. The most recent wave was conducted in 2008.[9] It covers about 55,000 households who participate on a voluntary basis. For scientific use, a 80% subsample is provided. EVS contains detailed information about every household member on employment, income from different sources and assets. Its main focus rests on expenditures for all types of commodities as well as on household equipment. All participants constantly keep record of their expenditures throughout a three-month period, which secures a high data quality. There are some notable differences with between EVS and GSOEP concerning representativeness of the German population (Becker et al., 2003). While income is covered in more detail in EVS, it exhibits under-coverage of households with very low and very high incomes, resulting to an income distribution with slightly thinner tails than in the GSOEP.

In order to draw inferences on indirect taxes, we have to impute consumption expenditures in GSOEP based on variables observed in both data sets. We adapt the ap-

[6] Official term: *Faktisch anonymisierte Daten aus der Lohn- und Einkommensteuerstatistik (FAST)*. For an overview, see Merz et al. (2005).

[7] Our approach relates to Buck (2006).

[8] Expenditures in GSOEP have been covered on a regular basis since 2010. However, the data quality is inferior to that of EVS. This is due to the retrospective survey design of GSOEP and justifies the additional effort of imputing consumption expenditures. For details on consumption expenditures in SOEP, see Marcus et al. (2013).

[9] See Destatis (2013) for a detailed description of the methodology.

proach of Decoster et al. (2013). Apart from income, we use household characteristics such as age, education and gender, employment type of the household head as well as household size, region and size of the community as determining variables. In a first step, we estimate the Engel curve, i. e. the relation between log consumption and log income, controlling for household characteristics. This is done separately for durable and non-durable commodities as a whole. In a second step, we regress expenditure *shares* for 15 non-durable consumption categories on the log of total consumption and the same covariates. As the commodity groups tobacco, alcoholic beverages, rents and education exhibit a large share of zero expenditures, we fit a probit model on a dummy indicating non-zero consumption for the respective group. Based on these estimates, we are able to impute household consumption in the GSOEP. Figure 7 in the Appendix demonstrates the accuracy of the method by comparing observed and imputed consumption expenditures by household types. This flexible procedure allows for capturing structural changes in consumption: if income rises, expenditures for leisure activities are likely to increase stronger than e.g. those for necessities.

3 Static tax benefit module

In this section, the modeling of the German tax benefit system is described. The description refers to the institutional setting as of 2014. Tax benefit rules from years since 1984 are, however, also implemented. As the system is very complex, we focus on the major parts of the model in this description.

3.1 Modeling the German income tax law

Individuals are subject to personal income tax. Residents are taxed on their global income; non-residents are taxed on income earned in Germany only.[10]

3.1.1 Income sources

The basic steps for the calculation of the personal income tax under German tax law are illustrated by table 2.

The first step is to determine a taxpayer's income from different sources and to allocate it to the seven forms of income, the German tax law distinguishes between[11]:

[10] The legal norm setting up the German tax system is called Einkommensteuergesetz (EStG). As the concrete tax rules, especially specific numerical values such as ceilings, allowances or deductible contributions constantly change, we will only present the general underlying principle of the tax system and refer to the concrete legal norm, from which the current concrete numerical values can be obtained.

[11] See EStG §§13 - 23.

Table 2: Calculation of the personal income tax

Σ	Sum of net incomes from 7 categories (receipts from each source minus expenses)
=	Income from all sources
-	Tax allowances for elderly persons and income from agriculture and forestry
-	Expenses for social security contributions
-	Personal Expenses (Single Parents and Children Allowance)
-	Special Expenses
-	Income-related Expenses
=	Taxable Income x
$\cdot$	tax formula $T(x)$
=	Tax due T

income from agriculture and forestry, business income, self employment income, salaries and wages from employment, investment income, rental income and other income (including, for example, annuities and certain capital gains). For each type of income, the tax law allows for certain income related deductions. In principle, all expenses that are necessary to obtain, maintain or preserve the income from a source are deductible from the receipts of that source. The second step is to sum up these incomes to obtain the adjusted gross income. Third, deductions like contributions to pension plans or charitable donations are taken into account, which gives taxable income as a result. Finally, the income tax is calculated by applying the tax rate schedule to taxable income.

3.1.2 Taxable income

The subtraction of special expenses (*Sonderausgaben*), expenses for extraordinary burden (*außergewöhnliche Belastungen*), income-related expenses (*Werbungskosten*), loss deduction and child allowance from adjusted gross income yields the taxable income (see Table 6 in the Appendix).

Furthermore, negative income from the preceding assessment period (loss deduction carried back) is deductible from the tax base.[12]

Each tax unit with children receives either a child allowance[13] or a child benefit[14] depending on which is more favorable.[15] In practice, each entitled tax unit receives the child benefit. If the child allowance is more favorable, it is deducted from the taxable income while in this case the sum of received child benefits is added to the

[12] See EStG §10d.
[13] Cf. EStG §32.
[14] The amount of child benefits can be found in §66 of the EStG.
[15] See EStG §31.

tax due. The model includes this regulation as it compares allowance and benefit for each case. Finally, taxable income is computed by subtracting these deductions from the adjusted gross income.

3.1.3 Tax due

The tax liability T is calculated on the basis of a mathematical formula which is, as of 2014, defined as follows:

$$T = \begin{cases} 0 & \text{if } x \leq 8,354 \\ (974.58\frac{x-8{,}355}{10{,}000} + 1,400)\frac{x-8{,}355}{10{,}000} & \text{if } 8,355 \leq x \leq 13,469 \\ (228.74\frac{x-13{,}469}{10{,}000} + 2,397)\frac{x-13{,}469}{10{,}000} + 971 & \text{if } 13,470 \leq x \leq 52,881 \\ 0.42x - 8,239 & \text{if } 52,882 \leq x \leq 250,730 \\ 0.45x - 15,761 & \text{if } x > 250,731 \end{cases} \tag{1}$$

where x is annual taxable income in Euros.[16] For married taxpayers filing jointly, the tax is twice the amount of applying the formula to half of the married couple's joint taxable income: $T(x_1 + x_2) = 2 * T\left(\frac{x_1+x_2}{2}\right)$. In addition, a solidarity surcharge (*Solidaritätszuschlag*) is levied, amounting to 5.5% of the income tax due.

In 2009, Germany switched to dual income tax system, treating capital income differently. Since then, a flat rate of 25% is levied on capital income.[17] There remains however the possibility to tax capital income according to the schedule (1), if this is more favorable for the household.

3.2 Social Security Contributions

Besides income taxes, labor earnings are also subject to mandatory social security contributions (SSC). They contribute to the health insurance scheme, the old age pension insurance, the unemployment insurance and the nursing care insurance.[18] In general, SSC are equally split between employer and employee. Self-employed workers may contribute voluntarily, while membership in the social security systems is compulsory for all employees. Civil servants however are not subject to contribution payments. SSC are calculated as a constant share of labor earnings. Receivers of other types of income do not contribute to the social security insurances. If labor income exceeds an assessment ceiling, SSC are kept constant.

[16] See EStG §32a.

[17] See EStG §32d. This is also referred to as withholding tax (*Abgeltungsteuer*).

[18] The fifth pillar of the German system of social insurance, the workplace accident insurance, is financed by employer contributions only.

Table 3: Social Security Contribution (SSC) rates and Assessment Ceilings

	SSC rate	Ass. Ceiling
Old Age Pension Insurance	9.45%	€ 5,950 / € 5,000[a]
Unemployment Insurance	1.50%	
Health Insurance Scheme	8.20%	€ 4,050
Nursing Care Insurance	1.03%	

[a] Different Ceilings in West and East Germany.
All figures as of 01/2014. SSC rates refer to employees' share of monthly income. Current contribution rates and ceilings can be found in the Sozialgesetzbuch (SGB). For health insurance see SGB-V, for old age insurance see SGB-VI, for unemployment insurance SGB-III and for nursing care insurance SGB-XI.

3.3 Consumption Taxes

The main consumption tax in Germany is the Value-Added Tax (VAT). Apart from the standard rate of 19%[19], a reduced rate of 7% is applied on: most food commodities, public transport, books, newspapers, journals, entrance to cultural facilities, and works of art.[20] Moreover, medical, educational and financial services as well as rents are fully exempted from VAT.[21]

We impute consumption expenditures differentiated according to 16 consumption categories (15 non-durable and 1 aggregate of durable commodities), as described in Section 2.4. However, the VAT legislation with its three tax rates (0%, 7%, 19%) is mostly not congruent to these expenditure categories. Therefore, we rely on the weighting scheme of the so-called "representative basket of products" by the German Federal Statistical Office (Destatis). An example illustrates this: The first expenditure category comprises consumption of food and non-alcoholic drinks, the former being taxed with the reduced rate, the latter taxed with the full rate. As non-alcoholic drinks are assigned a weight of 9.3% by Destatis, we allot 9.3% of category I expenditures the standard VAT rate. For, the remaining 90.8%, we apply a rate of 7%.

Beyond, we are able to simulate the most important excise taxes, namely those on energy (most prominently fuel) and on tobacco. These taxes are per-unit taxes and thus based on consumed quantities. Since the EVS provides only information on expenditures, we need to infer on consumed quantities auxiliary information on average prices.

[19] See §12 (1) UStG.
[20] §12 (2) UStG and Appendix 2, UStG.
[21] §4 UStG.

3.4 Modeling the benefit system

In addition to the tax schedule, the main pillars of the German benefit system, namely child benefit, unemployment benefit, housing benefit, and social benefits, are also modeled in IZAΨMOD.

3.4.1 Unemployment benefit I

Persons who were employed subject to social insurance contributions at least 12 months before getting unemployed are entitled to receive the so-called unemployment benefit I (according to the SGB-III). The amount to be paid depends on the average gross income of a certain period.

