Optimal Taxation when the Tax Burden Matters*

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Abstract

Survey evidence shows that the magnitude of the tax liability plays a role in value judgements about which groups deserve tax breaks. Such considerations can be explained with a role for the tax burden itself, but do not follow from standard welfarist optimal taxation. We show that the German tax-transfer system is not in line with a standard welfarist inequality averse social planner. Instead, it is optimal according to a planner who is both inequality averse and wants to avoid high tax liabilities. Such a tax-transfer schedule reflects non-welfarist value judgements of citizens in line with survey evidence or might arise if there is misspecification on the side of policy makers. Additionally, we show that redistributive systems are inconsistent with an inequality averse welfarist social planner in 17 European countries and the USA. The redistributive systems in 50% of these countries can be rationalized with an inequality averse social planner for whom the absolute tax burden matters.

Keywords Justness · Optimal Taxation · Income Redistribution · Inequality · Welfare Criteria

JEL Classification D63 · D60 · H21 · H23 · I38

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1 Introduction

A common assumption in the optimal taxation literature is that the social planner maximizes a welfarist social welfare function with weights decreasing with income (e.g., de Boer and Jongen 2017; Blundell et al. 2009; Saez 2002, 2001). Decreasing weights lie within the bounds confined by the two extreme cases of Rawlsian and Benthamite objective functions. However, studies of positive optimal taxation commonly find that social weights for the working poor implied by actual tax-transfer systems in many countries are lower than the weights of higher income households (Ayaz et al. 2021; Bargain et al. 2014a; Bourguignon and Spadaro 2012; Blundell et al. 2009; Immervoll et al. 2007). Survey evidence suggests that respondents consider both disposable income and the magnitude of the tax liability when deciding whether a particular tax system is just. Saez and Stantcheva (2016) show that both a household's tax burden and disposable income play a role when survey respondents assess whether a household deserves a tax break. Similarly, Charité et al. (2015), Weinzierl (2014) and Schokkaert and Devooght (2003) show that survey respondents in different countries prefer a lower tax burden for high income earners than the utilitarian principle implies. That is, very high tax liabilities or—equivalently—large deviations of net income from gross income are to be avoided. This survey evidence suggests that ideas of justness that acknowledge the magnitude of the tax liability play a role for actual tax policy making. Tax policy guided by principles that use gross income as reference points would be in line with loss aversion (Kahneman and Tversky 1979) in addition to the standard concern on dead-weight loss, where taxes paid are considered a loss relative to the endowment of gross earnings. A tax system accordant with this principle could either reflect biases on the side of policy-makers or the fact that policy makers take into account normative non-welfarist judgements of citizens. The aim of this paper is to test how well the German tax-transfer system can be modelled as resulting from the maximization problem of a social planner that is both averse to increasing taxes when the tax liability is high and to increasing taxes for low income groups.

We set up an optimal taxation problem and define a concept of justness, where the social planner's objective function reflects that she is averse to large absolute (*absolute tax burden* principle) or relative tax burdens (*relative tax burden* principle) for each income group. Specifically, we start from the generalized marginal social welfare weights (Saez and Stantcheva 2016) and decompose them into two components: The first component are *marginal social justness weights*, which determine aversion to increasing taxes for particular income groups. If these weights decrease with income, they reflect inequality aversion. Obtaining such weights in line with inequality aversion is the main objective of this study. The second component is a parametric function that captures the idea that the social planner is more averse to large tax burdens. Using German household data from the Socio-Economic Panel (SOEP) and taking the German tax-transfer system as given, we solve the optimal taxation problem for the social planner's weights. We find that the marginal social justness weights implied by the *absolute tax burden* principle decrease with income, meaning that the social planner is averse to increasing taxes for those with a high tax burden, but less so if their income is high. Moreover, we show that the *absolute tax burden* approach, which is based on a very simple functional form, can be calibrated such that weights are approximately constant, implying an inequality neutral social planner. In contrast, applying the standard welfarist principle to the current tax-transfer system implies the lowest weights for the working poor, which is at odds with inequality aversion of the social planner.

Alternative views of fair income taxation, which differ from utilitarianism, have been put forth, see Fleurbaey and Maniquet (2018) for a survey. The equal sacrifice principle (see Weinzierl 2014; Young 1988; Richter 1983; Musgrave and Musgrave 1973; Mill 1871) is based on the magnitude of the *tax liability*, characterized axiomatically in a recent study by Berg and Piacquadio (2020). It stipulates that all individuals should suffer the same 'sacrifice' through taxes in terms of utility. I.e., the difference in utility derived from gross income and utility derived from net income should be the same for all individuals and implies that *average tax rates* are flat under log utility of consumption.[1] As the equal sacrifice principle is based on the tax burden, it is closely related to the approaches proposed in this paper.

