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Documentation of the Tax-Benefit Microsimulation Model STSM

Version 2012

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Version 2012

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[1] The Tax-Benefit Microsimulation Model (STSM) is jointly developed at the Freie Universität Berlin and DIW Berlin.

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1 Introduction

The TAX-TRANSFER-SIMULATION-MODEL (STSM) is a microsimulation model used for the empirical analysis of the effects of taxes, statutory social security contributions and social transfers on the distribution of incomes, labour supply decisions of private households, and their budgetary (fiscal) effects in Germany. Besides a detailed depiction of the German tax and transfer system, the STSM includes a microeconometric household labour supply model. The database is the German Socio-Economic Panel Study (SOEP) of the German Institute for Economic Research (DIW Berlin). The STSM is programmed in the statistical software Stata, which is also used for the estimation of the integrated labour supply model.

The first version of the STSM was developed in 1998 within the project "Employment effects of wage subsidies for low wage earners" which was financed by the Hans Böckler Foundation. It was carried out under the leadership of Viktor Steiner and in collaboration with Hermann Buslei and Felix Brosius. This first version of the STSM referred to the simulation year 1995. Building on that basis, the model was expanded to cover the simulation years 1996 to 1999 in the framework of the project "Distribution effects and fiscal costs of wage subsidies for low wage earners", which was financed by the Fritz Thyssen Foundation and carried out under the leadership of Viktor Steiner and in collaboration with Peter Jacobebbinghaus[2]. Subsequently, partly funded through several projects granted to Viktor Steiner by the German Science Foundation and the Fritz Thyssen Foundation, Peter Haan, Katharina Wrohlich, Kai-Uwe Müller and Johannes Geyer have been working on the further development of the model at DIW Berlin. Currently the model is improved and updated for several projects under the leadership of Viktor Steiner (now Free University Berlin) and Peter Haan at DIW Berlin. The STSM model is now a joint model of the Chair of Empirical Economics at Free University Berlin and DIW Berlin.

Besides the task of bringing the database and legal regulations up to date, several important aspects of the labour supply model (the consideration of the fixed costs of employment, the model's dynamic specification, potential demand side restrictions) have also been improved

[2] Extensive documentation of this version can be found in Jacobebbinghaus and Steiner (2003), which also serves as a foundation for this document.

upon. Furthermore, the current version of the STSM uses a much broader database: in contrast to the first version of the STSM where only households with "flexible labour supply" were considered in the simulation, thus excluding pensioners and the self-employed, the current version represents the whole population (excluding individuals living in institutions). Apart from that, the database has been significantly broadened through the inclusion of an additional sample of high-income earners ("high-income sample") which has been collected in SOEP since 2002. This group had been underrepresented but has an important impact for many applications (for example, tax reform).

The STSM has been and is currently also used by a number of researchers at the Public Economics Department at DIW Berlin for their PhD theses. The STSM has also been further developed at ZEW Mannheim and IAB Nuremberg.

The STSM can be used to calculate, for each household in the simulation sample, the income tax burden and the amount of transfers on the basis of information on the various income components and other household characteristics contained in the SOEP and the tax-benefit regulations implemented in STSM. In the current version of the model, these calculations are possible for the years 1999 to 2012. Simulation results can be grossed up to represent the German population as a whole using the weighting factors available in SOEP for the simulation sample. By ageing the data and updating the tax-benefit regulations, simulations can also be made for future years. Although the STSM has usually been applied for short-term simulations of the effects of fiscal and social policies (see the list of publications based on STSM by topic at the end of this report), it also can be – and has been – applied for long-run simulations using the "static ageing" approach, i.e. by re-weighting the simulation sample according to demographic projections (see Buslei and Steiner, 2006a, 2006b, Steiner and Geyer, 2010, Geyer and Steiner, 2010).

The effects of changes in the tax-benefit system can be simulated on the basis of the STSM, for both constant and endogenous employment behaviour. In particular, the following questions, which are of interest for the ex-ante evaluation of many fiscal and social policies, can be examined:[3]

[3] For applications of the STSM, see the list of publications in section 6.

- How does a change in tax or transfer regulations affect the income situation of individual groups of people or households under given employment behaviour?
- In what way does a household's budget constraint depend on the employment behaviour of the members of the household?
- How do changes in tax and transfer regulations influence the employment behaviour of individual household members?
- Which distributive and fiscal effects result from a change in regulations when households do / do not adjust their employment behaviour (both labour force participation and working hours)?

Even for given employment behaviour, it is generally not possible to estimate the effects of the aforementioned or similar reforms on the net income of individual households without a detailed depiction of the tax and transfer system. Because of the complexity of the German tax and transfer system, in particular because of the interactions of its various components, it is generally not possible to know a priori how a regulation change will affect the households' net income. Since these interactions are depicted in detail in the STSM, the effects of changes in the tax-transfer system on the distribution of household income and on revenue from income tax and statutory social security contributions can be simulated under the assumption of constant employment behaviour (first-round effects). However, using the STSM, it is also possible to carry out simulations of net household income accounting for the employment behaviour of individual household members and to estimate the labour supply effects that arise from changes in the tax-transfer system under constant market wages (second-round effects). Furthermore, it is also possible to calculate the employment effects of reforms allowing for wage adjustments induced by these secondary-round effects. This is done by linking labour supply effects simulated under the assumption of flexible wages to wage elasticities of labour demand, which are estimated empirically and differentiated according to qualification groups (third-round effects).

This document contains a description of the procedure for calculating the household specific income taxes and transfers at the household level and some indications of possible applications of the STSM. It is a revised and updated version of the previous STSM documentations (Steiner et al., 2005; 2008). It takes into account the regulations of the tax

and transfer system as of 2012.[4] Chapter 2 introduces the possible applications. Chapter 3 presents the database and the selection of households included in the simulation. Chapter 4 describes in detail the relevant regulations of the German tax-benefit system and their implementation in the STSM. Chapter 5 summarizes research based on STSM by topic illustrating the wide range of possible applications.

2 Possible Applications of the STSM

Microsimulation models are instruments used to analyse the effects of potential or actual reforms of the tax-transfer system. The strength of these models is that they make it possible to perform ex-ante analyses of reforms under two alternative assumptions: First, when it can be assumed that private households do not change their behaviour, the pure income effects of a reform can be calculated to perform a distributional analysis. Second, it is also possible to simulate changes in household labour supply and possibly other behaviour induced by the reform. While "mechanical microsimulation" models without behavioural adjustment have a long tradition in economic policy analysis dating back to Orcutt (1957), more recently microsimulation which takes account of behavioural changes ("behavioural micro-simulation") has become more wide-spread and found a multitude of policy applications internationally. As in most of the available behavioural microsimulation models developed for the ex-ante evaluation of fiscal and social policies targeted at private households, STSM also includes a microeconometric labour supply model.[5] This also allows to perform welfare analyses of fiscal and social reforms as far as they affect households' labour supply behaviour. As in most other microsimulation models which account for endogenous labour supply, other behavioural adjustment, in particular in households' savings and consumption, is currently not modelled in STSM.

[4] This version includes a description of all improvements and developments of STSM which have been largely described in the previous version, see Steiner et al. (2008).

[5] For summaries of the integration of labour supply into microsimulation models see, for example, Creedy and Duncan (2002) and Creedy and Kalb (2003).

2.1 Simulations under given employment behaviour

Under the assumption of unchanged behaviour, a household's income tax burden and transfer claims can be simulated on the basis of the STSM under status-quo conditions. Using SOEP sampling weights, population aggregates can be derived and compared to the corresponding components of the German tax-benefit system as recorded by official statistics. Through this, it is also possible to test how well the model's simulations depict reality, as long as the variables in the model are set at a limit that corresponds to the definition of the official statistics. Bach et al. (2004a) show that the amounts of individual income components, taxable income and the assessed personal income tax simulated on the basis of the STSM correspond quite well to the aggregates derived from the official statistics on income taxes.

The goal of policy simulations when employment behaviour is taken as given is to determine how changes in the tax-benefit system would impact on household incomes. Comparing simulated incomes under status-quo regulations and those prevailing under the reform allows, for example, to calculate how a reduction of the marginal tax rate changes the amount of income tax due, social benefits and net incomes of individual households in the sample and – after grossing-up simulation results using the SOEP weighting factors – in the population as a whole. In order to take into account the loss of individual observations because of missing values in the model variables, the SOEP weighting factors are multiplied by the reciprocal of the (cell-specific) attrition rate, i.e. the share of households with valid information on all relevant variables to the total number of households within particular data cells defined by several household characteristics.

2.2 Simulations under exogenous variation in employment

The STSM can also be used to simulate hypothetical changes in net household income if employment behaviour of one or more household members is allowed to vary. For example, it is possible to calculate the change in net household income of a couple household with only one spouse currently working if that person changes from full-time to part-time work,

or if the spouse starts working part-time.[6] For this type of simulation, it has to be assumed that the hourly wage does not dependent of the number of working hours. Gross monthly earnings can then simply be calculated by multiplying the hourly wage of the employed person with the expected number of working hours under the status quo and the policy scenario, respectively, where expected working hours may change between the two scenarios. Since working hours are aggregated into a small number of categories, as described below, the calculation of expected gross monthly earnings and subsequently net household income for each hours combination for a couple household remains feasible.

For people who are currently not employed, the hourly wage is not directly observed and must therefore be estimated. This is also the case for a non-negligible share of observations due to item non-response. Following Heckman (1979), this is performed on the basis of selectivity-corrected wage regressions. These include dummies for vocational qualification, actual labour market experience and tenure with the firm as well as dummies for firm size, industry and region. Furthermore, we also account for depreciation of human capital due to unemployment and work interruptions. For the unobserved workplace characteristics of the people who are currently not employed, like tenure, firm size and industry affiliation, average effects are assumed in the wage predictions. The wage regressions are estimated separately for East and West Germany and, within each region, for men and women. Estimation is based on the SOEP panel data for the years starting from 1999 (see Table A1 in the Appendix) – if new waves from the SOEP are available the data are included in the estimation. Since the prediction of the expected hourly wage yields a much smaller variance than the conditional variance of observed wages, i.e. of currently employed people with the same characteristics as currently non-employed people, we adjust the variance of estimated hourly wages by adding residuals randomly drawn from the distribution of residuals obtained from conditional wage regressions in a way which balances conditional variances in the two sub-populations.

The simulations with exogenous changes in employment are similar to the simulations with exogenous changes of the gross wage, except for the difference that some social transfers

[6] Another example is the estimation of counterfactual incomes in alternative labour market states, like self-employment and wage employment; for a recent application using the STSM see Fossen (2008a, 2008b) and Geyer (2011).

may depend on own and potentially also on the spouse's working hours. For example, wage-replacement transfers and child rearing benefits or the newly introduced parent's benefit (Elterngeld) are only paid up to a maximum number of hours worked and in this way, hours worked affect the amount of transfers and net income.