The GSOEP panel data contains information about previous unemployment benefit payments, employment periods, etc. When modeling a person's working time categories it has to be examined whether the person might get unemployment benefits in certain working time categories. This is assumed for persons who received unemployment benefits or who were employed subject to social insurance contributions at least 12 months within the last 36 months. The remaining net income is deducted from the unemployment benefit.

3.4.2 Unemployment benefit II

The unemployment benefit II (UB II) replaced the former system of unemployment support and social benefits in the course of the so-called Hartz IV reform in 2005. All employable persons between 15 and 65 years and the persons living with them in the same household are entitled to receive unemployment benefit II, as soon as they are no longer entitled to receive unemployment benefit I.[22]

In contrast to the latter, unemployment benefit II depends on the neediness of the recipient and is therefore means-tested. A person is needy if he/she, by his own household's income, is not able to satisfy his/her own elementary needs and those of the persons living in the same household. The unemployment benefit II corresponds to the former social benefits system plus housing and heating costs if necessary. This basic amount for each person is means-tested against the household's net income as well as household wealth. Although wealth is not included regularly in the SOEP, it is proxied by the amount of household capital income.

[22] See SGB-II.

3.4.3 Social assistance

Persons who are not able to take care of their subsistence are entitled to receive social benefits. Ever since unemployment benefit II (see above) was introduced, only non employable persons can receive social assistance. Furthermore, social benefits are paid in extraordinary circumstances such as impairment of health. Analogous to unemployment benefit II the basic amount for each person and their respective household net income are taken into account to determine the amount of social benefits actually paid.[23]

3.4.4 Child benefits

Every family receives a lump-sum child benefit of € 184 per month for the first two children. For the third child, the benefit amounts to € 190, and to € 215 for every additional child[24]. As explained above, every household receives either child benefit or child allowance, depending on what is more favorable.

There is also a supplementary child benefit (*Kinderzuschlag*). Families are eligible for this benefit if their household income *plus* the supp. child benefit exceeds the subsistence level as defined by UB II. For these families, the suppl. child benefit is paid on top of the basic child benefit and amounts up to € 140 per month. Note that recipients of supplementary child benefit are not eligible for UB II.

3.4.5 Housing benefits

Housing benefits are paid on request to tenants as well as to owners. The number of persons living in the household, the number of family members, the income and the rent relative to the local rent level determine if a person is entitled to receive housing benefits.[25]

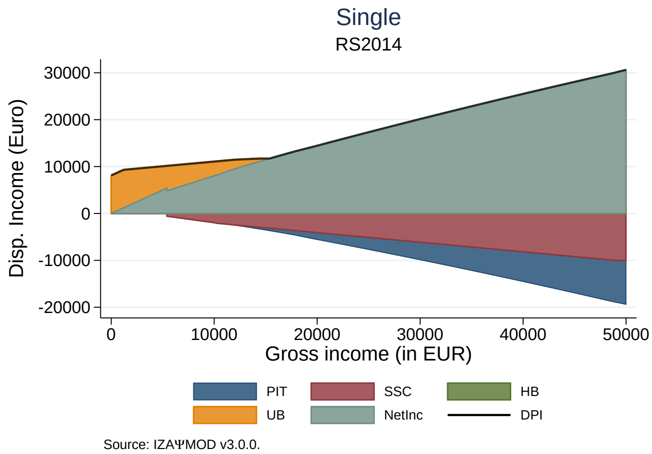
First, summing up the individual incomes considering the basic allowances gives the chargeable household income. Then, due to missing information about local rent levels, the weighted averages of rents up to the maximum support allowed are taken into account to determine the housing benefit. Housing benefits may also not be paid along with UB II.

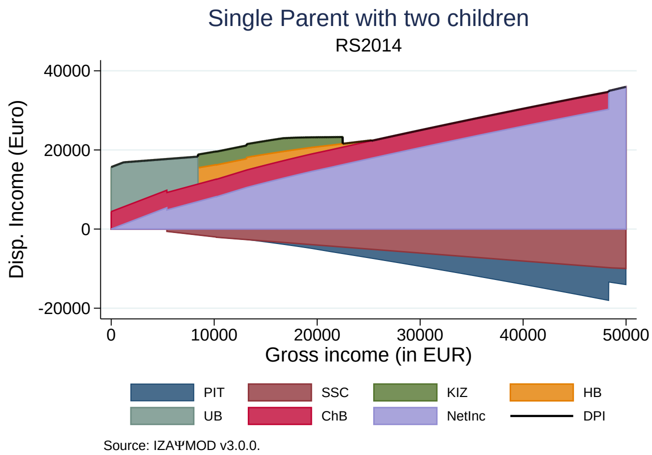
[23] See SGB-XII.
[24] See §66 (1) EStG.
[25] See §26 SGB-I and Wohngeldgesetz WoGG.

3.5 Visualization

The tax-benefit module can be used to visualize certain features of the German Tax-Benefit System. Figure 2 decomposes total disposable income (the gray line on top) into benefits received, tax and contribution payments, as well as net income. The decomposition is demonstrated for a single household and for a single parent with two children for a given value of market income on the x-axis. Comparable graphs for couples with and without kids are shown in Figure 8 in the Appendix. It is assumed that adults are in the labor force and thus eligible for unemployment benefit. Furthermore, full benefit take-up is assumed.

Figure 2: Detailed income decomposition (2014 Regime)

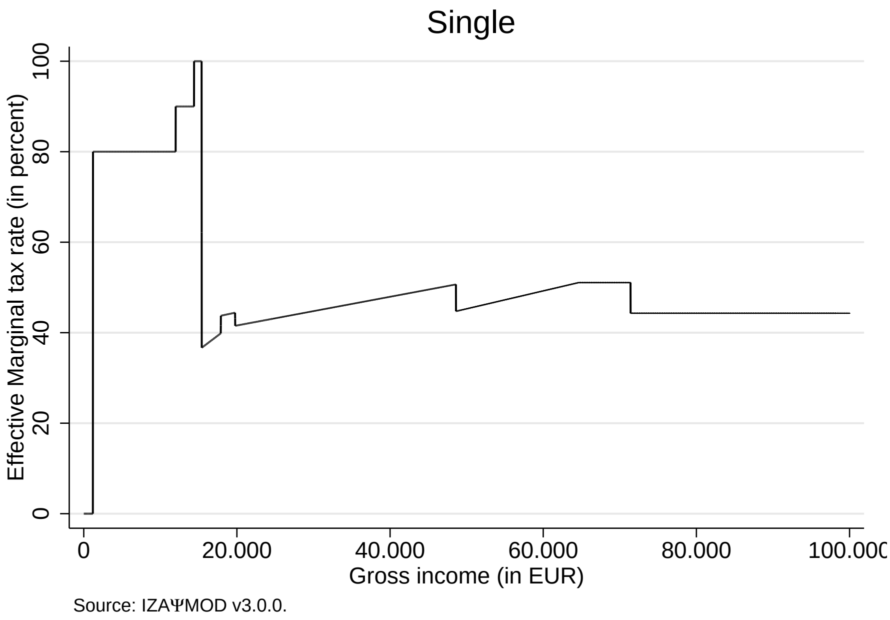




PIT: Personal Income Tax; SSC: Social Security Contributions; HB: Housing Benefit; ChB: Child Benefit; KIZ: Suppl. Child Benefit; UB: Unemployment Benefit II; NetInc: Net Income; DPI: Disp. Income.

The graphs demonstrate the basic unemployment benefit fading out as gross income rises. It can also be seen that social security contributions form the major fraction of the payment burden for households with gross income below € 50,000, as they kick in at a fairly low income level. The bottom graph demonstrates the interaction between Unemployment Benefit II, Supplementary Child Benefit and Housing Benefit.[26] If either of the latter two is sufficient to raise household income above the subsistence level, they are given priority to the unemployment benefit. Both benefits are means-tested, while the means-test rule for the supplementary child benefit creates a kink in the budget curve for this exemplary household. As income increases, housing and supplementary child benefits fade out. Finally, the basic child benefit is replaced by a tax allowance.

Figure 3: Effective marginal tax rate (2014 Regime)



From a behavioral perspective, it is more interesting to analyze the pattern of the effective marginal tax rate (EMTR). EMTR is defined as the change in the tax liability, including social contributions and benefit withdrawal, for a marginal change in gross income. Hence, it is a measure for the incentive to increase income at the margin, e. g. via increasing labor supply. Figure 3 plots the EMTR for a single household.[27] Monthly earnings of € 100 are not charged against the unemployment benefit. Hence, EMTR is zero up to € 1,200. Afterwards, 80% to 100% of earnings are deducted against Unemployment Benefit II. The bump just above € 20,000 is caused by two parallel rules to compute the solidarity surcharge, of which the more favorable one

[26] We assumed an average rent for a three-person household among those receiving UB II as of 01/2014.

[27] EMTR graphs for other household types can be found in the Appendix.

is applied.[28] For higher income levels, the EMTR for singles is mostly between 40 and 50 percent. The two kinks in the EMTR pattern are induced by the assessment ceilings for social security contributions (see Table 3). These are also the reason why marginal tax rates of top-income earners are slightly lower than for the middle class. Beyond, it should be noted that, except for lump-sum deductions, we do not assume any tax-deductible items in this calculation. Accounting for these may create a significant difference between gross income and taxable income, thus lowering the effective burden of taxation. In addition, capital income, which is taxed with a flat rate of only 25%, plays an increasing role for high-income earners.