Saez and Stantcheva (2016) introduce generalized marginal welfare weights that may depend on characteristics that do not enter utility. Our study is an application of that concept. In our approach, the social planner maximizes an objective function that allows for non-welfarist concepts of justness. This implies that, while individuals maximize utility, the social planner does not necessarily maximize a weighted sum of utilities but a function potentially including other criteria. The approach in our paper offers the advantage that we can directly quantify the value the social planner puts on a marginal improvement in a specific criterion for a given group compared to other groups. Thus, we can show which criterion is in line with either marginal social justness weights that decrease with income (implying inequality aversion) or are approximately constant. Saez and Stantcheva (2016) operationalize a libertarian concept using marginal *welfarist* weights

[1] A potentially undesirable property of equal sacrifice tax systems is that they do not guarantee Pareto efficiency (Weinzierl 2014). In the approach used in this paper positive weights guarantee Pareto efficiency.

that increase with net taxes paid. In this case decreasing taxes for those with a high tax burden is a high priority for the social planner. The tax burden principle is close to this libertarian concept and is based on the empirical fact that tax policy debate frequently concerns the magnitude of the tax burden. However, in addition we allow for the social planner to be inequality averse.

We make four main contributions: First, we extend the Saez (2002) model of optimal taxation to non-welfarist aims of the social planner and offer an alternative interpretation of the generalized marginal social welfare weights. This model allows for labor supply adjustments at both the intensive and the extensive margin. This is crucial because participation decisions have a strong impact on the optimal taxation of the working poor.[2] Second, we operationalize the *tax burden* principle incorporating concerns about the level of taxation. Third, we bring the model to the data using the SOEP and estimate labor supply elasticities via microsimulation and a structural labor supply model. Finally, we build on previous results in Bargain et al. (2014a) and apply the the *absolute tax burden* principle to 17 European countries and the United States. In addition to contributing to the literature on non-welfarist aims of tax policy, our paper adds to the literature on positive optimal taxation, which incorporates labor supply responses to obtain "tax-benefit revealed social preferences" (e.g., de Boer and Jongen 2017; Jacobs et al. 2017; Lockwood and Weinzierl 2016; Bargain et al. 2014a; Bourguignon and Spadaro 2012; Blundell et al. 2009). These papers commonly find that, assuming a welfarist social planner, weights are non-decreasing, often with the lowest weight on the working poor.

Our main results are obtained by solving an inverse optimal taxation problem. We find that the *relative tax burden* principle implies increasing weights and the *absolute tax burden* principle implies declining social weights. That is, the latter is in line with inequality aversion. The reason for this is that the working poor pay only a low amount of taxes in the first place. As the social planner is averse to high tax burdens, tax cuts for people with low tax burdens have a low priority per se. While the efficiency cost of redistributing one Euro to this group is relatively small, the reduction in the loss function is small too. So in order for the social planner to be indifferent to whether taxes for this group are cut, marginal social justness weights need to be relatively high. In contrast, in the welfarist case, high marginal tax rates and labor supply responses lead to a high efficiency cost of taxes for the working poor, reflected by a low social marginal welfare weight.

[2] The reason is that a marginal increase in disposable income for the unemployed induces some workers at *all* income levels to become unemployed. In contrast, an increase in disposable income for the working poor encourages some unemployed workers to join the labor force and induces some workers with slightly higher income to reduce their labor supply.

It is important to keep in mind that the social planner is an abstraction and, in practice, governments might have goals that are not reflected by commonly used social welfare functions. Naturally, other explanations for non-decreasing marginal welfare weights than those offered in this study are possible. For instance, lobbying of high income earners and weak political representation of the working poor might have resulted in a tax-transfer schedule implying non-decreasing weights. However, the aforementioned survey evidence suggests that aversion to high tax burdens plays a substantial role in citizens' value judgements. We show that actual tax-transfer schedules are in line with aversion to high tax burdens in combination with inequality aversion and thus might to some extent reflect these value judgements. We offer a simple and intuitive way to rationalize this.

The next section introduces the optimal taxation model for different concepts of justness. Section 3 describes the data. In Section 4, we describe the resulting weights for different concepts of justness. Moreover, we extend our analysis to 17 European countries and the United States. In Section 5 we show parameters for an inequality neutral social planner and discuss the robustness of our results. Section 6 concludes.

2 Optimal Taxation for Different Justness Concerns

2.1 The General Framework

Generalized social marginal welfare weights — We use generalized social marginal welfare weights proposed in Saez and Stantcheva (2016) to capture the aims of the social planner. We specify alternative views on justness of a social planner given actual tax policy and assess how implied inequality aversion varies when the social planner takes the tax burden into account. To this end, we solve an inverse optimal taxation problem that allows us to infer the generalized social marginal welfare weights $g_i(c_i, y_i)$ from tax rates for different income groups $i = 0, ..., I$ defined through the group's gross income y_i.[3] The g_i depend potentially on factors that are not contained in the utility function. In particular, weights can depend on both the level of consumption c_i and the tax burden $T_i = y_i - c_i$. We decompose the generalized social marginal welfare weights g_i into two multiplicative components: *i)* the marginal social justness weights μ_i. Below, we define μ_i in terms of the maximization problem of the social planner. *ii)* a parametric function that captures other