2.3 Simulations with labour supply adjustment

Since the STSM includes a structural labour supply model, the effects of changes in the regulations of the tax-benefit system on individual employment behaviour and their impact on household incomes can be simulated. This type of analysis is restricted to people who can reasonable be expected to potentially adjust their labour supply. This group of people, whom we define "flexible" with respect to labour supply, includes all individuals who are either the household head or the spouse, who are aged 20-64 year, and who are neither in full-time education or on maternity leave, nor severely disabled nor retired. Thus, the labour supply model estimated for the group of "flexible" people does not seem appropriate to analyse the working behaviour of pensioners or of students often working a few hours a week in so called "marginal jobs" not covered by social security ("geringfügige Beschäftigung"). Finally, the labour supply model focuses only on dependently employed persons, for an extension that includes the self-employed, see Fossen (2008a).

2.3.1 Household labour supply model

The household labour supply model implemented in STSM is a static structural discrete-choice model, as suggested by, amongst others, Aaberge et al. (1995) and van Soest (1995).[7] The advantage of the discrete-choice approach relative to traditional specifications of labour supply models with taxes and transfers (see, e.g., Hausman, 1985) is that it is much easier to account for the complex non-linearities in households' budget constraints. Moreover, the discrete-choice approach in combination with microsimulation provides a method to account for reasons of endogeneity of net income other than that arising from the progressivity of the income tax.

[7] Creedy and Kalb (2003) provide a very detailed user guide for this methodology.

The discrete-choice model implemented in STSM is based on the assumption that a household can choose among a finite number *J*+1 of working hours categories *(J* positive hours categories and non-employment). The definition of the hours categories is motivated by both economic considerations and the actual distribution of working hours in the sample. Although a relatively fine aggregation of hours into categories seems desirable in order to realistically approximate the household's budget constraint, the actual distribution of hours in the sample severely restricts the number of possible categories. In particular, men typically do not work part-time and their actual working hours are heavily concentrated between 35 and 40 hours per week. For them, in most applications we therefore only differentiate between three hours categories, namely: non-employment (unemployment and non-participation in the labor force), 1 – 40 hours, and more than 40 hours (overtime); for women, we usually differentiate between six hours categories.[8] Using this classification, the actual distribution of couple households in the sample across hours categories is given in the following table.

Table 1

Distribution of households among hours categories for couple households

<table>
<tr><th colspan="6">Couples, both spouses flexible hours</th></tr>
<tr><td></td><td></td><td colspan="4">Men</td></tr>
<tr><td rowspan="6">Women</td><td>Weekly Hours*</td><td>0</td><td>1-40 (37)</td><td>> 40 (48)</td><td>Sum</td></tr>
<tr><td>0</td><td>151 (3.9)**</td><td>533 (13.7)</td><td>360 (9.3)</td><td>1044 (26.9)</td></tr>
<tr><td>1-12 (8.5)</td><td rowspan="3">93 (2.4)</td><td>210 (5.4)</td><td>143 (3.7)</td><td rowspan="3">1485 (38.3)</td></tr>
<tr><td>13-20 (18)</td><td>275 (7.1)</td><td>181 (4.7)</td></tr>
<tr><td>21-34 (27)</td><td>359 (9.2)</td><td>224 (5.8)</td></tr>
<tr><td>35-40 (38.5)</td><td rowspan="2">136 (3.5)</td><td>598 (15.4)</td><td>329 (8.5)</td><td rowspan="2">1359 (35)</td></tr>
<tr><td>>40 (45)</td><td>149 (3.8)</td><td>147 (3.8)</td></tr>
<tr><td>Total</td><td>380 (9.8)</td><td>2124 (54.6)</td><td>1384 (35.8)</td><td>3888 (100)</td></tr>
</table>

Notes: * Average weekly working hours in parentheses; ** Share (in percent) in parentheses
Source: Steiner and Wrohlich (2008) based on SOEP, wave 20 (2003).

[8] In some of the STSM applications summarized in Chapter 5 (see Steiner and Wrohlich 2004, Bargain et al. 2006, Haan and Steiner 2006, 2007) a finer (6×6) aggregation of hours has been used, which had relatively little effect on estimated elasticities.

Each hours category, j=0,…,J, corresponds to a given level of disposable income C_{ij} - which equals in a static setting the household consumption - and each discrete bundle of working hours (leisure) and income provides a different level of utility. The utility V_{ij} derived by household i from making choice j is assumed to depend on a utility function U of the wife's leisure, Lf_{ij}, the husband's leisure, Lm_{ij}, the household's disposable income, C_{ij}, household characteristics Z_i, and on a random term ε_{ij}:

$$V_{ij} = U\left(Lf_{ij}, Lm_{ij}, C_{ij}, Z_i\right) + \varepsilon_{ij} \tag{1}$$

If the error terms ε_{ij} are assumed to be identically and independently distributed across alternatives and households according to the Extreme-Value type I (EVI) distribution, the probability that alternative k is chosen by household i is given by the Multinomial Logit model (McFadden 1974):

$$\mathrm{P}_{ik} = \Pr\left(V_{ik} \geq V_{ij}, \forall j = 0,..., J\right) = \frac{\exp(U_{ik})}{\sum_{j=0}^{J} \exp(U_{ij})},\ k \in J \tag{2}$$

The likelihood for a sample of observed choices can be derived from that expression and is maximized to estimate the parameters of the utility function U. In most of the applications we assume a quadratic specification of the utility function, as in Blundell *et al*. (2000).[9] For a couple household, the systematic part of the utility function is thus given by:

$$\begin{aligned} U_{ij} = {} & \beta_1^c C_{ij} + \beta_2^c C_{ij}^2 + \beta_3^{lf} Lf_{ij} + \beta_4^{lm} Lm_{ij} + \beta_5^{lf} Lf_{ij}^2 + \beta_6^{lf} Lm_{ij}^2 \\ & + \beta_7^{clf} C_{ij} \times Lf_{ij} + \beta_8^{clm} C_{ij} \times Lm_{ij} + \beta_9^{lflm} Lf_{ij} \times Lm_{ij} \end{aligned} \tag{3}$$

The utility function for a single household is a special case of equation (3), with β_9^{lflm} as well as the respective coefficients on the linear and quadratic leisure and income terms restricted to zero.

Preferences are allowed to vary across households through taste shifters on linear income and leisure coefficients:

[9] We have also estimated the model based on the translog specification of the household utility function, as suggested by van Soest (1995). This specification differs from (3) only in that net household income and leisure of both spouses enter the utility index (3) in logs. For a discussion about functional form assumptions, see Creedy and Kalb (2003). For our data, these two alternative specifications of the household utility function yielded very similar estimates of labour suppy elasticities.

$$\begin{aligned}\beta_1^c &= \alpha_0^c + X_1'\alpha_1^c \\ \beta_3^{lf} &= \alpha_0^{lf} + X_2'\alpha_1^{lf} \\ \beta_4^{lm} &= \alpha_0^{lm} + X_3'\alpha_1^{lm}\end{aligned} \tag{4}$$

where X_1, X_2, X_3 are column vectors including age, number and age of children, disability indicators, and region of residence, and the α's are (vectors of) coefficients to be estimated jointly with the remaining β coefficients given in the utility function above.

The labour supply model is usually estimated for couple household with both spouses assumed to be "flexible", for couples with only one "flexible" spouse, and for singles. As an illustration, estimation results of the utility function for couple household with two "flexible" spouses are presented in the Table A2 in the Appendix. Coefficient estimates are hardly interpretable, however, due to the various interaction terms included in the utility function. Estimation results are, therefore, usually interpreted in terms of empirical labour supply elasticities, as described in Section 2.3.2.

In the standard multinomial logit model the independence of irrelevant alternatives (IIA) property is assumed to hold.[10] Since this assumption is likely to be violated in the discrete-choice labour supply model regarding several hours categories (like working part-time 1-12 and 13-20 hours, respectively, see Table 1), a random-coefficient specification of the preference parameters in equation (4), for which the IIA no longer needs to hold, has been estimated by Haan (2006). His main finding is that labour supply elasticities in this more general model do not differ significantly from those obtained when estimating the simple Conditional Logit model in equation (4).

2.3.2 Labour supply elasticities

In the discrete-choice model, labour supply elasticities cannot be derived analytically but have to be calculated numerically. We do this by calculating the relative change in the labour force participation rate and the number of weekly working hours for a relative increase in the individual gross hourly wage. For couples we calculate these elasticities for a percentage

[10] For a discussion of this property of the Conditional Logit model and potential extensions of this model to relax this assumption see, e.g., Greene (2008, Chapter 23.11) or Train (2003).

change of the respective gross wages of the each spouse. Thereby, we can also calculate cross elasticities of wages between spouses.

Creedy and Duncan (2002) distinguish two main techniques to derive labour supply elasticities, the “calibration” and the “probability” technique. The probability technique assigns to each individual expected working hours and an expected participation rate given the probability of each choice category. The relative change of the expected values before and after the wage change measure the elasticities. One limitation of this approach is that it does not make use of the information on the actual labour supply behaviour under status-quo conditions as observed in the data. This information is exploited in the so called “calibration technique” (Duncan and Weeks, 1998, Creedy and Kalb, 2003, or Bonin and Schneider, 2006). In general, estimated elasticities derived by either of the two techniques do not differ much if evaluated at mean characteristics in the population as a whole but may differ substantially if calculated for specific labor market groups or at the tails of the income distribution.

The idea of the calibration technique is to draw from the extreme value error distribution and to calibrate a vector of error terms which, when added to the model predictions, makes the model replicate each household’s labour supply decision under status-quo conditions, i.e. for the prevailing tax-benefit system and before the wage change. Adding this calibrated vector of error terms to the deterministic part of the utility function, the new optimal choice of hours categories resulting from a percentage change of wages (or from a policy reform) is then calculated. To obtain robust elasticity estimates, these calculations need to be averaged over a relatively large number of draws, where robustness checks have shown that at least 100 draws are necessary. This technique allows to calculate both elasticities at the extensive (labour force participation) and intensive (working hours) labour supply margin. The following table presents the labour supply elasticities estimated using the calibration technique.

Table 2

Labor supply elasticities

couples, both spouses flexible		couples, only one spouse flexible		singles	
women	men	women	men	women	men
change in the participation rate (in percent points)					
0.15	0.15	0.22	0.08	0.20	0.23
(0.11 – 0.19)	(0.12 – 0.19)	(0.16 – 0.32)	(0.03 – 0.15)	(0.15 – 0.25)	(0.16 – 0.27)
change in total hours worked (in percent)					
0.32	0.20	0.37	0.12	0.27	0.30
(0.28 – 0.36)	(0.17 – 0.25)	(0.26 – 0.5)	(0.05 – 0.18)	(0.21 – 0.35)	(0.23 – 0.37)

Notes: Elasticities are gross elasticities with respect to a 1% change in, respectively, the male and female gross hourly wage rate. evaluated at population means. Calculations are based on the calibration technique as described in Creedy and Duncan (2002). In brackets are the 90% confidence intervals derived by parametric bootstrap.