4 Behavioral labor supply module

The evaluation of policy reforms is divided in two steps. First, purely static calculations yield so called morning-after or first round effects, holding labor supply decisions constant and ignoring behavioral responses. In a second step, we analyze potential changes in the labor market outcomes due to the reform. Thereby, the analysis accounts for the fact that policy reforms not only change net incomes and tax revenues but also affect the incentives whether and how much to work. Many policy measures like the *Hartz reforms* in Germany or the Earned Income Tax Credit (EITC) in the US are even targeted at increasing the incentives for participation in the labor market and increasing hours worked. Ignoring behavioral aspects of a policy reform thus yields only a imperfect image of the likely effects of the reform.

Structural labor supply models have become the standard tool to evaluate such behavioral responses. The idea is to estimate individual preferences under the observed status quo and to predict behavioral responses under the new policy regime but assuming preferences to be constant. Within this structural approach, there are several possibilities to model labor supply. A major distinction can be made between the use of continuous and discrete behavioral models. We briefly describe these two strengths of the literature and proceed by describing the static discrete choice labor supply model implemented in IZAΨMOD.[29]

4.1 Discrete vs. continuous labor supply modeling

The first empirical approaches in labor supply modeling relied on the derivation of marginal utility with respect to hours of work. This technique follows directly from

[28] The solidarity surcharge *Soli* depends on the income tax liability $T(x)$ as follows: $Soli = \min(0.055 * T(x), 0.2 * (T(x) - 972)$. The second term is lower for small values of $T(x)$.

[29] This section draws heavily from Löffler et al. (2014) and Löffler (2013).

the standard textbook neoclassical labor supply models and assumes that the household's utility is maximized over a continuous set of hours of work. This approach was introduced by Hausman (see, e.g. Hausman, 1981) and is therefore also known as *Hausman approach*. However, the classical model has some shortcomings. First, labor supply responses are restricted to the intensive margin and neglect the participation decision, which contradicts the empirical observation that labor supply is more responsive on the extensive than on the intensive margin (Heckman, 1993). Second, it has proven quite cumbersome to employ this kind of model in case of couple households or when the budget set is non-convex, which is often the case given the complicated tax and benefit systems in many countries and also in Germany. Third, the estimation of these models required rather restrictive a priori assumptions (see, e.g. MaCurdy et al., 1990, or Bloemen and Kapteyn, 2008, for details) and the estimated models are very sensitive to the underlying wages (Ericson and Flood, 1997, Eklöf and Sacklén, 2000).

For these reasons, it has become increasingly popular since the mid-1990s to model labor supply as choice between different jobs job types—known as *discrete choice approach*. Pioneered by Aaberge, Dagsvik and Strøm (1995), van Soest (1995) and Hoynes (1996), this approach incorporates the labor supply decision in the context of a random utility model. The model is estimated comparing different levels of utility instead of deriving the marginal utility over the set of possible working hours. This allows to incorporate the full complexity of taxes and transfers without worrying about non-convexities, non-monotonicity or corner solutions in the choice set. The same is true for couple households and the joint labor supply decision of both partners, which can be modeled rather easily in the discrete choice context. In addition to these technical considerations, highly regulated labor markets as in Germany, are also better described as choice between different jobs or discrete working hours categories instead of a continuous decision on hours worked. Furthermore, a richer stochastic specification in terms of unobserved wage rates of non-workers and random preferences can be incorporated into a discrete choice model.

For recent surveys of the empirical literature on labor supply models, see, for example, Blundell and MaCurdy (1999), Bargain and Peichl (2013), Löffler et al. (2014), Bargain et al. (2014) or Aaberge and Colombino (2014).

4.2 Labor supply estimation

We follow recent developments in the literature and implement the behavioral labor supply module in a discrete choice context. Following the standard procedure in the literature, we assume that the household's head and his partner jointly maximize a unitary utility function in the arguments consumption and leisure of both partners. Stated mathematically, household n opts for alternative i if this choice alternative is utility maximizing:

$$U\left(C_{ni}, L_i^m, L_i^f, P_{ni}, \epsilon_{ni}\right) = \max_{j \in J_n} U\left(f\left\{w_{nj}^m h_j^m, w_{nj}^f h_j^f, I_n\right\}, T - h_j^m, T - h_j^f, P_{nj}, \epsilon_{nj}\right) \quad (2)$$

where the household chooses from jobs or job types $j \in J_n$ (including non-participation in the labor market with $j = 0$), C_{nj} denotes consumption levels, L_j^m and L_f^f denote leisure of the male and the female partner, respectively, P_{nj} denotes whether the household is eligible for and also claims welfare participation. The function $f(\cdot)$ represents the tax and transfer system that transforms gross to net incomes, I_n denotes non-labor income of the household, T is the total time endowment, h_j^m and h_j^f denote working hours of both spouses and ϵ_{nj} captures unobservable tastes or disutility components for household n when choosing job j.

In line with the common procedure in the literature, we assume that households choose from a set of pre-defined job types, classified according to intervals of work hours. Single decision makers decide to work 0, 10, 20, 30, 40, 50, 60 hours per week, couples face $7 \times 7 = 49$ hours alternatives. This classification of intervals also roughly corresponds to the observed hours distribution. Although this choice set representation is sometimes criticized because of the arbitrary classification of working hours (see, e.g. Aaberge et al., 2009), sensitivity analyses have shown that these rather typical hours intervals are a good approximation to more flexible models (see, e.g. Flood and Islam, 2005, or Bargain et al., 2014). Moreover, for every job type that makes the household eligible for transfer receipt, households decide whether to claim the benefit. In principle, this makes up to 14 alternatives for singles and 98 alternatives for couples. However, welfare eligibility often ends at the latest when working full-time.

4.2.1 Utility specification

As in the standard conditional logit model of McFadden (1974), we assume that unobservables ϵ_{nj} are additive separable and i.i.d. extreme value type I distributed. This leaves us with the specification of the systematic part of the utility function. IZAΨMOD incorporates a set of different utility specification, all three are frequently used in the literature (see survey in Löffler et al., 2014).

Quadratic utility specification The so called quadratic utility function describes a second-order polynomial in the choice variables consumption and leisure. This specification has been used, e.g. in Blundell et al. (1999, 2000) and Bargain et al. (2014).

$$\begin{aligned} U^q\left(C_{nj}, L_j^m, L_j^f, P_{nj}, \epsilon_{nj}\right) = &\, \boldsymbol{x_{nj}^1}\boldsymbol{\beta_1'}C_{nj} + \beta_2 C_{nj}^2 + \beta_3 C_{nj}L_j^m + \beta_4 C_{nj}L_j^f \\ &+ \boldsymbol{x_{nj}^2}\boldsymbol{\beta_5'}L_j^m + \beta_6 L_j^{m2} + \boldsymbol{x_{nj}^3}\boldsymbol{\beta_7'}L_j^f + \beta_8 L_j^{f^2} \\ &+ \boldsymbol{x_{nj}^4}\delta' P_{nj} + \boldsymbol{x_{nj}^5}\gamma' + \epsilon_{nj} \end{aligned} \quad (3)$$

In addition to consumption and leisure and their squared terms, the utility function also accounts for potential stigma from welfare participation δ (if $P_{nj} = 1$) and labor market restrictions such as fixed costs or working hours regulations γ.

Translog utility specification A slightly different version of the quadratic utility function is known as translog utility specification. In this form, the logs instead of the levels of consumption and leisure enter the utility function. The translog specification has been used, e.g. by van Soest (1995), Haan (2006) and Flood et al. (2007).

$$\begin{aligned} U^t\left(C_{nj}, L_j^m, L_j^f, P_{nj}, \epsilon_{nj}\right) = &\, \boldsymbol{x_{nj}^1}\boldsymbol{\beta_1'}\ln C_{nj} + \beta_2(\ln C_{nj})^2 + \beta_3 \ln C_{nj}\ln L_j^m + \beta_4 \ln C_{nj}\ln L_j^f \\ &+ \boldsymbol{x_{nj}^2}\boldsymbol{\beta_5'}\ln L_j^m + \beta_6(\ln L_j^m)^2 + \boldsymbol{x_{nj}^3}\boldsymbol{\beta_7'}\ln L_j^f + \beta_8(\ln L_j^f)^2 \\ &+ \boldsymbol{x_{nj}^4}\delta' P_{nj} + \boldsymbol{x_{nj}^5}\gamma' + \epsilon_{nj} \end{aligned} \quad (4)$$

Again, the pure utility is given by coefficients $\boldsymbol{\beta_1}$ to β_8. The vector δ denotes the potential disutility from welfare participation, γ captures labor market restrictions.

Box-Cox utility specification The third utility specification refers to a Box-Cox transformed functional form. The Box-Cox specification has been used, e.g. by Aaberge et al. (1995), Blundell and Shephard (2012) and Löffler et al. (2014).

$$\begin{aligned} U^b\left(C_{nj}, L_j^m, L_j^f, P_{nj}, \epsilon_{nj}\right) = &\, \boldsymbol{x_{nj}^1}\boldsymbol{\beta_1'}C_{nj}^{(\lambda_C)} + \beta_3 C_{nj}^{(\lambda_C)}L_j^{m(\lambda_L^m)} + \beta_4 C_{nj}^{(\lambda_C)}L_j^{f(\lambda_L^f)} \\ &+ \boldsymbol{x_{nj}^2}\boldsymbol{\beta_5'}L_j^{m(\lambda_L^m)} + \boldsymbol{x_{nj}^3}\boldsymbol{\beta_7'}L_j^{f(\lambda_L^f)} + \boldsymbol{x_{nj}^4}\delta' P_{nj} + \boldsymbol{x_{nj}^5}\gamma' + \epsilon_{nj} \end{aligned} \quad (5)$$

The Box-Cox variables $L_j^{m(\lambda_L^m)}$, $L_j^{f(\lambda_L^f)}$ and $C_{nj}^{(\lambda_C)}$ are defined as follows ($s = m, f$):

$$C_{nj}^{(\lambda_C)} = \begin{cases} \frac{C_{nj}^{*\,\lambda_C} - 1}{\lambda_C} & \text{if } \lambda_C \neq 0 \\ \ln C_{nj}^* & \text{if } \lambda_C = 0 \end{cases} \qquad L_j^{s(\lambda_L^s)} = \begin{cases} \frac{L_j^{s*\lambda_L^s} - 1}{\lambda_L^s} & \text{if } \lambda_L^s \neq 0 \\ \ln L_j^{s*} & \text{if } \lambda_L^s = 0 \end{cases} \quad (6)$$

$$C_{nj}^* = C_{nj}/1000 \qquad L_j^{s*} = L_j^s/80 \quad (7)$$

In all these specifications, the vectors x_{nj}^1 to x_{nj}^5 capture individual and household characteristics, the vector x_{nj}^5 includes alternative specific variables as well. Thereby, all three utility specifications allow for observed heterogeneity in preferences. In addition, it has become standard practice in structural labor supply models to allow for unobserved heterogeneity in preferences as well. We incorporate this possibility in IZAΨMOD by allowing preference coefficients (β_1 to β_8, δ and γ) to be random. This modeling approach—known as *random coefficients model*—assumes that specific parameters are multivariate normally distributed.[30] The rather technical extension allows us to estimate the full distribution of tastes across all households in our sample (more specifically, the mean and the variance of this distribution) instead of estimating just the average preference for consumption or leisure over all households.

