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ZEW-EviSTA: A Microsimulation Model of the German Tax and Transfer System

ZEW-EviSTA®: A Microsimulation Model of the German Tax and Transfer System

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Abstract

This article describes ZEW-EviSTA®, the microsimulation model developed and used at ZEW - Centre for European Economic Research in Mannheim. The model simulates the German tax and transfer system using household micro level data. By estimating fiscal effects, labor market outcomes as well as distributional impacts the model allows for a comprehensive ex ante analysis of reform proposals. Heterogeneity analyses targeting specific subgroups of the population are feasible, too. The present article describes which data sources are used for the simulation, how key features of the German tax and transfer system are implemented, which simulation methods are employed to analyze policy changes and how the model is validated against official statistics. Moreover, by providing examples of the outputs which ZEW-EviSTA generates the paper gives an idea of the questions that can be answered using the model.

Keywords: microsimulation, tax system, tax policy, labour market, labour supply, labour demand, Germany, policy analysis
JEL Classification: D58, H20, J22, J23

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1 Introduction

This article describes ZEW-EviSTA®, the microsimulation model developed at ZEW – Leibniz Centre for European Economic Research in Mannheim.[1] Microsimulation models (MSMs) are used to simulate policy effects on economic agents at the individual and household level (Figari et al., 2015; Bourguignon and Spadaro, 2006). The main idea is to employ a partial equilibrium approach to predict the effects of changes in the tax and transfer scheme on households. Three outcome dimensions are key: First, total budget effects are calculated to assess the fiscal aspects of planned policy changes. Second, from the political economy point of view, heterogeneity analyses for specific subgroups of the population allow to assess which groups of the population are winners or losers of the changes. In particular, distributional outcomes of reforms which often are in the focus of political debates can be studied. Third, labor economic aspects are captured as MSMs enable the analysis of changing labor market incentives induced by potential reforms to the tax and benefit system. Accordingly, MSMs offer a flexible way to carry out pre-reform policy analysis and can translate complex reform options into easy-to-understand numbers to educate the public and policy-makers about fiscal, distributional and incentive effects of reforms.

MSMs dealing with distributional analyses use frameworks of differing complexity. As Bourguignon and Spadaro (2006) note, all MSMs use microdata containing individuals' economic and socio-demographic characteristics. Furthermore, all of them require a framework of policy rules and individual constraints within which the analyses are performed. However, not all of them allow for individual behavioral responses to policy changes. Models that do not take these responses into account are also called *arithmetical models*. While appealing due to their simplicity, they only capture so-called first-round policy effects ("morning after") since behavioral reactions to reforms are ignored. For example, individual labor supply as well as labor demand would be left unchanged pre and post a modeled tax reform.

Different from arithmetical models, *behavioral MSMs* incorporate such effects by allowing for heterogenous behavioral responses to changes in the tax and transfer scheme (Aaberge et al., 1999). Usually, households' choice is modeled according to the rationale of utility maximization. In these models, frequently used response categories are consumption and labor supply choices. The incorporation of a microeconometric labor supply model provides the basis for individuals' behavioral responses grounded in eco-

[1] EviSTA is short for evaluation model for integrated tax and transfer analyses (***Ev****aluationsmodell für* ***i****ntegrierte* ***S****teuer- und* ***T****ransferpolitik-****A****nalysen*)

nomic theory. Such labor supply models allow for the modeling of both extensive margin (labor market participation yes/no) as well as intensive margin (hours worked) labor supply decisions. The following sections will show that ZEW-EviSTA combines both: its arithmetic part allows for simple mechanical analyses while its behavioral labor supply module takes account of heterogenous behavioral responses to policy changes.

ZEW-EviSTA has related projects at ifo Munich and IZA Bonn which grew from the same code base. For additional information, the reader is referred to Blömer and Peichl (2020) and Löffler et al. (2014).[2]

The remainder of this paper is structured as follows. Section 2 introduces the module structure of ZEW-EviSTA and explains the broad simulation steps. Section 3 comments on the data sources used for estimation. Section 4 outlines the most relevant aspects of the German tax and transfer system modeled in ZEW-EviSTA's static tax benefit module. Sections 5 and 6 give a more detailed insight into the labor supply and labor demand estimation procedures used in the respective modules. Section 7 gives an overview of the outputs created using ZEW-EviSTA and how those are validated against official statistics while section 8 concludes with the papers and projects for which the model has been used in the past.

[2]The model at the Institute of Labor Economics (IZA) in Bonn is called IZAΨMOD. The sister project at ifo Institute – Leibniz Institute for Economic Research at the University of Munich is named ifo-MSM-TTL (ifo Microsimulation Model). The development of the microsimulation model started in the mid 2000s at FiFo Cologne - Institute for Public Economics at the University of Cologne. It was further developed first at IZA and later at ZEW (see Peichl et al., 2010). Today, all versions of the model are maintained independently at the respective institutes. We thank all contributors to the project but especially Maximilian Blömer, Max Löffler, Andreas Peichl, Nico Pestel and Eric Sommer for laying the foundations and/or major developments of the code base of the microsimulation model. The continuous development at the different institutes transformed each model into a singular working object with different properties and capabilities. Still, the key parts and structure which are subject of this documentation remained similar. The present documentation is thus similar in parts to just-mentioned papers.

2 Structure of the Model

ZEW-EviSTA consists of four main modules. The following list gives an overview of what they are used for. The static tax benefit module is the basis for the latter three modules. Given its pivotal nature for the application of the other modules it is numbered 0 in the following list:

0 Static Tax Benefit Module: Short: static module. It simulates the tax and transfer policy environment for each year between 1984 and 2022. This module provides the basis (also referred to as status quo) for the analysis of policy changes.

1 Morning After Module: The morning after module is used to compute how households would be affected if they did not react to reforms by changing their behavior (i.e. hours worked). Accordingly, it can be seen as the effect on the "morning after the reform" when people have not changed their behavior, yet. Furthermore, it allows to illustrate how incentives change in the course of a hypothetical reform.

2 Behavioral Labor Supply Module: The labor supply module is used to compute households' labor supply responses to tax and transfer policy reforms as well as to estimate the resulting distributional and budgetary consequences. The relevant preference parameters are micro-econometrically estimated from the status quo and then used for the prediction of behavioral changes in response to (hypothetical) policy changes.

3 Labor Demand Module: The labor supply module assumes that everybody who wants to work finds a job on the labor market and that prices for labor and thus wages are not affected by changes in labor supply. The labor demand module allows to loosen this assumption and estimates changes in the demand for labor in response to labor supply reactions induced by policy reforms (Peichl and Siegloch, 2012). The interplay of labor supply and labor demand module completes the partial equilibrium analysis of labor market reactions to reforms.

By default ZEW-EviSTA uses data from the German Socio-Economic Panel (SOEP) which is the most prominent panel study of German households and represents the counterpart to, e.g., the Panel Study of Income Dynamics (PSID) for the US (Goebel et al., 2019). However, alternative input sources can be incorporated as well. For example, the existing model can be complemented with administrative data from the EVS (*Einkommens- und Verbrauchsstichprobe*) as well as German Income Tax Return Data

(FAST). Furthermore, the fourth module is based on labor demand parameters which have been estimated using the Linked Employer-Employee Data from the IAB (LIAB) (see Peichl and Siegloch, 2012).

Figure 1 shows the simulation steps of ZEW-EviSTA. First, the data for the year of interest are loaded and cleaned. Missing individual wages in the dataset are imputed with a Heckman procedure (Heckman, 1979) which is common practice in the literature. Then, the cleaned data are used to simulate the current state of the tax and transfer system which is referred to as "status quo" (SQ) in the following. The status quo serves as a benchmark to which the resulting outcomes after a reform (Ref) can be compared.

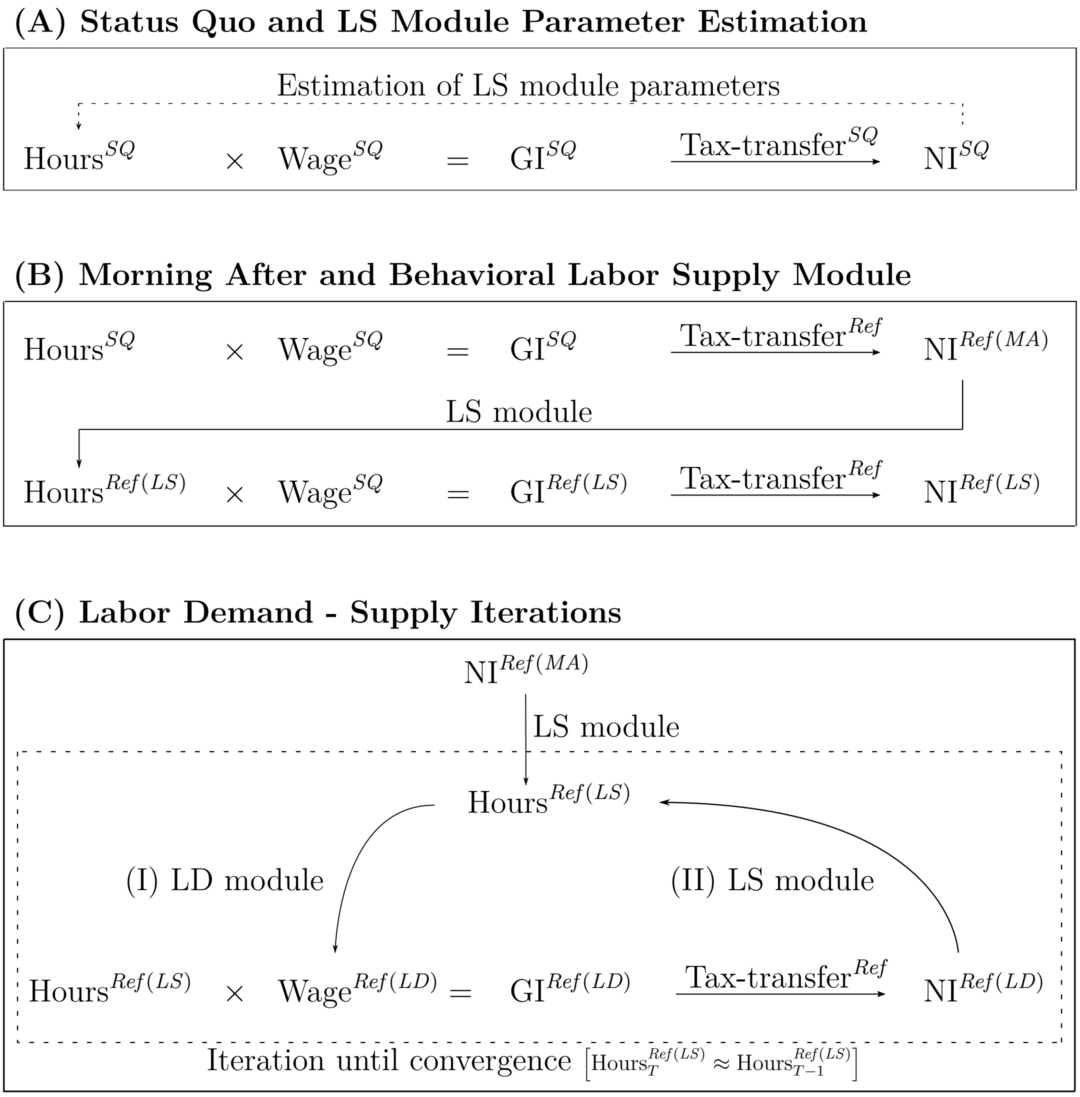
This is depicted in panel (A) of figure 1 where households' status quo gross income GI^{SQ} is fed into the current tax and transfer system (Tax-transfer^{SQ}) which yields status quo net income NI^{SQ}.[3] In this step, individual deductible amounts are accounted for and subtracted through the static tax-transfer module. Using NI^{SQ} and the observed hours choices, the relevant behavioral parameters for the behavioral labor supply (LS) module can be estimated. These parameters are assumed to be constant to be able to employ them in the behavioral labor supply module. That is, each household is assumed to have the same consumption/leisure preferences before and after a reform (Hurwicz, 1962).

Panel (B) shows how the mechanical morning after (MA) effects are retrieved by applying the reformed tax-transfer module to status quo gross income. The second-round effects including behavioral responses to a reform are calculated by applying the behavioral labor supply module to morning after net income $\text{NI}^{Ref(MA)}$ which results in $\text{NI}^{Ref(LS)}$.

The behavioral labor supply module reflects the idea that individuals react to policy reforms. However, these behavioral adjustments also affect the decisions of employers demanding labor which in turn affects the labor supply decisions again. To account for these repercussions, the demand side is incorporated in ZEW-EviSTA via the labor demand module (Peichl and Siegloch, 2012). This is depicted in panel (C) of figure 1. To obtain a more precise approximation of the reform effects, supply-demand iterations are carried out. First, the behavioral hours of work estimate is retrieved by applying the LS module to $\text{NI}^{Ref(MA)}$ (see panel (B)). Then, the iterative procedure starts. In step (I), the labor demand module is used to estimate the effect of increased/reduced working hours on the wage offered by firms $\text{Wage}^{Ref(LD)}$. This step reflects the idea that firms' demand for labor is affected by changes in labor supply. With the resulting measure, $\text{GI}^{Ref(LD)}$ can be calculated. Then, by applying the reformed tax-transfer module again, $\text{NI}^{Ref(LD)}$ is retrieved. Since the wage changes induced by altered labor demand in step (I) had previously not been incorporated in households' labor supply decision, households'

[3]Net income and disposable income are used interchangeably in this section.

Figure 1: Simulation Steps in ZEW-EviSTA



Notes: The figure gives a simplified representation of the simulation steps in ZEW-EviSTA. *SQ* denotes the status quo before a reform (*Ref*) is implemented. Tax-transfer refers to ZEW-EviSTA's tax and benefit module. LS and LD denote the behavioral labor supply and labor demand module, respectively. GI and NI are gross income and net income. *Ref*(*MA*) stands for the reform's mechanical "morning after" effects calculated with the static tax benefit module. *Ref*(*LS*) refers to the reform effect after applying the behavioral labor supply module (see section 5) while *Ref*(*LD*) represents the outcomes after applying the labor demand module (see section 6). The figure is split into three panels. (A) First, the status quo is simulated by applying the current tax and transfer system. The resulting net income measure is used to estimate the LS module parameters. (B) In a similar manner, the morning after net income can be calculated by applying the changes in the tax-transfer module to status quo gross income GI^{SQ}. The behavioral labor supply module is then applied to translate the resulting net income into behavioral labor supply responses on the hours of work choice Hours$^{Ref(LS)}$. Finally, panel (C) depicts how the LS and the LD module can be iteratively applied until a partial labor market equilibrium is reached. Convergence is reached when the change in working hours from the last iteration T is arbitrarily small (see section 6 for a more detailed explanation). *Source:* Own illustration, modified from Blömer and Peichl (2020) will adjust their labor supply decision to the new circumstances. Thus, the labor supply module has to be applied again (step (II)). The process of applying steps (I) and (II) iteratively is continued until the induced changes in households' labor supply choices are small enough (see section 6 for further information).

3 Data

The following section describes the data sources used in ZEW-EviSTA. The microdata used in the model contain sample weights such that the simulation results are representative for the whole population. This enables a detailed distributional analysis of reform effects.

3.1 SOEP

The German Socio-Economic Panel (SOEP) is a longitudinal household-survey encompassing around 30,000 people from 15,000 private households (DIW Berlin, 2021). The SOEP represents the default data basis for ZEW-EviSTA. It started in 1984 including only Western Bundesländer. Since 1990, Eastern federal states are part of the study, too (Goebel et al., 2019). The sample of households was enlarged over time and specific groups are oversampled to achieve representativeness for the whole population as well as to allow for more detailed analyses of certain subgroups of the population. For example, an additional sample D1 of migrants was drawn in 1994/95, high income earners were targeted via sample H in 2002 while refugees entering Germany in the course of 2015's migration movements were focused in 2016 (sample M4). SOEP participants answer a detailed catalogue of questions regarding many aspects of their personal lives like personal economic conditions, employment status or personal well-being. For ZEW-EviSTA, employment (job type, working hours) and income information (gross wages, government transfers) are the most important categories. However, other dimensions are exploited, too. These are household characteristics like, for example, household composition, household members' age and education. The ZEW-EviSTA modules are constantly updated to the newest SOEP wave. However, it is also possible to employ prior waves if this is useful for studying a certain topic. The labor supply and demand module of ZEW-EviSTA rely on a different household concept than the SOEP. We will return to this point in section 5.

3.2 LIAB

To implement the labor demand module, information about the employer side is required which is not available in the SOEP since the latter only surveys private households. Thus, the LIAB (Linked Employer-Employee Dataset) is used for this purpose instead. It is provided by the IAB (*Institut für Arbeitsmarkt- und Berufsforschung*) in Nuremberg. One part of the LIAB data comes from official records of the German Federal Employment Agency (*Bundesagentur für Arbeit*) (Alda et al., 2005). For LIAB, it provides employment statistics covering each employee who pays social security contributions or receives unemployment benefits. This information exists as German employers are required to report all employees subject to social security to the social security agencies since 1973 (Bender and Haas, 2002). Approximately 80 percent of German employees are covered this way whereas civil servants, self-employed and family workers are not included in the statistics. The data provides, among other variables, region, industry, occupation, daily wages, age, schooling, training, and seniority information (Bender et al., 2000). When these data are combined with the information about received unemployment benefits, the whole employment history is completed.

These data are linked to the second data source – the IAB Establishment Panel – which contains information about the plants as well as the employees at the respective establishment (Ruf et al., 2021). It is an annual survey where stratified samples of the approximately two million German employers registered at the Federal Employment Agency's are formed from which establishments are selected at random. This ensures representativeness for the sample. For the West German states the establishment panel is available since 1993 whereas the new eastern Länder are covered since 1996. Both a longitudinal and a cross-sectional version of the LIAB exist. ZEW-EviSTA uses the latter, spanning the period from 1996 to 2007. 4,000 to 16,000 establishments with 1.8 to 2.5 million employees are covered in each year.

3.3 FAST

FAST is a data set of administrative tax data stemming from the wage and income tax statistics (*Faktisch anonymisiserte Daten aus der Lohn- und Einkommensteuerstatistik*) published by the German Ministry of Finance (Forschungsdatenzentrum, 2018). FAST is a ten percent sample (approximately 3.5 million tax units) subject to the German income tax and are thus representative of around 35 million tax cases in Germany. The data are available for the years 1998, 2001, 2004, 2007, 2010 and 2014. The FAST data contain income variables as well as all deductions claimed by taxpayers. The inclusion of all tax relevant variables, their precision, as well as their low measurement error represent an advantage compared to other data sources like the SOEP. For example, it would not be possible to precisely compute the amount of deductions for each household with only SOEP data since the relevant information is missing. Contrary, the FAST contain the three deduction categories in Germany: income-related expenses (*Werbungskosten*), special expenses (*Sonderausgaben*), and extraordinary burden expenses (*außergewöhnliche Belastungen*). The latter two are summarized as *other deductions*. If the deduction possibilities were not accounted for, the tax base would be overestimated and disposable income would be too low.