Source: Bargain et al. (2006), Table 9.

2.3.3 Extensions

In recent work we have extended the basic labour supply model described in Section 2.3.1 in various dimensions. These extensions include the integration of child care costs and the modelling of demand-side constraints as well as the dynamic specification of the labour supply model. Depending on the specific application, these extensions are crucial for the empirical evaluation of fiscal and social policies. For example, the distributional and labour market effects of family policies depend on the availability and private costs of child care which therefore should be included in the modelling of private households' budget constraints. The assumption that all individuals can freely choose their optimal labour supply at given market wages, which is implicitly made in the basic labour supply model, also seems likely to be violated at least for some labour market groups. And finally, elasticities derived from the static labour supply model abstract from short-term adjustment in labour supply behaviour and thus represent the long-term effects of a wage (or policy change) only, while for some applications the short-run effects might also be of considerable interest. In the following we briefly describe these extensions in turn.

2.3.3.1 Childcare costs

To calculate the actual disposable net income, the costs of employment must be subtracted. Childcare costs make up a large amount of fixed (and variable) costs of work. Thus, STSM has the option to subtract childcare costs depending on the working hours of the parents for all

families with children up to 10 years. In this section, we briefly describe how these costs are calculated. A more detailed description can be found in Wrohlich (2007).

In some years, actual childcare costs for children in formal or informal childcare are reported in the SOEP. This information is obviously only available for children who are in childcare. For all others, these costs have to be estimated in order to predict potential child care costs. However, for households facing access restrictions to childcare slots, this would be an inappropriate measure of childcare costs. In order to account for the fact that some parents might be restricted in access to subsidized childcare, we not only estimate the costs for these sorts of childcare, but also the probability to have access to it. Using this information, and assuming that parents who do not have access to subsidized formal childcare need to buy private care arrangements at a much higher cost, we construct a measure called "expected costs of childcare". This is a weighted average of childcare costs in subsidized facilities and private costs, where the weights are the individually estimated probabilities to have access to a subsidized slot. Estimation of this probability as well as the estimation of fees to subsidized childcare facilities are documented in Wrohlich (2007). We estimate expected costs of childcare for part-time and full-time care. These costs can then be deducted from net household income depending on working hours of the parents. Since child care costs observed in the SOEP refer to the year 2002, estimated expected costs for subsequent years have to be extrapolated using growth rates of household incomes and information on known changes in institutional regulations affecting the determinants of these costs.

2.3.3.2 Demand-side constraints

The standard labour supply model assumes that all individuals can freely choose their optimal labour supply and do not face any demand-side constraints in the labour market. Bargain et al. (2006) relax this assumption and combine the labour supply model described in Section 2.3.1 with a probability model that accounts for demand-side rationing at the individual level by way of a double-hurdle specification. In this specification, the first hurdle refers to the decision to be voluntarily inactive or to participate in the labour market, the second hurdle gives the probability of being "involuntarily" unemployed for those who chose to participate. The specification of the probability model for involuntary unemployment

includes both demand-side regional variables and individual characteristics, such as education, age and an individual's previous unemployment history. As shown by Bargain et al. (2006), accounting for demand-side rationing may affect estimated labor supply elastiticities substantially, depending on the particular reform analyzed. This is in particular true for single men and women and less so for married women for whom the larger share of unemployment is voluntary.

Another form of demand-side constraints relates to the assumption of given market wages, which is made both in the standard labour supply model and in the extended model accounting for involuntary unemployment. This assumption can be relaxed assuming flexible market wages instead (see, e.g., Buslei and Steiner, 1999; Creedy and Duncan, 2001). Applying this methodology, Buslei und Steiner (1999), Steiner (2002) and Haan and Steiner (2006) first simulate the aggregate change in working hours induced by the respective reform to the tax-benefit system based on STSM and then iteratively calculate, making use of empirically estimated wage elasticities of labour demand with respect to total working hours, the change in market wages and employment in the new labour market equilibrium. In these calculations it is usually assumed that wages of currently employed people are also affected by the additional increase in labour supply, which may result in quite substantial overall wage effects. In the aforementioned applications, wage elasticities of the demand for total working hours are only differentiated by skill group and gender. Empirical labour demand elasticities for a much more detailed breakdown of the workforce have recently been estimated by Freier and Steiner (2007) who distinguish between eight labour categories including "marginal employment", i.e. low paying jobs with only a few working hours and partially exempted from social security contributions. These were used in Müller and Steiner (2010) to simulate the employment effects of the introduction of a minimum wage in the German labour market and the resulting second-round effects on the income distribution.

2.3.3.3 Integration of household consumption

Müller and Steiner (2010) also analyse the distributional and labour market effects of the minimum wage that arise through changes of consumer prices for different types of goods[11]. Since the SOEP does not include detailed information of expenditures on consumption goods, these are imputed on the basis of the German income and consumption survey ('Einkommens- und Verbrauchsstichprobe', EVS) and estimated Engel curves as a function of income and a number of explanatory variables available both in the EVS and the SOEP. The same approach was applied in Bach et al. (2006) in their analysis of the distributional and labour market effects of a re-financing of social security contributions by increasing the value-added tax in Germany.

2.3.3.4 Dynamic specification of labour supply model

The standard static labour supply model does not capture short-run deviations from equilibrium, and labour supply elasticities derived from this model are interpreted as representing the long-run effects of a wage (or policy) change on labour supply. To account for short-run deviations from equilibrium and to distinguish between short-run and long-run labour supply elasticities at the extensive and the intensive margin, Haan (2006) introduces "state dependence" into the basic discrete-choice labor supply model. The econometric model controls for unobserved heterogeneity and the initial conditions problem. Estimation results show that state dependence is significantly positive at the extensive margin, yet modest or non-existing at the intensive margin. Estimated labor supply elasticities differ significantly between the short-run and the long-run: The long-run elasticities turn out to be similar in size to the ones obtained from the static labour supply model embedded in the STSM, whereas the short-run elasticities are significantly smaller. Labor supply seems to adjust within two to three periods to exogenous income shocks. Haan and Uhlendorff (2012) have extended this dynamic version of the labour supply model accounting for involuntary unemployment as described in Section 2.3.3.2. They find similar differences in estimated elasticities with and without involuntary unemployment as for the static labour supply

[11] Such information is contained in the 2010 wave of the SOEP for the first time.

model, and that long-run elasticities derived from this dynamic model are very similar to the elasticities derived in the static labour supply model with involuntary unemployment.

2.3.3.5 Long-term projections

The STSM can also be used to model policy reforms that take effect in the future. In order to simulate representative results it is necessary to project the structure of the population in addition to policy changes. In the context of STSM this has been done using a static ageing algorithm suggested by (Merz 1983) and a detailed household projection by Buslei et al. (2006). Static ageing means that a cross section ages by adjusting the respective weighting factors by future population aggregates. Using this approach Buslei and Steiner (2006a; 2006b) calculate the fiscal and distributional effects of the German pension reform of 2004 (Retirement Income Act) that implies a gradual increase of the taxable share of pension income until 100% in the year 2040 and a tax exemption of pension contributions until 2025. The same approach could be applied to simulate the future distribution of net household incomes of still active birth cohorts after their retirement, given simulations of future pensions and projections of other income at the household level (see, e.g., Geyer and Steiner, 2010).

3 The Database

The empirical realisation of the STSM requires a database that contains the necessary characteristics of individuals and households, is representative of the German population, has a sufficient number of observations and is available up to date. The Socio-economic panel (SOEP) of DIW Berlin meets these requirements.[12] In 2005, SOEP contained information about 12,800 households with about 19,000 people over 16 years of age. SOEP contains all the necessary demographic variables, detailed information on various income components (income from dependent employment, self-employment, pensions and other social transfers, and capital income) at the individual and the household level as well as detailed information on current employment (employment status and working hours). Since

[12] A complete documentation of SOEP can be found in Haisken-DeNew and Frick (2001),in Schupp and Wagner (2002), and in Wagner et al. (2007). The development of the SOEP sample size is documented in Spieß and Kroh (2008) and Kroh (2010).

in each SOEP wave over 80% of all households are surveyed in the first four months of the year, we use the retrospective annual values from a particular wave to simulate the legal regulations of the previous year. This means that the simulation year 2010 is based on the SOEP wave from 2011.

In the year 2002, a special sample of high income earners (the "high-income sample") was included into the SOEP. Initially this sub-sample comprised approximately 1,200 households (with about 2,700 interviewees) with monthly incomes exceeding 3,835 euro. The income threshold was raised to 4500 euro in 2003. In 2010, the sample included 1,400 individuals living in about 600 households (for a detailed description of this sub-sample, see Schupp et al., 2003 and (Schupp u. a. 2009)). Information concerning the households in this sample is very useful, for example, in connection with distributional analyses of tax reforms that primarily benefit high income earners like, for example, the German tax reform in 2000 (Haan and Steiner, 2005).[13]

Table 3 describes the number of persons and households in the simulation samples for the years 2003 and 2004 (referring to SOEP waves 2004 and 2005, respectively) and the corresponding numbers in the total population, which are derived using the SOEP weighting factors for the respective year. Due to missing information for some variables used in the calculation of net incomes, not all observations can be included in simulation samples (see Table 3). As described above, the exclusion of these observations is taken into account by adjusting the weighting factors by cell-specific attrition rates which depend on age, number of children and region. Missing entries on particular income types as well as the duration of employment and unemployment are imputed with the help of cross-section and time-series data from SOEP (for the details, see Frick and Grabka, 2003).

[13] As shown by Bach et al. (2007) on the basis of an integrated data file composed of SOEP and data from the official income tax statistics, the SOEP represents high incomes very well except for the top 1 % of the gross income distribution.