It should be stressed that we do not impose any conditions on the marginal utility of consumption and leisure. While the marginal utility of consumption is estimated to be positive for the vast majority of households, this is not the case for leisure. This reflects the intrinsic utility of being employed.

As noted before, we not only model preferences for the level of consumption, but also take account of the source of income by allowing for potential disutility δ from welfare participation (Moffitt, 1983). The underlying rationale is to pick up the empirical observation that some households decide not to become welfare recipients although they would be eligible. One reason might be, that households do not want to enter the welfare bureaucracy for a potentially small benefit payment. This modeling approach has been proposed by Hoynes (1996) and Keane and Moffitt (1998).

Labor market regulations also crucially influence individual labor market decisions. In the literature, different approaches have been taken. While van Soest (1995) arbitrarily allowed part-time jobs to have lower utility levels, e.g. due to higher search costs, Euwals and van Soest (1999) introduced fixed costs of working instead of part-time restrictions. Although fixed costs are easier to interpret, their modeling assumption still remains rather ad hoc. Aaberge et al. (1995) provide a theoretically more convincing concept that models the share of market opportunities and peaks in the working hours distribution due to working hours regulations. The behavioral labor supply module implemented in IZAΨMOD incorporates all these different approaches.

4.2.2 Wage imputation

In order to evaluate the latent and thus unobserved choice set, we have to produce counterfactual choice alternatives and calculate what the households consumption

[30] We introduced unobserved heterogeneity in three coefficients, one in β_1, one in β_5 and one in β_7.

would be, had it chosen a job type different from the observed one. A crucial issue when estimating preferences and labor market conditions thus concerns the imputation of hourly wages. Wage rates have to be imputed at least for non-workers, but some authors also impute wages for the full sample of all households trying to avoid two distinct wage distributions—the observed one for actual employees and the estimated one for non-workers.

In addition to the imputation method, there are also different methods to predict wages. The most important issue relates to the treatment of wage prediction errors. Often, only the average predicted wage is used for the estimation, assuming that offered jobs pay this wage with certainty. Instead of this rather restrictive assumption, it becomes more and more common practice, to take account of the full distribution of wage predictions and integrating the wage prediction error out during the labor supply estimation.

Löffler et al. (2014) show that the modeling decisions of how and for whom to impute wages substantially impact the estimated labor supply elasticities. In fact, some imputation methods lead to substantial bias and even double the estimated labor supply elasticities.

4.2.3 Estimation

To uncover the preference coefficients, we estimate the outlined model via maximum likelihood methods. While the simplest version of this model reduces to a standard conditional or multinomial logit model with a closed form solution, this model exhibits the so called assumption of Independence of Irrelevant Alternatives (IIA, see, e.g. Luce, 1959). The IIA assumption implies that the preference between two alternatives does not depend on the presence or the characteristics of any other alternative. This assumption may sometimes be justified, but will be rather restrictive and unrealistic in most cases. Therefore, it is common practice to also include unobservable components as in the random coefficients model or prediction errors in wages. Both extensions depart from the simple multinomial logit model and thereby also yield more complex substitution patters, overcoming the IIA assumption.

In turn, these so called mixed logit models (McFadden and Train, 2000) no longer have a closed form solution. The reason is that the probabilities of household n choosing job type i now have to be evaluated over the range of possible individual preference coefficients $\boldsymbol{\beta}_n$, labor market conditions γ_n and wage predictions $\hat{\boldsymbol{w}}_n$:

$$L = \prod_{n=1}^{N} \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \frac{\exp\left(v_{ni}\left\{\cdot|\hat{\boldsymbol{w}}_{ni}, \boldsymbol{\beta}_n\right\}\right) g\left(i|\gamma_n\right)}{\sum_{j\in J_n} \exp\left(v_{nj}\left\{\cdot|\hat{\boldsymbol{w}}_{nj}, \boldsymbol{\beta}_n\right\}\right) g\left(j|\gamma_n\right)} f(\boldsymbol{\beta}_n, \gamma_n) f(\hat{\boldsymbol{w}}_n)\, \mathrm{d}\boldsymbol{\beta}_n \mathrm{d}\gamma_n \mathrm{d}\hat{\boldsymbol{w}}_n \quad (8)$$

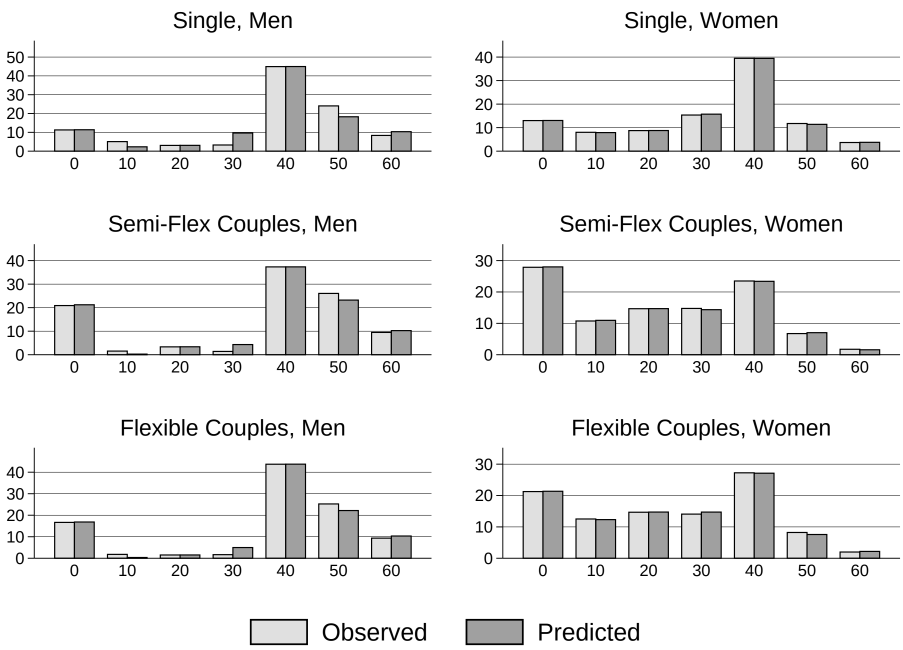
By evaluating the full set of coefficients and wage predictions—each weighted by the respective probability density—, we are able to estimate the distribution of the coefficients and not only population averages. In order to estimate this kind of model, Train (2009) proposes the use of simulation methods to approximate the integrals of equation (8) and maximize a simulated log-likelihood based on a sequence $\left\{\boldsymbol{\beta}_{\boldsymbol{n}}^{(r)}, \gamma_{\boldsymbol{n}}^{(r)}, \hat{\boldsymbol{w}}_{\boldsymbol{n}}^{(r)}\right\}_{r=1}^{R}$ with $r = 1, \ldots, R$ draws sampled from the (joint) distributions of $(\boldsymbol{\beta_n}, \gamma_n, \hat{\boldsymbol{w}}_{\boldsymbol{n}})$. The maximum simulated log-likelihood is given by:

$$\ln(SL) = \sum_{n=1}^{N} \ln \left(\frac{1}{R} \sum_{r=1}^{R} \frac{\exp\left(v_{ni}\left\{\cdot \middle| \hat{\boldsymbol{w}}_{\boldsymbol{ni}}^{(r)}, \boldsymbol{\beta}_{\boldsymbol{n}}^{(r)}\right\}\right) g\left(i \middle| \gamma_{\boldsymbol{n}}^{(r)}\right)}{\sum_{j \in J_n} \exp\left(v_{nj}\left\{\cdot \middle| \hat{\boldsymbol{w}}_{\boldsymbol{nj}}^{(r)}, \boldsymbol{\beta}_{\boldsymbol{n}}^{(r)}\right\}\right) g\left(j \middle| \gamma_{\boldsymbol{n}}^{(r)}\right)} \right). \tag{9}$$

We use Halton sequences instead of (pseudo) random draws in order to increase the stability of our estimation results. The labor supply estimation is performed using the Stata command `lslogit` (see Löffler, 2013, for technical details on the estimation).

4.2.4 Benchmark model

Figure 4: Fit of hours distribution



While IZAΨMOD allows us to easily check the sensitivity of our results with regard to the utility specification or the wage imputation procedure, our benchmark model uses a setting that is both computationally feasible and able to replicate the observed hours distribution. This is satisfied by a model that assumes a translog utility function as in Equation 4. Preference coefficients are assumed to be non-random, and the individual choice set is inflated to endogenize the welfare participation. Labor market regulations are adopted according to Aaberge et al. (1995). We use predicted wages only if they are not observed. Information on hours and income refers to the year before the sample period. Alternatively, one could use hours worked from the reference week.