[3]The number of income groups is assumed to be fixed. In the empirical application, we define groups $1, .., I$ as quintiles of the positive gross income distribution.

concerns, $f_i(c_i, y_i)$. In our application this implies a penalty, which increases with the deviation from a reference point perceived as just, in our case paying no taxes:

$$g_i(c_i, y_i) = \mu_i f_i(c_i, y_i). \tag{1}$$

In our specifications, we allow $f_i(c_i, y_i)$ to depend on the tax burden—either absolute or relative to gross income—it captures the respective aim of the social planner to minimize it. We specify $f_i(c_i, y_i)$ such that the penalty to the social planner's objective function increases more than proportionally with an increase in the tax burden for a specific group. μ_i captures other considerations of the social planner, for instance inequality aversion, in which case μ_i is lower for high-income groups than for low-income groups. In that case, the social planner trades off reducing inequality against reducing the tax burden for those who pay high taxes. Thus, $g_i(c_i, y_i)$ might be higher for people with higher net income (and a higher tax burden) than for people with low income, even if the social planner is in principle inequality averse.

The social planner's maximization problem — We write the problem of the social planner in terms of a continuum of individuals indexed by $m \in M$ with measure $d\nu(m)$, where M is a set of measure one. Our approach nests the welfarist approach, where the social planner maximizes a weighted sum of utility. While throughout most of the paper it is not necessary to distinguish between individuals in one income group, in the welfarist case we allow for utility to differ among individuals in an income group i. The reason is that we need to allow for disutility of work to differ between individuals in order for the utility function to be consistent with labor supply elasticities that take on other values than zero or infinity.[4]

The social planner maximizes a sum W based on the function $\Psi_m(F_m(c_i, y_i), i)$, which captures the planner's belief on which variables matter for justness, by choosing tax liabilities T_i to finance a public good P or transfers (negative values T_i). In the following we will sometimes omit the arguments of the functions. We assume that Ψ_m does not directly depend on c_i. We adjust the canonical model by Saez (2002), which combines the pioneering work by Diamond (1980) and Mirrlees (1971), to capture non-welfarist objective functions (see Appendix A for a formal derivation).

[4] A small tax increase for individuals in group i leads all marginal individuals, who are indifferent between working in group i or a different group, to change group. If disutility of work does not differ between individuals in a group, either all individuals are marginal or none is.

The social planner takes into account labor supply adjustments and maximizes the following objective function subject to the government budget constraint,

$$\max_{T_0,\dots,T_I} W = \int_M \Psi_m(F_m(c_i,y_i),i)d\nu(m) \quad \text{s.t.} \quad \sum_{i=0}^{I} h_i T_i = P, \tag{2}$$

where h_i denotes the share of households in group i relative to the total population. Note that this share is endogenous as individuals adjust their labor supply to the tax-transfer system. Using the chain rule, we take the derivative of $\Psi_m(F_m(c_i,y_i),i)$ with respect to c_i. Denote by ψ_m the first derivative of Ψ_m with respect to F_m and by and f_m the first derivative of F_m with respect to c_i. Denote the Lagrange multiplier of the government budget constraint by λ. As in Saez (2002), marginal social welfare weights are defined as

$$g_i = \frac{1}{\lambda h_i} \int_M \psi_m(c_i,y_i,i) f_m(c_i,y_i) d\nu(m). \tag{3}$$

While we allow for F_m to differ across individuals in one income group, in our applications, f_m is constant across individuals in a given group i and we write $f_i = f_m$. Moreover, define $\psi_i \equiv \frac{1}{h_i}\int_M \psi_m d\nu(m)$, i.e. the group average of ψ_m, and define $\mu_i \equiv \psi_i/\lambda$. Substituting then yields equation (1). In most of the following we take observed tax liabilities T_i as given, obtain implied social marginal welfare weights g_i, specify functional forms for $f_i(c_i,y_i)$, and solve for μ_i. The advantage of our approach is that the weights μ_i have a rather intuitive interpretation. When comparing two groups, e.g., i and $i-1$, the social planner values increasing F_i by one μ_i/μ_{i-1} times as much as increasing F_{i-1} by one. For the welfarist approach, the planner is indifferent between distributing one Euro to group i and distributing μ_{i-1}/μ_i Euro to group $i-1$. As pointed out in Saez (2002), positive weights $g_i(c_i,y_i)$ imply that the tax schedule is second-best Pareto efficient. This implies that the tax schedule is Pareto efficient as long as all $f_i(c_i,y_i)$ and μ_i are positive.

2.2 Operationalization of Justness Concepts

The key advantage of the generalized social marginal welfare weights is that the aim of the social planner can be defined very generally, thus allowing us to capture a broader set of concepts of justness than the standard approach. Apart from the welfarist approach, we operationalize two ideas of justness that are based on increasing functions of the tax liability: *absolute tax burden* based on the absolute tax liability and *relative tax burden* based on the tax liability relative to gross income, i.e., the average tax rate.