The advantage of using both SOEP as well as FAST data is that missing information in the SOEP can be complemented with data from the FAST. To do so, ZEW-EviSTA uses separate Tobit models for the two deduction categories (income-related expenses and other deductions) and regresses them on shared covariates in the two datasets as well as interaction terms of the latter. This enables the imputation of missing deduction information in the SOEP. Our approach follows Buck (2006). The shared variables comprise age, number of children, income and squared income as well as interactions of the latter. To account for the possibility of systematically different deduction possibilities and choices between differing household compositions, ZEW-EviSTA runs separate regressions for married (joint) and individual taxpayers.

3.4 EVS

Besides measuring income and wealth, the EVS (*Einkommens- und Verbrauchsstichprobe*) provides information about consumption expenditures of private households in Germany. While income tax-relevant variables are recorded more precisely in the SOEP, it does not provide detailed information about household expenditures which the EVS does. Thus, in ZEW-EviSTA, EVS data can be used to analyze households' consumption decisions in a separate module which enables the assessment of the effect of indirect taxes such as VAT or excise taxes which otherwise would not be covered. The EVS is conducted by the German Federal Statistical Office and uses a representative sample of approximately 60,000 households (see Stabu, 2017). For scientific use an 80 percent subsample is provided. It is a cross-sectional survey that appears in five year intervals since 1962/63. The most recent wave was conducted in 2018. Before reunification, only West German households were covered but since 1993 Berlin and East German states are included in the survey, too. EVS tracks every household members' employment status as well as income from various sources and assets. Participants in the survey record all their expenditures during a three-month survey period. The focus lies on expenditures for all types of commodities as well as household equipment. One problem of the EVS is that high and low income households are underrepresented. This is a difference to the SOEP where the income distribution has slightly fatter tails.[4]

Similar to the procedure used for the imputation of missing deduction information via FAST data, the EVS can be used to impute missing consumption expenditures in SOEP. Therefore, variables observed in both datasets are used to separately predict consumption levels of durable and non-durable consumption. We follow the procedure outlined in Decoster et al. (2013) who perform a similar task for the European Union MSM (EUROMOD). Shared variables besides income are household head characteristics such as age, gender, education and employment type as well as household size, region and community size. In a first step, the relationship between consumption and income, i.e. Engel curves, are estimated. In this step, durable and non-durable consumption are analyzed in two separate specifications. Other household characteristics are included as control variables in the regressions. In a second step, expenditure shares for 15 non-durable consumption categories are regressed on the logarithm of total consumption plus covariates. For consumption categories exhibiting a high share of zero-expenditures (tobacco, rents, alcoholic beverages, education) we employ a probit model in which the respective consumption category is regressed on a dummy indicating non-zero consumption. The inclusion of the EVS and the estimation method just discussed enables us to assess structural changes in the consumption composition. As income rises, shifts of consumption preferences from expenditures for necessities towards, e.g., leisure activities, are likely.

4 Static Tax Benefit Module

This section describes the static tax benefit module in which the German tax and transfer system is modeled. Since the system is complex, only the most relevant pieces of the framework are introduced here. The legal setting for 2022 is presented here. However, institutional settings dating back until 1984 are modeled in the code and can be analyzed retroactively if necessary.

4.1 The German Personal Income Tax System

The following sections describe the German Personal Income Tax System. German residents are taxed on their global income whereas non-residents are only taxed on income

[4] For further information see Becker et al. (2003).

earned in Germany. The legal norm setting up the German tax system is called *Einkommensteuergesetz (EStG)*. Since the exact numerical values for specific rules are subject to ongoing change, the reader is referred to the respective legal norms via footnotes in the following paragraphs.

4.1.1 From Gross Income to Taxes Due

The following paragraph explains the steps from gross income to the tax due alongside table 1. The German tax system distinguishes between seven income categories. These are (1) income from agriculture and forestry, (2) business income, (3) self-employed income, (4) salaries and wages from employment, (5) investment income, (6) rental income, and (7) other income sources.[5] These sources are added up to compute broad gross income. Summing up and subtracting income-related expenses (*Werbungskosten* and *Betriebsausgaben*) for each income category results in adjusted gross income. Note that so-called *Minijobs* (monthly gross income below EUR 450), are usually lump-sum taxed and therefore exempt from income taxation and thus not included in the summation. From adjusted gross income, expenses for various categories as well as tax allowances are subtracted. These are exemptions for the elderly, single parents as well as for agricultural and forestry income, losses from other periods[6], special expenses (*Sonderausgaben*), extraordinary burden expenses (*außergewöhnliche Belastungen*), as well as deductions for other categories if applicable. For example, parents receive either the child benefit (*Kindergeld*) or the child allowance (*Kinderfreibetrag*)[7] depending on which is more favorable[8]. If the favorability calculation selects the child allowance – which is the case for high income earners – it is subtracted from taxable income while the received child benefit payments are added to the tax due, instead. ZEW-EviSTA includes all the steps depicted in table 1 in its simulation.

[5]§§ 13-23 EStG
[6]§ 10d EStG
[7]§ 32 EStG
[8]§ 31 S. 4 EStG

Table 1: From Gross Income to Tax Due

	Sum of incomes from seven legal sources
−	Income-related expenses from each source (*Werbungskosten, Betriebsausgaben*)
=	**Adjusted gross income**
−	Exemptions for the elderly, single parents, agriculture and forestry income
−	Losses from other periods
−	Special expenses (*Sonderausgaben*)
	· Pension savings and insurances, church tax, donations, ...
−	Extraordinary burden expenses (*außergewöhnliche Belastungen*)
	· Medical care, disability, alimony, ...
−	Other deductions including child allowances if applicable
=	**Taxable income (TI)**
	Tax formula: $T(TI)$
=	**Tax due**

Notes: The table shows the simplified taxation scheme leading from gross income to tax due. The tax formula in equation 1 is applied to taxable income (TI). *Source:* Own illustration following Blömer and Peichl (2020).

4.1.2 Tax Formula

The following formula determines the tax liability for German taxpayers in 2022.[9] TI is short for taxable income in euros.

$$T(TI) = \begin{cases} 0 & \text{if } TI \leq 9{,}984 \\ (1{,}008.70 \cdot \frac{TI - 9{,}984}{10{,}000} + 1{,}400) \cdot \frac{TI - 9{,}984}{10{,}000} & \text{if } 9{,}984 < TI \leq 14{,}926 \\ (206.43 \cdot \frac{TI - 14{,}926}{10{,}000} + 2{,}397) \cdot \frac{TI - 14{,}926}{10{,}000} + 938.24 & \text{if } 14{,}926 < TI \leq 58{,}596 \\ 0.42 \cdot TI - 9{,}267.53 & \text{if } 58{,}596 < TI \leq 277{,}825 \\ 0.45 \cdot TI - 17{,}602.28 & \text{if } 277{,}825 < TI \end{cases} \tag{1}$$

For joint taxpayers (JTP) the formula is applied to the mean of the taxpayers' income. In the following formula, $P1$ and $P2$ stand for person 1 and person 2 and TI_{P1}, TI_{P2} for each person's individual taxable income, respectively.

$$TI = \begin{cases} TI_{P1} & \text{if } ITP \\ \frac{TI_{P1} + TI_{P2}}{2} & \text{if } JTP \end{cases}$$

[9] § 32a EStG

After applying the tax formula to TI, the amount $T(TI)$ is multiplied by two for joint taxpayers. This splitting rule favors joint tax filers with a large spread in individual incomes.

Figure 2 gives an intuitive graphical depiction of the 2022 German tax scheme. There are five tax brackets: No taxes are paid on incomes below $9,984$ euros. Brackets two and three exhibit a linearly increasing marginal tax rate – a peculiarity of the German tax system. In bracket four and five, a flat marginal tax rate of 42 percent (*Höchststeuersatz*) and 45 percent (*Spitzensteuersatz*) is applied, respectively.

In addition to the tax formula, the so-called solidarity surcharge (*Solidaritätszuschlag*) is added to the tax due.[10] It was introduced in 1991 and amounts to 5.5% of the income tax due. In 2021, the calculation formula of the solidarity surcharge has changed considerably such that a lower tax burden falls on low and medium income taxpayers than previously. More precisely, the solidarity surcharge exemption was increased to EUR 16,956 of taxes due for individual taxpayers and to EUR 33,912 for joint taxpayers. These thresholds correspond to a yearly taxable income of EUR 62,127 (joint taxpayers: EUR 124,255). Compared to the previous situation where individual taxpayers had to pay the solidarity surcharge on yearly taxes above EUR 972 (joint taxpayers: EUR 1,944), this represents a substantial increase of the exemption. As a consequence, most taxpayers don't have to pay the solidarity surcharge anymore. The current calculation formula is:

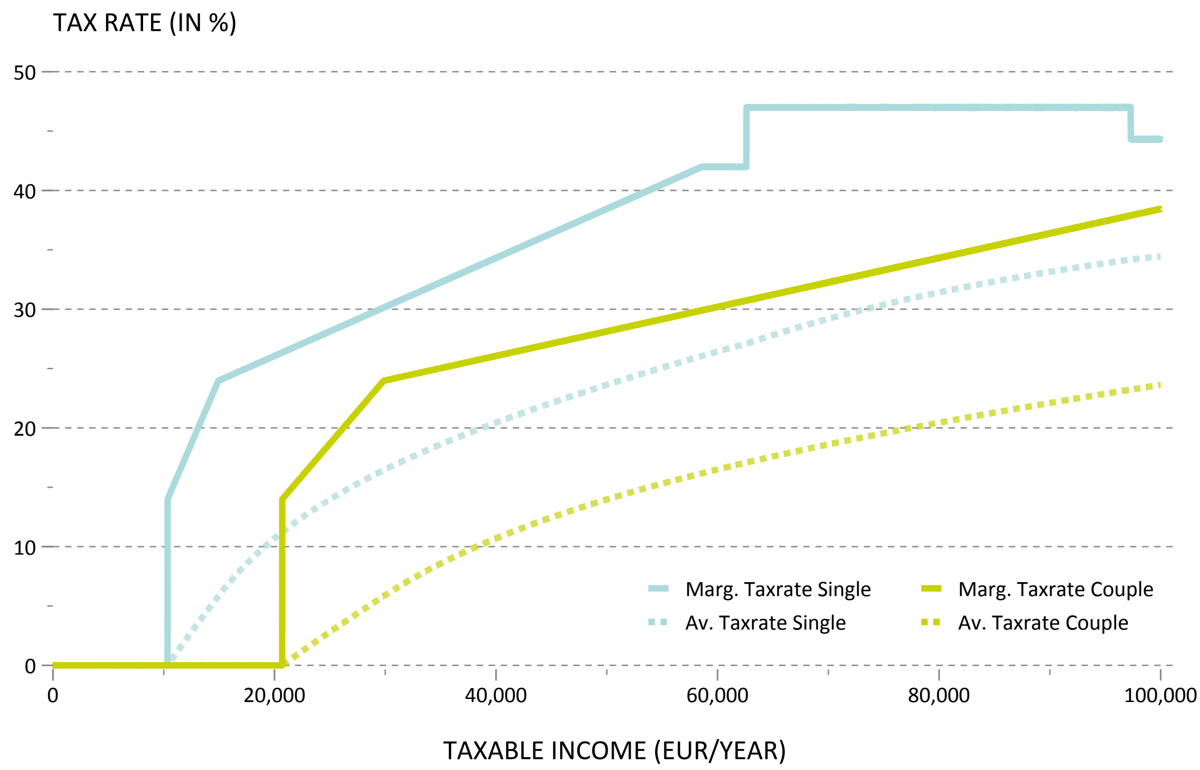
$$S = \min\left[0.055T, \max\left(0.119\left(T - 16{,}956\right), 0\right)\right] \quad (2)$$

In figure 2, the solidarity surcharge can be seen for taxpayers who do not file jointly. At a taxable income of EUR 62,127 the marginal tax rate jumps discontinuously where the phase-in zone of the solidarity surcharge starts.

Another relevant feature of the tax system is the switch to a dual system in 2009. Since then, capital income is treated differently such that a flat tax rate of 25% is levied on capital income for capital gains greater than the tax allowance of EUR 801 (EUR 1602 for joint payers). However, if incomes are low enough such that the individual marginal tax rate in formula 1 is below 25%, taxpayers can claim the application of the more favorable personal income tax rate on their capital gains.[11]

[10]§ 153 SGB III
[11]§ 32d Abs. 6

Figure 2: Marginal and Average Tax Rates for Individual and Joint Taxpayers



Notes: The figure shows marginal and average tax rates of individual and joint taxpayers for taxable incomes between EUR 0 and EUR 100,000 (x-axis) for the year 2022. The solidarity surcharge (*Solidaritätszuschlag*) is included in the figure. *Source:* ZEW-EviSTA.

4.2 Social Security Contributions

Besides income taxes, labor incomes are subject to four categories of social security contributions (SSC): (1) Health insurance, (2) old age pension insurance, (3) unemployment insurance, and (4) long-term care insurance. The payments for the four categories are calculated as a fixed share of labor income. The shares are depicted in table 2. The amount due is split equally among employers and employees (with minor exceptions).[12] The employee shares of SSC contributions are as follows: health insurance payments are 7.3 percent of income, old age pension payments amount to 9.3 percent, unemployment insurance is 1.2 percent and long-term care insurance is 1.525 percent of labor incomes. Note that other income categories are not subject to the social security system. For the self-employed, SSC are voluntary whereas for employees the payments are compulsory.

[12] For long-term care insurance, an additional contribution of 0.35 percent of the gross wage is borne fully by the employee if he/she is childless and aged older than 23 years. Furthermore, Saxony uses a special splitting rule for long-term care contributions such that employers pay 2.025 percent while employees pay a reduced rate of 1.025 percent.

Furthermore, civil servants are not subject to the SSC system.

The SSC system is progressive for low and medium incomes. This is reflected in the fact that marginal employments (*Minijobs*) with earnings of less than EUR 450 per month are exempt from SSC. Furthermore, labor incomes between EUR 450 and EUR 1300 (*Midijobs*) are not subject to the full contribution shares. Instead, these groups fall into a phase-in zone in which SSC rise gradually. Next to low incomes, also high incomes are treated favorably by the SSC system. After some income threshold is reached, SSC are held constant so that the social security system becomes regressive for high labor income earners. The thresholds differ by contribution class: in 2022, marginal health insurance and long-term care insurance payments for yearly incomes above EUR 58,050 (EUR 4,837.5 monthly) are zero. For old age pension insurance and unemployment insurance the tax exempt threshold is EUR 84,600 (EUR 7,050 monthly) in the old Bundesländer and EUR 81,000 (EUR 6,750 monthly) in the eastern German countries. Table 2 lists the assessment ceilings.

Table 2: Social Security Contribution Rates and Assessment Ceilings

	SSC Rate	AC Month	AC Year
Old Age Pension Insurance Unemployment Insurance	9.300% 1.200%	€6,750/€7,050[a]	€81,000/€84,600[a]
Health Insurance Long-term Care Insurance	7.300% 1.525%[b]	€4,837.5	€58,050

Notes: The table shows social security contribution (SSC) rates and their respective monthly/yearly assessment ceilings (AC) for the year 2022. SSC are held constant for gross incomes above the respective ceilings. *Source:* The values can be found in §§ 3,4 SVRechGrV 2022 (*Sozialversicherungs-Rechengrößenverordnung 2022*).

[a] Assessment ceilings for old age pension insurance and unemployment insurance differ between old and new German states. The first value represents AC of East German states and the second of the old Bundesländer.

[b] See footnote 12.

4.3 Consumption Taxes

There are two rates of the VAT which is the most important consumption tax in Germany. Usually, the standard rate of 19% is applied while certain other goods are subject to the reduced rate of 7%.[13] Among these products are agricultural produce, animal feed, most

[13] § 12 Abs. 1 UStG determines the two rates. § 12 Abs. 2 UStG lists the goods subject to the reduced rate. To foster consumption during the COVID-19 pandemic the rates were temporarily reduced to 16% and 5% in the second half of 2020.

groceries (except luxury foods), books, newspapers, works of art, and cultural facilities. Certain goods are fully exempt from the VAT (medical, educational, financial services and rents, ...).[14]

To analyse VAT, excise and carbon taxes, consumption expenses can be imputed into ZEW-EviSTA using data from the EVS. Therefore consumption expenditures are differentiated into 16 categories, 15 of which comprising non-durable and one representing durable consumption (see section 3.4). However, the variety of goods falling into the expenditure categories does not allow for a clean application of one of the three VAT rates to each category. This problem can be circumvented by applying the weighting scheme of the so-called "representative basket of products" provided by the German Federal Statistical Office (Destatis, 2019). An example illustrates the procedure: The first expenditure category comprises food and non-alcoholic beverages where food is taxed at 7% whereas non-alcoholic beverages are taxed at the full rate. Since approximately 12.4% of this category's expenditures accrue to non-alcoholic drinks, the 19% VAT rate is applied to 12.4% of total expenditures for this category, accordingly. The residual 87.6% representing food consumption are accounted for with the reduced rate of 7%. The most relevant remaining excise taxes can also be simulated in ZEW-EviSTA. These are the energy tax (especially fuel) and the tax on tobacco which are both per-unit taxes.

4.4 Modeling the Benefit System

Together with taxes and SSC, the benefit system is an important pillar of the German tax and transfer system. Therefore, ZEW-EviSTA also models child benefits, social assistance, unemployment benefits (I and II), housing benefits as well as alimony advance payments.

4.4.1 Unemployment Benefit I

According to SGB III, persons that were employed in a job subject to social insurance contributions for at least 12 months before getting unemployed are eligible to receive unemployment benefit I (UB I, *Arbeitslosengeld I*). It is paid for up to 12 months while older unemployed above age 50 can receive payments for up to 24 months. The payment period depends on the duration of previous employment and the size of the claim depends on the average gross income within a certain period (see SGB III for details). ZEW-EviSTA exploits information from the SOEP panel which can be used to calculate eligibility to decide whether an individual is entitled to get UB I in some working time categories. Generally, we assume that a person is eligible if she received unemployment

[14] § 4 UStG

benefits according to the data or if she fulfills the eligibility criteria of the unemployment benefit system.

4.4.2 Unemployment Benefit II

Unemployment benefit II (UB II, *Arbeitslosengeld II*) was introduced in 2005 in the course of the so-called Hartz-IV reform. It replaced the former unemployment support (*Arbeitslosenhilfe*) and social benefits (*Sozialhilfe*) system which caused practical problems due to overlaps in responsibilities resulting from missing selectivity. Today, as soon as an employable person of working age is no longer entitled to receive UB I, he or she can receive UB II.[15] Furthermore, individuals living in the same household as the eligible person are also entitled.

UB II was introduced to secure the satisfaction of basic material needs for everyone. Thus, in contrast to UB I, the neediness of a household is taken into account to determine eligbility and payments which makes UB II means-tested. Both household net income as well as a household's wealth are taken into account in means-testing. A person is regarded as needy if she is not able to satisfy her own elementary needs and those of other persons living in the same household with her household's income. The amount of UB II payments resembles the former social benefits system including housing and heating if applicable. To determine the payments, a certain necessary amount (*Regelbedarf*) is assigned to each person belonging to the household depending on each individual's characteristics. The SOEP panel includes nearly all relevant variables to determine UB II. One exception is wealth which is available in the data only in some years. Although households' wealth levels are not surveyed in every year, we can exploit the panel structure of the data and carry-forward existing information from previous years. If no such information is available we approximate households' wealth level using information on capital income. If this is not possible, we infer information on household wealth using information on whether a household actually received social subsistence benefits (SGB II and SGB XII).