As Figure 4 shows, the distribution of predicted choices corresponds to the one observed across all household types.[31] This model will be used in the following for the estimation of elasticities.

4.2.5 Labor Supply Elasticities

Instead of analyzing the effects of a tax reform, MSM can also be employed to derive labor supply elasticities, a measure frequently reported in labor economics indicating the percentage reaction of labor supply induced by a certain percentage rise of one of the variables determining income. There are several distinctions that have to be borne in mind when reporting elasticities. First, it has to be distinguished between hours and participation elasticities. The former ones report the percentage change in labor supply after a rise of an income related variable. Thus, they indicate the reaction at the intensive margin, whereas participation elasticities focus on the effect at the extensive margin, measured as percentage change of the Participation rate. Secondly, elasticities may be conditional or unconditional. Conditional elasticities measure the labor supply reactions conditional on being part of the labor force prior to the change in income, whereas unconditional elasticities also take into account reactions at the extensive margin. Thirdly, elasticities can be uncompensated or compensated. The latter ones only measure the substitution effect, whereas the former ones comprise substitution and income effect. Fourthly, the rise of the income variable may vary. Normally it is either increased by one or by ten percent. Finally, the income variable itself has to be chosen. Commonly, one increases the gross wage, the net wage or the net income.

Table 4 shows the uncompensated, unconditional, one percent, own wage hours and participation elasticities.[32] Uncompensated elasticities are easier to communicate and thus more relevant from a policy perspective as a measure of the labor supply

[31] Single Parents are estimated jointly with Singles, controlling for presence of children in various age groups.

[32] The hours elasticity is defined as the mean percentage change in hours due to the reform from those in work. $\varepsilon_{Hours} = \frac{1}{n}\sum_i \frac{h_{1i}-h_{0i}}{h_{0i}}\Big|_{h_{0i}>0}$. The participation elasticity is defined as the percentage change in the share of active workers (Saez, 2002).

reaction to a marginal wage change. From looking at the table three basic conclusions can be drawn. First, all hours elasticities are positive, implying that the positive (negative) substitution effect of a wage rise on labor (leisure) overcompensates the negative (positive) income effect. Second, participation elasticities are smaller than hours elasticities, which must be true, since we have estimated unconditional hours elasticities which comprise the participation decision. Nevertheless, it becomes obvious that the participation elasticities make up a big share of the hours elasticities, implying that the participation decision is the driver of the positive labor supply effect. Finally, women have higher elasticities than men.

Table 4: Estimated one percent Supply elasticities

	Singles		Couples	
	Men	Women	Men	Women
Hours	0.1421	0.2260	0.2468	0.3122
Participation	0.0931	0.1059	0.1944	0.1115

The results are qualitatively and quantitatively in line with other studies both for Germany (see, e.g., Bonin et al., 2002, Steiner and Wrohlich, 2004, Haan and Steiner, 2005, Haan and Steiner, 2006, Haan and Uhlendorff, 2007, Fuest et al., 2008) or Bargain et al., 2010 and Bargain et al., 2014 in an international context. Most studies on labor supply find that labor supply responds rather along the extensive than the intensive margin (see, e.g., Heckman, 1993, Immervoll et al., 2007 or Fuest et al., 2008). In particular, certain subgroups (at the bottom of the income distribution) have rather high participation elasticities (see Eissa and Liebman, 1996, Meyer and Rosenbaum, 2001 and Aaberge et al., 1999). Moreover, working-hours elasticities are close to zero for men (see Blundell and MaCurdy, 1999) and women (see Mroz, 1987, Triest, 1990).

4.3 Counterfactual analysis

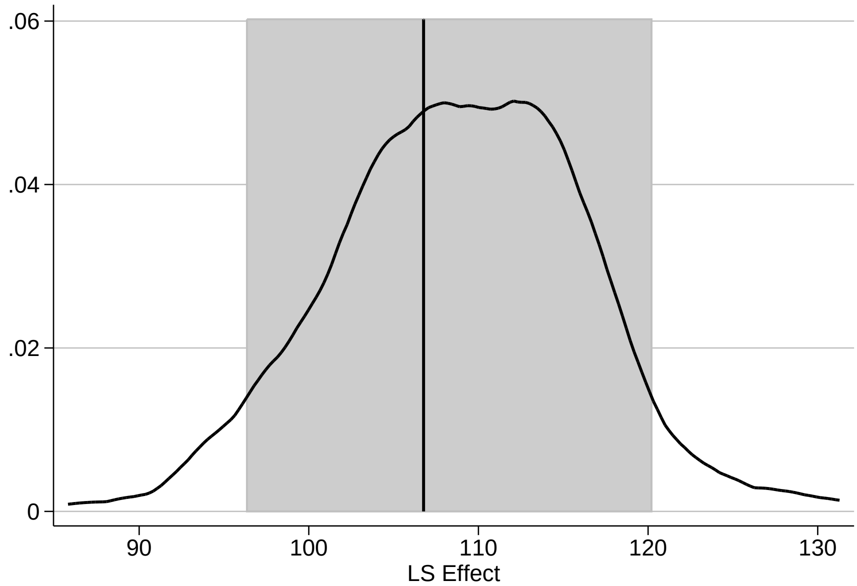
Once the preference coefficients are obtained, the behavioral labor supply module allows us to run counterfactual analysis holding the previously estimated preferences constant.[33] In order to perform these analysis, we predict the labor market decisions under the current tax regime and under the new policy environment after the implementation of a policy reform of interest. This gives us choice probabilities for all potential labor market choices both under the current and the new tax regime. By comparing the expected labor market outcomes or the expected earnings, tax revenues

[33] Preferences may change over time and there is indeed evidence that they do so in the long-run (see Heim, 2009). However, we do not consider long-run effects that evolve over several decades.

or benefit payments, IZAΨMOD allows us to predict the likely behavioral effects of a reform.

When evaluating the effects of reforms changing the status quo, we are faced with the problem that the GSOEP data are made available with a delay of about two years. Hence, our most recent data base is not a sample from the current population. For example, at the time of writing, the most recent data available refer to the German population from 2012. In order to obtain a meaningful starting point for reforms, we apply the current tax regime as a reform to the system from the sample year. The labor market equilibrium (section 5) from this run serves then as baseline for the actual reform scenario.

Figure 5: Density of reform effects from abolishing the solidarity surcharge



Using bootstrapping methods, we are also able to check the statistical significance and the confidence bands of our predictions. An example is given in Figure 5. The underlying policy reform is the abolishment of the solidarity surcharge (see Section 3.1.3). This was suggested by the liberal democratic party (FDP) for the general election in 2013. Households subject to income taxation experience an increase in disposable income, which leads to an overall increase in labor supply. The baseline simulated reform effect for the whole sample amounts to an increase of 107,000 Full-Time Equivalents. The Figure plots the distribution of reform effects for 200 bootstraps. 95% of the effects lie in the interval [96,000;120,000], as indicated by the shaded area in the graph.

5 Labor demand module

The incorporation of labor demand adjustments is an important extension to microsimulation models, since employment predictions can only be accurate when taking into account the demand side as well. In order to control for demand effects and see how labor supply reactions eventually translate into employment outcomes, we firstly estimate the labor demand for Germany (section 5.1). In a second step, we feed this information into IZAΨMOD (section 5.2).

5.1 Labor demand estimation

This section provides only a brief description of our labor demand estimation strategy and our results. For a more thorough presentation see Peichl and Siegloch (2012). Almost all studies that estimate labor demand depart from the *dual approach*. Assuming a constant output, cost minimization yields the same factor demands as profit maximization (Hamermesh, 1993). In general, we are faced with a cost function of some form. We apply Shephard's lemma (Shephard, 1970) to the cost function and derive estimable factor demand functions conditional on output. From these it is trivial to derive own-wage elasticities for differently skilled labor. There are several cost functions, which can be chosen. For IZAΨMOD we pick a non-constant return to the scale Translog specification with three differently skilled, flexible labor inputs, capital as a quasi-fixed input, a time trend and industry dummies. We obtain a labor demand elasticity of -0.65, -0.37 and -1.05 for high-, medium- and low-skilled workers.[34]

5.2 Supply-demand iterations

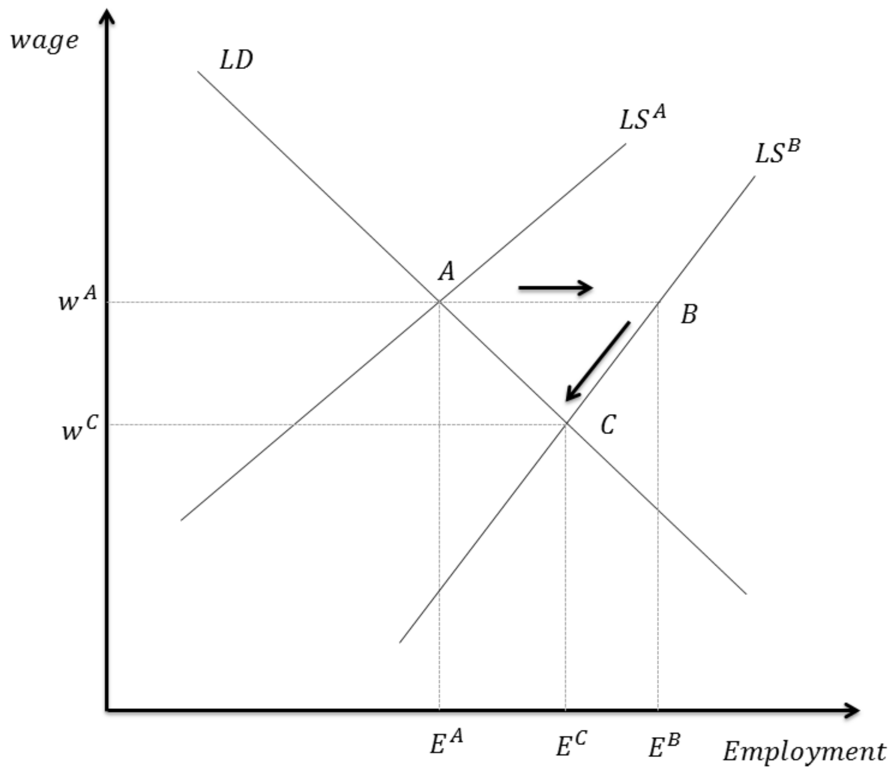
The demand module of IZAΨMOD uses these elasticities to calculate labor demand adjustments after a change of the labor supply. Building on approaches proposed by Creedy and Duncan (2005) and Haan and Steiner (2006), these adjustments can be considered as a third-round effect after the technical adjustment of the budget and the behavioral effects of the labor supply following a tax reform. The rationale behind the demand module can be best described graphically and is based on the presentation by Haan and Steiner (2006).