From solving our inverse optimal taxation problem, we obtain marginal social justness weights μ_i, which depend on the point at which they are evaluated. To make the comparison of weights between concepts of justness easier, we calculate relative weights by dividing the obtained weights μ_i through the weight of Group 0, μ_0, as in Blundell et al. (2009).

Welfarist approach — Our approach nests the welfarist approach, where the social planner maximizes a sum of individual utilities, i.e., $\Psi_m(F_m(c_i,y_i),i)) = u_m(c_i,i)$. The planner assumes that individuals maximize a utility function of the form

$$u_m(c_i,i) = \Psi_m(c_i - l_m(i)) \tag{4}$$

with $\Psi'_m(\cdot) > 0, l'_m(\cdot) > 0, l''_m(\cdot) > 0$ and where $l_m(i)$ denotes the disutility of work in income group i. As in Saez (2002), this functional form rules out income effects.

In our notation, $F_m = c_i - l_m(i)$. It determines individual behavior and is in principle observable through revealed preferences. The first derivative with respect to c_i, f_m, equals 1. In contrast, Ψ_m describes the belief of the social planner about cardinal utility of different individuals or, equivalently, the planner's subjective weights.

Therefore, using in the welfarist case, g_i equals μ_i,

$$g_i(c_i,i) \equiv \frac{1}{\lambda h_i} \int_{M_i} \psi_m f_m d\nu(m) = \mu_i. \tag{5}$$

In this case, g_i can be interpreted as capturing some form of subjective weight of the social planner, capturing, e.g., inequality aversion.

Absolute Tax Burden approach — The individuals trade off income against leisure as in the welfarist case. However, the social planner's idea of justness is not based on this specification of utility but rather captured by a penalty function

$$\begin{aligned} F_i(c_i,y_i) &= -(y_i - c_i)^\gamma \text{ if } y_i \geq c_i, \\ F_i(c_i,y_i) &= \theta(c_i - y_i)^\delta \text{ if } c_i > y_i, \\ \gamma > 1, &\delta \leq 1, \theta > 0. \end{aligned} \tag{6}$$

The first line gives the penalty of paid taxes and $\gamma > 1$ implies that the penalty increases more than proportionally with the amount of taxes paid. This formalizes the idea that the social planner dislikes the idea of tax increases for those who already have a high tax liability. The second line captures the gains of individuals who receive net transfers. With $\delta < 1$, the marginal benefits of transfers are decreasing. θ scales the benefit of transfers relative to the burden of taxes. The parameter only impacts marginal weights of net transfer recipients relative to those of other groups. In practice, we maximize the negative of the penalty function, which is equivalent to minimizing the penalty. For the *absolute tax burden* approach generalized marginal social welfare weights are given by

$$\begin{aligned} g_i(c_i,i) &= \mu_i \gamma (y_i - c_i)^{\gamma-1} \text{ if } y_i \geq c_i, \\ g_i(c_i,i) &= \mu_i \theta \delta (c_i - y_i)^{\delta-1} \text{ if } c_i > y_i. \end{aligned} \tag{7}$$

Analogously to the welfarist case, declining marginal social justness weights μ_i imply that the social planner puts a higher weight on households with lower income.

Note that the *absolute tax burden* approach uses gross income given the current job choice as reference point. This gross income differs from a laissez faire counterfactual for at least two reasons. First, the entire economy would be different without the provision of public goods by the government. Second, if the consumer faced no taxes, she might choose a job with higher income. Nonetheless, we use the gross income in the current job as a reference point because public debates usually focus on the amount of taxes paid in the status quo. This reflects the idea that individuals are to some degree entitled to their market income.

Relative Tax Burden approach — The social planner's belief on justness is captured by

$$\begin{aligned} F_i(c_i,y_i) &= -\left(\frac{y_i - c_i}{y_i}\right)^{\gamma} \text{ if } y_i \geq c_i, \\ F_i(c_i,y_i) &= \theta \left(\frac{c_i - y_i}{y_i}\right)^{\delta} \text{ if } c_i > y_i > 0, \\ &\gamma > 1, \delta \leq 1, \theta > 0. \end{aligned} \tag{8}$$

In this case the social planner dislikes large tax payments relative to the level of gross income, i.e. high *average tax rates*.[5] For the *relative tax burden* approach marginal social welfare weights

[5] Note that equation (8) does not include a definition of the function for $y_i = 0$. While we are interested in the relative relations of the weights of the groups with positive gross income, with the *relative tax burden* specification, we need define f_0, i.e., the derivative of the justness function for this group. A straightforward calibration is to set the value of the derivative of the justness function for income Group 0 to equal that of Group 1 times θ. This does not change the relations of weights for groups with positive gross income, which are the focus of this study. The weight of Group 0 can be scaled relative to that of all other groups via θ.

are given by

$$g_i(c_i, i) = \mu_i \frac{\gamma((y_i - c_i)/y_i)^{\gamma-1}}{y_i} \text{ if } y_i \geq c_i,$$
$$g_i(c_i, i) = \mu_i \frac{\theta\delta((c_i - y_i)/y_i)^{\delta-1}}{y_i} \text{ if } c_i > y_i. \tag{9}$$

It is important to understand that in most parts of our analysis the marginal social justness weights μ_i are the parameters to be estimated, not γ and δ.