4.4.3 Social Benefits

Since UB II was introduced, only persons who are not employable can receive social benefits. Social benefits are meant to help people who are not able to care for their subsistence on their owns or by help of others. Social benefits are also paid under extraordinary circumstances such as grave and persistent impairments of individuals' health. Similar to

[15] § 19 SGB II

UB II a household's net income as well as the basic amount for each person are taken into account to determine the actual amount of social benefit payments.[16]

4.4.4 Child Benefits

Every household with children receives a monthly lump-sum child benefit payment of EUR 219 for the first and the second child as well as EUR 225 and EUR 250 for the third and fourth child, respectively.[17] As explained before, an assessment whether the child benefit or the child allowance is more favorable is carried out (*Günstigerprüfung*). Households either receive the child benefit or the child allowance but never both. Moreover, there is a supplementary child benefit (*Kinderzuschlag*) transferred to low-income families. Families are eligible if their gross income amounts to at least EUR 900 (singles, EUR 600) and if the sum of their household income, wealth, (potential) housing benefits payments as well as the supplementary child benefit lies above the subsistence level as defined by UB II. The maximum monthly payment in 2022 is EUR 209 per child. If parents' adjusted incomes exceed a certain amount (*Bemessungsgrenze*), the maximum supplementary child benefit is reduced at a rate of 45% for the difference between the two measures. Furthermore, recipients of supplementary child benefit are not eligible for UB II but can additionally receive housing benefits.

4.4.5 Alimony Advance Payment

The alimony advance payment (*Unterhaltsvorschuss*) is a social service payment for children aged 18 or younger. Children of single parents are eligible if the other parent cannot (fully) pay the legal alimony amount.[18] That is, after taking into account child benefit payments the minimum alimony would otherwise not be reached. In 2022, the effective payments are EUR 177 for children aged 0 to 5, EUR 236 for children aged 6 to 11 and EUR 314 for children aged 12 to 17. Alimony advance payments are given priority before UB II payments. This implies that whenever a parent receives UB II payments she has to apply for alimony advance payments, too. If the alimony advance payment requirements are met, the paid amount is fully charged against UB II payments. Supplementary child benefit and housing benefits are also partly charged against alimony advance payments.

The SOEP data exhibit some problems regarding alimony advance payments. First, the terminology is confusing as alimony payment sounds similar to alimony advance payments although its meaning differs. Accordingly, households seem to indicate incorrect amounts

[16] See SGB XII
[17] § 66 EStG
[18] § 1612a BGB

or omit the answer. Therefore, the aggregate levels in the SOEP are too low. Second, in 2017 a reform of alimony advance payments was carried out such that the results are not easily comparable to previous years.

4.4.6 Housing Benefits

Housing benefits (*Wohngeld*) help individuals with low incomes to pay their rents or to finance the cost for owner-occupied housing.[19] Variables determining the eligibility as well as the level of payments are the number of people living in the household, the number of family members, household income as well as the relative rent compared to the local rent level. The computation in ZEW-EviSTA can be broadly described as follows. In a first step, all individual incomes are summed up where the basic allowances are taken into account to receive chargeable household income. Missing local rent levels are imputed by using official information for all German municipalities and by exploiting the regional data in the underlying micro-dataset. Housing benefits cannot be paid along with UB II.

5 Behavioral Labor Supply Module

Before introducing the specific features of the labor supply module, it is necessary to explain the labor supply unit separation used for estimation. The labor supply module is based on SOEP data. In the SOEP, all household members including, e.g., children and their grandparents, are considered as belonging to the same household if they share the same residence. However, since ZEW-EviSTA uses a joint utility model for couples (see Aaberge et al., 1999), only one- and two-person households are considered as labor supply units. This implies that an adult offspring living in a three-person household with her parents is understood as a separate labor supply unit in the analysis if she is not in education anymore. This affects 2163 households in the 2019 SOEP which represent approximately 3.5 million German households when applying weights. In ZEW-EviSTA, these cases are separated into more than one labor supply unit.

The labor supply model distinguishes between five types of households: (1) single households, (2) single parents, (3) couple households with only one spouse being flexible regarding working hours (see below for who is considered to be inflexible), (4) couple households in which both spouses have flexible labor supply, and (5) households which are completely inflexible regarding their labor supply decision. The differentiation of household types is relevant because they are assumed to face a qualitatively different consumption/leisure

[19] § 26 SGB I and WoGG (*Wohngeldgesetz*)

decision. This is also true for the separation of flexible/inflexible household types. For example, a prime-age worker arguably faces a substantially different labor/leisure decision than a retiree. Of course, a decision on how to categorize labor supply units has to be made. Accordingly, a person is assumed to be fully inflexible regarding her labor supply decision if she is/has:

- aged younger than 18
- aged older than 65 years and out of regular employment (depending on the legal retirement age)
- still in education or military service
- receiving old age or disability pensions
- self-employed or a civil servant
- current or past refugee status in recent years

All other individuals are allocated to the flexible labor supply group. Although it is clear why, e.g., retirees or children can be assumed to have inflexible labor supply according to the above list, this is less obvious for, e.g., the self-employed. In the latter case, it is inherently hard to estimate labor supply reactions of the self-employed. In contrast to employees, so far there exists no clear evidence on how to model the labor supply decisions of the self-employed in the literature. This is due to the complexity of the topic as the self-employed have more adjustment margins than just hours of work. For example, it is easier to avoid or evade taxes for this group by simply not indicating self-employed incomes which is not possible for (mostly) third-party reported wage income. We thus focus on employed and unemployed individuals – the largest group in the German labor market.

ZEW-EviSTA groups individuals along their skill level. This is of relevance for the labor supply and demand estimation. More specifically, three skill groups are formed:

Low-skilled: Neither obtained high-school degree (*Abitur*), nor completed vocational training.

Medium-skilled: Either obtained Abitur or completed vocational training.

High-skilled: Hold university, college or polytechnical degree.

After making the above separations, ZEW-EviSTA takes two steps in order to evaluate the impacts of policy reforms. As mentioned in the introduction, a purely static calculation produces the so-called morning-after or first-round effects in the first step. Purely static means that labor supply decisions are held constant and any behavioral responses are ruled out. In the second step, ZEW-EviSTA takes account of incentive changes following policy reforms and simulates the altered labor supply choice structure. Thereby it accounts for the fact that policy changes do not only affect net incomes and tax revenues but at the same time have an impact on the decision whether and how much to work. Not incorporating these effects in the model would mean to ignore that some policies specifically aim at changing incentives for labor market participation. This is, e.g., true for the Hartz reforms in Germany or the Earned Income Tax Credit (EITC) in the US which were introduced to increase labor market participation among the unemployed and/or low income earners.

To measure these effects, ZEW-EviSTA employs a structural labor supply model (Aaberge et al., 1995; Aaberge and Colombino, 2014). These models are the standard tool for such purposes in the literature. The idea is to use the observed status quo information to pin down individual preference parameters which are assumed to be constant, that is, they are assumed to be unaffected by the analyzed policy. The behavioral responses can then be modeled by using the elicited stable preference parameters. There are two major strands of modeling labor supply: (1) continuous vs. (2) discrete behavioral models. Before going into a more detailed description of the ZEW-EviSTA behavioral labor supply model, the following section briefly discusses the two potential model choices.

5.1 Discrete vs. Continuous Labor Supply Modeling

Early empirical approaches in modeling labor supply reflect the standard neoclassical labor supply model. Since household's utility is maximized over a continuous set of hours of work in these models, empirical researchers also relied on a continuous measure of work hours to derive marginal utility. Because Hausman (1981) was the first to use this method, it is usually referred to as the "Hausman approach". Multiple problems arise from the classical model. First, restricting individuals' labor market decision to the intensive margin neglects the importance of participation decisions. This is against empirical evidence highlighting that the extensive margin is usually more relevant than the hours decision (see, e.g., Heckman, 1993; Keane, 2011). Furthermore, working hours decisions are usually not continuous but subject to discrete adjustment frictions. Second, from a practical perspective, it is often complicated to model labor market decisions of couple households or when the budget set is non-convex. Given the complexity of the tax and transfer system in most countries this is a common issue. Third, restrictive assumptions are required if the classical model is employed (Bloemen and Kapteyn, 2008; MaCurdy et al., 1990) and the estimation is very sensitive to the underlying wage structure (Eklöf and Sacklén, 2000; Ericson and Flood, 1997).

Given the above problems, during the 1990s it became popular to model individuals' labor supply decision as a choice of so-called ”job packages” (Aaberge et al., 1995, p.657). In these models, individuals no longer face a continuous hours set from which they choose but instead decide upon a certain type of job which is characterized by a wage rate and a certain amount of hours of work while other non-pecuniary job attributes are unobserved and captured in the error term. The approach puts the labor supply decision in the context of a random utility model (Aaberge et al., 1995; van Soest, 1995; Hoynes, 1996). Compared to continuous labor supply models, another novelty is that different levels of utility attached to each "job package" are compared instead of focusing on marginal utilities. This approach has various advantages. While allowing the researcher to account for the full complexity of the system, she does not have to carefully handle the problems of non-convexities, non-monotonicities or corner solutions in the choice set. Furthermore, couples' labor market decisions can be simulated more easily in the discrete context. As noted above, this style of modeling also resembles the real-world choice set more closely. Finally, the discrete choice model also allows for richer stochastic specifications regarding unobserved wage rates for those who currently do not work should they decide to enter the labor market (in response to a policy reform of interest).[20]

5.2 Labor Supply Estimation

Given the advantages of discrete labor supply models, ZEW-EviSTA relies on this approach. Following the standard procedure in the literature, each household has a unitary utility function which is maximized jointly by picking collective consumption and a separate hours/job type decision for each partner. Household n chooses alternative i if this choice maximizes utility. The mathematical representation looks as follows:

$$U\left(C_{ni}, L_i^m, L_i^f, P_{ni}, \epsilon_{ni}\right) = \max_{j \in J_n} U\left(f\left\{w_{nj}^m h_j^m, w_{nj}^f h_j^f, I_n\right\}, T - h_j^m, T - h_j^f, P_{nj}, \epsilon_{nj}\right). \quad (3)$$

The household chooses job type $j \in J_n$ (where non-participation in the labor market is denoted by $j = 0$), C_{nj} is household consumption, L_j^m and L_j^f represent leisure for

[20]For an overview of the empirical literature on labor supply models, see Bargain and Peichl (2016); Aaberge and Colombino (2014); Bargain et al. (2014); Löffler et al. (2014); Blundell and Macurdy (1999).

the male and the female partner and $P_{nj} \in \{0, 1\}$ denotes whether the household claims welfare participation. $f(\cdot)$ is an income-transforming function which translates gross incomes into net incomes, I_n is a household's non-labor income, T represents the total time endowment, working hours for both partners are denoted by h_j^m, h_j^f and the error term ϵ_{nj} captures unobservable preference parameters for household n with job type choice j. In ZEW-EviSTA, single households can choose from a discrete set of 7 weekly working hours alternatives. They work 0, 10, 20, 30, 40, 50, or 60 hours a week. Since couples make a decision for each partner, there are $7 \times 7 = 49$ potential alternatives. This set broadly captures the observed hours of work distribution and is also in line with common procedures in the literature. Furthermore, sensitivity analyses show that these hours intervals approximate more flexible models quite well (Bargain et al., 2014; Flood and Islam, 2005). However, ZEW-EviSTA is also capable of employing other specifications of the hours of work set. Since for every job type which makes a household eligible for transfer receipt there is also a choice to either take up benefits or not (in P_{nj}), the set of possible alternatives increases to 14 for single households and 98 for couples.

5.2.1 Utility Specifications

ZEW-EviSTA allows to employ three different utility specifications which are all frequently used in the literature (see, e.g., Löffler et al., 2014). The following paragraph introduces the functional forms. The relevant assumptions are that unobservable characteristics in ϵ_{nj} are additively separable and i.i.d. extreme value type I distributed (see McFadden, 1974).

Quadratic Utility Specification

The quadratic utility specification we use is a second-order polynomial in the variables consumption and leisure. It has been used, e.g., in Blundell et al. (2000b,a) and Bargain et al. (2014). Utility is summarized by coefficients β_1 to β_8. Potential stigma from welfare participation is captured by δ (if $P_{nj} = 1$). Possible labor market restrictions such as fixed costs or working hour regulations appear in γ.

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

Translog Utility Specification

The second functional form is known as translog utility specification. In this specification, instead of the levels, the logarithm of the choice variables is used. The parameter interpretation is the same as in the quadratic utility specification.

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

Box-Cox Utility Specification

The last utility specification is a Box-Cox transformation. It has been used by Aaberge et al. (1995), Blundell and Shephard (2012) and Löffler et al. (2014)

$$\begin{aligned} U^b\left(C_{nj}, L_j^m, L_j^f, P_{nj}, \epsilon_{nj}\right) = {} & x_{nj}^1 \beta_1' C_{nj}^{(\lambda_C)} + \beta_3 C_{nj}^{(\lambda_C)} \left(L_j^m\right)^{(\lambda_L^m)} + \beta_4 C_{nj}^{(\lambda_C)} \left(L_j^f\right)^{(\lambda_L^f)} \\ & + x_{nj}^2 \beta_5' \left(L_j^m\right)^{(\lambda_L^m)} + x_{nj}^3 \beta_7' \left(L_j^f\right)^{(\lambda_L^f)} \\ & + x_{nj}^4 \delta' P_{nj} + x_{nj}^5 \gamma' + \epsilon_{nj} \end{aligned} \tag{6}$$

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

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

$$C_{nj}^* = C_{nj}/1000 \qquad L_j^{s*} = L_j^s/80$$

In all specifications, vectors x_{nj}^1 to x_{nj}^5 capture relevant characteristics of each individual in a household as well as characteristics of the household itself. In x_{nj}^5 alternative specific variables can be included as well. Accordingly, all of the above utility specifications allow for observed heterogeneity in preferences. Furthermore, in structural labor supply models it has become common practice to allow for unobserved heterogeneity in preferences as well. ZEW-EviSTA accounts for this by allowing all preference coefficients β_1 to β_8 as well as δ, γ to be random. In doing so, we assume that certain parameters are multivariate normally distributed. Accordingly, this modelling approach is called *random coefficients model*. Although this extension is rather technical, it enhances the properties of our simulation since the full distribution of tastes across all households can be estimated instead of only obtaining average preferences for consumption and leisure which would be the case in simpler specifications.

The inclusion of δ into all specifications is relevant to account for the empirical observation that eligible households for welfare benefit payments often do not take them up. δ can be interpreted as a stigma parameter and allows for differing utility gains from earned income versus social benefit payments. Moffitt (1983) discussed this potential disutility from welfare participation. The modelling approach has been proposed by Hoynes (1996) and Keane and Moffitt (1998).

In all developed countries, labor market regulations crucially affect households' labor market decisions. To include these effects in labor supply models, various approaches have been proposed in the literature. For example, van Soest (1995) allowed part-time jobs to induce lower utility levels than full-time jobs. Since this approach was rather arbitrary, Euwals and van Soest (1999) included fixed costs of working instead of part-time restrictions into the model which has similar implications but an arguably stronger theoretical backing. An even more convincing concept can be found in Aaberge et al. (1995) who model the share of market opportunities alongside peaks in the working hours distribution arising from hours of work regulations. ZEW-EviSTA's behavioral labor supply module flexibly allows to switch between each of the latter three approaches.

5.2.2 Wage Imputation

The stochastic nature of the behavioral labor supply model requires the production of counterfactual choice alternatives. With the set of counterfactual choices we can calculate what the household's consumption decision would have been, had the choice of the job type been different than the one realized. To achieve this, the imputation of counterfactual hourly wages is a crucial task. Especially for people who do not work at all it is inevitable to compute counterfactual wages. However, some authors also produce them for the full sample of households in order to avoid two distinct wage distributions - the observed one for actual employees and the estimated counterfactual one for non-workers (see MaCurdy et al., 1990, for a discussion of both procedures). Besides the imputation method, there also exist various different techniques to predict wages. The most relevant difference relates to how wage prediction errors are treated. Many studies use a simple procedure which relies on the average predicted wage for estimation. That is, the offered jobs pay this wage with certainty. However, recently it has become common practice to incorporate the full distribution of wage prediction errors which are integrated out during the labor supply estimation process. ZEW-EviSTA allows for all the above specification choices. As Löffler et al. (2018) show, the decisions can have a strong impact on the model's predictions. In our standard specification we impute only missing wages and include wage prediction errors which are integrated out in the process.

5.2.3 Estimation

Maximum likelihood methods are used to estimate the preference coefficients via the model specifications introduced above. The simplest version of the model reduces to a standard conditional or multinomial logit model. This model, however, requires the independence of irrelevant alternatives (IIA) assumption (see, e.g., Luce, 1959) which implies that the preference order for two alternatives does not depend on the existence or certain properties of the respective other alternative. Since this assumption usually cannot be credibly made, it is common practice to incorporate prediction errors in wages or unobservable components as in the random coefficients model. By choosing such models, the necessity to make the IIA assumption can be overcome. Furthermore, these specifications yield more complex substitution patterns between potential alternatives. The increased complexity of the models also implies that they no longer have a closed-form solution. This is because the probabilities for each household n choosing job type i have to be assessed over the whole range of possible preference coefficients β_n, labor market conditions/regulations γ_n and wage predictions $\hat{w}_n$.

$$L = \prod_{n=1}^{N} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \frac{exp\left(v_{ni}\left\{\cdot|\hat{w}_{ni}, \beta_n\right\}\right) g\left(i|\gamma_n\right)}{\sum_{j\in J_n} exp\left(v_{ni}\left\{\cdot|\hat{w}_{ni}, \beta_n\right\}\right) g\left(i|\gamma_n\right)} f\left(\beta_n, \gamma_n\right) f\left(\hat{w}_n\right) d\beta_n d\gamma_n d\hat{w}_n \quad (7)$$

Proceeding this way means to estimate the full distribution of coefficients and wage predictions instead of only population averages. In doing so, each coefficient is weighted by its respective probability density. To estimate this model we follow Train (2009) who proposes to approximate the integrals of equation 7 by simulating them. Then, the simulated log-likelihood is maximized based on a sequence $\left\{\beta_n^{(r)}, \gamma_n^{(r)}, \hat{w}_n^{(r)}\right\}_{r=1}^{R}$ where $r = 1, ..., R$ is the number of draws from the joint distributions of $(\beta_n, \gamma_n, \hat{w}_n)$. The maximized simulated log-likelihood is written as:

$$ln\left(SL\right) = \sum_{n=1}^{N} ln\left(\frac{1}{R}\sum_{r=1}^{R} \frac{exp\left(v_{ni}\left\{\cdot\middle|\hat{w}_{ni}^{(r)}, \beta_n^{(r)}\right\}\right) g\left(i\middle|\gamma_n^{(r)}\right)}{\sum_{j\in J_n} exp\left(v_{ni}\left\{\cdot\middle|\hat{w}_{ni}^{(r)}, \beta_n^{(r)}\right\}\right) g\left(i\middle|\gamma_n^{(r)}\right)}\right) \quad (8)$$

In order to increase the stability of our procedure, we use Halton sequences instead of (pseudo) random draws. In ZEW-EviSTA, we use the Stata command `predictnl`.