Table 3

Basic data selection for the simulation years 2003 and 2004

	Persons		Households	
	Observations	Grossed-up total	Observations	Grossed-up total
Whole sample Simulation 2003 (SOEP 2004)	27,041	82,372,641	11,294	39,812,450
Incomplete interviews of household head or/and his partner/invalid weighting factor	3,559		1,174	
Remaining observations	23,482	72,822,370	10,120	34,626,549
Children younger than 16	3,966	10,634,568		
Remaining observations	19516	62542009	10120	34626549
Whole sample Simulation 2004 (SOEP 2005)	29,029	82,114,063	12,361	39,908,109
Incomplete interviews of household head or/and his partner + invalid personal inflation factors	3,977		1,348	
Remaining observations	25,052	71,797,726	11,013	34,291,113
Children younger than 16	4,129	10,186,644		
Remaining observations	20,923	61,611,081		

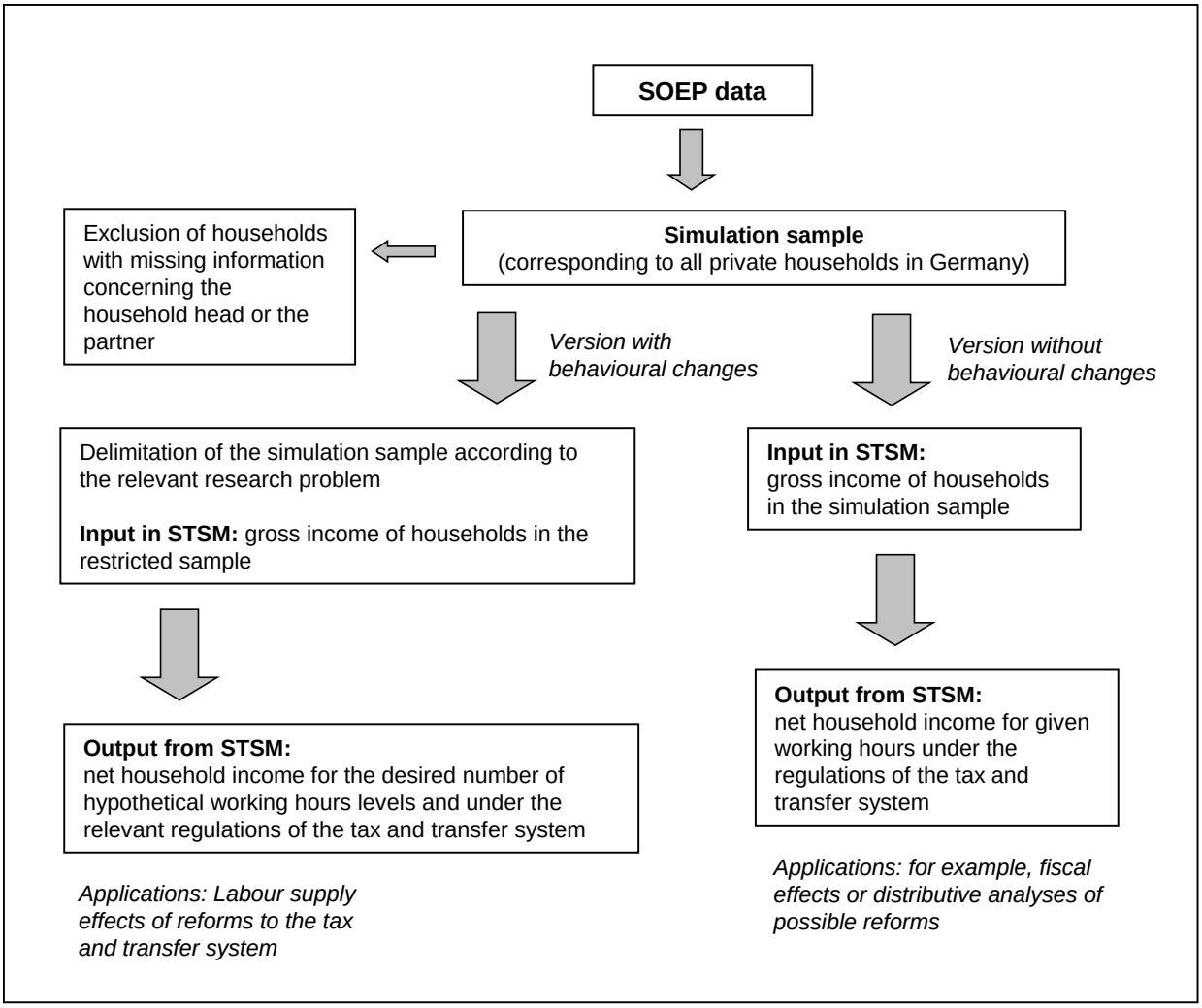
Source: Own calculations based on SOEP, wave 23.

For the remaining observations, net income can be simulated for all households if employment behaviour is assumed constant. If behavioural changes are simulated, the simulation sample must be further restricted since the labour supply decision cannot be modelled as an economic decision between leisure and consumption (income) in the same way for all groups. This applies to pensioners, for example, but also to people participating in apprenticeships or vocational training, people doing their military or alternative civilian service, and school students. As mentioned above, we also do not consider the static labour supply model implemented in STSM appropriate for the analysis of the employment behaviour of self-employed people. Most analyses using STSM have therefore concentrated on dependent employees and the unemployed. The exact restriction of the sample depends, however, on the specific research question and can be adjusted to fit the problem at hand.

Figure 1 presents the two simulation versions that are possible in the STSM. The simulation without behavioural changes examines the effects of a reform on net household income. These so-called “first-round effects” can be calculated for all households and, building on this, distributional analyses can be carried out (see for example Haan and Steiner 2005,

Steiner and Wrohlich, 2008). If households adjust their labour supply and if these changes are taken into consideration when the effects are simulated, then the simulation sample should be further limited to fit the specific research problem, as was explained above. For all households in this restricted sample, the net income is not only calculated for given employment behaviour (i.e. working hours), but also for all alternative working hours categories. The hypothetical income levels for alternative working hours or leisure time combinations determine the utility from the choice of a particular alternative according to the basic household labor supply model or one of its extensions described in Section 7.

Figure 1
Selection of the households and applications areas of the STSM



4 The Tax-Benefit System and its Implementation in STSM

The main focus of the STSM is the calculation of net household income for given and changed legal regulations as well as for given or varying labour supply. The following section provides a short overview of the income and tax elements that have been taken into account. Specific regulations will then be examined in more detail.

Composition of net household income

The definition of net income as calculated in the STSM derives from the components listed in Table 4. The first section of the table contains the households' earnings, wage replacement benefits and transfers are listed in the second section, and the third section lists the included deductions.

Table 4
Components of net household income

		Income components	Determined in the STSM
1	+	Income from dependent employment	
	+	Income from capital	
	+	Income from renting and leasing	
		Income from self-employment, income from agriculture, forestry and business enterprise	
	+	Other income (pensions)	
2	+	Unemployment benefit I (since 2005)	X
	or	Unemployment benefit II since 2005, unemployment assistance before)	X
	+	Additional child benefit ("Kinderzuschlag")	X
	+	Child benefit	X
	+	Parental-leave benefit	X
	+	Housing allowance	X
	+	Social assistance	X
	+	Education allowance (BAföG), scholarships, apprentice allowance, claim to maintenance, widow's allowance, short term and seasonal work compensation benefit, maternity allowance.	
3	–	Employees' social security contributions	X
	–	Income tax	X
	–	Solidarity surcharge tax ("Solidaritätszuschlag")	X
	=	Net household income	

Information concerning income from renting and leasing as well as income from capital is only available at the household and not at the individual level. We assume that in couple households this income is shared equally between spouses. Unemployment benefits (I and II) for entitled recipients can be calculated directly from the data. In the simulations which take account of behavioural changes, unemployment benefits must be simulated. [14]

4.1 Income tax and solidarity surcharge

The following sections describe in more detail the simulation of income and taxes in the STSM. The legal basis for this is taken from the Income Tax Law (*Einkommensteuergesetz,* EStG). Table 5 summarizes the determination of taxable income.

4.1.1 Determination of positive income from all sources

Income from employment

Income from dependent employment (salaries, wages, bonuses, renumerations) is the main source of income for the great majority of households in Germany. Pensions of former civil servants ("Versorgungsbezüge") are also included in income from dependent employment (employee pensions are not included here but count as other income, see below). In addition, income from agriculture and forestry and entrepreneurial income is also included here. The comprehensive income taxation principle in Germany ensures that most income tax regulations are identical for the dependently employed and the self-employed, whereas there are special regulations for income from agriculture and forestry. STSM does not account for these latter regulations and mainly focuses on dependently employed people, although it can also be used for the analysis of entrepreneurial income (see Fossen, 2008a).

[14] The church tax is not considered in the determination of net household income, since it is considered to be voluntary and therefore equivalent to other personal expenditures.

Table 5
Determination of taxable income according to § 2 EStG

	Legal income concepts and their components	**EStG**
	Income from agriculture and forestry	§§ 13-14a
+	Income from business enterprise	§§ 15 - 17
+	Income from self-employment	§ 18
+	Income from dependent employment	§ 19
+	Income from capital[15]	§ 20
+	Income from renting and leasing	§ 21
+	Other income	§ 22
=	**Positive income from all sources**	**§ 2 III**
–	Negative income (loss compensation)	
=	**Income from all sources**	**§2 III**
–	Tax allowance for elderly persons (for people over 64)	§ 24a
–	Tax allowance for agriculture and forestry	§ 13 III
=	**Adjusted gross income**	**§ 2 III**
–	Other expenditures (actual or lump-sum)	§§ 10 -10c
–	Extraordinary charges (actual or lump-sum)	§§ 33 - 33c
–	"Loss deductions" (reimbursements, deficits carried forward not considered here)	§ 10d
=	**Income**	**§ 2 IV**
–	Tax allowance for children (“Kinderfreibetrag”)	§ 32 VI
–	Single parents’ tax allowance (“Haushaltsfreibetrag”)	§ 32 VII
=	**Taxable income**	§ 2 V

Implementation in STSM

In the SOEP the following information on income from dependent employment is available:

- income received as an employee;
- earnings from secondary jobs;
- bonuses;
- pensions received as a former civil servant.

[15] Since 2009 earnings from interest and dividends are subject to a flat rate withholding tax of 25%.

Since no information is available in the SOEP, it is assumed that income from earnings from secondary jobs is always derived from dependent employment. Bonuses include the 13th- and 14th-monthly pay, Christmas and holiday pay, bonuses and other special bonuses. Pensions of civil servants are only observed for some years in the SOEP, missing information in other waves is imputed on the basis of this information and eligibility criteria.

For given employment, income from dependent employment can be directly calculated from the SOEP data. For simulations accounting for behavioural adjustment, income from dependent employment is the product of the (estimated) individual hourly wage and estimated working hours (see Section 2.32). This includes wage income and income from earnings from secondary jobs but not other sources of remuneration mentioned above. We thus add an amount that accounts for other bonuses. This amount is estimated on the basis of the SOEP data by means of a simple quadratic function in the individual gross wage which takes into account that the share of bonuses increases in the gross wage. Information on extra pay for Sunday work, public holidays and night shifts, as well as tips, is not recorded in SOEP for all years. For years with missing entries, the values are imputed by means of regression using the information for previous years.