Parametrization — In our main application, we set γ to two and δ to one. We set for normalization the scaling parameter θ such that the weight of Group 0 is twice that of Group 1, that is $\mu_0/\mu_1 = 2$.[6] Note that δ and θ affect only the unemployed, the only group that receives net transfers in our application and thus has a 'negative tax burden'. Thus, these parameters scale the weight of Group 0 relative to the other groups but do not affect the interpretation of the weights of groups 1-5 relative to one another.

The social pay-off to decreasing relatively high tax burdens (*absolute tax burden* approach) or high average tax rates (*relative tax burden* approach) increases with γ. On the other hand, the increase in net income necessary to reduce the average tax rate increases with gross income in progressive tax systems. We provide a sensitivity analysis in Online Appendix B showing that our main result remains when varying γ .

2.3 Inverse Optimal Taxation

As in Saez (2002), we consider the benchmark case with no income effects, where $\sum_{i=0}^{I} \partial h_j / \partial c_i = 0$, in line with the empirical evidence suggesting relatively small income effects (Bargain et al. 2014b; Saez et al. 2012). Summing the first order conditions (equation (19) in the appendix) over all $i = 0, \ldots, I$ we obtain the normalization of weights such that

$$\sum_{i=0}^{I} h_i g_i = 1. \tag{10}$$

Following Saez (2002), we assume that labor supply adjustment is restricted to intensive changes to "neighbor" income groups and extensive changes out of or into the labor force (see Appendix A). Thus h_i depends only on differences in after-tax income between "neighbor groups" ($c_{i+1} - c_i$,

[6] For the *absolute tax burden* concept, $\theta = 649$ and for the *absolute tax burden* concept, $\theta = 1.72$. We leave the parametrization unchanged for the subgroup analysis in Online Appendix A.

$c_i - c_{i-1}$) and differences between group i and the non-working group ($c_i - c_0$). The intensive mobility elasticity is

$$\zeta_i = \frac{c_i - c_{i-1}}{h_i} \frac{\partial h_i}{\partial (c_i - c_{i-1})} \tag{11}$$

and the extensive elasticity is given by

$$\eta_i = \frac{c_i - c_0}{h_i} \frac{\partial h_i}{\partial (c_i - c_0)}. \tag{12}$$

The main theoretical insight in Saez (2002) is that the optimal tax formula for group i expressed in terms of the participation elasticities η_j and the intensive elasticity ζ_i is

$$\frac{T_i - T_{i-1}}{c_i - c_{i-1}} = \frac{1}{\zeta_i h_i} \sum_{j=i}^{I} \left[1 - g_j - \eta_j \frac{T_j - T_0}{c_j - c_0}\right] h_j. \tag{13}$$

The intuition of this equation can be seen by considering an increase of the same amount dT in all T_j for income groups $j = i, i+1, \ldots I$. A small increase in taxes mechanically increases tax revenues but induces individuals to move to a lower income class or to unemployment, which reduces tax revenues. After multiplying equation (13) with $dT \zeta_i h_i$, the left hand side shows the amount by which tax revenue is reduced due to individuals switching from job i to $i-1$. At the optimum, this must equal the mechanical tax gains, which are valued at $[\sum_{j=i}^{I}(1-g_j)h_j]dT$, minus tax losses due to individuals moving to Group 0, $-dT \sum_{j=i}^{I} \eta_j h_j \frac{T_j - T_0}{c_j - c_0}$.

The system of equations defining the optimal tax schedule consists of equation (10) and I equations like equation (13). In our application, we use the 2015 German tax system, i.e. we calculate the actual tax liability T_i of each income group, and solve for $g_0, \ldots, g_I$ and calculate marginal social justness weights for the welfarist case and for the alternative approaches. Alternatively, one could assume social weights and calculate the optimal tax schedule that maximizes equation (2) (as done in Appendix B).

3 Empirical Calibration

3.1 The Data

We use data from the 2015 wave of the German Socio-Economic Panel (SOEP), a representative annual household panel survey. Goebel et al. (2018) and Wagner et al. (2007) provide a detailed description of the data.[7] As the model does not cover spousal labor supply, we restrict the analysis

[7] Socio-Economic Panel (SOEP) data for the year 2015, version 32, 2016, doi:10.5684/soep.v32.

to working-age singles. We exclude individuals with children, heavily disabled and people who receive Unemployment Benefit I[8] because their budget constraints and labor supply behavior differ substantially from that of the rest of the population. We exclude the long-term unemployed with transfer non-take up, as they differ substantially from the standard case and face a different budget constraint.