Figure 6 shows the effects of some general tax reform shifting labor supply to the north-east. Without a demand module, implicitly assuming a perfectly elastic labor demand, the resulting employment would be at E^B. Taking into account the labor

[34] For more details on the impacts of different specifications and the estimation procedure and a comparison of our results with findings on labor demand for Germany, see Peichl and Siegloch (2012).

demand curve, however, it is trivial to see that this cannot be the solution of the labor market under perfect competition, since supply does not equal demand. Since the own-wage labor demand elasticities are theoretically and also empirically negative, a rise in employment is associated with a decrease in the wage. These elasticities can be used to arrive at the market equilibrium in point C.

Figure 6: Demand module



The labor demand module of IZAΨMOD, thus, uses the elasticities derived from the labor demand estimations to calculate the change in wage which has to follow the change in employment of $E^B - E^A$. In a next step this wage change is used to recalculate the net income of the household, which will again have an effect on labor supply. This effect is simulated using the new net income and the established leisure/consumption preferences. Assuming a positive labor supply elasticity, the labor supply shifts to the left reducing the initial positive employment effect. Once again using the demand elasticities, this reduction of the employment will lead to an increase in the wage, leading to a right shift of the supply curve. This procedure is iterated until the employment shifts and thus the wage shifts become arbitrarily small[35] and the model converges. At this point supply equals demand and we are situated in the market equilibrium.[36] The iteration procedure is carried out separately for three different skill groups to account for different elasticities on the demand side.

6 External validation

The quality of the microsimulation model can be assessed by comparing simulated quantities (e. g. number persons, tax revenues, benefit payments) against official data. Errors may arise from lacking representativeness of the data base, non-observable household characteristics, and from errors in the tax-benefit calculation. If the model is able to replicate the status quo with sufficient accuracy, credibility of simulation results is enhanced.

Table 5: Validation of simulated Tax-Benefit amounts

	Year	Simulated	Reference	Ratio
		Mill. Euros		
Revenues				
Income Tax	2007[a]	205,113	210,953	97.2%
Withholding Tax	2011	6,597	8,020	82.3%
Pension contributions	2011	170,630	188,999	90.3%
Health insurance contributions[b]	2011	136,161	144,596	94.1%
Unemployment insurance contributions	2011	25,460	25,434	100.1%
Expenses				
Unemployment Benefit II	2011	19,321	19,384	99.7%
Housing Benefit	2011	2,004	1,784	112.3%
Child Benefit	2011	25,848	33,213	77.8%

Own calculations with IZAΨMOD v3.0.

[a] Reliable reference values for the income tax (*Lohn- und Einkommensteuerstatistik*) are published only three-annually and with some delay.

[b] without contributions from pensioners.

Table 5 compares simulated amounts for the most important taxes, contributions and social benefits. The personal income tax is fairly met, while the withholding tax on capital income is under-covered. It is a typical feature of survey studies to not capture all capital income. There is some under-coverage for pension insurance

[35] Here we consider a change of less than 10,000 hours a months, which equals 250 full-time equivalents or less than 0.1 percent of the average labor supply effect of our reform scenarios to be arbitrarily small. The maximum number of iterations is set at 50.

[36] It must be noted that Figure 6 is merely a broad illustration of that iteration process. The figure misleadingly suggests that the way into the equilibrium in point C is achieved by walking along the new labor supply curve. In reality, the wage change which is calculated via the labor demand elasticity leads to a new simulation of the labor supply reaction. Thus the LS shifts again until the final curve LS^B is reached.

contributions, whereas simulated benefit payment roughly correspond to actual ones. A potential source of error is the interplay between UBII and Child Benefit, which can be claimed at the same time. If this is the case, the latter is fully deducted from the former, leaving household budgets unaffected.

7 Applications

So far, IZAΨMOD has been applied to simulate the effects of several reform proposals for Germany. The model is flexible enough to assess a wide range of possible changes of the German tax and benefit system, such as an introduction of workfare concepts, flat tax schedules, tax credits or negative income tax systems.

Among others, concrete reform proposals which have been recently analyzed using IZAΨMOD are:

- the introduction of a minimum wage in Germany (Arni, Eichhorst, Pestel, Spermann and Zimmermann, 2014)
- a distributional analysis of the election manifestos for the 2013 national elections (Peichl, Pestel, Siegloch and Sommer, 2014).
- the distributional impact of shifting the tax burden from Income Tax and Social Security Contributions towards Value Added Tax (Pestel and Sommer, 2013).
- the introduction of an integrated system of taxation, introducing a complete transition towards a tax-financed benefit system (Löffler, Peichl, Pestel, Schneider and Siegloch, 2012).
- an investigation on marginal employment in Germany, with some suggestions for reforms (Eichhorst, Hinz, Marx, Peichl, Pestel, Siegloch, Thode and Tobsch, 2012).
- alternative schedules for fading-out the unemployment benefit for working benefit recipients. (Schneider, Peichl, Pestel, Siegloch and Löffler, 2012, Peichl, Pestel, Schneider and Siegloch, 2011b).
- the distributional and fiscal impact of the 2008-09 crisis (Bargain, Immervoll, Peichl and Siegloch, 2012)
- a bracket model for income tax schedule, as proposed by Paul Kirchhoff (Löffler, Peichl, Pestel, Schneider and Siegloch, 2011).

- a set of tax reforms replacing the current, step-wise linear tax function with a bracket model (Peichl, Pestel, Schneider and Siegloch, 2011a, 2010)..
- the relation between changes in household structure and changes in the income distribution (Peichl, Pestel and Schneider, 2011).
- a bracket schedule for income tax, combined with a fundamental reform of the benefit system, as suggested by the new federal government in 2009 (Neumann, Peichl, Schneider and Siegloch, 2009).

References

Aaberge, R. and Colombino, U. (2014). Labour Supply and Policy Simulation, *in* C. O'Donoghue (ed.), *Handbook of Microsimulation Modelling*, Emerald Group Publishing.

Aaberge, R., Colombino, U. and Strom, S. (1999). Labor Supply in Italy: An Empirical Analysis of Joint Household Decisions, with Taxes and Quantity Constraints, *Journal of Applied Econometrics* **14**(4): 403–422.

Aaberge, R., Colombino, U. and Wennemo, T. (2009). Evaluating Alternative Representations of the Choice Sets in Models of Labor Supply, *Journal of Economic Surveys* **23**(3): 586–612.

Aaberge, R., Dagsvik, J. K. and Strøm, S. (1995). Labor Supply Responses and Welfare Effects of Tax Reforms, *The Scandinavian Journal of Economics* **97**(4): 635–659.

Alda, H., Bender, S. and Gartner, H. (2005). The Linked Employer-Employee Dataset of the AB (LIAB), *Schmollers Jahrbuch - Journal of Applied Social Science Studies* **125**(2): 327–336.

Arni, P., Eichhorst, W., Pestel, N., Spermann, A. and Zimmermann, K. F. (2014). Der gesetzliche Mindeslohn in Deutschland: Einsichten und Handlungsempfehlungen aus der Evaluationsforschung, *Schmoller's Jahrbuch - Journal of Applied Social Science Studies, forthcoming* .

Bargain, O., Caliendo, M., Haan, P. and Orsini, K. (2010). "Making work pay" in a rationed labor market, *Journal of Population Economics* **23**(1): 323–351.

Bargain, O., Immervoll, H., Peichl, A. and Siegloch, S. (2012). Distributional consequences of labor demand shocks: the 2008 - 2009 recession in Germany, *International Tax and Public Finance* **19**(1): 118 – 138.

Bargain, O., Orsini, K. and Peichl, A. (2014). Comparing Labor Supply Elasticities in Europe and the US: New Results, *Journal of Human Resources* (forthcoming).

Bargain, O. and Peichl, A. (2013). Steady-State Labor Supply Elasticities: An International Comparison, *IZA Discussion Paper* **7698**.

Becker, I., Frick, J. R., Grabka, M. M., Hauser, R., Krause, P. and Wagner, G. G. (2003). A comparison of the main household income surveys for Germany: EVS and SOEP, *in* R. Hauser and I. Becker (eds), *Reporting on Income Distribution and Poverty*, Springer, Heidelberg, pp. 55–90.

Bender, S. and Haas, A. (2002). Die IAB beschäftigtenstichprobe, *IAB Kompendium Arbeitsmarkt- und Berufsforschung. Beiträge zur Arbeitsmarkt- und Berufsforschung. BeitrAB* **250**: 3–12.