Except for expenses for commuting, professional expenses, which can be deducted from total wage income as far as they are individually verifiable, are not recorded in the SOEP. For these latter items, the lump-sum allowance for professional expenses is therefore deducted, in addition to the recorded amount of expenses for commuting. For pensions of civil servants the general tax allowance is deducted.

Income from capital

§ 20 I, II EStG contains an open catalogue of types of capital income. The list includes, among others, corporate dividends, interest on bonds, and earnings from holdings in a trading company as silent partner.

Implementation in STSM

The information regarding income from capital is limited in the data in several respects:

- Information regarding earnings from interest and dividends are only recorded for households and not for individuals. For married or cohabiting couples it is assumed that

this income is divided equally between spouses. Since 2009 earnings from interest and dividends are subject to a flat rate withholding tax of 25%.[16]

- Respondents in the SOEP could either state the exact amount of capital income, or alternatively indicate into which of five categories is fell. Whilst the majority of respondents made use of the second option, high-income people predominantly stated the exact amount of their capital income.

This information is used to calculate amounts of capital income for those households providing only categorical information. For these latter households, the median amount of capital income in each of the five given categories is imputed, as derived from the subgroup of households providing information of the amount of their capital income. Although there might be a selection effect regarding this imputation, any resulting errors are likely to be small because of the relatively small amounts of capital income for households for whom it needed to be imputed. Since expenses related to capital income (brokerage and deposit fees etc.) are not recorded in our data, it must be assumed that these do not exceed the lump-sum allowance.

Income from renting and leasing

§ 21 EStG contains a closed catalogue of income from renting and leasing from which expenditures for the preservation and construction of buildings can be deducted. As a basic principle, preservation expenditures are to be expensed within the relevant period, whereas larger expenditures are to be depreciated evenly over a period of two to five years.

Implementation in STSM

Information on income from renting and leasing contained in the SOEP refers to the household and not to individuals within the household. For couples it is assumed that each partner receives half of this income. Information on income form renting and leasing is incomplete since only renting and leasing of land or property is recorded in the SOEP. Related expenditures recorded in the SOEP include those for operating or maintenance and for capital servicing. The latter expenditures cannot be distinguished between interest and

[16] Under this system dividends are taxed at the shareholder's personal income tax rate with an allowance for the tax paid at the corporate rate.

debt repayment which is not deductible. On the other hand, repayment can be seen as an indicator for depreciation in the value of the property. For this reason, we deduct debt repayment from income from renting and leasing.

There is a considerable number of missing values in the entries for interest and debt repayment as well as for operating costs incurred related to income from renting and leasing. In these cases, values were imputed by mean values calculated on the basis of those people in the SOEP who reported positive values. On average, this implied setting operating and maintenance costs at a level of 40 % and interest payments and debt repayment at 80 % of the income from renting and leasing. Despite this imputation, the losses from renting and leasing in the STSM are too low in comparison to the official tax statistic (see Bach et al. 2008).

Other income

Other income (§§ 22, 23 EStG) consists of five types of income:

- old-age pensions;
- alimony payments between divorced or permanently separated couples as far as deductible by the payer in accordance with § 10, paragraph 1, sentence 1;
- income from speculation as defined by § 23 EStG;
- income from additional work, and the renting of moveable objects;
- other compensations.

In case actual expenses for the various items do not exceed the lump-sum allowance for professional expenses, the latter is applied

Implementation in STSM

Old-age pension is the only “other income” component explicitly recorded in the SOEP. It also records whether it is an own old-age pension or a “derived pension”, such as the survivor’s pension.

4.1.2 Determination of adjusted gross income

Adjusted gross income is given by income from all sources, less the old-age relief ("Altersentlastungsbetrag"; § 24a EStG) and the exception for agriculture and forestry (§ 13 III EStG).

Implementation in STSM

Income from agriculture and forestry only plays a role in the simulation sample as earnings from secondary jobs. Exemptions related to income from agriculture and forestry, are not taken into account in the simulation.

The old-age relief is a tax allowance for tax payers who reached the age of 64 in the year before the taxable income is calculated. 40% of income from a salaried occupation up to a maximum amount of € 1908 in 2004 is deducted from taxable income. The Old Age Income Act (2004) reduces this tax allowance gradually starting from 2005 until 2040 when it will disappear. In 2012 it is 28.8% up to a maximum amount of 1,368 euro.

The Old Age Income Act also introduced several other changes in the tax treatment of pensions and social security contributions. Until 2004 old-age pension provision expenditures were treated as special expenses up to a maximum amount. At the same time old-age pensions were mostly untaxed due to their relatively low profit share. The Old-Age Income Act increases steadily the degree of tax exemption of old-age pension provision expenditures to 100% between 2005 and 2025. At the same time the profit share of old-age pensions is set to 50% in 2005 and will increase until 2040 to 100%. In 2012 it has increased to 64%.

In the following sections we will refer to the pre- and post 2004 period when we discuss the implementation of income components that were affected by this law.[17]

4.1.3 Determination of income

Income is determined by subtracting actual or lump-sum deductible expenses („Sonderausgaben"), actual or lump-sum extraordinary expenses („außergewöhnliche

[17] For more details on the Old-Age Income Act and its implementation in STSM see Buslei and Steiner (2006a). They use the STSM in a static aging framework to analyse the long term distributional effects of this law (see Section 2.3.3.5).

Belastungen“) from adjusted gross income as well as applying loss deductions if appropriate (see § 2 IV EStG).

Deductible expenses

These consist of (see § 10 EStG):

- alimony payments to the divorced or married, non-cohabiting spouse
- social security contributions
- contributions to other selected insurance types
- church tax payments
- tax consultancy expenses
- expenses for vocational training or other continuing training
- expenses for home help
- donations

Deductible expenses can only be deducted from adjusted gross income up to a maximum amount. Until 2010, employees who pay old-age insurance contributions can deduct a lump-sum amount („Vorsorgepauschale“) if actual contributions do not exceed this amount.

Implementation in STSM

Since the SOEP does not contain information on maintenance payments, the church tax, other charity gifts, expenses for tax consultancy etc., these deductible expenses have to be estimated. The amount of these expenses is estimated on the basis of official tax statistics. Estimation results yield a constant elasticity of these expenses with respect to adjusted gross income of about 1.3.

For persons who are voluntarily insured in the social health insurance scheme, their social security contributions are deducted up to the maximum amount. The calculation of social security contributions is described in more details in section 4.2. Due to missing information in the SOEP, expenses related to contributions to other insurances or home ownership saving plans cannot be considered.

Whenever social security contributions are below the lump-sum amount, the latter is applied. For simulations after 2004 the increased tax exempted share of old-age pension

provision expenditures is taken into account. After 2010 contributions to health and long-term care insurance are fully deductible. Self-employed individuals as well as employees who do not pay social security contributions (e.g. „mini-jobbers“) are not entitled to this lump-sum amount (see § 10 c II-IV).

Extraordinary expenses

According to (§ 33 I EStG) a person can claim extraordinary expenses if he or she has to face certain higher expenses than the majority of other tax payers with similar income, wealth and family status. Typically, extraordinary expenses can be claimed by disabled persons or by parents for their dependent children over 18 if they are in education.

Implementation in STSM

SOEP contains information whether a person is disabled and, if so, on the degree of disability. Using this information, we determine extraordinary expenses on a lump-sum basis. At a disability degree of less than 50%, lump-sum deductions are only possibly if the disabled person receives legal disability pension or other pension payments. These pensions are paid if the disability causes a visible and permanent restriction of movement or if the disability was caused by a recognised occupational disease. Since this information is not available in the SOEP, we assume that only individuals with a disability degree of 50% or more are entitled to claim extraordinary expenses.

In order to determine whether there is a claim for the education tax allowance („Ausbildungsfreibetrag“), we count the number or children older than 18 who are in education. In addition, we use information on the number of children for whom the parents receive child benefits. Assuming that child benefits are mostly paid for children under 18, we can determine the amount of children older than 18 for whom parents do not get child benefit but the education tax allowance.

All other forms of extraordinary expenses that are not standardised and depend on individual circumstances cannot be considered due to data limitations.

Loss deduction

Any remaining losses from income sources taken into account in the calculation of adjusted gross income can be deducted up to a maximum amount.

Implementation in STSM

Since negative incomes are rarely observed in the SOEP, we do not consider loss deduction.

4.1.4 Determination of taxable income

Taxable income is calculated by subtracting child tax allowances as well as the single parent's tax allowance from gross income.

Child benefit and child tax allowance

Parents with dependent children are eligible to child benefits. For each child, only one person can claim the benefit. Married parents can choose whether mother or father receives the child benefit for their children. In the case of separately living parents, the parent receives the child benefit with whom the children are staying most of the time or who bears the larger share of the maintenance.

Child benefit is paid for biological, adopted, and foster children who are living in the same household with their parents. The benefit is paid for children up to 18 years. In case that children older than 18 are still in education and do not have own income that exceeds a certain threshold, the child benefit can be received up until the 27th birthday.[18]

Child benefit and child tax allowance are meant to guarantee a tax-exempt minimum income for children and cannot be claimed jointly but only alternatively according to a higher-yield test that is calculated by the tax authorities.

Implementation in STSM

We calculate a higher-yield test between child benefit and child tax allowance. We first grant all households who are entitled to either of the two measures the child benefit. In a second step we calculate whether the child tax allowance would yield a higher tax relief than the child benefit. If so, we lower the income tax amount due by this amount.

[18] For male children this period can be extended by the time spent in compulsory military service or alternative civilian service.

Single parent's tax allowance

Single parents are entitled to claim a single parent's tax allowance in addition to the child benefit. Until 2004, all unmarried parents could claim the single parent's tax allowance („Haushaltsfreibetrag") who were receiving child benefit or child tax allowance for at least one child living in the same household. The amount of the single parent's tax allowance does not depend on the number of children. Living together with a spouse did not lead to loss of the entitlement. In 2004, this allowance was abolished and replaced by another tax allowance („Entlastungsbetrag") that can only be claimed by single parents who are living alone.

Implementation in STSM

The single parent's tax allowance is granted to all non-married parents with children for whom they receive a child benefit. From 2004 on, it is only granted for parents without a partner.

4.1.5 Calculation of income tax, progressivity tax and solidarity surcharge

The income tax amount is calculated by applying the income tax tariff (§ 32a EStG) on taxable income. We assume that all married partners choose joint filing (according to § 26b and § 32a V). Thus, we add the taxable income of married spouses and apply the income tax tariff to half of this sum. Afterwards, the tax amount is doubled in order to get the tax amount due for married couples. If married spouses are living separately, we assume that they choose separate filing.