Löffler (2013) provides technical details on the estimation.

5.2.4 Benchmark Model

As discussed above, ZEW-EviSTA allows for the use of various utility specifications. While this enables us to test the sensitivity of our results with respect to the modeling choice we pick a benchmark model that is (1) computationally feasible and (2) which replicates the observed hours of work distribution well. These requirements are best met by the translog utility specification in equation 5. In this specification we assume non-random preference coefficients. To simulate labor market regulations we follow Aaberge et al. (1995). Moreover, predicted wages are only used if the real wage is not observed. The income and hours of work information stems from the year prior to the sample period. As figure A.5 in the appendix shows, the predicted hour choices closely match the observed distribution across all household types. This validates our estimation approach. The labor supply elasticities presented in the following section are estimated with the benchmark model.

5.2.5 Labor Supply Elasticities

The labor supply elasticity is a standard economic measure which reports the percentage change in labor supply in response to a one percent increase in own wage. Other specifications analyze different percentage changes (e.g. a ten percent rise in wages) or focus on different income-related measures other than wage. Besides analyzing the impacts of tax reforms, ZEW-EviSTA can be used to estimate labor supply elasticities, too. Since various dimensions are included in the labor supply choice, there exist several ways of calculating labor supply elasticities via MSMs. First, they can be reported along the intensive margin (hours of work) and along the extensive margin (participation yes/no). Second, labor supply elasticities can be conditional or unconditional. The former measure changes in labor supply conditional on being part of the labor force before the change in the income-related variable of interest took place, whereas unconditional elasticities incorporate extensive margin responses, too. Third, there exist compensated and uncompensated elasticities. In standard microeconomic theory, a wage increase induces a substitution effect by ceteris paribus making labor more attractive than leisure. At the same time, there is an income effect. If leisure is a normal good, the worker demands more of it as income increases. Under the normal good assumption, substitution and income effect work in opposite directions. Compensated elasticities ignore the income effect while uncompensated elasticities measure the full effect, that is, the net effect taking both the income effect and the substitution effect into account. Finally, the income-related variable that varies has to be chosen. This can be the gross wage, the net wage or the net income.

In table 3, unconditional, uncompensated, one percent, hours of work and participation elasticities are shown.[21] Several basic insights can be drawn from the table. First, all depicted elasticities are positive, which implies that the positive substitution effect on labor is of greater sign than the negative income effect. Second, participation elasticities are smaller than hours elasticities, which is necessarily true as unconditional hours elasticities incorporate the participation decision. Still, they show that a substantial part of the overall positive labor supply effect is driven by the participation margin.

Our elasticity estimates for single taxpayers are in line with the results in other studies (see e.g. the meta-analysis by Bargain and Peichl, 2016).[22] For women in couples, we find slightly lower elasticities compared to the ones reported in Bargain and Peichl (2016). One reason for this is that the estimates for Germany reported in Bargain and Peichl (2016) all stem from data prior to 2004 whereas our analysis is based on the SOEP 2019 wave. Preferences to work might have considerably changed especially for married women. In line with this the literature has documented a decreasing trend in female own-wage elasticities over time and increases in women's labor force participation (see Bargain and Peichl, 2016; Heim, 2007; Blau and Kahn, 2007).

Table 3: Hours of Work and Participation Elasticities

	Singles		Couples	
	Male	Female	Male	Female
Hours	0.1980	0.2147	0.1415	0.1924
Participation	0.1108	0.1180	0.0773	0.0738

Notes: The table shows unconditional, uncompensated, one percent labor supply elasticities along the intensive margin (hours of work) and the extensive margin (participation). *Source:* Elasticities are calculated with ZEW-EviSTA using the SOEP 2019 wave.

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

[22]For the German context see, e.g., Fuest et al. (2008); Haan and Uhlendorff (2007); Haan and Steiner (2006, 2005); Steiner and Wrohlich (2004); Bonin et al. (2002). For the international context see, e.g., Bargain et al. (2014, 2010).

5.3 Counterfactual Analysis

With the preference parameters obtained in the previous steps, counterfactual analyses can be performed by holding the estimated parameters fixed. This requires the assumption that preferences do not change which might initially seem too strong. Indeed, Heim (2009) shows that preferences do change over long time horizons. However, as we do not analyze long periods but are interested in short-run effects instead, the assumption is reasonably justified.

To run counterfactual analyses, we first simulate labor market decisions and outcomes of the status quo. Then we run the same analysis for a new policy environment after a reform has been introduced holding the previously estimated preference parameters fixed. Finally, we compare the results from both simulations. Various outcome dimensions such as labor market participation, earnings, benefit payments or tax revenues can be analyzed with ZEW-EviSTA. The insights from such simulations can guide policy makers as they allow to assess the likely impacts of a reform before it takes place. An issue in the analysis with ZEW-EviSTA is that SOEP data are made available only with a lag of around two years. For the present article, the most recent SOEP wave covers the year 2019. Accordingly, we have no exact information on the current population. To get our baseline results we thus apply the current tax and transfer scheme to the most recent SOEP wave. The actual reform scenario is then compared to this benchmark. To bring the results closer to the year under analysis we use a forward projection which adjusts incomes to the current level. Furthermore, by applying bootstrapping methods which deliver confidence bands for our predictions, we can test the statistical significance of our results. Section 7.2 explains by an example how such counterfactual analyses are implemented in ZEW-EviSTA.

5.4 Take-up Responses in Morning After Simulations

One shortcoming in static simulation approaches (morning after effects) concerns the simulation of reforms in which households that had been ineligible in the status quo become eligible for benefits due to the reform. In this case, the static module calculates the mechanical change in net incomes after a reform is introduced by simply applying the new tax and transfer scheme to the status quo gross income (see figure 1). That is, households who were not eligible for benefits in the status quo but are eligible after the reform are implicitly assumed to not take up benefits. As a consequence, fiscal and distributional effects are underestimated. This exact problem appears, e.g., under a hypothetical increase in unemployment benefits II (*Grundsicherung*). However, ZEW-EviSTA can circumvent this issue. To do so, we estimate conditional take-up probabilities for each job type category in the behavioral labor supply module which indicate how likely a newly eligible household is to take up benefits. By including these conditional probabilities into our static module, take-up probability for newly eligible households are captured by the morning after effects already. This procedure yields more credible outcomes and improves upon previous measurement approaches.

To illustrate these issues, table 4 depicts the estimated effects of two hypothetical UB II reforms. In the first scenario, the level of *Grundsicherung* is increased by 30% whereas the second case represents a reduction by the same relative amount. The increase in the level of *Grundsicherung* broadens the group of potential beneficiaries such that a differential budgetary effect between the old morning after computation and the simulation approach including take-up probabilities (MA^{tu}) is expected. The table shows that this is indeed the case. The differential UB II expenses amount to approximately EUR 700 million, a difference of 11.1%. That is, without predicting the share of new beneficiaries, expenses would rise by EUR 6.3 billion while the new modeling approach estimates a stronger increase of EUR 7.0 billion.

On the other hand, the second hypothetical reform does not yield a differential effect between the MA and MA^{tu}. This is in line with expectations since no additional persons become eligible for UB II payments due to the policy change. Instead, only people who received payments before now lose their eligibility. Accordingly, the induced change in UB II expenses in response to the reform is negative and exactly the same across both simulation approaches (EUR -4.3 billion).

Table 4: Effects of Hypothetical UB II Reforms, Bn. €

	SQ 2021	MA	MA^{tu}	Difference
30% Increase in *Grundsicherung*				
UB II Expenses	31.0	+6.3	+7.0	11.1%
30% Decrease in *Grundsicherung*				
UB II Expenses	31.0	-4.3	-4.3	0.0%

Notes: The figure shows the effects of a hypothetical 30% increase and decrease in the level of *Grundsicherung*. All absolute values are in billion euros. SQ is the status quo in 2021. MA stands for morning after and MA^{tu} represents the morning after simulation approach including take-up probabilities used in ZEW-EviSTA. The last column captures the relative change in UB II expenses between MA and MA^{tu}. *Source:* Reform effects are simulated with ZEW-EviSTA using the SOEP 2019 wave.

6 Labor Demand Module

The labor demand side plays an equally important role in shaping labor market conditions as the labor supply decisions of workers described above. Thus, ZEW-EviSTA incorporates a labor demand module which enables us to simulate the repercussions between labor supply and labor demand in the aftermath of policy reforms that affect the labor market. The module first simulates labor demand for Germany such that the information gained can be fed into ZEW-EviSTA in a second step. The following section only provides a short description of the labor demand estimation process. More thorough explanations can be found in Peichl and Siegloch (2012).

6.1 Labor Demand Estimation

Almost all studies which estimate labor demand are based on the cost function. Following Hamermesh (1993), cost minimization yields the same factor demands as profit maximization if output is held constant. By applying Shepard's Lemma (Shepard, 1970) to the cost function we derive estimable factor demand functions conditional on output. With the resulting functions, own-wage elasticities for differently skilled labor can be derived. As for the labor supply estimation, there exists a variety of potential cost functions. ZEW-EviSTA relies on a non-constant return to scale translog specification with three skill levels, flexible labor inputs, capital as a quasi-fixed input, a time trend and industry dummies. Since labor demand is estimated separately for each skill group (see section 5), the respective information from the LIAB data is necessary. Accordingly, observations with missing information on the skill level are dropped for estimation. Then, for each establishment in the LIAB data and for each skill group within the establishment average deflated real wages are computed. The labor demand elasticities for the three worker skill levels are: -0.56, -0.37, and -1.05 for the high-skilled, medium-skilled and low-skilled, respectively.[23]

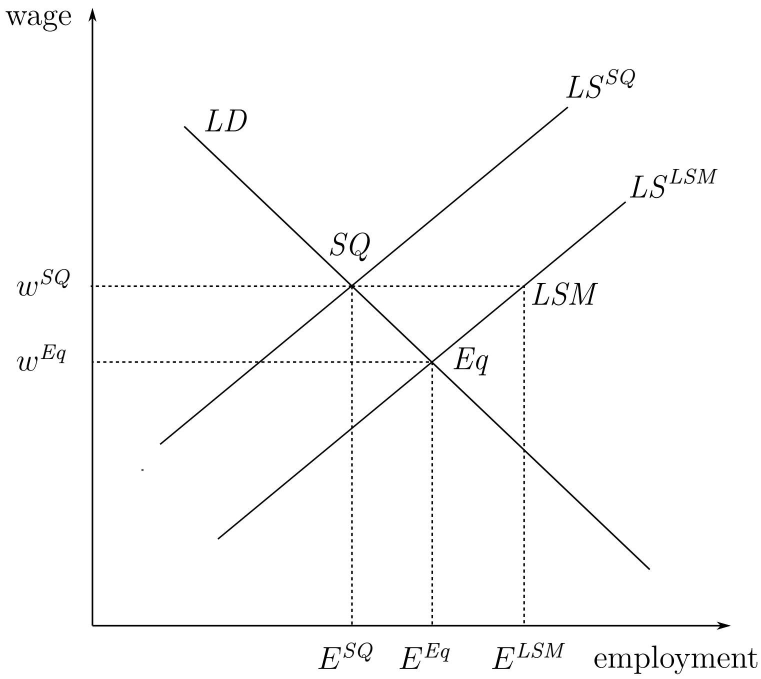
6.2 Supply-Demand Iterations

The above elasticities are used to simulate labor demand adjustments in response to changed labor supply. This can be interpreted as a third-round effect after (1) the mechanical budget effect and (2) the behavioral labor supply responses. To do so, we build

[23]More details on the effects of using different specifications and estimation procedures as well as a thorough comparison of our results with other findings on labor demand for Germany are provided by Peichl and Siegloch (2012).

on approaches by Creedy and Duncan (2002) and Haan and Steiner (2006). Haan and Steiner (2006) provide the rationale behind the reciprocation of labor demand and labor supply effects which can best be seen in a graphical representation (see figure 3). The

Figure 3: Omitting the Labor Demand Module



Notes: The figure shows how labor supply and labor demand interact to produce the equilibrium wage and the equilibrium employment level on the labor market (*Eq*). Regarding ZEW-EviSTA, the figure highlights the distortion of the true equilibrium if the labor demand module is omitted (*LSM*). *Source:* Own illustration, slightly modified from Blömer and Peichl (2020).

figure shows what happens if the labor demand module is omitted. If, for example, an unspecified tax reform shifts labor supply to the right, the labor supply module would yield the increased employment level E^{LSM}. This is because wages would remain constant at level w^{SQ} due to the implicit assumption of fully elastic labor demand. If, however, the labor demand module is incorporated, *LSM* cannot be the labor market equilibrium since firms would not demand E^{LSM} at wage level w^{SQ}. As shown above, labor demand elasticities are negative – both theoretically and empirically. Thus, increased labor supply has a negative impact on wages. In ZEW-EviSTA, the previously determined elasticities can be used to calculate the labor market equilibrium *Eq* in an iterative procedure. First, the labor demand module is used to estimate the reduced wage level w^{LSM} following a labor supply change from E^{SQ} to E^{LSM}. The lower wage feedbacks on labor supply: individuals reduce their labor supply which again has an impact on labor demand. Given the lower labor supply, firms would now prefer to pay a slightly higher wage to attract more workers. This repercussive process continues until the equilibrium level is reached, i.e. when the wage level reaches the point at which supply and demand are balanced. From a practical point of view, this is reached in ZEW-EviSTA when the labor supply and labor demand adjustments and thus the wage shifts become arbitrarily small.[24] Then, supply equals demand and the market equilibrium is reached. The iterative procedure is carried out separately for each of the three different skill groups defined above. This is done to allow for different demand elasticities depending on the skill-level of each group.

7 Outputs

This section presents selected outputs produced using ZEW-EviSTA. It gives some examples of which analyses are feasible using the microsimulation model.

7.1 Status Quo Analysis

ZEW-EviSTA's tax-benefit model discussed in section 4 can be used to analyze various aspects of the German tax and transfer system. This section introduces mainly visual examples to show how this is done.

Figure 4 as well as figures A.1 and A.2 in the appendix show the evolution of disposable income (dashed line) as gross income changes along the x-axis for three different types of hypothetical households. They are called hypothetical households (*Musterhaushalte*) as they do not represent real households from the SOEP but are stylized household types with selected characteristics.[25] The green line in the figures serves as a benchmark for how gross income would develop if neither taxation nor transfers existed (gross income = DPI). The colored areas represent both taxes paid and SSC as well as money received via net income and transfers. While figure 4 (A.1) depicts a single household without (with two) children, figure A.2 shows the same graph for a single earner couple with two children. In all of the figures, full benefit takeup is assumed. To simplify matters, it is further assumed that households only receive labor income.

[24]Let $t = 1, ..., T$ be the number of labor supply-demand iterations and $\text{Hours}_t^{Ref(LS)}$ be weekly working hours after iteration t. Arbitrarily small means that the iterative process stops when the induced change in weekly working hours $\text{Hours}_T^{Ref(LS)} - \text{Hours}_{T-1}^{Ref(LS)} < M$ is below $M = 10,000$ (250 full-time equivalents) or 0.1 percent of the induced labor supply response. Furthermore, the maximum number of iterations is set at 50.

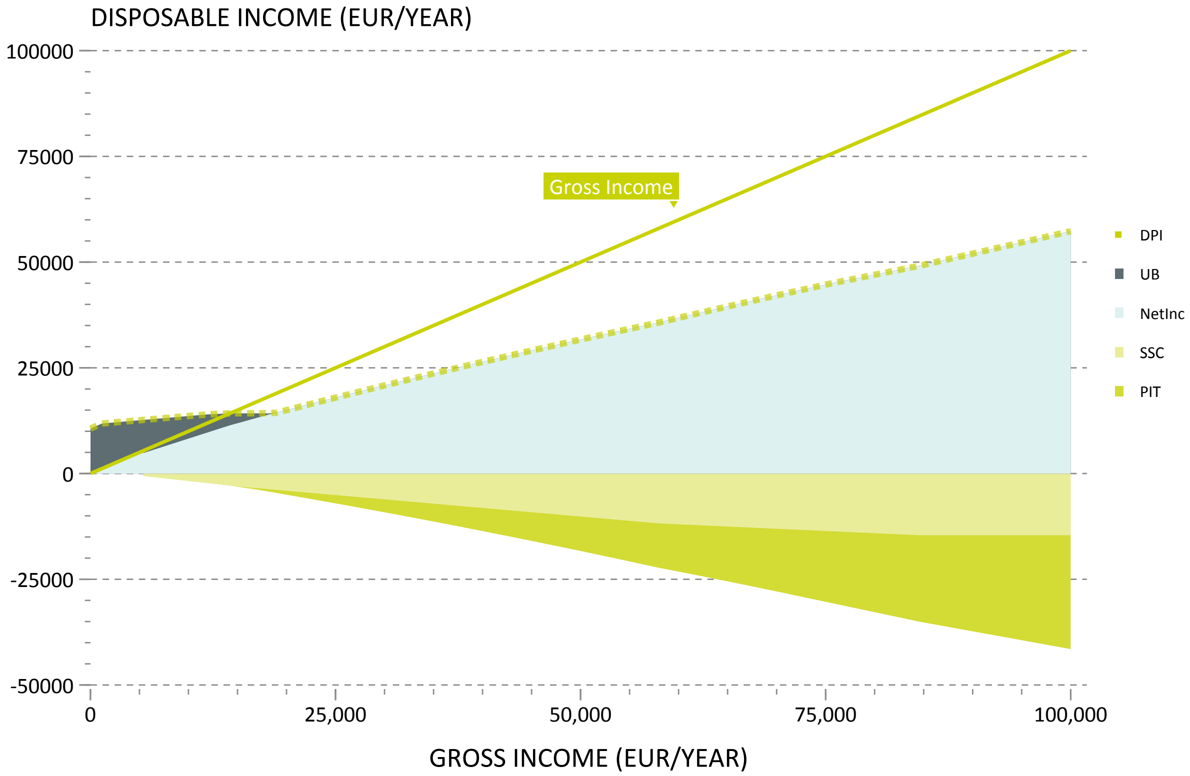
[25]Stylizing households is helpful in order to reduce complexity and by this means focusing on the aspects at the center of attention. Specific household characteristics affect the benefits received and the taxes paid. E.g. the monthly rent paid can impact the amount of social benefits received. Underlying characteristic can be adjusted flexibly to the research question.

The figures carve out the basic characteristics of the tax and transfer scheme. The crossing point of the solid and dotted green lines shows at which point each household type switches from net recipient to net contributor of the tax-benefit system. The figures also highlight the support for families. The financial aid to single parents via alimony advance payments is especially pronounced. Furthermore, the comparison of figures A.1 and A.2 shows the relatively lower burden arising from the personal income tax for married couples. This financial advantage mainly stems from joint tax filing of couples (*Zusammenveranlagung*) as explained in the tax formula (section 4.1.2). Interestingly, for a gross income of approximately EUR 100,000, both couples and single parents with two children end up with almost the same disposable income. Furthermore, the cutoff for unemployment benefits II as well as the fading-out of housing benefits and supplementary child benefits can be seen in the lower income area of the graphs. When the subsistence cutoff for UB II is reached, the housing benefit and supplementary child benefit are given priority.