Bender, S., Haas, A. and Klose, C. (2000). The IAB Employment Subsample 1975-1995, *Schmollers Jahrbuch - Journal of Applied Social Science Studies* **120**(4): 649–662.

Bloemen, H. G. and Kapteyn, A. (2008). The estimation of utility-consistent labor supply models by means of simulated scores, *Journal of Applied Econometrics* **23**(4): 395–422.

Blundell, R., Duncan, A., McCrae, J. and Meghir, C. (1999). Evaluating In-Work Benefit Reform: the Working Families Tax Credit in the UK. paper presented at the Joint Center for Poverty Research conference, Northwestern University.

Blundell, R., Duncan, A., McCrae, J. and Meghir, C. (2000). The Labour Market Impact of the Working Families' Tax Credit, *Fiscal Studies* **21**(1): 75–104.

Blundell, R. and MaCurdy, T. (1999). Labor Supply: A Review of Alternative Approaches, *in* O. Ashenfelter and D. Card (eds), *Handbook of Labor Economics, Vol. 3A*, Elsevier, Amsterdam, pp. 1559–1695.

Blundell, R. and Shephard, A. (2012). Employment, Hours of Work and the Optimal Taxation of Low-Income Families, *Review of Economic Studies* **79**(2): 481–510.

Bonin, H., Kempe, W. and Schneider, H. (2002). Household Labor Supply Effects of Low-Wage Subsidies in Germany, IZA Discussion Paper No. 637.

Bourguignon, F. and Spadaro, A. (2006). Microsimulation as a tool for evaluating redistribution policies, *Journal of Economic Inequality* **4**(1): 77–106.

Buck, J. (2006). *Datenfusion und Steuersimulation*, Shaker.

Creedy, J. and Duncan, A. (2002). Behavioural Microsimulation with Labour Supply Responses, *Journal of Economic Surveys* **16(1)**(1): 1– 39.

Creedy, J. and Duncan, A. (2005). Aggregating labour supply and feedback effects in microsimulation, *Australian Journal of Labour Economics* **8**(3): 277 – 290.

Decoster, A., Ochmann, R. and Spiritus, K. (2013). Integrating Indirect Taxation into EUROMOD - Documentation and Results for Germany. Euromod Working Paper No. EM 20/13.

Destatis (2013). Einkommens- und Verbrauchsstichprobe – Aufgabe, Methode und Durchführung der EVS, Fachserie 15 Heft 7.

Eichhorst, W., Hinz, T., Marx, P., Peichl, A., Pestel, N., Siegloch, S., Thode, E. and Tobsch, V. (2012). Geringfügige Beschäftigung: Situation und Gestaltungsoptionen, *IZA Research Report* **47**. Based on a project for the Bertelsmann Stiftung.

Eissa, N. and Liebman, J. (1996). Labor supply response to the earned income tax credit, *Quarterly Journal of Economics* **111**: 605–637.

Eklöf, M. and Sacklén, H. (2000). The Hausman-MaCurdy Controversy: Why Do the Results Differ across Studies?, *Journal of Human Resources* **35**(1): 204–220.

Ericson, P. and Flood, L. (1997). A Monte Carlo Evaluation of Labor Supply Models, *Empirical Economics* **22**(3): 431–460.

Euwals, R. and van Soest, A. (1999). Desired and actual labour supply of unmarried men and women in the Netherlands, *Labour Economics* **6**(1): 95–118.

Flood, L. and Islam, N. (2005). A Monte Carlo evaluation of discrete choice labour supply models, *Applied Economics Letters* **12**(5): 263–266.

Flood, L., Wahlberg, R. and Pylkkänen, E. (2007). From Welfare to Work: Evaluating a Tax and Benefit Reform Targeted at Single Mothers in Sweden, *LABOUR* **21**(3): 443–471.

Fuest, C., Peichl, A. and Schaefer, T. (2008). Is a flat tax reform feasible in a grown-up democracy of Western Europe? A simulation study for Germany, *International Tax and Public Finance* **15**: 620–636.

Haan, P. (2006). Much ado about nothing: conditional logit vs. random coefficient models for estimating labour supply elasticities, *Applied Economics Letters* **13**(4): 251–256.

Haan, P. and Steiner, V. (2005). Distributional Effects of the German Tax Reform 2000 - A Behavioral Microsimulation Analysis, *Schmollers Jahrbuch* **125 (1)**: 39–49.

Haan, P. and Steiner, V. (2006). Labor market effects of the german tax reform 2000, *in* C. Dreger, H. P. Galler and U. Walwei (eds), *Determinants of Employment*, Nomos, Baden-Baden, pp. 101–117.

Haan, P. and Uhlendorff, A. (2007). Intertemporal Labor Supply and Involuntary Unemployment, IZA Discussion Paper No. 2888.

Hamermesh, D. (1993). *Labor Demand*, Princeton University Press, Princeton.

Hausman, J. A. (1981). Exact Consumer's Surplus and Deadweight Loss, *The American Economic Review* **71**(4): 662–676.

Heckman, J. (1979). Sample Selection Bias as a Specification Error, *Econometrica* **47**: 153–161.

Heckman, J. (1993). What has been learned about labor supply in the past twenty years?, *American Economic Review Papers and Proceedings* **85**: 116–121.

Heim, B. T. (2009). Structural Estimation of Family Labor Supply with Taxes, *Journal of Human Resources* **44**(2): 350–385.

Hoynes, H. W. (1996). Welfare Transfers in Two-Parent Families: Labor Supply and Welfare Participation Under AFDC-UP, *Econometrica* **64**(2): 295–332.

Immervoll, H., Kleven, H., Kreiner, C. and Saez, E. (2007). Welfare Reform in European Countries: A Micro-Simulation Analysis, *The Economic Journal* **117 (516)**: 1–44.

Keane, M. P. and Moffitt, R. (1998). A Structural Model of Multiple Welfare Program Participation and Labor Supply, *International Economic Review* **39**(3): 553–589.

Löffler, M. (2013). Fitting Complex Mixed Logit Models: An Application to Labor Supply. Mimeo, presented at the Stata Conference in New Orleans, July 2013.

Löffler, M., Peichl, A., Pestel, N., Schneider, H. and Siegloch, S. (2011). Einfach ist nicht immer gerecht: Eine Mikrosimulationsstudie der Kirchhof-Reform für die Einkommensteuer, *Vierteljahreshefte zur Wirtschaftsforschung* **80**(4): 147–160.

Löffler, M., Peichl, A., Pestel, N., Schneider, H. and Siegloch, S. (2012). Effizient, einfach und gerecht: Ein integriertes System zur Reform von Einkommensteuer und Sozialabgaben, *Perspektiven der Wirtschaftspolitik* **13**(3): 196 – 213.

Löffler, M., Peichl, A. and Siegloch, S. (2014). Structural Labor Supply Models and Wage Exogeneity. IZA Discussion Paper 8281.

Luce, R. D. (1959). *Individual Choice Behavior: A Theoretical Analysis*, Wiley, New York.

MaCurdy, T., Green, D. and Paarsch, H. (1990). Assessing Empirical Approaches for Analyzing Taxes and Labor Supply, *The Journal of Human Resources* **25**(3): 415–490.

Marcus, J., Siegers, R. and Grabka, M. M. (2013). Preparation of Data from the New SOEP Consumption Module: Editing, Imputation and Smoothing. DIW Data Documentation No. 70.

McFadden, D. (1974). Conditional logit analysis of qualitative choice behavior, *in* P. Zarembka (ed.), *Frontiers in Econometrics*, Academic Press, New York.

McFadden, D. and Train, K. E. (2000). Mixed MNL Models for Discrete Response, *Journal of Applied Econometrics* **15**(5): 447–470.

Merz, J., Vorgrimler, D. and Zwick, M. (2005). De facto anonymised microdata file on income tax statistics 1998, FDZ-Arbeitspapier Nr. 5.

Meyer, B. and Rosenbaum, D. (2001). Welfare, the earned income tax credit, and the labor supply of single mothers, *Quarterly Journal of Economics* **116**: 1063–1114.

Moffitt, R. (1983). An Economic Model of Welfare Stigma, *American Economic Review* **73**(5): 1023–1035.

Mroz, T. (1987). The sensitivity of an empirical model of married women's hours of work to economic and statistical assumptions, *Econometrica* **55**: 765–799.

Neumann, D., Peichl, A., Schneider, H. and Siegloch, S. (2009). Die Steuerreformpläne der neuen Bundesregierung und Bürgergeld, *Wirtschaftsdienst* **89**(12): 805–812.

Peichl, A. (2009). The Benefits and Problems of Linking Micro and Macro Models: Evidence from a Flat Tax Analysis for Germany, *Journal of Applied Economics* p. forthcoming.

Peichl, A., Pestel, N. and Schneider, H. (2011). Mehr Ungleichheit durch kleinere Haushalte? Der Zusammenhang zwischen Veränderungen der Haushaltsstruktur und der Einkommensverteilung in Deutschland, *Zeitschrift für Arbeitsmarkt-Forschung* **43**(4): 327–338.

Peichl, A., Pestel, N., Schneider, H. and Siegloch, S. (2010). Alter Wein in neuen Schläuchen: Der Fünf-Stufen-Steuertarif der FDP auf dem Prüfstein, *IZA Standpunkt* **27**.

Peichl, A., Pestel, N., Schneider, H. and Siegloch, S. (2011a). Bemessungsgrundlage kontra Fünf-Stufen-Tarif: Eine Simulationsanalyse des Reformvorschlags nach Rose, *Wirtschaftsdienst* **91**(5): 328–332.

Peichl, A., Pestel, N., Schneider, H. and Siegloch, S. (2011b). Reform der Hartz IV-Hinzuverdienstregelungen: Ein verfehlter Ansatz, *Perspektiven der Wirtschaftspolitik* **12**(1): 12–26.