Unemployment benefits and unemployment assistance (until the year 2005), special wage replacement payments for short-time work ("Kurzarbeitergeld", "Winterausfallgeld") maternity leave benefits and parent's benefit (only after 2007) are taxable according to the progressivity tax ("Progressionsvorbehalt"). This means that income from these sources is not itself taxable but affects the income tax rate on the other sources of income. In this case, the income tax rate for the other sources of income is calculated as the one that would be due if all progressivity tax income were fully taxable. This is realised in STSM.

Finally, we calculate the solidarity surcharge according to § 32 EStG.

4.2 Social Security Contributions

Social security contributions levied on wage income represent a very large share of labour income in Germany and comprise health and long-term care insurance, old-age insurance (public pensions), and unemployment insurance.

Health and long-term care insurance contributions

In Germany, a distinction is made between private and statutory health insurance. Public servants and the self-employed are insured privately, and dependent employees can also be insured privately if their income exceeds the designated income threshold. The regulation changed, before 2007 and now it is sufficient to have an income exceeding the threshold in the current year. Between 2007 and 2010 one had to earn a high income in the last three years and in the current year. All other persons are insured under the statutory health insurance scheme. Their health insurance contributions are a fixed proportion of their income up to the contribution assessment ceiling. Below this ceiling, the total contribution rate is 15.5% of the gross wage. Half of the contribution is paid by the employer and the other half by the employee.[19] One important feature of the public health insurance system is that family members who are not already covered by health insurance otherwise (e.g., as an employee), are co-insured as a spouse or child (subject to certain age limits) of the insured person without any extra contribution payment. By contrast, contributions to private health insurance are risk equivalent.

In addition to health insurance, there are contributions to the long-term care insurance that amount on average to 1.95 %[20] of the gross wage (capped at the relevant income ceiling). This has to be paid by all people covered by either private or statutory health insurance.

The SOEP contains information regarding the type of insurance paid and, for private health insurance, the amount of the contribution. For simulations with varying working hours, we simply assume that dependent employees are insured with the statutory insurance regardless of their income level. For simulations involving changes in self-employment

[19] The overall contribution rate is 14.6% and shared between employer and employee. There is an additional contribution of 0.9% that is only paid by the employee.

[20] Employer and employees contribute an equal share. Childless persons have to pay an additional amount of 0.25% by themselves.

status, hypothetical private health insurance contributions for dependently employed people in the counter-factual state of self-employment can be imputed using information contained in the SOEP, as described in Fossen (2008a, Section 5.3.2).

Old-age insurance contributions

Except for public servants, the self-employed and people in "marginal employment", all employees are insured under the statutory old-age insurance scheme. Mandatory contributions to this scheme are a fixed proportion of gross earnings up to the contribution assessment ceiling. Below this ceiling, the total contribution rate is 19.6% of gross earnings. Half of the contribution is paid by the employer and the other half by the employee. The self-employed are usually covered by private old-age insurance schemes, for some professions old-age insurance is, however, also mandatory.

SOEP records whether the contributions paid by people surveyed are voluntary or compulsory, although the amount paid for voluntary contributions is not recorded. Statutory contributions can be calculated by applying half the contribution rate to the relevant gross wage. In so doing, gross wage (or salary) is only considered up to the contribution assessment ceiling. The regulations concerning marginal employment (so-called "mini jobs") are also taken into consideration. People in this group pay no contributions up to the minimal income ceiling.

Implementation in STSM

Once again, the described procedure can only be used without limitation for those people whose working hours do not vary within the framework of the simulation. For people with variable working hours, it is assumed that they are always insured under the statutory old-age insurance scheme. For simulations involving changes in self-employment status, the imputation of hypothetical old-age contributions to private old-age insurance funds requires certain assumptions regarding contributions to private schemes relative to statutory old-age insurance. For example, it could be assumed that self-employed people contribute the same share of their income to old-age insurance as the employee's share in the statutory old-age insurance, or that they contribute the upper limit of provisions deductible as special expenses from taxable income (see Fossen, 2008a, Section 5.3.2). There is unfortunately little information in the SOEP to assess this empirically.

Unemployment insurance contributions

Except for public servants, the self-employed and people in “marginal employment”, all employees are covered by unemployment insurance. Mandatory contributions to this scheme are a fixed proportion of gross earnings up to the contribution assessment ceiling. Below this ceiling, the total contribution rate is 3% of gross earnings. Half of the contribution is paid by the employer and the other half by the employee.

4.3 Social transfers

In addition to the child benefit, which is granted as an alternative to the child allowance as described in Section 4.1.4, social transfers include the following: unemployment benefits, the parental-leave benefit, housing benefits, and social assistance.

Unemployment benefit I

Unemployed people registered with the employment office who have paid unemployment insurance contributions for at least 12 months within the two years preceding the start of the unemployment period are entitled to the unemployment benefit I. In contrast to the unemployment benefit II to be described below, it is based on the insurance principle and thus not means-tested. It amounts to 60 % of previous net earnings and to 67 % if the unemployed person has at least one child in terms of the income tax law. If a person receiving unemployment benefits is employed for up to 15 hours per week, the income earned from that employment is partially deducted from the unemployment benefit. The duration of entitlement to unemployment benefits depends on an individual’s previous insurance period (within a reference period of 5 years) and age. The minimum duration of entitlement is six months. Before the Hartz reforms, the maximum entitlement period was 32 months. From 2006, the maximum period of entitlement to unemployment benefits will be limited to one year (for persons over 55, 18 months). At the beginning of 2008, this has been changed again by increasing the maximum entitlement period to 24 months for unemployed people over 58 years of age.

Implementation in STSM

Depending on whether or not behavioural changes in labour supply are simulated, the implementation of unemployment regulations differs. In the version without behavioural changes, the actually received amount recorded in the SOEP is used. If behavioural changes are simulated, net income is calculated for every household for several hypothetical levels of labour supply (including zero working hours). In this case, it is implausible to accord to each person the hypothetical unemployment benefit in the zero-hours category. The reason is that unemployment benefits are only paid temporarily, whereas the static labour supply model simulates permanent behaviour. For this reason, instead of transitory unemployment benefit we calculate the amount of means-tested unemployment benefit ("unemployment benefit II") which is, in principle, paid on a permanent basis.

Unemployment benefit II ("Arbeitslosengeld II")

Since 2005 the former "unemployment assistance" has been combined with the former "social assistance" (described below) by the introduction of the "unemployment benefit II" to which all "employable" persons are entitled. "Employability" is defined as being able to work for a minimum of 3 hours per day. The amount of the unemployment benefit II does not depend on an individual's previous employment history, as was the case for the unemployment assistance existing before.[21] Instead, the amount is solely determined by the needs of the household. The level of the benefit is determined on the basis of the basic benefit rate for adults and children for whom it differs by age. Until 2007, the basic benefit rate in East Germany was somewhat lower than in West Germany, since then the rates do no longer differ between the two regions. In addition to the basic benefit rates, housing costs up to a maximum amount that depends on household size are also paid for under the unemployment benefit II scheme. Moreover, recipients of unemployment benefit II are covered by health and old-age insurance. Similarly to the former social assistance scheme, assets and wealth have to be used before persons can claim unemployment benefit II,

[21] "Unemployment assistance", which existed until the end of 2004, was available to unemployed people who entitlement to unemployment benefits had run out and who passed the means test regarding other income and wealth assessed at the household level (i.e., people with a maintenance obligation). Unemployment assistance has no time limit and is equal to 53% of the most recent net working income. If there is a child with an entitlement to child assistance living in the household, the level of assistance is increased to 57%.

although there are some more generous allowances depending on number and age of family members. In case of earnings from employment, the benefit is withdrawn at the same rate as for the unemployment benefit I. If a "reasonable" job offer or the participation in some labour market programme is refused, or if the unemployed person does not engage in job search activities, the benefit may be reduced.

Implementation in STSM

As it is the case with unemployment benefit or unemployment assistance, the SOEP records whether a household received unemployment benefit II at the time of the interview as well as over the whole year, and if so, the amount received. As far as housing costs are concerned, we use information on the actual costs for rent and heating that is available in the SOEP. We assume that these costs are covered by the unemployment benefit II as long as they do not exceed the maximum amount of costs for rent and heating according to the regulations of the housing benefit (see below).

In simulations with given labour supply this information is used for the calculation of net household income. If labour supply reactions are simulated, we first check for persons with flexible labour supply whether they would be entitled to unemployment benefit II if they were not working. Entitlement is precluded if either of the two following conditions is fulfilled:

- The relevant income, including income of the spouse, is higher than the potential claim for unemployment benefit II.
- Cumulated assets exceed the personal allowance and the general saving allowance. The personal allowance depends on age. It is calculated as the product of 150 Euros times age with a minimum of 3,100 € and a maximum of 10,050 euro.[22] The general saving allowance is 750 €. Since the SOEP does not contain detailed information on assets in every year, we draw on information about interest income from renting and leasing. We

[22] Cohorts born between 1958 and 1963 and cohorts born between 1948 and 1957 have a maximum allowance of 9,900 euro and 9,750 euro, respectively. People born before 1948 have a personal allowance of 520 Euros times age (maximum of 33,800 Euro). Assets that are dedicated for a private pension insurance are subject to a more generous allowance of 750 Euros times age.

assume that a household passes the wealth test if income from interest is lower than 2% of the maximum amount of wealth that is exempted.

We assume that all persons who are not disabled or are disabled at a degree not exceeding 80 % are "able to work". Since there is no information in the SOEP which could be used to determine whether a benefit sanction is imposed due to the reasons given above, this possibility cannot be taken into account in the simulations. On the other hand, in the simulations full take-up of unemployment benefit II is assumed which is likely to overstate the actual take-up according to official statistics.

Additional child benefit ("Kinderzuschlag")

Since 2005 there is an additional child benefit ("Kinderzuschlag") for parents who are not entitled to unemployment benefit II for themselves but their children are. The maximum amount of this transfer is 140 € per month for children under 18 years who are living in the same household as their parents. Both, the lower and the upper income threshold for eligibility depend on the potential unemployment benefit II amount of the household. The lower income threshold is determined by the unemployment benefit II level of the adult members of the household, while the upper income threshold amounts to the total level of unemployment benefit II, including all children in the household. Income above this threshold is withdrawn at a rate of 70%

Implementation in STSM

Calculation of eligibility and the amount of the additional child benefit is embedded in the calculation of the unemployment benefit II claims. Maintenance payments received for children count as income in the calculation of the additional child benefit and are withdrawn at a rate of 100%, while wage income of the parents is only withdrawn at a rate of 70%.