Besides showing the composition of taxes, SSC and transfers ZEW-EviSTA allows to calculate the corresponding effective marginal tax rates (EMTR) for different household types. The EMTR can then be depicted graphically as shown in figures 5, A.3, and A.4. Again, hypothetical households are used and full takeup is assumed. The EMTR is defined as the change in disposable income when gross income marginally changes. That is, it measures which share of an additional euro of earned gross income is taken away from a household. Importantly, the EMTR does not only capture the effect of taxes but includes all dimensions of the benefit system (social security contributions and transfers), too. Therefore, the EMTR is a great tool to analyze the behavioral incentives induced by the system. Incentives, e.g., to increase labor supply, are lower the higher the EMTR is. In all of the following figures only standard deductions are included in the calculation of the EMTR. Including some of them would lower the EMTR.

Figure 5 shows the EMTR for a stylized single household without children. Since monthly earnings up to EUR 100 are not charged against the unemployment benefit II, the EMTR equals zero until a yearly gross income of EUR 1,200. For monthly incomes between EUR 100 and EUR 1,000, 80% of earned income is charged and subtracted from UB II. This share increases to 90% for monthly incomes between EUR 1,000 and EUR 1,200 and reaches 100% for monthly incomes greater than EUR 1,200. The marked drops in SSC at EUR 58,050 and EUR 84,600 are caused by the assessment ceilings (*Beitragsbemessungsgrenze*) for SSC which were discussed in section 4.2. Correspondingly, the marginal personal income tax (PIT) increases at these points. These discontinuous PIT jumps are caused by the deductibility of social security contributions. A certain

Figure 4: Gross and Disposable Income of a Single Household

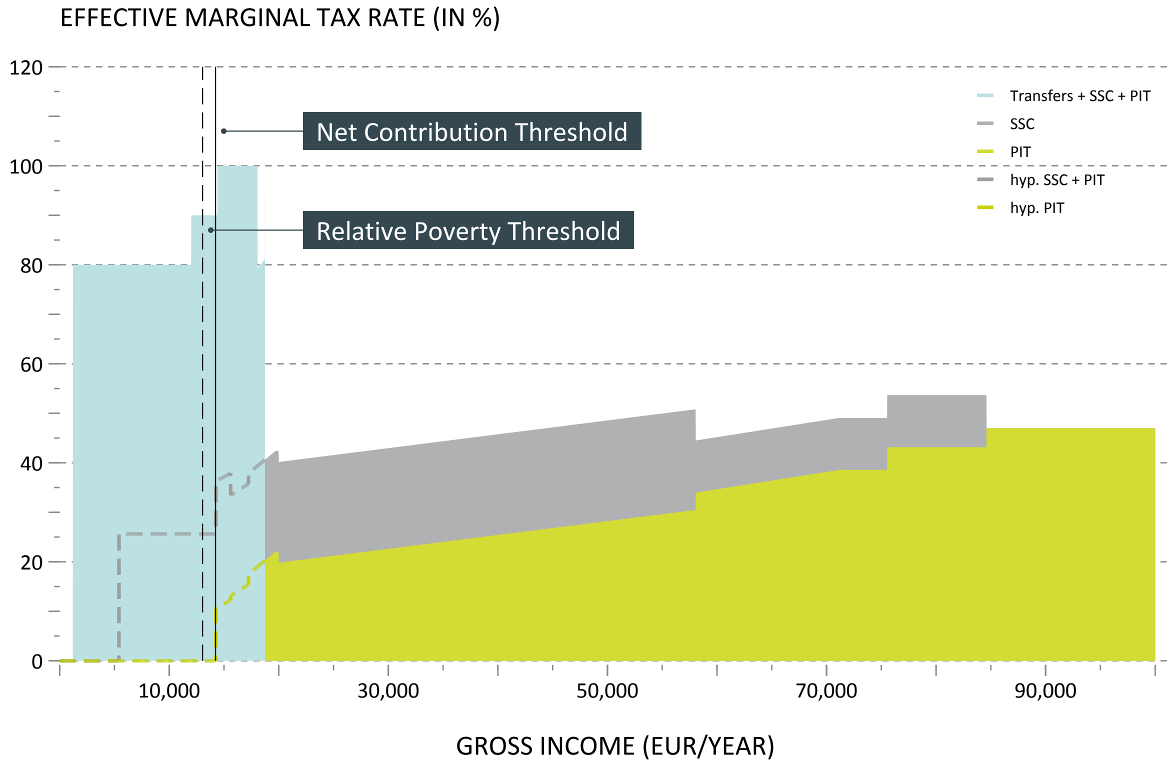


Notes: The figure shows gross and disposable income of a single household. DPI is disposable household income, UB are unemployment benefits, NetInc is net income, SSC are social security contribution payments and PIT depicts the personal income tax due. The solid green line represents the hypothetical case without taxes and transfers in which DPI would equal gross income. The green dotted line shows actual DPI under the 2022 tax-benefit system. *Source:* ZEW-EviSTA.

share of SSC expenses can be deducted from taxable income such that the marginal PIT increases at the thresholds where the respective SSC ceases to be paid. Aside from that, the discontinuity in PIT at approximately EUR 75,000 stems from the solidarity surcharge levied on a taxable income above EUR 62,127. For higher incomes the EMTR only consists of the solidarity surcharge and the top tax rate such that the EMTR lies between 40 and 50 percent. The final discontinuity for very high incomes where the marginal PIT rate increases to 45 percent (*Reichensteuersatz*) is omitted in the graph.

As discussed above, the figures presented so far use hypothetical households (*Musterhaushalte*) with certain characteristics. However, ZEW-EviSTA also allows to simulate the EMTR for all households from the SOEP. This gives an idea about the actual marginal burden of the tax and transfer system across the income distribution. To calculate the actual EMTR, each labor supply unit receives an additional euro of monthly gross income from their primary income source (e.g. labor income, capital income, ...). Within

Figure 5: Effective Marginal Tax Rate of a Single Household in 2022



Notes: The figure shows the effective marginal tax rate (EMTR) of a West German single household without children for the year 2022. Net Contribution Threshold marks the gross income at which taxes and social security contributions of the household equal exactly transfer payments from UB II, housing benefits and child benefits. Relative Poverty Threshold is the threshold at which the household has exactly 60 percent of the median disposable income at her availability. Hyp. SSC + PIT (and hyp. PIT) represent the EMTR when transfers (and SSC) are discarded. *Source:* ZEW-EviSTA.

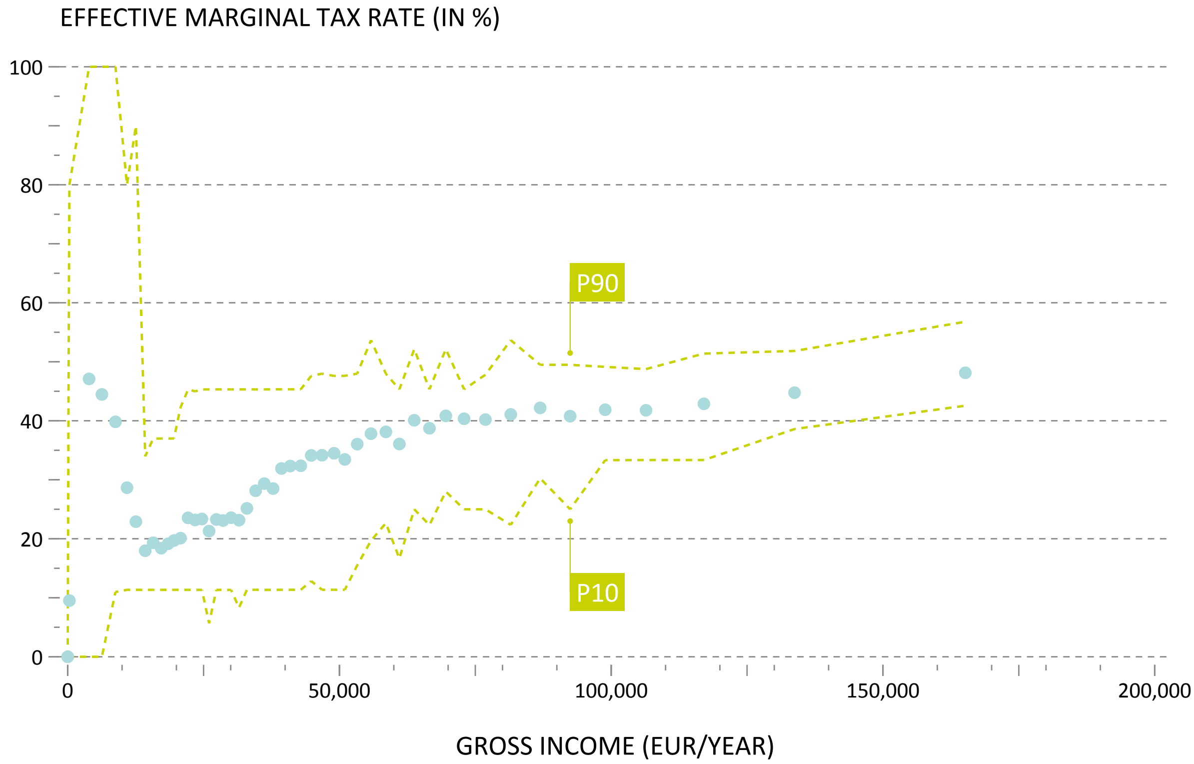
couples, the additional money is allocated according to the relative gross income share of each partner. The static tax benefit module is then applied to both initial monthly gross income (GI_{old}) as well as to monthly gross income increased by one euro (GI_{new}) which yields monthly disposable incomes DPI_{old} and DPI_{new}. The EMTR is simply calculated as $EMTR = (DPI_{new} - DPI_{old})/(GI_{new} - GI_{old})$. The outcomes are depicted in figure 6.

In the figure, each blue dot represents approximately two percent of the overall SOEP population binned by yearly gross income (x-axis). Each dot indicates the average EMTR across the respective gross income bin. The green dashed lines display the dispersion of the EMTR within the bins. The upper line represents the 90$^{\text{th}}$ percentile whereas the lower line shows the 10$^{\text{th}}$ percentile. The overall pattern highlights a spike and a drop in the EMTR for low gross incomes. The strong dispersion of the EMTR in this part of the income distribution is mainly due to the take-up of transfers. Households receiving social transfers which exhibit a very high EMTR as well as households that don't receive social transfers and exhibit a very low or even zero EMTR either because they do not take up or they are not eligible are included in the figure. The difference is evident when comparing the blue shaded area and the grey dotted line in figure 5. Similarly, the inclusion of both singles and couples in the graph can explain parts of the wide dispersion as singles and couples face different EMTRs especially in the lower part of the income distribution. When comparing the actual EMTR to the hypothetical household figures it is obvious that the actual EMTR is much lower especially in the lower part of the distribution. There are two main reasons for this. First, as discussed before not all households are eligible and among the eligible households not every household takes up benefits. Second, for a given income level old age pensioners which predominantly locate in the gross income range up to EUR 50,000 have to contribute much less to the tax and transfer system which substantially reduces the EMTR in this region. The effect can easily be seen when the EMTR is only calculated on the sample of employees, i.e., when pensioners are excluded from the analysis (see figure A.6 in the appendix). Additionally but to a lesser extent, self-employed's not contributing to social security and people living from capital income contribute to lower observed EMTRs, too. Moreover, it is interesting to see that the EMTR is quite stable for middle to very high income households. The incentive for high income households to earn additional money does not decrease as strongly as one might assume taking into account the tax system only.

7.2 Counterfactual Analysis

This section describes how counterfactual analyses are carried out in ZEW-EviSTA. To illustrate this, we use an exemplifying reform which has been discussed by German policy makers. The policy change under consideration is the flattening of the so-called "middle class belly" (*Mittelstandsbauch*). This term was introduced in the 1960s to describe a peculiarity of the German marginal tax rate which increased in a hump-shaped fashion for middle income earners during that period. In 1990, the second linear progression zone (*lineare Progressionszone*) was introduced such that technically the term is not adequate anymore. Still, it is used frequently in public discourse to emphasize the perceivedly high tax burden placed on middle income earners. A particular design of the reform discussed by politicians as well as its effects are depicted in figure 7. Panel 7a shows marginal and average tax rates for the 2022 status quo (blue lines) as well as for the hypothetical reform scenario in which the marginal tax rate is reduced in the two linear progression zones of the tax scheme (green lines). Moreover, the solidarity surcharge threshold is

Figure 6: Effective Marginal Tax Rate for SOEP Households



Notes: The figure shows average effective marginal tax rates (blue dots) across the gross income distribution (x-axis) for all SOEP households. The calculation procedure is described in the text. Each blue dot represents approximately two percent of SOEP households. The green dashed lines show the EMTR for the 90$^{\text{th}}$ and the 10$^{\text{th}}$ percentile across the 50 gross income bins. *Source:* ZEW-EviSTA using the SOEP 2019 wave.

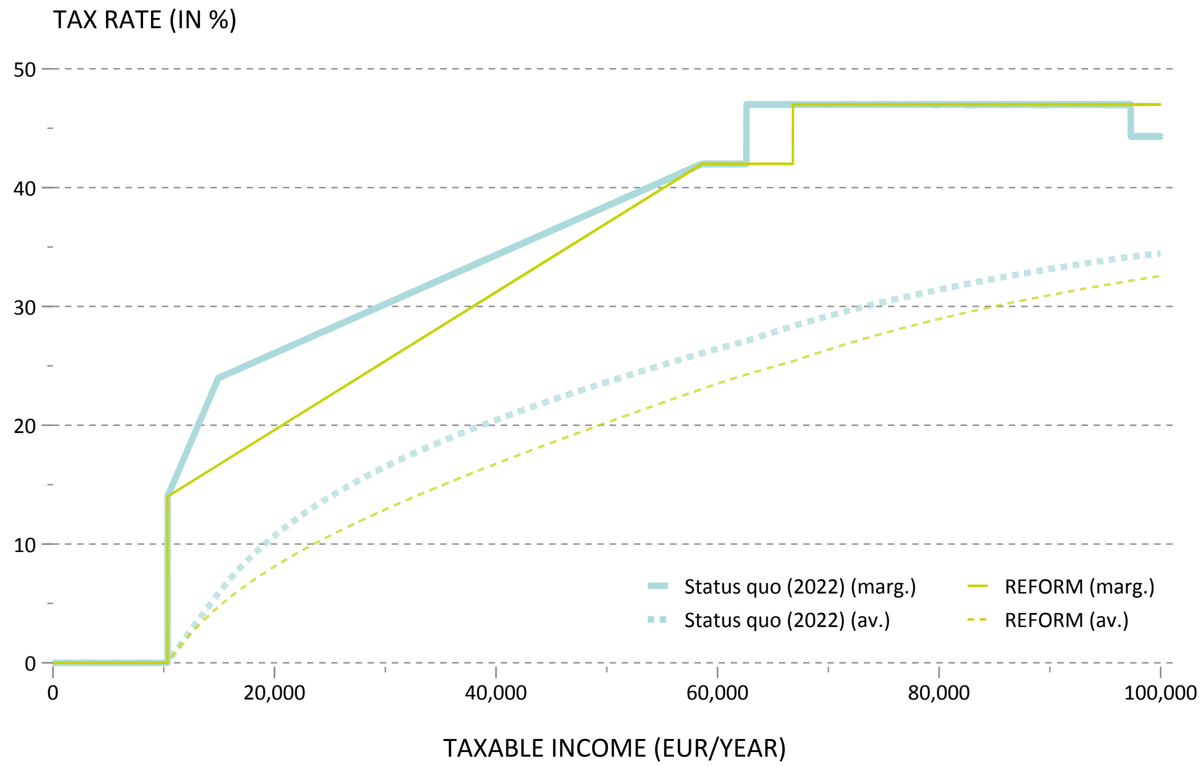
shifted to the right compared to the status quo. The dotted lines show how the policy change translates into substantially lower average tax rates for all taxable incomes above the tax-free allowance (*Grundfreibetrag*).

Figure 7b shows how this scenario translates into total budgetary effects. To calculate the effects 200 bootstrap samples are drawn. The variation in parameter estimates from these runs delivers the bell-shaped distribution (green line) as well as the 95% confidence interval (blue shaded area). As expected, the figure shows that flattening the ”middle class belly” has a substantial negative effect on the total budget of approximately EUR 35.2 billion. The narrow confidence interval emphasizes that this effect is fairly stable and statistically significantly different from zero. Similarly, figure 7c shows the reform effects on labor supply measured in thousand full-time equivalents (FTE). As expected, the reform strongly increases labor supply by approximately 237,000 FTE since incentives to work are increased due to the substantially lower tax rate in combination with the positive own-wage elasticities presented in table 3 above.

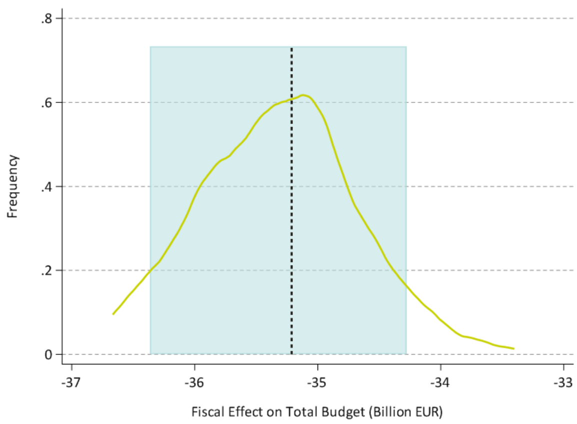
For a thorough analysis of planned changes to the tax and transfer system more detailed analyses are often useful. It might, for example, be interesting to analyze whether a reform would mainly benefit poorer or richer households (progressivity vs. regressivity). ZEW-EviSTA allows to answer such questions by separately analyzing the impacts on specific subgroups of the population. Using the *Mittelstandsbauch* reform scenario, table A.1 depicts the effects on households' disposable income (DPI) while distinguishing between income deciles as well as certain household types. This gives an intuition on the distributional impacts of the policy change. Both the mechanical reform effects (MA) and the outcomes after applying the behavioral labor supply module (LS) are listed in the respective columns. Absolute and relative DPI changes are shown. The results displayed in the table are in line with expectations. Since poor households are mostly below the tax-free allowance threshold (see figure 7a) they do benefit less from the marginal tax rate reduction in the linear progression zones of the tax scheme. Looking at the LS effects, their household income is only increased marginally by EUR 22.5 – a share of only 0.2% of their total disposable income. The absolute effect of the reform increases steadily across income deciles and reaches an additional EUR 2,777 for the 10^{th} decile. In relative terms, a similar pattern emerges which mainly differs in the marked drop between the 9^{th} and 10^{th} decile households for whom the relative contribution to household income drops from 3.7% to 2.7%. The other sections of the table show how several household types would likely be affected by the policy change. Couples with children benefit most in absolute as well as relative terms (EUR 2,077; 3.2% after labor supply adjustment) while single parents benefit least (EUR 572; 1.8%). The effects for households with and without children are listed in the lower panel of the table. Families with no children benefit least from the reform whereas families with two children are most positively affected. Results for families are driven by the distribution of taxable income of the households in

Figure 7: Flattening the "Middle Class Belly" (*Mittelstandsbauch*)

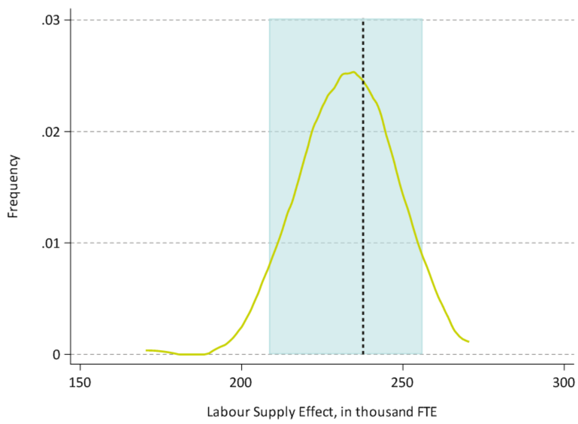
(a) Average and Marginal Tax Rates



(b) Total Budget



(c) Labor Supply



Notes: Panel 7a shows marginal (marg.) and average (av.) tax rates for an individual taxpayer. The blue lines represent the status quo in 2022. The green line depicts a reform scenario in which the "middle class belly" (*Mittelstandsbauch*) is flattened. The solidarity surcharge (*Solidaritätszuschlag*) is included in the figure. Figure 7b and figure 7c show effects on the total budget as well as labor supply effects. FTE refers to full-time equivalents. 200 bootstrap samples are drawn and the distribution of resulting budgetary/labor supply effects over these runs is illustrated in the graph. The blue shaded area represents the 95% confidence interval. The benchmark for calculation is the 2022 status quo. The simulation makes use of ZEW-EviSTA's behavioral labor supply module. *Source:* Own illustration using ZEW-EviSTA.

the respective group.