Peichl, A., Pestel, N., Siegloch, S. and Sommer, E. (2014). Bundestagswahlkampf 2013: Klientelpolitik durch Steuerreform?, *Perspektiven der Wirtschaftspolitik* **14**(2): 182–194.

Peichl, A., Schneider, H. and Siegloch, S. (2010). Documentation IZAΨMOD: The IZA Policy SImulation MODel. IZA Discussion Paper No. 4865.

Peichl, A. and Siegloch, S. (2012). Accounting for labor demand effects in structural labor supply models, *Labour Economics* **19**(1): 129 – 138.

Pestel, N. and Sommer, E. (2013). Shifting Taxes from Income to Consumption: Efficient, but Regressive? IZA Discussion Paper No. 7804.

Saez, E. (2002). Optimal Income Transfer Programs: Intensive Versus Extensive Labor Supply Responses, *The Quarterly Journal of Economics* **117**(3): 1039–1073.

Schneider, H., Peichl, A., Pestel, N., Siegloch, S. and Löffler, M. (2012). Finanzielle und Beschäftigungswirkungen unterschiedlicher Tarifverläufe alternativer Hinzuverdienstregelungen, *IZA Research Report* **46**. On behalf of the German Federal Ministry of Economics and Technology.

Shephard, R. W. (1970). *The Theory of Cost and Production Functions*, Princeton University Press, Princeton.

Steiner, V. and Wrohlich, K. (2004). Household Taxation, Income Splitting and Labor Supply Incentives - A Microsimulation Study for Germany, *CESifo Economic Studies* **50**(3): 541–568.

Train, K. E. (2009). *Discrete Choice Methods with Simulation*, second edn, Cambridge University Press.

Triest, R. (1990). The effect of income taxation on labor supply in the United States, *Journal of Human Resources* **25**: 491–516.

van Soest, A. (1995). Structural Models of Family Labor Supply – A Discrete Choice Approach, *Journal of Human Resources* **30**(1): 63–88.

Wagner, G. G., Frick, J. R. and Schupp, J. (2007). The German Socio-Economic Panel (SOEP) - Scope, Evolution and Enhancements, *Schmoller's Jahrbuch - Journal of Applied Social Science Studies* **127**(1): 139–169.

Appendix

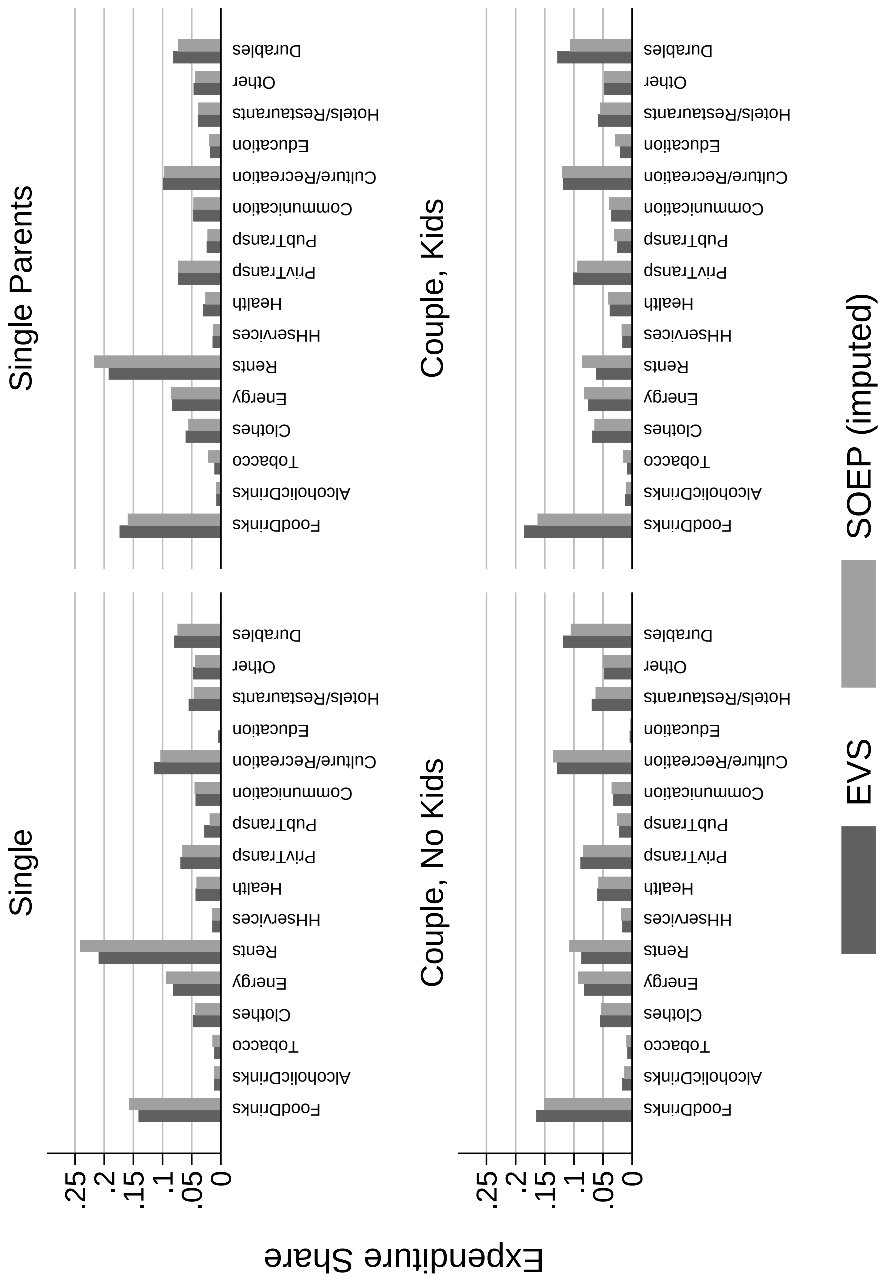
Details on deductible expenses

Table 6: Overview over deductible expenses

Category	Type of Expenses
Special Expenses	Alimony payments Church tax Tax consultant fees Expenses for professional training School Fees of children Charitable Donations Donations to political parties Expenses for financial provision, i.e. social insurance contributions (see EStG §§10 - 10c) $*$
Extraordinary Burden Expenses	Expenses for the education of dependents, for the cure of illness, for home help with elderly or disabled people, commuting expenses caused by disability Child care costs Tax allowances for self used proprietary, premises and historical buildings (see EStG §§33 - 33b) Allowances for disabled persons, surviving dependents and persons in need of care $*$
Expenses linked to income-generating activities	Commuting Costs $*$ Expenses for running two households Expenses for work materials Costs of training

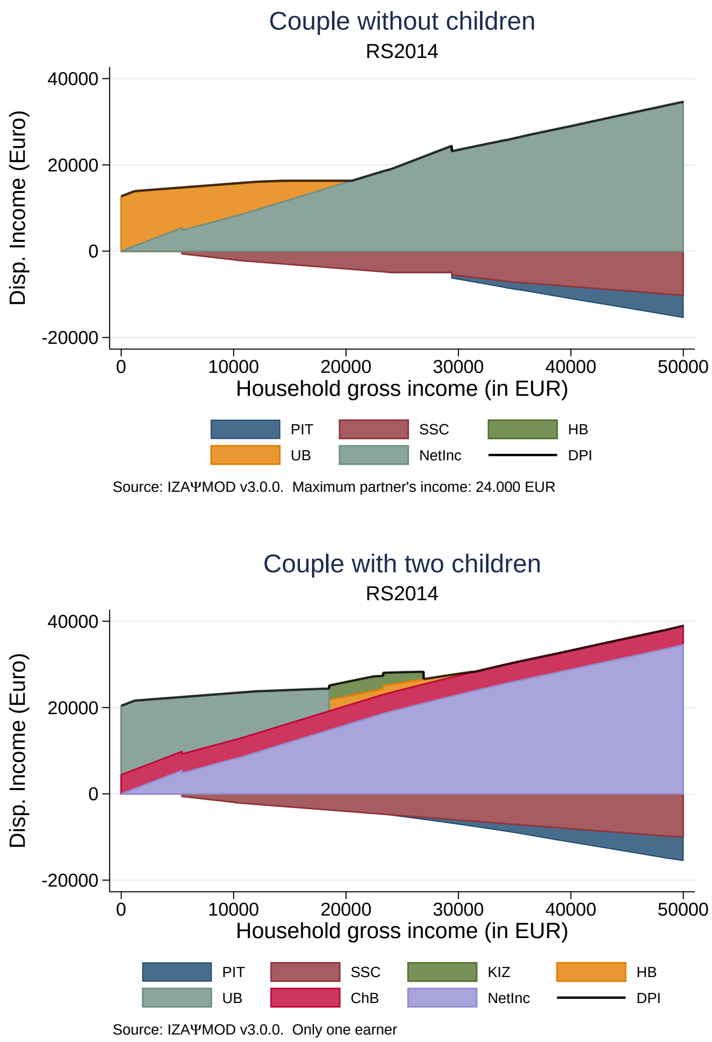
All items, with the exception of those marked with an asterisk ($*$), are imputed from the Income Tax Return data.

Figure 7: Structure of expenditures in EVS and SOEP



Visualizing other household types

Figure 8: Detailed income decomposition (2014 Regime)



PIT: Personal Income Tax; SSC: Social Security Contributions; HB: Housing Benefit; ChB: Child Benefit; KIZ: Suppl. Child Benefit; UB: Unemployment Benefit II; NetInc: Net Income; DPI: Disp. Income. The upper graph displays the budget for double-earner couple. The first spouse works until an income of € 24,000 is reached. Afterwards, income grows from second spouses' earnings. In the bottom graph, only one spouse works.

Figure 9: Further Effective Marginal Tax Rate (EMTR) graphs