Parent's benefit ("Elterngeld")

Since 2007 the previously existing "child-rearing benefit" has been replaced by the "parent's benefit" ("Elterngeld").[23] While the child-rearing benefit was means tested, the new parent's

[23] Since 2001 parents who worked less than 30 hours per week and whose household income was below certain upper limits could choose between two alternative forms of the child-rearing benefit ("Erziehungsgeld"): a relatively small monthly benefit paid for 24 months and a higher amount paid for 12 months. In 2001, this upper limit was set at 38,350 €

benefit replaces 67 % of net earnings if one parent stays at home in the first year after birth. The maximum monthly amount of the benefit is 1,800 €. For low-income parents who did not work before the birth of their child there is minimum amount of 300 € per month. Low-income families with net monthly income of less than 1,000 € receive a higher parent's benefit: for every 20 euro below this income threshold, the replacement rate is increased by 1% to a maximum of 100%. The parent's benefit is paid for a maximum duration of 14 months which is only granted, however, if the two parents share the parental leave with a maximum duration of 12 months for each parent.

While the full amount of the benefit is paid to parents who do not work at all, parents who reduce pre-birth working hours by 50% receive half of the benefit. In contrast to the child-rearing benefit, which was granted in addition to social assistance, the amount of the parent's benefit exceeding the minimum of 300 € per month is counted as income within the social assistance scheme. Another difference to the former child-rearing benefit, which was completely exempted from taxation, is that the new parent's benefit is due to the progressivity tax.

Implementation in STSM

Since the parent's benefit is due to the progressivity tax, it is calculated together with unemployment benefits before the income tax is computed. The amount of the potential parent's benefit is calculated on the basis of information recorded in the SOEP on gross earnings in the year before a child's birth as well as on the mother's working hours in the first year after the birth of a child. The possibility that several months can be transferred to the other parent is ignored and it is assumed that the parent with lower working hours is receiving the benefit for 12 months.

Social assistance

Since 2005, there is "social assistance" ("Sozialhilfe") for people whose income, assets and other social benefit payments are insufficient to secure the "social minimum" and who are

per year in the first six months after the birth of the child; from the child's seventh month, the income threshold was lower and gradually decreasing. In the previous version of STSM this child-rearing benefit was implemented under the simplifying assumption that all households chose the 24-months' option.

not considered "employable" according to the unemployment benefit II definition.[24] The reason why the person is in need of extra assistance is not important; the social minimum is guaranteed by law. The amount of social assistance is calculated as the sum of the standard benefit rates for all household members (according to the specific definition of a household by the respective law, "Bedarfsgemeinschaft") and the actual expenditures for accommodation and heating within certain maximum amounts. The level of the standard benefit rate for the household head is equal to unemployment benefit II. Thus the standard benefit rates for the other household members are determined relative to that of the household head and depend on their age.

The means test refers to both to income and wealth. Realisable assets above a small allowance are to be used before a claim to social assistance is made. The allowance is 1,600 Euro for people younger than 60 and 2,600 for older recipients. The allowance increases by 614 Euro for the spouse and by 256 Euro for a dependant child.

In general, the social assistance recipient's own income is taken fully into account. Taxes and social security contributions can be deducted. 30% of income from dependant employment or self-employment is exempted. However, this amount must not exceed half of the basic rate of 347 Euro. Otherwise it is assumed that the recipient has the capacity to work at least 3 hours a day and falls under the regulation of unemployment benefit II.

There is a general maintenance obligation between direct relatives set by the law. It is therefore ascertained by the local welfare office in each case whether and to what extent the recipient of social assistance receives assistance from first degree relatives (children and parents) or from their husband or wife. Grandparents, grandchildren and other distant relatives are not required to contribute.

People older than the statutory retirement age and people with a permanent and full reduction in earnings capacity receive the basic income support ("Grundsicherung"). The main difference to the social assistance is that there is no maintenance obligation between direct relatives (as long as they earn less than 100,000 Euro per year) set by the law for this

[24] Before 2005, social assistance was available to people who passed the means test and were not eligible to unemployment assistance irrespective of whether they were considered „employable" or not. Earnings up to 25 % of the standard benefit rate were not withdrawn, earnings above this amount were withdrawn at a rate of 85 % up to a maximum of 50% of the standard benefit rate, while earnings exceeding this amount were fully withdrawn.

transfer. Income of the spouse that exceeds a fictive own entitlement to the basic income support has to be accounted for. Other income and wealth is treated as for the entitlement to social assistance.

Implementation in STSM

In the simulation of social assistance and basic income support, the standard benefit rates used for the head of the household are applied. For the other household members benefit rates are derived accordingly.

Since there is no direct information on the value of specific assets in the SOEP on a yearly basis, we assume the household not to pass the relevant means test where income and annual interest and dividends exceed the allowances.

Housing benefit

All households with an income below specific thresholds are entitled to housing benefits which are available to renters as well as owner-occupiers according to housing benefits table which depends on the following factors:

- the number of family members in the household;
- income: the sum of gross income of all family members living in the household minus living expenses up to a certain upper limit and lump sum exemptions and deductions which depend on the living situation of the recipient.
- the amount of rent or loan repayments and maintenance costs that can be subsidised: rents and (for owner-occupiers) loan repayments and maintenance costs are only considered up to certain amounts which depend on the age of the apartment or house, whether it is equipped with central heating and a bathroom/shower, and the rent level of the flat, measured by 6 categories.

The upper limit of the housing benefit is thus determined by the number of family members, the rent level of the apartment or house, as well as its age and equipment. Housing benefits must be applied for unless the entitled household already receives social assistance, in which case the regulations mentioned above apply.

Implementation in STSM

Family income in the sense of the housing benefit regulations is calculated by first deducting from the individual annual income of each family member lump sum professional expenses for wages and salaries and capital income as well as exemptions which depend on the income level of people paying social security contributions and/or income tax. In the next step, the resulting individual net incomes of all family members are added family related exemptions are deducted. These include child benefits as well as the exemption for children between 16 and 25 who earn their own income and the exemption for over 62 year olds who live together with a (step) child who is over 25.

Since the rent level of the current apartment or house, which, among other things, determines the upper threshold of the housing benefit, is not recorded at the individual level in the SOEP, it is approximated by average values derived from information on to the number of people receiving housing benefits in each rent level, differentiated according to household size. This information is obtained from the official housing benefits statistics.

The amount of the actual rent or loan repayment and maintenance costs is recorded in SOEP. The amount of the housing benefit received is calculated from tables classified by three factors: the household size, the level of rent or imputed rent, and monthly family income. In the simulations, for each household size the table entries are approximated by a function in the two other variables.

Alignment of housing benefits and social assistance

Households receive either the housing benefit or unemployment benefit II or social assistance including a lump sum for housing costs and heating. Normally, the administration determines if the household is better off with housing benefits or social assistance (or unemployment benefit II) including a lump sum for housing costs. Accordingly, STSM calculates both and then applies the option that is better for the household.

Financial Aid to Students ("BAFoeG")

All students who start higher education below the age of 30 (there are some exceptions to this age limit) are eligible to financial aid for students according to the "Berufsausbildungsförderungsgesetz", BAFoeG). BAFoeG is means-tested and depends on

parental income, income of the spouse if the student is married, as well as income and assets of the applicant. Moreover, it depends on the presence, age and income of siblings. Since the beginning of the 1990s, BAFoeG is provided half as a grant and half as a loan that has to be paid back after completion of higher education.

Implementation in STSM

Using information on the original household number in the SOEP, we can track parents and siblings of students who have already left home. This is the prerequisite in order to calculate the individual claim for BAFoeG. For unmarried students, the BAFoeG amount is a non-linear function of the income of their parents and the number and age of siblings. Moreover, it depends on whether the student is living in the same household with his or her parents or not. For married students, the BAFoeG amount also depends on the income of the spouse.

The SOEP provides all required information to calculate the amount of BAFoeG not only for individuals actually enrolled at university but also for potential students, i.e. persons holding a university admission degree. Instead of using parental income from two years before the application for BAFoeG, as the regulations would require, we use income from only one year before. Thus, we do not have to merge several waves of the SOEP in order to calculate the BAFoeG claim. We also do model the regulation that part of the BAFoeG has to be paid back later, but treat it as a source of income in the same way as other transfers.

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7 Appendix

Wage regression

The wage regression is estimated with pooled data from the SOEP. Wage regressions are estimated separately by gender and region. All regressions control for selection into the labour force. The following tables show the estimated coefficients for the four groups. The meaning of variable names is explained below.

SOEP does not contain hourly wages. We generate gross hourly wages for dependant employees by dividing monthly gross labour earnings by monthly working time. To improve the information about weekly working hours we use data on paid and unpaid overtime in order to adjust for imbalances between the timing of working hours and their payment.

Explanation of variable names

lwhr2	log hourly wage rate in euro (dependent variable)
ausbj	years of schooling
vollz	years of full time experience
vollz2	years of full time experience squared and divided by 100
teillz	years of part time experience
teillz2	years of part time experience squared and divided by 100
ten	tenure
ten2	tenure squared and divided by 100
exp	years of full- and part time experience
exp2	years of full- and part time experience squared and divided by 100
hkabbau	depreciation of human capital: years of being not in employment nor apprenticeship in the last 10 years, i.e. years of unemployment or out of the labour force. The suffix “dt” denotes an interaction with a dummy variable that indicates German nationality.
bula0	West-Berlin
bula1	Schleswig-Holstein and Hamburg
bula2	Lower Saxony and Bremen
bula3	North Rhine-Westphalia
bula4	Hesse
bula5	Rhineland-Palatinate and Saarland
bula6	Baden-Württemberg
bula7	Bavaria
bula10	East-Berlin
bula11	Mecklenburg-Western Pomerania
bula12	Brandenburg
bula13	Saxony-Anhalt
bula14	Thuringia
bula15	Saxony

d1996	Year 1996
d1997	Year 1997
d1998	Year 1998
d1999	Year 1999
d2000	Year 2000
d2001	Year 2001
d2002	Year 2002
bra_1o	Industry: Agriculture and forestry
bra_2o	Industry: Mining and energy
bra_3o	Industry: Chemical industry, wood, paper
bra_4o	Industry: Clay, stones, earthes, construction
bra_5o	Industry: Iron, steel, heavy industry
bra_6o	Industry: Clothes
bra_7o	Industry: Wholesale trade
bra_8o	Industry: Train, post, communication
bra_9o	Industry: Public services
bra_10o	Industry: Private services
bra_11o	Other industries
bet_1o	Firm size: 1-4
bet_2o	Firm size: 5-19
bet_3o	Firm size: 20-199
bet_4o	Firm size: 200-1999
beamter	civil servant
_cons	constant
real_and	secondary school - normal degree
sbabitur	secondary school – high degree
lehre	apprenticeship
bbstudi	tertiary degree
deutsch	German nationality
erwm	degree of disability
erwm2	degree of disablity squared and divided by 100
ehe	married
kind3	number of own kids below 3 in household
kind6	number of own kids between 3 and 5 in household
kind16	number of own kids between 6 and 16 in household
kind17	number of own kids aged 17 or older in household
ysonst	other household income

Table A1
Estimation results for the wage regressions – OLS estimation (1999-2005)