Table A.2 shows how the subgroup-specific changes in income translate into the overall negative total budget effect found in figure 7b. Again, morning after effects and effects after employing the behavioral labor supply module are shown. Absolute values as well as the relative impact as a share of the total budgetary effect are depicted.[26] Looking at morning after effects by income deciles shows that low income households contribute less to the negative budget effect compared to upper deciles. While there is hardly any effect for the first decile the responses of the richest decile reduce total budget by EUR 11.9 billion. This represents approximately one third of the overall budget effect (29%). Besides this, it is interesting to compare morning after results with the outcomes after applying the behavioral labor supply module. Increases in labor supply can decrease the overall costs of the reform not only by higher tax revenues but also by higher revenues from social security and by fewer expenses for social benefits. A simple comparison of the budget effect in absolute values between the MA and the LS column shows that the reform entails positive work incentives for every subgroup as the LS values are all smaller than the MA results. This is not the case for relative contributions. While the difference between MA and LS column is larger or equal to zero for the first to the seventh decile, this pattern reverses for the eighth to the tenth decile. This implies that compared to upper income households the increase in labor supply of low and middle income households offsets a larger part of their negative MA budget impact. This is the case because they increase labor supply more than richer households' in response to the decrease in their marginal tax rate. The results for households separated according to the number of children are informative, too. For example, the relative contribution of large families with four or more children is only one percent. The biggest fraction of the effect accrues to households without children.

To obtain additional information, it is also possible to split labor supply responses by subgroups. This is shown in table A.3. Changes in full-time equivalents in 1000 individuals as well as the share of the total FTE change accruing to each subgroup are depicted in the "FTE" columns. The same numbers are show for participation responses (extensive margin). As expected, all groups exhibit a positive labor supply reaction to the reform. In line with insights from the previous tables it can be seen that the fourth decile of the income distribution adjusts its labor supply most pronouncedly in relative terms (13.8%). As discussed before, incentives for workers in the lowest decile are not changed substantially by the reform which explains the weak response for this subgroup. The top decile households exhibit a rather weak labor supply reaction, although they benefit a lot

[26]Note that the total effect (LS, EUR -35.2 billion) corresponds to the value shown in figure 7b

in terms of their DPI (see table A.1).

Overall, the tables indicate that the reduction of marginal and average tax rates when flattening the ”middle class belly” would have regressive effects as upper income deciles benefit more than lower deciles. With increasing focus on the distributional aspects of reforms, this is relevant information to evaluate planned policy changes. Furthermore, the negative effects on total budget estimated using ZEW-EviSTA can be an important factor to assess the feasibility of reforms. In this vein, ZEW-EviSTA is a valuable tool to guide policy makers. To get a more comprehensive picture of its capabilities, the interested reader is referred to section 8 where articles using ZEW-EviSTA are listed.

7.3 Validation Using Official Statistics

To evaluate the quality of ZEW-EviSTA, the outcomes produced by the model are compared to data from official sources. This helps to assess whether, e.g., the calculated amount of tax revenues or benefit payments is measured accurately. However, not only fiscal parameters are validated but also other socio-economic dimensions of interest. Deviations between the outputs and official statistics can arise from measurement error in the underlying data source (SOEP), a lack of representativeness of the data, unobservable individual and household characteristics and not least from flaws in the simulation procedure. Thus, hitting the target values from official records is ZEW-EviSTA’s main performance benchmark. Especially for estimating fiscal expenses, the quality of the underlying microdata and a precise structural estimation of take-up behavior is essential.

The comparison with official records is shown in table 5. Here, various revenue and expense categories as well as other relevant socio-economic dimensions are depicted. The table compares the values estimated with ZEW-EviSTA in column ”ZEW-EviSTA” to administrative reference values in column ”References”. Column ”Source” lists the source from which the information is taken. The model is benchmarked for 2019 as not all reference values are available for later years. Furthermore, the years 2020 and onward are confounded by the economic distress and the policy measures taken during the global COVID-19 pandemic. As the table shows, ZEW-EviSTA’s estimates are close to the administrative statistics which is reassuring of the quality of the model.

Table 5: Validation of ZEW-EviSTA, Administrative Reference Values, 2019

	EviSTA	Reference	Source
Revenues *(Billion EUR)*			
Income Tax	323.8	322.1	Bundesministerium der Finanzen (2020)
Withholding Tax	6.6	5.1	Bundesministerium der Finanzen (2020)
Solidarity Surcharge	16.6	17.9	Bundesministerium der Finanzen (2020)
Old Age Pension	233.7	222.5	Deutsche Rentenversicherung (2020)
Unempl. Insurance	31.2	29.9	Bundesagentur für Arbeit (2020)
Health Insurance	282.2	292.9	Bundesgesundheitsministerium (2020a,b)
Expenses *(Billion EUR)*			
Unempl. Benefit II	28.3	28.6	Bundesagentur für Arbeit (2021)
SGB 12	5.6	7.4	Destatis (2021b)
Housing Benefit	1.2	1.0	Destatis (2021d)
Child Benefit	38.1	38.8	Destatis (2021c)
Supp. Child Benefit	0.6	0.4	Familienkasse (2020)
Inequality and Poverty			
Gini Coefficient	28.5	29.7	Eurostat (2022)
ARP Rate	14.3%	14.8%	Destatis (2022b)
ARP Threshold	€1,197	€1,176	Destatis (2021a)
Labor Market Outcomes *(Million Individuals)*			
Participation			
Overall	43.3	42.4	Destatis (2020a)
Female	20.9	19.8	Destatis (2020a)
Male	22.4	22.6	Destatis (2020a)
FTE	39.0	37.6	Statistikportal (2020)[a]
Transfers			
Eligible Households *(Thousand Individuals)*			
UB II	2,669	2,850	Bundesagentur für Arbeit (2019)
Housing Benefit	528	504	Destatis (2020b)
Supp. Child Benefit	153	104	Familienkasse (2020)
Eligible Children Child Benefit *(Million Individuals)*			
Age Child < 18	13.8	13.7	Destatis (2022a)
Age Child < 25	16.5	17.5	Bundesagentur für Arbeit (2022)[b]

Notes: The table shows outputs from ZEW-EviSTA for the most relevant revenue and expense categories as well as socio-demographic characteristics. Administrative reference values for the year 2019 are listed in column "Reference". ARP stands for at-risk-of-poverty. FTE are full-time equivalents. *Source:* ZEW-EviSTA using the SOEP 2019 wave; various administrative sources for validation.
[a] Data for Thuringia is missing. Therefore, the administrative value is too small.
[b] The reference value is an approximation for the year 2020. Since child benefits are paid by various institutions, there exists no precise aggregate value.

8 Applications

Various publications use ZEW-EviSTA to simulate the effects of proposed policy reforms in Germany. The flexibility of the model discussed above allows to investigate a broad range of potential changes to the German tax and transfer system. Among others, the following topics have been analyzed using ZEW-EviSTA: effects of the proposed tax reforms by the German political parties for the federal election 2021, effects of family support via in-kind benefits, reforms of the child benefit scheme, (dis)incentives through the effective marginal tax rate pattern, and distributional effects of the German Federal Government's reform plans for the legislative period 2021-2025. Besides that, ZEW-EviSTA is used in ZEW's project cooperation with the German Federal Ministry of Labour and Social Affairs (BMAS, *Bundesministerium für Arbeit und Soziales*). In this context, ZEW-EviSTA represents a valuable tool for providing policy evaluations at short notice. Usually, projects from the cooperation cannot be published and are thus not included in the list below. The list provides a non-exhaustive overview of publications relying on ZEW-EviSTA.

- Blömer, M., Bonin, H., and Stichnoth, H. (2016). Evaluation von Reformoptionen für eine verbesserte materielle Absicherung von Kindern. Gutachten für die Bundestagsfraktion von Bündnis 90/Die Grünen, Mannheim
- Blömer, M. and Stichnoth, H. (2016). Familienförderung: Sachleistungen. Gutachten für die Bundestagsfraktion von Bündnis 90/Die Grünen, Mannheim
- Blömer, M. and Stichnoth, H. (2016). Mikrosimulationsstudie zur Familienförderung. Gutachten für die Bundestagsfraktion von Bündnis 90/Die Grünen, Mannheim
- Blömer, M., Buhlmann, F., Löffler, M., Peichl, A., Siegloch, S., and Stichnoth, H. (2016). Kinderfreibeträge in der Sozialversicherung. Gutachten für das Bundesministerium für Wirtschaft und Energie, Mannheim
- Blömer, M., Buhlmann, F., Löffler, M., Peichl, A., and Stichnoth, H. (2017). Kinderfreibeträge in der gesetzlichen Rentenversicherung: Verteilungs- und Verhaltenswirkungen. *Wirtschaftsdienst*, 97(4):266–271
- Bonin, H., Buhlmann, F., Sommer, E., and Stichnoth, H. (2018). Arbeitsangebotseffekte einer Reform des Kinderzuschlags. Expertise 85, Forschungsinstitut zur Zukunft der Arbeit (IZA), Bonn

- Bonin, H., Buhlmann, F., Sommer, E., and Stichnoth, H. (2018). Mikrosimulation von Reformszenarien zur finanziellen Entlastung von Geringverdienern. Studie im Auftrag des Bundesministeriums für Wirtschaft und Energie, Mannheim und Bonn
- Bonin, H., Buhlmann, F., Siegloch, S., and Stichnoth, H. (2019). Aufkommens-, Verteilungs- und Arbeitsangebotswirkungen einer stufenweisen Abschaffung des Solidaritätszuschlags. Kurzgutachten für das Bundesministerium für Wirtschaft und Energie, Mannheim und Bonn
- Buhlmann, F., Camarero Garcia, S., Stichnoth, H., Bonin, H., Pestel, N., and Sommer, E. (2017). Ökonomische Bewertung verschiedener Reformoptionen im deutschen Steuer- und Transfersystem – Kurzexpertise 1. Studie im Auftrag des Bundesministeriums für Wirtschaft und Energie, Mannheim und Bonn
- Buhlmann, F., Löffler, M., and Peichl, A. (2017). Grenzbelastungen im Steuer-, Abgaben- und Transfersystem - Fehlanreize, Reformoptionen und ihre Wirkungen auf inklusives Wachstum. Gutachten für die Bertelsmann Stiftung, Gütersloh
- Buhlmann, F., Sommer, E., and Stichnoth, H. (2018). Verteilungswirkungen der Reformpläne der Großen Koalition: Rentner und Familien sind die Hauptprofiteure. Policy Brief 2, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim
- Buhlmann, F., Hebsaker, M., and Siegloch, S. (2020). Einführung einer Garantiesicherung. Gutachten für die Bundestagsfraktion von Bündnis 90/Die Grünen, Mannheim
- Buhlmann, F., Hebsaker, M., and Siegloch, S. (2021). Reformvorschläge der Parteien zur Bundestagswahl 2021 – Finanzielle Auswirkungen. Eine Berechnung für die Süddeutschen Zeitung mithilfe des Evaluationsmodells für integrierte Steuer- und Transferpolitik-Analysen (ZEW-EviSTA) – aktualisiert am 19. Juli, 5. und 27. August 2021. Kurzexpertise 21-05, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim
- Buhlmann, F., Siegloch, S., Stichnoth, H., and Hebsaker, M. (2021). Verteilungswirkungen der Reformpläne im Koalitionsvertrag 2021-2025. Eine Analyse auf Basis des ZEW-EviSTA-Modells und des Sozio-oekonomischen Panels (SOEP). Kurzexpertise 21-12, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim

- Fuest, C., Löffler, M., Peichl, A., and Stichnoth, H. (2015). Integration des Solidaritätszuschlags in die Einkommensteuer: Verteilungs- und Aufkommenswirkungen. Wirtschaftsdienst, 95(5):319–324
- Löffler, M., Peichl, A., Pestel, N., Siegloch, S., and Sommer, E. (2014). Documentation IZAΨMOD v3.0: The IZA Policy Simulation Model. Research Report 8553, Forschungsinstitut zur Zukunft der Arbeit (IZA), Bonn

References

Aaberge, R. and Colombino, U. (2014). Labour Supply Models. In O'Donoghue, C., editor, *Contributions to Economic Analysis*, volume 293, pages 167–221. Emerald Group Publishing Limited.

Aaberge, R., Colombino, U., and Strøm, S. (1999). Labour 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., Dagsvik, J. K., Strøm, S., and Strom, S. (1995). Labor Supply Responses and Welfare Effects of Tax Reforms. *The Scandinavian Journal of Economics*, 97(4):635.

Alda, H., Bender, S., and Gartner, H. (2005). The Linked Employer-employee Dataset of the IAB (LIAB). Discussion Paper 06/2005, Institut für Arbeitsmarkt- und Berufsforschung (IAB) der Bundesagentur für Arbeit (BA), Nuremberg.

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., Orsini, K., and Peichl, A. (2014). Comparing Labor Supply Elasticities in Europe and the United States: New Results. *Journal of Human Resources*, 49(3):723–838.

Bargain, O. and Peichl, A. (2016). Own-wage Labor Supply Elasticities: Variation Across Time and Estimation Methods. *IZA Journal of Labor Economics*, 5(1):10.

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 Hauser, R. and Becker, I., editors, *Reporting on Income Distribution and Poverty*, pages 55–90. Springer, Berlin, Heidelberg.

Bender, S. and Haas, A. (2002). Die IAB-Beschäftigtenstichprobe. Technical Report BeitrAB 250, Institut für Arbeitsmarkt- und Berufsforschung (IAB) der Bundesagentur für Arbeit (BA), Nuremberg.

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

Blau, F. D. and Kahn, L. M. (2007). Changes in the Labor Supply Behavior of Married Women: 1980–2000. *Journal of Labor Economics*, 25(3):393–438.

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. (2000a). Evaluating In-Work Benefit Reform: The Working Families Tax Credit in the U.K. Working Paper 160, Northwestern University/University of Chicago Joint Center for Poverty Research, Chicago.

Blundell, R., Duncan, A., McCrae, J., and Meghir, C. (2000b). 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 *Handbook of Labor Economics*, volume 3, pages 1559–1695. Elsevier.

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

Blömer, M., Bonin, H., and Stichnoth, H. (2016a). Evaluation von Reformoptionen für eine verbesserte materielle Absicherung von Kindern. Gutachten für die Bundestagsfraktion von Bündnis 90/Die Grünen, Mannheim.

Blömer, M., Buhlmann, F., Löffler, M., Peichl, A., Siegloch, S., and Stichnoth, H. (2016b). Kinderfreibeträge in der Sozialversicherung. Gutachten für das Bundesministerium für Wirtschaft und Energie, Mannheim.

Blömer, M., Buhlmann, F., Löffler, M., Peichl, A., and Stichnoth, H. (2017). Kinderfreibeträge in der gesetzlichen Rentenversicherung: Verteilungs- und Verhaltenswirkungen. *Wirtschaftsdienst*, 97(4):266–271.

Blömer, M. and Peichl, A. (2020). The ifo Tax and Transfer Behavioral Microsimulation Model. Working Paper 335, ifo Institute – Leibniz Institute for Economic Research at the University of Munich, Munich.

Blömer, M. and Stichnoth, H. (2016a). Familienförderung: Sachleistungen. Gutachten für die Bundestagsfraktion von Bündnis 90/Die Grünen, Mannheim.

Blömer, M. and Stichnoth, H. (2016b). Mikrosimulationsstudie zur Familienförderung. Gutachten für die Bundestagsfraktion von Bündnis 90/Die Grünen, Mannheim.

Bonin, H., Buhlmann, F., Siegloch, S., and Stichnoth, H. (2019). Aufkommens-, Verteilungs- und Arbeitsangebotswirkungen einer stufenweisen Abschaffung des Solidaritätszuschlags. Kurzgutachten für das Bundesministerium für Wirtschaft und Energie, Mannheim und Bonn.

Bonin, H., Buhlmann, F., Sommer, E., and Stichnoth, H. (2018a). Arbeitsangebotseffekte einer Reform des Kinderzuschlags. Expertise 85, Forschungsinstitut zur Zukunft der Arbeit (IZA), Bonn.

Bonin, H., Buhlmann, F., Sommer, E., and Stichnoth, H. (2018b). Mikrosimulation von Reformszenarien zur finanziellen Entlastung von Geringverdienern. Studie im Auftrag des Bundesministeriums für Wirtschaft und Energie, Mannheim und Bonn.

Bonin, H., Kempe, W., and Schneider, H. (2002). Household Labor Supply Effects of Low-Wage Subsidies in Germany. *SSRN Electronic Journal*.

Bourguignon, F. and Spadaro, A. (2006). Microsimulation as a Tool for Evaluating Redistribution Policies. *The Journal of Economic Inequality*, 4(1):77–106.

Buck, J. (2006). *Datenfusion und Steuersimulation: Theorie und Empirie im Rahmen des Mikrosimulationsmodells GMOD*. Berichte aus der Statistik. Shaker, Aachen.

Buhlmann, F., Camarero Garcia, S., Stichnoth, H., Bonin, H., Pestel, N., and Sommer, E. (2017a). Ökonomische Bewertung verschiedener Reformoptionen im deutschen Steuer- und Transfersystem – Kurzexpertise 1. Studie im Auftrag des Bundesministeriums für Wirtschaft und Energie, Mannheim und Bonn.