Table 1: Summary Statistics

	Mean	Std. Dev.	Obs.
Monetary variables			
Monthly Gross Income	2,626.75	1,925.41	1,119
Monthly Net Income	1,766.18	991.86	1,119
Demographics			
Sex (1=men, 2=women)	1.41	0.49	1,119
Weekly Hours of Work*	41.66	9.51	990
Age	43.97	10.47	1,119
East Germany Dummy	0.27	0.45	1,119

Source: Own calculations based on the SOEP; Monetary values in Euro.
*Excluding the unemployed

Table 1 shows summary statistics for our sample. Net incomes equal gross incomes and transfers minus income taxes and social security contributions. For the empirical analysis, we define six income groups, where Group 0 consists of the unemployed receiving Unemployment Benefit II[9] and Group 1 to 5 are quintiles of the positive gross income distribution. Bargain et al. (2014a) show that changing the cut-off points does not affect the results of an inverse optimal taxation exercise based on the Saez (2002) model substantially.

3.2 Labor Supply Elasticities

Similarly to Bargain et al. (2014a), Haan and Wrohlich (2010), and Blundell et al. (2009), we calibrate the optimal taxation analysis with labor supply estimates obtained from a structural labor supply model using the same representative German microdata (the SOEP), which we used to generate income groups. To this end we specify a random utility discrete choice labor supply model following van Soest (1995) and Aaberge et al. (1995). See Aaberge and Colombino (2014)

[8]This transfer is targeted at the short-term unemployed and depends on the previous labor income.

[9]This transfer is targeted at the long-term unemployed and covers the social existence minimum.

for an overview. We flexibly specify the transcendental logarithmic utility function V_{mj}, which is "a local second-order approximation to any utility function" (Christensen et al. 1975). While the highest value of V_{mj} over the j hours alternatives non-stochastically determines the choice of labor supply, additionally an independently and identically distributed random term φ_{mj} captures an idiosyncratic component.

Gross income is defined as the product of wages and hours of work. Of course, we do not observe potential wages for unemployed. Therefore, we predict potential hourly wages of the unemployed using a selectivity-corrected wage regression. The selectivity correction follows the two-step Heckman (1979) approach with binary variables for young children of four age groups, marital status, non-labor income, and indicators for health as exclusion restriction. We assume that the excluded variables impact the extensive labor supply decision but do not have a direct effect on the hourly wage.

Given their hourly wage, individuals make a discrete choice of weekly working hours to maximize utility, which depends on leisure L_{mj} and after-tax and transfer income C_{mj}. We discretize hours of work into five alternatives with positive working hours and unemployment (weekly working hours $\in \{0, 10, 20, 30, 40, 50\}$) for the precise calculation of net incomes associated with labor supply decisions using the STSM (see Jessen et al. 2017; Steiner et al. 2012). In contrast to most continuous labor supply models, the model does not require convexity of the budget set.

The error terms φ_{mj} are assumed to be distributed according to the Extreme-Value type I distribution, such that the probability that alternative k is chosen by person m is given by a conditional logit model (McFadden 1974):

$$P_{mk} = Pr(V_{mk} > V_{mj}, \forall j = 1 \dots J, j \neq k) = \frac{exp(U_{mk})}{\sum_{j=1}^{J} exp(U_{mj})}, j \in J, \tag{14}$$

where the deterministic component is

$$U_{mj} = \beta_1 \ln(C_{mj}) + \beta_2 \ln(C_{mj})^2 + \beta_3 \ln(L_{mj}) + \beta_4 \ln(L_{mj})^2 + \beta_5 \ln(C_{mj}) \ln(L_{mj}). \tag{15}$$

Observed individual characteristics contained in X_1 and X_2 shift tastes for leisure and consumption with $\beta_1 = \alpha_0^C + X_1' \alpha_1^C$, $\beta_2 = \alpha_0^{C^2} + X_1' \alpha_1^{C^2}$, $\beta_3 = \alpha_0^L + X_2' \alpha_1^L$, $\beta_4 = \alpha_0^{L^2}$, $\beta_5 = \alpha_0^{C \times L}$. In particular, X_1 contains a dummy for East Germany and X_2 contains a dummy for East Germany, a dummy for German citizenship, dummies for degrees of disability, a quadratic polynomial for age, and dummies for part time working hours. The estimation is carried out separately for female and male single households.

To obtain mobility elasticities we first assign each individual m to an income group $i = 1,..,I$ based on the wage-hours combination observed in the data. For instance, an individual m with an hourly wage of 20 Euros earns a gross income of approximately 860 Euros per month if she works 10 hours per week and about 1720 Euros if she works 20 hours. If she works 10 hours, she is assigned to Group 1, $C_{m,k=10} = c_{i=1}$. If she works 20 hours, she is assigned to group II, $C_{m,k=20} = c_{i=2}$. In contrast, a person with an hourly wage of 50 Euros is assigned to income group II if she works 10 hours, earning about 2,150 Euro per month, $C_{m,k=10} = c_{i=2}$.