	Women, west Germany		Women, east Germany		Men, west Germany		Men, east Germany	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
ausbj	0.0697***	0.0023	0.0574***	0.0026	0.0693***	0.0017	0.0534***	0.0022
vollz	0.0123***	0.0028	0.0131***	0.0020				
vollz2	-0.0201*	0.0082	-0.0361***	0.0053				
teilz	-0.0001	0.0041	-0.0042	0.0022				
teilz2	-0.0075	0.0205	-0.0010	0.0107				
ten	0.0133***	0.0035	0.0307***	0.0019	0.0154***	0.0027	0.0082***	0.0017
ten2	-0.0181	0.0113	-0.0506***	0.0053	-0.0281***	0.0080	-0.0113*	0.0046
hkabbau	-0.0405***	0.0086	-0.0589***	0.0079	-0.0646***	0.0117	-0.1731***	0.0103
ausbj_dt	0.0015	0.0018			0.0041**	0.0016		
volz_dt	0.0057	0.0029						
volz2_dt	-0.0243**	0.0085						
telz_dt	-0.0029	0.0042						
telz2_dt	0.0052	0.0211						
ten_dt	0.0056	0.0037			-0.0038	0.0028		
ten2_dt	-0.0065	0.0117			0.0195*	0.0083		
hkabb_dt	0.0065	0.0091			-0.0912***	0.0132		
bula1	0.0723***	0.0197			0.0154	0.0177		
bula2	0.0170	0.0181			0.0060	0.0161		
bula3	0.0429*	0.0172			0.0378*	0.0154		
bula4	0.0925***	0.0185			0.0546***	0.0165		
bula5	0.0423*	0.0192			0.0006	0.0168		
bula6	0.0954***	0.0178			0.0804***	0.0158		
bula7	0.0537**	0.0175			0.0323*	0.0157		
d1999	-0.0833***	0.0111	-0.1227***	0.0189	-0.1100***	0.0091	-0.1687***	0.0175
d2000	-0.0830***	0.0098	-0.0836***	0.0176	-0.1101***	0.0082	-0.1351***	0.0164
d2001	-0.0305**	0.0095	-0.0420*	0.0174	-0.0258**	0.0080	-0.0651***	0.0164
d2002	-0.0216*	0.0101	-0.0267	0.0181	-0.0319***	0.0085	-0.0590***	0.0172
d2003	-0.0047	0.0097	0.0031	0.0177	-0.0036	0.0083	-0.0199	0.0168
d2004	0.0089	0.0099	0.0101	0.0180	-0.0073	0.0084	-0.0091	0.0170
bra_1o	0.0350***	0.0093	-0.0663**	0.0222	0.0664***	0.0048	-0.0007	0.0121
bra_2o	0.2545***	0.0350	0.2018***	0.0463	0.0545***	0.0161	0.1427***	0.0252
bra_3o	0.0646***	0.0112	0.0504	0.0336	0.0731***	0.0078	0.0374	0.0192
bra_4o	-0.0273	0.0192	-0.0022	0.0262	-0.0582***	0.0072	-0.0549***	0.0108
bra_5o	0.0399*	0.0183	-0.0816*	0.0378	0.0232**	0.0075	-0.0261	0.0151
bra_6o	-0.1349***	0.0262	-0.2484***	0.0412	-0.1199***	0.0268	-0.1575*	0.0638
bra_7o	-0.1099***	0.0062	-0.1636***	0.0116	-0.0984***	0.0073	-0.1539***	0.0141
bra_8o	0.0203	0.0135	0.0304	0.0244	-0.0832***	0.0081	-0.0228	0.0158
bra_9o	0.0288***	0.0032	0.0864***	0.0048	-0.0211***	0.0048	0.0893***	0.0087
bra_10o	0.0450***	0.0071	-0.0023	0.0139	0.1081***	0.0072	0.0672***	0.0154
bra_11o	-0.1175***	0.0103	-0.1624***	0.0171	-0.0501***	0.0097	-0.0076	0.0178
bet_1o	0.0074*	0.0037	-0.0007	0.0068	0.0254***	0.0031	0.0465***	0.0078
bet_2o	-0.0636**	0.0246	-0.1030*	0.0440	-0.0833***	0.0226	0.0021	0.0466
bet_3o	-0.0231***	0.0033	-0.0018	0.0053	-0.0324***	0.0032	-0.0414***	0.0043
bet_4o	0.0736***	0.0081	0.0176	0.0128	0.0289***	0.0066	0.0778***	0.0121
beamter	0.0284***	0.0036	0.0284**	0.0090	-0.0177***	0.0029	0.0304***	0.0068
bula11			-0.1198***	0.0238			-0.1381***	0.0226

Table A1 continued

	Women, west Germany		Women, east Germany		Men, west Germany		Men, east Germany	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
bula12			-0.1157***	0.0218			-0.1309***	0.0201
bula13			-0.1649***	0.0215			-0.1677***	0.0199
bula14			-0.1593***	0.0219			-0.2104***	0.0197
bula15			-0.1838***	0.0203			-0.2094***	0.0187
exp					0.0159***	0.0022	0.0178***	0.0018
exp2					-0.0271***	0.0051	-0.0397***	0.0044
exp_dt					0.0045	0.0023		
exp2_dt					-0.0142**	0.0053		
Constant	1.3556***	0.0337	1.5060***	0.0529	1.5703***	0.0240	1.8103***	0.0419
Selection Equation								
real_and	0.5489***	0.0299	1.1502***	0.0824	0.3703***	0.0426	0.8309***	0.0915
sbabitur	1.1126***	0.0271	1.6832***	0.0713	0.6006***	0.0351	1.0985***	0.0764
lehre	0.8566***	0.0197	1.4166***	0.0635	0.6970***	0.0271	0.9455***	0.0672
bbstudi	1.5672***	0.0263	2.1228***	0.0701	1.1953***	0.0333	1.4095***	0.0736
vollz	0.0790***	0.0020	0.0866***	0.0036				
vollz2	-0.2036***	0.0054	-0.2590***	0.0092				
teilz	0.0618***	0.0027	0.0179**	0.0055				
teilz2	-0.2047***	0.0111	-0.1578***	0.0234				
deutsch	-0.0646**	0.0229			0.2351***	0.0262		
erwm	-0.0052***	0.0014	-0.0109***	0.0027	-0.0123***	0.0013	-0.0173***	0.0027
erwm2	-0.0125***	0.0019	-0.0078*	0.0038	-0.0062***	0.0018	0.0013	0.0036
ehe	-0.0535***	0.0156	0.3876***	0.0279	0.1819***	0.0205	0.4535***	0.0331
kind3	-0.7284***	0.0303	-0.6151***	0.0567	0.2390***	0.0424	0.2214***	0.0669
kind6	-0.0570*	0.0252	0.2168***	0.0546	0.2036***	0.0393	0.3991***	0.0714
kind16	0.2721***	0.0165	0.2036***	0.0317	0.2468***	0.0236	0.1261***	0.0379
kind17	0.3613***	0.0165	0.4195***	0.0287	0.5182***	0.0211	0.6727***	0.0339
ysonst	-0.0002***	0.0000	-0.0004***	0.0000	-0.0005***	0.0000	-0.0007***	0.0000
bula1	0.0629	0.0494			0.1617**	0.0605		
bula2	0.1105*	0.0452			0.1294*	0.0543		
bula3	0.0559	0.0431			0.1629**	0.0516		
bula4	0.1740***	0.0465			0.2688***	0.0562		
bula5	0.0025	0.0474			0.0948	0.0576		
bula6	0.1729***	0.0444			0.4088***	0.0536		
bula7	0.1712***	0.0439			0.2254***	0.0529		
bula11			0.0197	0.0605			-0.1447*	0.0673
bula12			0.0658	0.0550			-0.1464*	0.0602
bula13			0.0039	0.0542			-0.0665	0.0601
bula14			-0.0654	0.0546			-0.0491	0.0601
bula15			0.0846	0.0515			-0.0993	0.0567
exp					0.1240***	0.0024	0.1135***	0.0039
exp2					-0.3336***	0.0055	-0.3114***	0.0090
Constant	-1.2173***	0.0507	-1.6740***	0.0838	-0.6525***	0.0612	-0.8588***	0.0875
Mills lambda	0.0277**	0.0093	0.0268	0.0159	-0.0158**	0.0059	0.0084	0.0129
N	45.041		15.087		39.186		13.202	

* p<0.05, ** p<0.01, *** p<0.001

Source: Estimation based on SOEP, wave 23.

Table A2
Maximum likelihood estimation results for the utility function underlying the discrete-choice household labor supply model –couple household with both spouses "flexible"

Variable	Coefficient	Standard Error
income	0.1801**	0.0440
income squared	-0.0006	0.0005
income × husband's leisure	-0.0006**	0.0002
income × wife's leisure	0.0001	0.0001
husband's leisure	0.3684**	0.0349
husband's leisure squared	-0.0021**	0.0001
wife's leisure	0.1445**	0.0307
wife's leisure squared	-0.0001	0.0000
husband's leisure × wife's leisure	-0.0004*	0.0002
husband's leisure × dummy1	-0.0144	0.0164
wife's leisure × dummy1	-0.0100	0.0124
husband's leisure × wife's leisure × dummy1	0.0002	0.0002
income × dummy1	0.0342	0.0393
income squared × dummy 1	-0.0001	0.0005
husband's leisure × dummy 2	-0.0315**	0.0121
wife's leisure × dummy 2	-0.0497**	0.0096
husband's leisure × wife's leisure × dummy 2	0.0004**	0.0002
income × dummy 2	-0.0765**	0.0276
income squared × dummy 2	0.0010**	0.0003
husband's leisure × husband's age	-0.0035**	0.0012
husband's leisure squared × husband's age squared	0.0049**	0.0012
wife's leisure × wife's age	-0.0063**	0.0012
wife's leisure squared × wife's age squared	0.0088**	0.0013
husband's leisure × husband's health status	0.0336**	0.0077
wife's leisure × wife's health status	0.0130	0.0099
wife's leisure × dummy 3	0.0743**	0.0052
wife's leisure × dummy 4	0.0376**	0.0030
wife's leisure × dummy 5	-0.0042	0.0026
Number of observations: 58320 (3888 households, 15 choice categories)		
Log Likelihood: -9383.37 LR chi² (28): 2291.05		

Notes: Dummy 1: Head of household (person answering the GSOEP household questionnaire) is German
Dummy 2: Household is living in east Germany
Dummy 3: Children under the age of 3 in household
Dummy 4: Children between 3 and 6 in household
Dummy 5: Children under the age of 17 in household
× indicates an interaction term
* indicates significance at 10 % level
** indicates significance at 5 % level

Source: Steiner and Wrohlich (2008), Appendix B.