Buhlmann, F., Hebsaker, M., and Siegloch, S. (2020). Einführung einer Garantiesicherung. Gutachten für die Bundestagsfraktion von Bündnis 90/Die Grünen, Mannheim.

Buhlmann, F., Hebsaker, M., and Siegloch, S. (2021a). Reformvorschläge der Parteien zur Bundestagswahl 2021 – Finanzielle Auswirkungen. Eine Berechnung für die Süddeutschen Zeitung mithilfe des Evaluationsmodells für integrierte Steuer- und Transferpolitik-Analysen (ZEW-EviSTA) – aktualisiert am 19. Juli, 5. und 27. August 2021. Kurzexpertise 21-05, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim.

Buhlmann, F., Löffler, M., and Peichl, A. (2017b). Grenzbelastungen im Steuer-, Abgaben- und Transfersystem - Fehlanreize, Reformoptionen und ihre Wirkungen auf inklusives Wachstum. Gutachten für die Bertelsmann Stiftung, Gütersloh.

Buhlmann, F., Siegloch, S., Stichnoth, H., and Hebsaker, M. (2021b). Verteilungswirkungen der Reformpläne im Koalitionsvertrag 2021-2025. Eine Analyse auf Basis des ZEW-EviSTA-Modells und des Sozio-oekonomischen Panels (SOEP). Kurzexpertise 21-12, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim.

Buhlmann, F., Sommer, E., and Stichnoth, H. (2018). Verteilungswirkungen der Reformpläne der Großen Koalition: Rentner und Familien sind die Hauptprofiteure. Policy Brief 2, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim.

Bundesagentur für Arbeit (2019). Monatsbericht zum Arbeits- und Ausbildungsmarkt. URL: `http://statistik.arbeitsagentur.de` (visited on 2022-06-27).

Bundesagentur für Arbeit (2020). Finanzentwicklung in der Arbeitslosenversicherung - Bericht über das Geschäftsjahr 2019. URL: `https://www.arbeitsagentur.de/datei/ba146294.pdf` (visited on 2022-06-27).

Bundesagentur für Arbeit (2021). Ausgaben für aktive und passive Leistungen im SGB II (Jahreszahlen). URL: `https://statistik.arbeitsagentur.de/SiteGlobals/Forms/Suche/Einzelheftsuche_Formular.html?nn=1460460&topic_f=ausgaben-sgbii` (visited on 2022-06-27).

Bundesagentur für Arbeit (2022). Familienkassenreform - Bundesagentur für Arbeit.

URL: https://www.arbeitsagentur.de/institutionen/familienkassenreform (visited on 2022-06-27).

Bundesgesundheitsministerium (2020a). Die Finanzentwicklung der sozialen Pflegeversicherung Ist-Ergebnisse ohne Rechnungsabgrenzung. URL: https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/3_Downloads/Statistiken/Pflegeversicherung/Finanzentwicklung/2020_Finanzentwicklung-der-sozialen-Pflegeversicherung_bf.pdf (visited on 2022-06-27).

Bundesgesundheitsministerium (2020b). Gesetzliche Krankenversicherung Vorläufige Rechnungsergebnisse 1. bis 4. Quartal 2019. URL: https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/3_Downloads/Statistiken/GKV/Finanzergebnisse/KV45_1-4_Quartal_2019_Internet.pdf (visited on 2022-06-27).

Bundesministerium der Finanzen (2020). Steuereinnahmen (ohne reine Gemeindesteuern) - in Tsd. Euro - Bundesgebiet insgesamt - nach Steuerarten. URL: https://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Steuern/Steuerschaetzungen_und_Steuereinnahmen/2020-01-31-steuereinnahmen-kalenderjahr-2019.pdf?__blob=publicationFile&v=5 (visited on 2022-06-27).

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

Decoster, A., Ochmann, R., and Spiritus, K. (2013). Integrating Indirect Taxation Into EUROMOD: Documentation and Results for Germany. EUROMOD Working Paper EM 20/13, Institute for Social and Economic Research, University of Essex, Essex.

Destatis (2019). Consumer Price Index for Germany, Weighting Pattern for Base Year 2015. URL: https://www.destatis.de/DE/Themen/Wirtschaft/Preise/Verbraucherpreisindex/Methoden/Downloads/waegungsschema-2015.html (visited on 2022-06-27).

Destatis (2020a). Bevölkerung und Erwerbstätigkeit - Erwerbsbeteiligung der Bevölkerung Ergebnisse des Mikrozensus zum Arbeitsmarkt. URL: https://www.statistischebibliothek.de/mir/servlets/MCRFileNodeServlet/DEHeft_derivate_00057277/2010410197004_korr13102020.pdf (visited on 2022-06-27).

Destatis (2020b). Wohngeld 2019: Zahl der Haushalte um 8 % gesunken. URL: https://www.destatis.de/DE/Presse/Pressemitteilungen/2020/09/PD20_368_223.html (visited on 2022-06-27).

Destatis (2021a). Armutsgefährdungsschwelle und Armutsgefährdung (monetäre Armut) in Deutschland. URL: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Einkommen-Konsum-Lebensbedingungen/Lebensbedingungen-Armutsgefaehrdung/Tabellen/armutsschwelle-gefaehrdung-silc.html (visited on 2022-06-27).

Destatis (2021b). Ausgaben und Einnahmen der Sozialhilfe nach dem SGB XII. URL: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Soziales/Sozialhilfe/Tabellen/ausgaben-einnahmen-t01-bruttoausgaben-insg-hilfearten-ilj-zv.html (visited on 2022-06-27).

Destatis (2021c). Empfängerinnen und Empfänger von Kindergeld und Ausgaben. URL: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Soziales/Elterngeld/Tabellen/empfaenger-ausgaben.html (visited on 2022-06-27).

Destatis (2021d). Wohngeld - Ausgaben im Zeitvergleich am 31.12. URL: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Soziales/Wohngeld/Tabellen/02-zv-bl-ausg-insg.html (visited on 2022-06-27).

Destatis (2022a). Bevölkerung: Deutschland, Stichtag, Altersjahre. URL: https://www-genesis.destatis.de/genesis/online?operation=statistic&levelindex=0&levelid=1649750005806&code=12411#abreadcrumb (visited on 2022-06-27).

Destatis (2022b). Lebensbedingungen und Armutsgefährdung. URL: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Einkommen-Konsum-Lebensbedingungen/Lebensbedingungen-Armutsgefaehrdung/_inhalt.html (visited on 2022-06-27).

Deutsche Rentenversicherung (2020). Rentenatlas 2020, Einnahmen 2019. URL: https://www.deutsche-rentenversicherung.de/SharedDocs/Downloads/DE/Statistiken-und-Berichte/Rentenatlas/2020/rentenatlas_2020_einnahmen_2019.html;jsessionid=6E0156F7E09ED046F035762F3A1F63F0.delivery1-7-replication (visited on 2022-06-27).

DIW Berlin (2021). DIW Berlin: Sozio-oekonomisches Panel (SOEP). URL: https://www.diw.de/de/diw_01.c.412809.de/presse/glossar/sozio_oekonomisches_panel_soep.html (visited on 2022-06-27).

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

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

Eurostat (2022). Gini coefficient of equivalised disposable income - EU-SILC survey. URL: http://appsso.eurostat.ec.europa.eu/nui/show.do?wai=true&dataset=ilc_di12 (visited on 2022-06-27).

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.

Familienkasse (2020). Kindergeld/Kinderzuschlag, Jahreszahlen 2019, Die wichtigsten Zahlen zu Kindergeld- und Kinderzuschlagsgewährung, Entwicklung seit 1975. URL: https://statistik.arbeitsagentur.de/Statistikdaten/Detail/201912/fam ka/famka-jz/famka-jz-d-0-201912-pdf?__blob=publicationFile (visited on 2022-06-27).

Figari, F., Paulus, A., and Sutherland, H. (2015). Microsimulation and Policy Analysis. In *Handbook of Income Distribution*, volume 2, pages 2141–2221. Elsevier.

Flood, L. and Islam, N. (2005). A Monte Carlo Evaluation of Discrete Choice Labour Supply Models. *Applied Economics Letters*, 12(5):263–266.

Forschungsdatenzentrum (2018). Lohn- und Einkommenssteuerstatistik 2010, Scientific Use File, Version 0. URL: https://www.forschungsdatenzentrum.de/de/10-21242-73111-2010-00-00-3-1-0 (visited on 2022-06-27).

Fuest, C., Löffler, M., Peichl, A., and Stichnoth, H. (2015). Integration des Solidaritätszuschlags in die Einkommensteuer: Verteilungs- und Aufkommenswirkungen. *Wirtschaftsdienst*, 95(5):319–324.

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(5):620–636.

Goebel, J., Grabka, M. M., Liebig, S., Kroh, M., Richter, D., Schröder, C., and Schupp, J. (2019). The German Socio-Economic Panel (SOEP). *Jahrbücher für Nationalökonomie und Statistik*, 239(2):345–360.

Haan, P. and Steiner, V. (2005). Distributional Effects of the German Tax Reform 2000 - A Behavioral Microsimulation Analysis. *Schmollers Jahrbuch : Journal of Applied Social Science Studies / Zeitschrift für Wirtschafts- und Sozialwissenschaften*, 125(1):39–49. Publisher: Duncker & Humblot, Berlin.

Haan, P. and Steiner, V. (2006). Labor Market Effects of the German Tax Reform 2000. In Dreger, C., Galler, H. P., and Walwei, U., editors, *Determinants of Employment*, number 22 in Schriften des Instituts für Wirtschaftsforschung Halle, pages 101–117. Nomos Verl.-Ges., Baden-Baden.

Haan, P. and Uhlendorff, A. (2007). Intertemporal Labor Supply and Involuntary Unemployment. *Empirical Economics*, 44(2):661–683.

Hamermesh, D. S. (1993). *Labor Demand*. Princeton University Press, Princeton, NJ, 1st edition.

Hausman, J. A. (1981). Exact Consumer's Surplus and Deadweight Loss. *The American Economic Review*, 71(4):16.

Heckman, J. J. (1979). Sample Selection Bias as a Specification Error. *Econometrica*, 47(1):153.

Heckman, J. J. (1993). What Has Been Learned About Labor Supply in the Past Twenty Years? *The American Economic Review*, 83(2):7.

Heim, B. T. (2007). The Incredible Shrinking Elasticities: Married Female Labor Supply, 1978–2002. *Journal of Human Resources*, XLII(4):881–918.

Heim, B. T. (2009). Structural Estimation of Family Labor Supply with Taxes: Estimating a Continuous Hours Model Using a Direct Utility Specification. *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.

Hurwicz, L. (1962). On the structural form of interdependent systems. In Nagel, E., Suppes, P., and Tarski, A., editors, *Logic, methodology and philosophy of science*, pages 232–239. Stanford University Press, Stanford, CA.

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

Keane, M. P. (2011). Labor Supply and Taxes: A Survey. *Journal of Economic Literature*, 49(4):961–1075.

Luce, R. D. (1959). *Individual Choice Behavior: A Theoretical Analysis*. John Wiley, Oxford, England.

Löffler, M. (2013). Fitting Complex Mixed Logit Models with Particular Focus on Labor Supply Estimation. Stata Conference 8, New Orleans.

Löffler, M., Peichl, A., Pestel, N., Siegloch, S., and Sommer, E. (2014). Documentation IZAΨMOD v3.0: The IZA Policy Simulation Model. Research Report 8553, Forschungsinstitut zur Zukunft der Arbeit GmbH (IZA), Bonn.

Löffler, M., Peichl, A., and Siegloch, S. (2018). The Sensitivity of Structural Labor Supply Estimations to Modeling Assumptions. Research Report 11425, Forschungsinstitut zur Zukunft der Arbeit GmbH (IZA), Bonn.

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.

McFadden, D. (1974). Conditional Logit Analysis of Qualitative Choice Behavior. In *Frontiers in Econometrics*, pages 105–142. Academic Press, New York.

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

Peichl, A., Schneider, H., and Siegloch, S. (2010). Documentation IZAΨMOD: The IZA Policy Simulation Model. *SSRN Electronic Journal*.

Peichl, A. and Siegloch, S. (2012). Accounting for Labor Demand Effects in Structural Labor Supply Models. *Labour Economics*, 19(1):129–138.

Ruf, K., Schmidtlein, L., Seth, S., Stüber, H., and Umkehrer, M. (2021). Linked Employer-Employee Data from the IAB: LIAB Cross-Sectional Model 2 (LIAB QM2) 1993-2019.

FDZ-Datenreport 03/2021, Bundesagentur für Arbeit, Nuremberg.

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

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

Stabu (2017). Einkommens- und Verbrauchsstichprobe – Aufgabe, Methode und Durchführung der EVS 2013. Technical Report 7, Statistisches Bundesamt (Destatis), Wiesbaden.

Statistikportal (2020). Erwerbstätige in Vollzeitäquivalente. URL: `https://www.statistikportal.de/de/etr/ergebnisse/arbeitsvolumen#tabellen` (visited on 2022-06-27).

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*. Cambridge University Press, 2nd edition.

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

A Appendix

Table A.1: Flattening the "Middle Class Belly": Distributional Effects

	MA		**LS**	
	€	%	€	%
Total	978.2	2.4	1101.4	2.7
Income Deciles				
1st Decile	16.3	0.1	22.5	0.2
2nd Decile	138.8	0.7	190.4	0.9
3rd Decile	276.9	1.1	375.5	1.5
4th Decile	476.8	1.6	621.1	2.1
5th Decile	673.8	1.9	841.7	2.4
6th Decile	1015.7	2.5	1224.6	3.0
7th Decile	1329.2	2.9	1541.6	3.4
8th Decile	1715.5	3.2	1920.6	3.6
9th Decile	2166.4	3.5	2327.9	3.7
10th Decile	2727.5	2.7	2777.1	2.7
Household Type				
Single	494.1	2.0	549.0	2.2
Single parent	466.5	1.4	571.5	1.8
Couple without children	1267.5	2.5	1418.7	2.8
Couple with children	1823.3	2.8	2076.6	3.2
Number of Children in the Household				
None	820.6	2.3	916.2	2.6
1 child	1540.2	2.8	1755.7	3.2
2 children	1641.9	2.7	1879.1	3.1
3 children	1445.2	2.3	1665.2	2.7
4 or more children	1002.6	1.7	1205.0	2.1

Notes: The table shows the effects of flattening the "middle class belly" (*Mittelstandsbauch*) on disposable income for several subgroups of the population. The reform specification under consideration is depicted in figure 7a. The outcomes of the policy change are calculated in comparison with the 2022 status quo. Columns "%" depict the percent change in DPI for each subgroup. *Source:* Reform effects are simulated with ZEW-EviSTA using the SOEP 2019 wave.

Table A.2: Flattening the "Middle Class Belly": Fiscal Effects

	MA		LS	
	Bn. €	%	Bn. €	%
Total	-40.9	100	-35.2	100
Income Deciles				
1st Decile	-0.1	0	0	0
2nd Decile	-0.6	-1	-0.2	-1
3rd Decile	-1.1	-3	-0.6	-2
4th Decile	-1.9	-5	-1.2	-3
5th Decile	-2.6	-6	-1.9	-5
6th Decile	-3.5	-9	-2.8	-8
7th Decile	-5.0	-12	-4.2	-12
8th Decile	-6.2	-15	-5.5	-16
9th Decile	-8.1	-20	-7.5	-21
10th Decile	-11.9	-29	-11.3	-32
Household Type				
Single	-10.6	-26	-9.0	-26
Single parent	-0.8	-2	-0.6	-2
Couple without children	-16.7	-41	-14.8	-42
Couple with children	-12.8	-31	-10.9	-31
Number of Children in the Household				
None	-27.3	-67	-23.8	-68
1 child	-6.6	-16	-5.7	-16
2 children	-5.5	-13	-4.6	-13
3 children	-1.2	-3	-0.9	-1
4 or more children	-0.3	-1	-0.2	-1

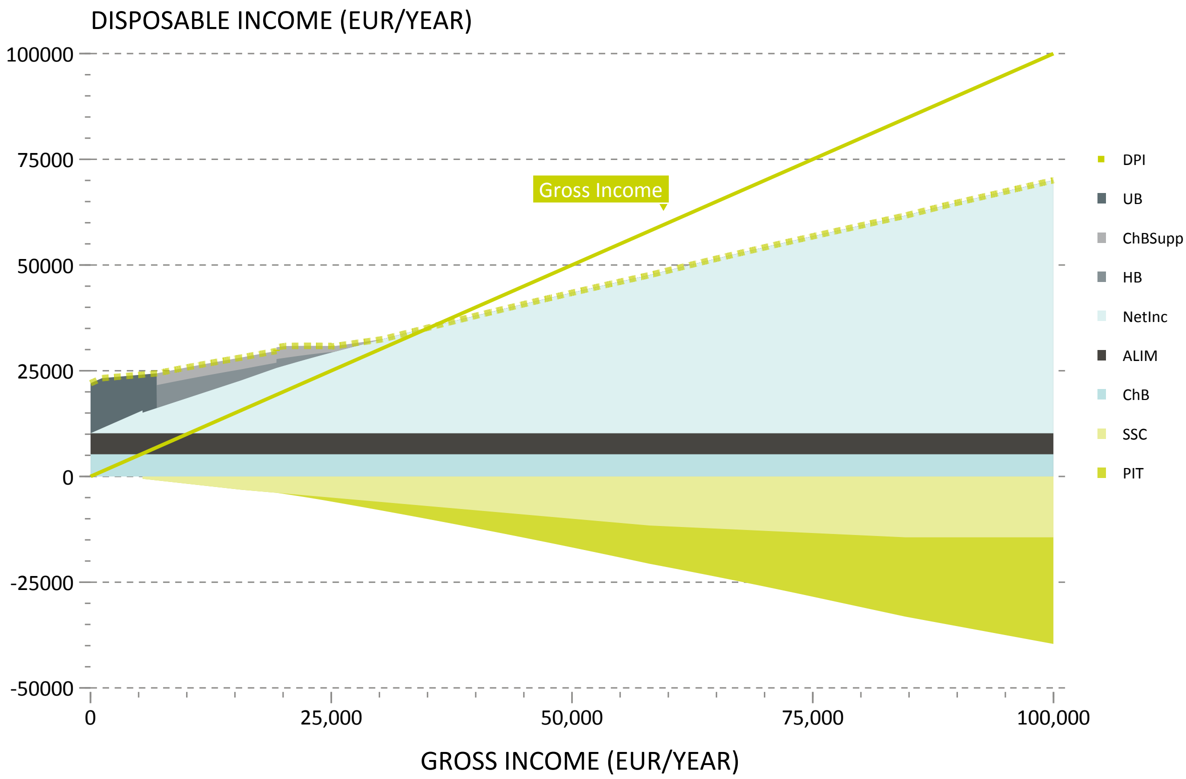
Notes: The table shows the effects of flattening the "middle class belly" (*Mittelstandsbauch*) on total budget for several subgroups of the population. The reform specification under consideration is depicted in figure 7a. The outcomes of the policy change are calculated in comparison with the 2022 status quo. Columns "%" depict the share of the total fiscal effect accruing to each subgroup. *Source:* Reform effects are simulated with ZEW-EviSTA using the SOEP 2019 wave.