Changes in net income associated with specific hours points lead to changes in the choice probabilities given by equation (14). These allow for the calculation of aggregate labor supply effects of a hypothetical increase in income. We simulate these effects by the *Probability or expectation method*, i.e. we assign to each individual probabilities for each hours category (see Creedy and Duncan 2002) and thus for different income groups.

Then, we predict changes in relative employment shares of income groups due to changes in relative net incomes $c_i - c_{i-1}$ and $c_i - c_0$ (in practice we increase annual net income of hours choices associated with specific income groups by 10%) and calculate the mobility elasticities given by equations (11) and (12). The elasticities are reported in Table 2 in the next section.

4 Main Results

4.1 Solving for Weights

Table 2 shows average monthly individual gross incomes (column I) and corresponding average net incomes (column II) for the six income groups. As is apparent from the modest increase in net incomes from Group 0 to Group 1, the marginal transfer withdrawal rate is substantial in the status quo.

Column III shows the population share of each income group,[10] columns IV and V display the estimated extensive and intensive mobility elasticities. For Group 1, there is only one elasticity, see equations (11) and (12). Relatively few papers estimate Saez-style mobility elasticities. One is Bargain et al. (2014a), which reports elasticities for childless singles of similar magnitudes for

[10] In 2015, the unemployment rate was around 6.4%. By focusing only on working-age singles the unemployment rate is around 11% in our representative sample. Among other countries, Bargain et al. (2014a) apply the model to German data for the year 1998. In their sample, the share of those with a gross income of zero is 14%, which is slightly higher than in our sample.

several European countries as those we have obtained for Germany for the year 2015. For Germany (years 1998 and 2001) they obtain smaller intensive elasticities for groups 2-5 and somewhat larger participation elasticities for all groups than we do. In section 4.2 we show how the elasticities estimated in that paper impact the implied marginal social justness weights for the *absolute tax burden* approach.

Column VI shows relative weights μ_i/μ_0, i.e. marginal social justness weights divided by the weight for group 0, for the welfarist case. Recall that in the welfarist case $\mu_i = g_i$ such that the results are directly comparable to the literature. The last two columns show μ_i/μ_0 for the absolute and relative tax burden approach. The welfarist approach, column VI, is an application of Saez (2002) as, e.g., in de Boer and Jongen (2017) and Blundell et al. (2009). Group 0 has the highest social weight, the working poor (Group 1) have the lowest weight in line with previous studies mentioned in the introduction.

Table 2: Resulting Relative Weights for Different Justness Concepts

	I	II	III	IV	V	VI	VII	VIII
Group	Gross Income	Net Income	Share	η	ζ	Welfarist	Tax Burden Abs.	Tax Burden Rel.
0	0	625	0.11	—	—	1	1	1
1	1,137	949	0.19	0.08*	0.08*	0.29	0.50	0.50
2	2,082	1,452	0.17	0.10	0.08	0.38	0.19	0.65
3	2,697	1,755	0.19	0.09	0.07	0.37	0.13	0.72
4	3,472	2,170	0.17	0.07	0.06	0.41	0.10	0.95
5	5,458	3,257	0.18	0.05	0.08	0.39	0.06	1.31

Note: German single households without children; own calculations based on the SOEP and the STSM. Relative weights μ_i/μ_0.
*Overall elasticity of group one is 0.16.

The welfarist weights show the costs of redistributing one Euro from individuals in Group 0 to individuals in other groups. For instance, distributing one Euro uniformly from individuals in Group 0 to individuals in Group 1 would reduce income in Group 0 by only 0.29 Euros because individuals would move from Group 0 to Group 1, reducing the transfer burden of the state. At the optimum, the social planner is indifferent to small tax changes. Thus, if the current tax schedule is optimal, the social planner values increasing the income for Group 1 by one Euro 0.29 times as much as increasing the income of Group 0 by one Euro. The low weights for the working poor are related to the high marginal tax rate for individuals moving from Group 0 to Group 1.[11] Relative weights of the upper four income groups are close to each other, in line with previous findings for Germany by Bargain et al. (2014a).[12]

Column VII of Table 2 reports weights implied by the *absolute tax burden* approach. The negative marginal impact of taxes paid by a specific income group on the social planner's objective function increases with the tax liability of that group and with the weight the social planner attributes to this group. A comparison of the weights of tax-paying groups shows that the working poor have the highest weight, 0.5, and that the weights decrease with income. The social planner is indifferent between imposing a slight increase in the penalty $F_i(c_i, y_i)$ on the working poor and imposing four times this increase on the middle class (Group 3). This result follows from the fact that the working poor pay only a low amount of taxes in the first place. Tax increases for individuals with a low tax burden have a relatively small impact on the social planner's objective function, since she is more averse to high tax burdens under the *absolute tax burden* principle. Therefore, the increase in the penalty function from a tax increase for the working poor, which could be used to finance tax cuts for other groups, would be small. A relatively high marginal social justness weight is required for the social planner to be indifferent to a tax increase for this group. According to this principle, the social planner appears to be inequality averse. In contrast, in the welfarist case, high marginal tax rates and labor supply responses imply a high efficiency cost of taxes reflected by a low weight. Consequently, the *absolute tax burden* principle with decreasing subjective weights is in line with the 2015 German tax and transfer system.