Table A.3: Flattening the "Middle Class Belly": Labor Supply Effects

	FTE		Participation	
	in 1000	%	in 1000	%
Total	237	100	121	100
Income Deciles				
1st Decile	3	1	2	1
2nd Decile	18	8	9	8
3rd Decile	27	11	14	11
4th Decile	33	14	17	14
5th Decile	30	13	15	13
6th Decile	31	13	16	13
7th Decile	31	13	16	13
8th Decile	24	10	12	10
9th Decile	23	10	12	10
10th Decile	18	8	10	8
Gender				
Women	121	51	58	48
Men	116	49	63	52
Household Type				
Single	66	28	36	30
Single parent	10	4	6	5
Couple without children	83	35	67	31
Couple with children	79	33	42	35
Number of Children in the Household				
None	149	63	74	61
1 child	41	17	20	17
2 children	36	15	20	17
3 children	9	4	6	5
4 or more children	3	1	2	2

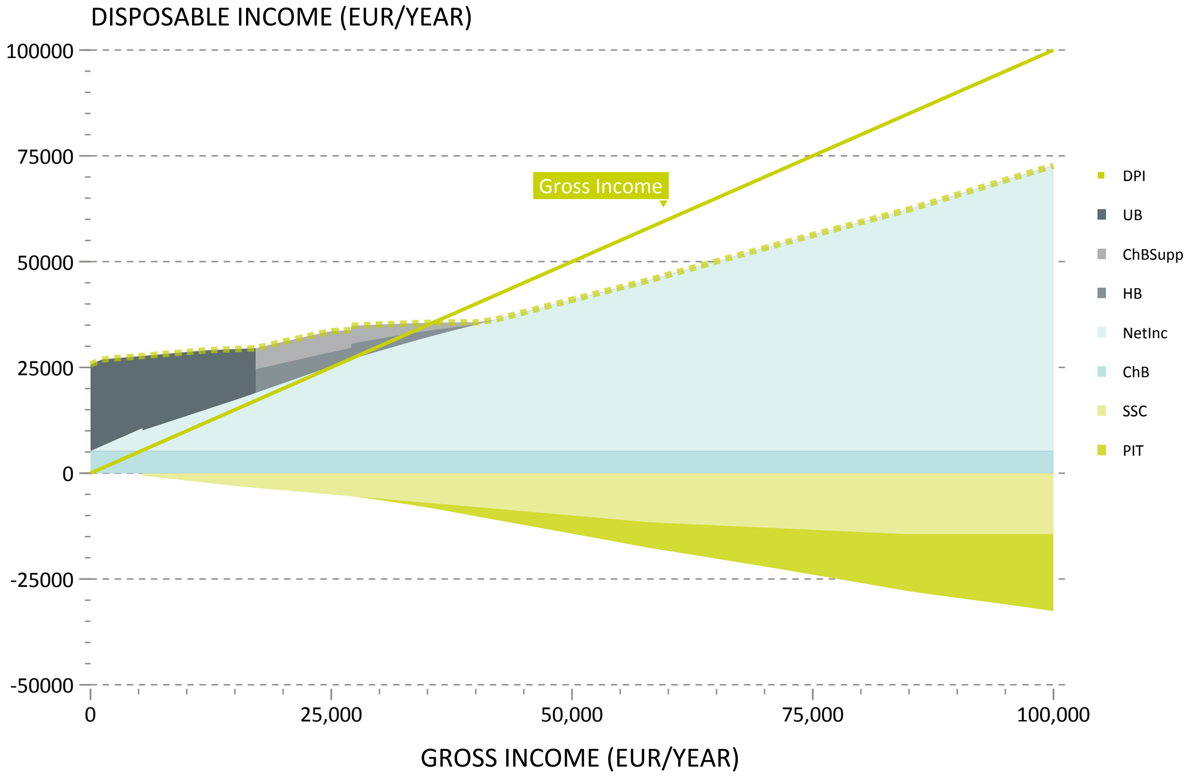
Notes: The table shows the effects of flattening the "middle class belly" (*Mittelstandsbauch*) on labor supply for several subgroups of the population. The reform specification under consideration is depicted in figure 7a. The outcomes of the policy change are calculated in comparison with the 2022 status quo. FTE stands for full-time equivalents. Columns "%" depict the share of the total FTE and labor market participation response accruing to each subgroup. *Source:* Reform effects are simulated with ZEW-EviSTA using the SOEP 2019 wave.

Figure A.1: Gross and Disposable Income of a Single Household with Two Children



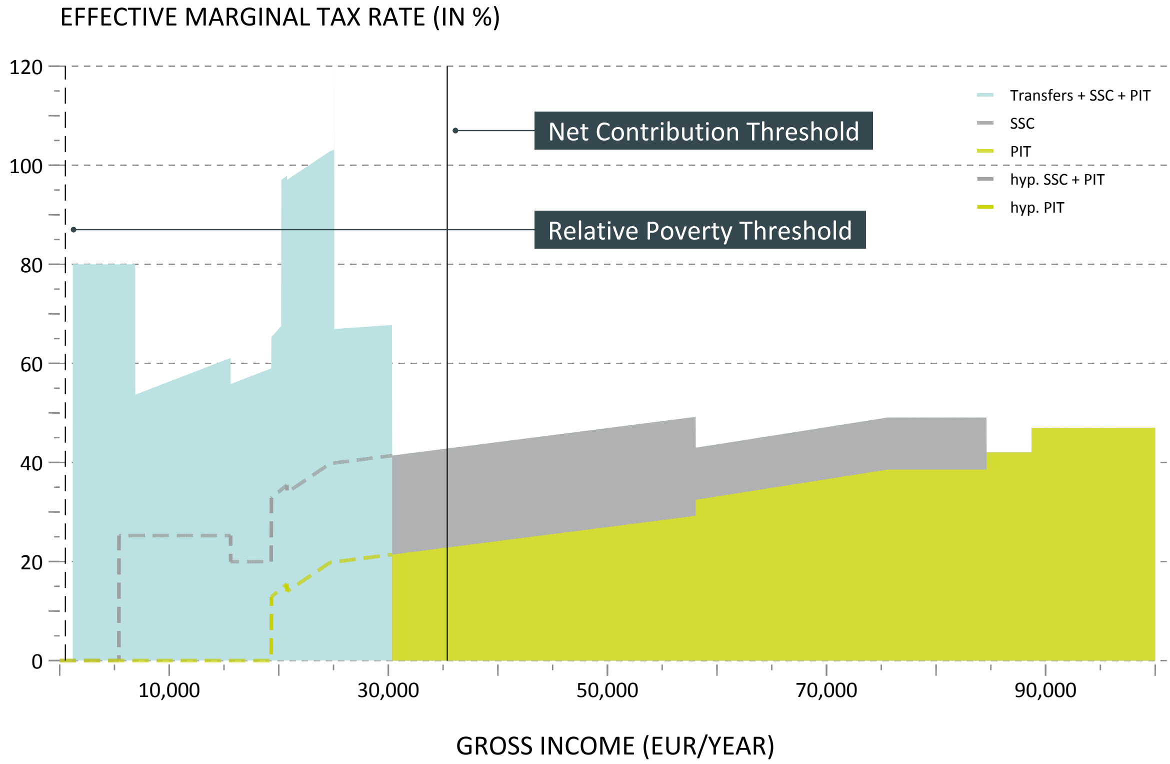
Notes: The figure shows gross and disposable income of a single household with two children. DPI is disposable household income, UB are unemployment benefits, ChBSupp is supplementary child benefit, HB are housing benefits, NetInc is net income, ALIM are alimony advance payments, ChB are child benefits, SSC are social security contribution payments and PIT depicts the personal income tax due. The solid green line represents the hypothetical case without taxes and transfers in which DPI would equal gross income. The green dotted line shows actual DPI under the 2022 tax-benefit system. *Source:* ZEW-EviSTA.

Figure A.2: Gross and Disposable Income of a Single Earner Couple with Two Children



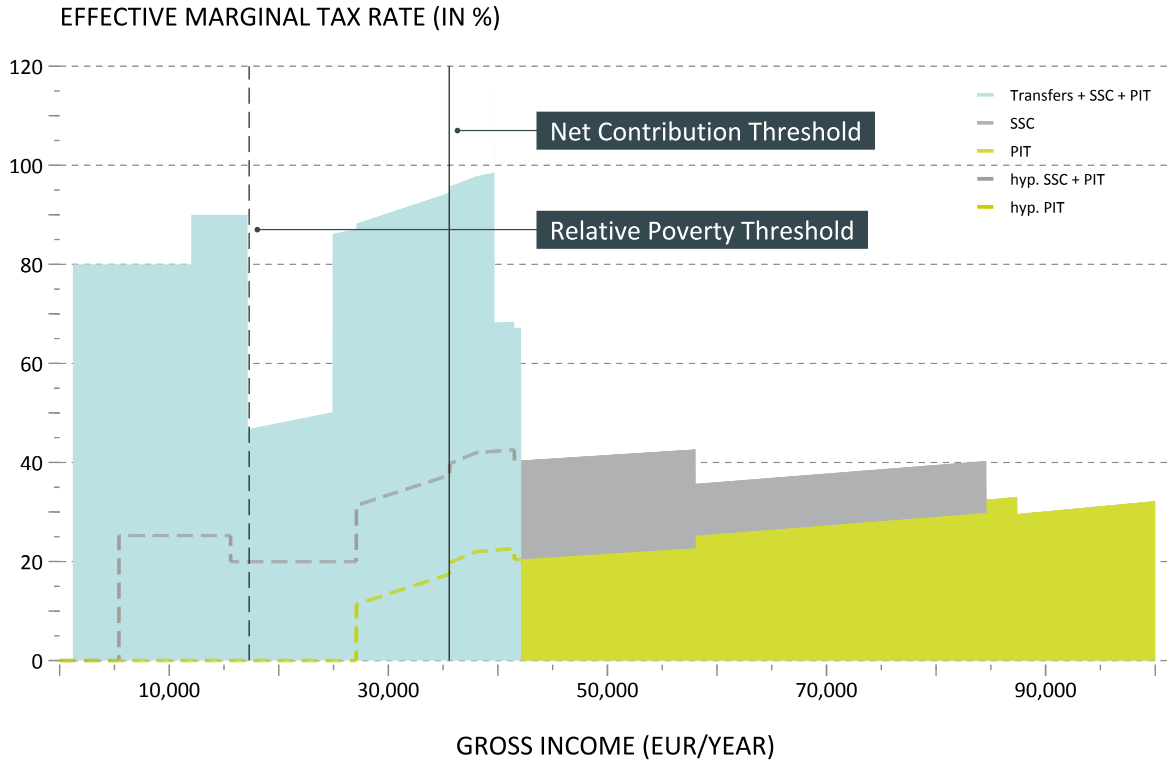
Notes: The figure shows gross and disposable income of a single earner couple with two children. DPI is disposable household income, UB are unemployment benefits, ChBSupp is supplementary child benefit, HB are housing benefits, NetInc is net income, ChB are child benefits, SSC are social security contribution payments and PIT depicts the personal income tax due. The solid green line represents the hypothetical case without taxes and transfers in which DPI would equal gross income. The green dotted line shows actual DPI under the 2022 tax-benefit system. *Source:* ZEW-EviSTA.

Figure A.3: Effective Marginal Tax Rate of a Single Household with Two Children



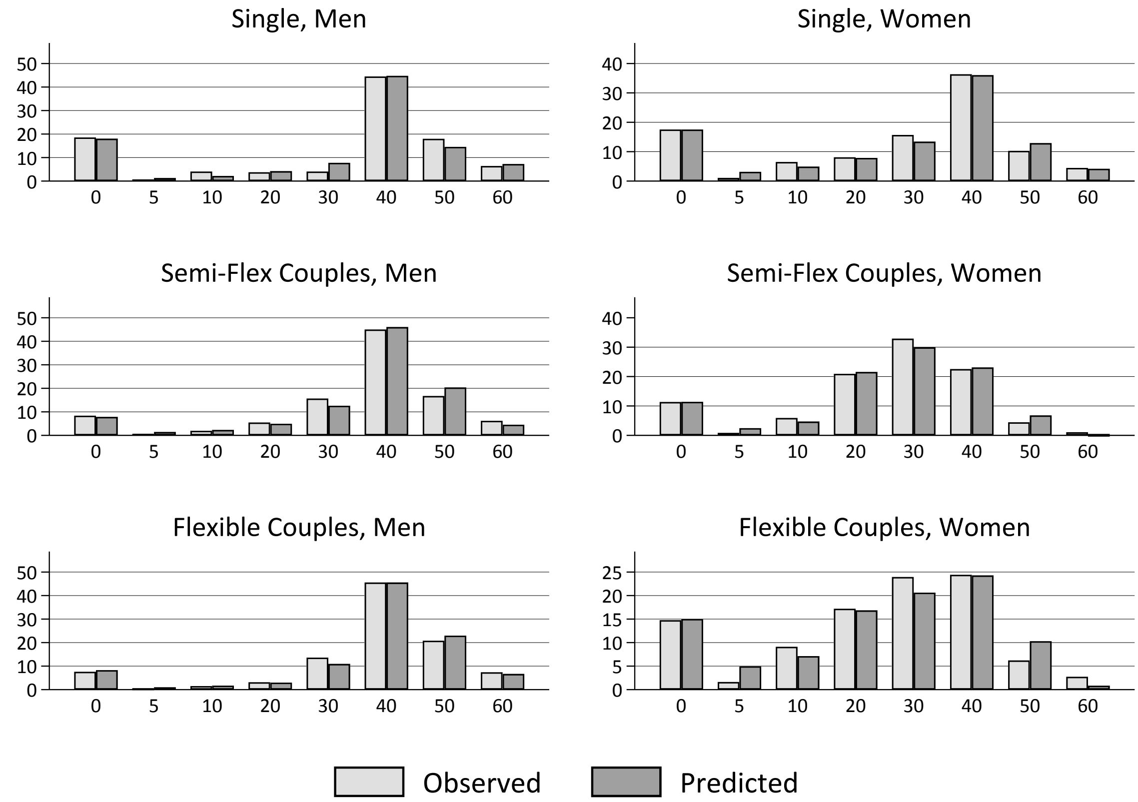
Notes: The figure shows the effective marginal tax rate (EMTR) of a single household with two children. Net Contribution Threshold marks the gross income at which taxes and social security contributions (SSC) of the household equal exactly transfer payments from UB II, housing benefits and child benefits. Relative Poverty Threshold is the threshold at which the household has exactly 60 percent of the median disposable income at her availability. Hyp. SSC + PIT (and hyp. PIT) represent the EMTR when transfers (and SSC) are discarded. *Source:* ZEW-EviSTA.

Figure A.4: Effective Marginal Tax Rate of a Couple with Two Children



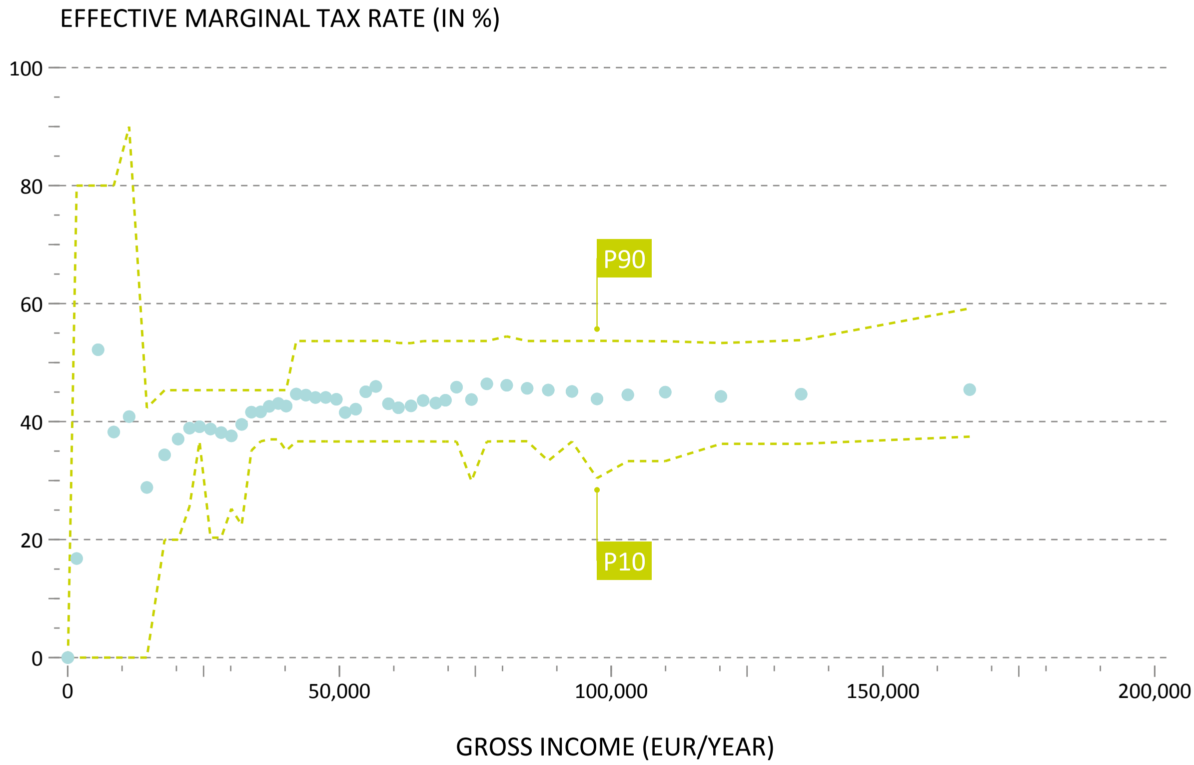
Notes: The figure shows the effective marginal tax rate (EMTR) of a couple with two children. Net Contribution Threshold marks the gross income at which personal income taxes (PIT) and social security contributions (SSC) of the household equal exactly transfer payments from UB II, housing benefits and child benefits. Relative Poverty Threshold is the threshold at which the household has exactly 60 percent of the median disposable income at her availability. Hyp. SSC + PIT (and hyp. PIT) represent the EMTR when transfers (and SSC) are discarded. *Source:* ZEW-EviSTA.

Figure A.5: Observed and Predicted Hours of Work Distribution Across Household Types and Gender



Notes: The figure shows the predicted and the observed distribution of hours of work for women and men across different labor market types. The translog utility specification from equation 5 is used to obtain the predicted values. *Source:* Predicted hours are calculated with ZEW-EviSTA using the SOEP 2019 wave.

Figure A.6: Effective Marginal Tax Rate for Employee-only SOEP Households



Notes: The figure shows average effective marginal tax rates (blue dots) across the gross income distribution (x-axis) for employee-only SOEP households. The calculation procedure is described in the text. Each blue dot represents approximately two percent of employee-only SOEP households. The green dashed lines show the EMTR for the 90$^{\text{th}}$ and the 10$^{\text{th}}$ percentile across the 50 gross income bins. *Source:* ZEW-EviSTA using the SOEP 2019 wave.

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