Column VIII reports results for the *relative tax burden* principle. In contrast to the *absolute tax burden* principle, weights for groups 1-5 are increasing with income, not decreasing. The intuition is similar as for the *absolute tax burden* principle. Top income earners have relatively high weights according to the *relative tax burden* principle, because the tax paid is divided through a high gross income. In fact, the working poor have the lowest weight according to this principle as one would have to redistribute much less to members of this group than to members of other groups in order to reduce the penalty function. In other words, like the average tax rate itself, the

[11] *Ceteris paribus*, higher elasticities and higher marginal tax rates imply a position further to the right of the Laffer curve and thus lower social weights.

[12] For comparison, Table B.5 in Appendix B shows the optimal welfarist tax schedule with welfarist weights decreasing with income. The resulting optimal tax schedule implies a substantially lower marginal transfer withdrawal rate for the working poor than in the status quo and higher net incomes for groups 1, 2, and 3. This shows that decreasing welfarist weights would imply lower transfer withdrawal rates.

penalty is concave in gross income in this case. Thus, the 2015 German tax and transfer system does not imply decreasing social weights and thus an inequality averse social planner under the *relative tax burden* principle.

In sum, we find that the *absolute tax burden* principle is in accordance with declining social weights in the status quo. Thus, the minimization of the weighted sum of an increasing function of the tax liability combined with some degree of inequality aversion might be a good description of the aims of German society regarding the tax and transfer system. In Online Appendix A we show separate results for women and men and for East and West Germany. The main results hold.

4.2 Cross-Country Analysis

To verify that our results for Germany hold for other countries, we build on previous results in Bargain et al. (2014a, Tables 1 and 3), who report marginal welfare weights as well as average gross incomes and disposable incomes for childless singles in 17 European countries and the United States of America. Their analysis covers the policy year 2005 for the United States of America, 1998 and/or 2001 for the EU-15 except Luxembourg, and 2005 for Estonia, Hungary, and Poland. Data used cover different years, from 1995 to 2001, depending on the country. We use their estimates to calculate marginal social justness weights based on the absolute tax burden approach as $\mu_i = g_i / f_i$.[13] We refer the reader to Bargain et al. (2014a, Tables 3 and 4) for estimated labor supply elasticities and marginal tax rates. Bargain et al. (2014a) obtain marginal welfare weights from a positive optimal taxation exercise. Then they calculate the degree of inequality aversion implied by different countries' redistributive systems by estimating a function of the marginal welfare weights that approximates the redistributive taste of the social planner. While they find some degree of inequality aversion for all countries, this result is mainly due to large marginal welfare weights for the unemployed. In fact, marginal welfare weights do not decrease strictly with income in any of the countries in the sample; even for the top 3 income groups marginal welfare weights are never decreasing.

[13] We calibrate θ such that the weight of Group 0 is twice that of Group 1. For Belgium and Germany, Bargain et al. (2014a) report marginal welfare weights of zero and for Denmark, Ireland, Sweden, and Hungary they report disposable incomes that exceed gross incomes for Group 1. For these countries we calibrate θ such that the weight of Group 0 equals twice that of Group 2. Note that, as in the previous analysis, we are mainly interested in the weights of groups with positive gross income relative to one another. For some countries, Bargain et al. (2014a) report gross and disposable incomes for two years. Here we take the averages over the two years. For Estonia, gross income equals net income in group 1, such that f_i equals zero. For simplicity, we set gross income of this group one Euro higher.

Table 3: Relative Weights for the *Absolute Tax Burden* Approach for Various Countries

	Group						Weights decreasing
	0	1	2	3	4	5	from group
Austria	1.00	0.50	0.17	0.11	0.09	0.05	0
Belgium	1.00	0.00	0.50	1.02	0.51	0.49	3
Denmark	1.00	0.24	0.50	0.32	0.26	0.17	2
Finland	1.00	0.50	0.05	0.04	0.03	0.01	0
France	1.00	0.50	0.13	0.10	0.07	0.04	0
Germany	1.00	0.00	0.50	0.35	0.30	0.20	2
Greece	1.00	0.50	0.27	0.20	0.12	0.04	0
Ireland	1.00	8.00	0.50	0.81	0.40	0.25	3
Italy	1.00	0.50	0.07	0.07	0.04	0.04	3
Netherlands	1.00	0.50	0.04	0.04	0.03	0.02	0
Portugal	1.00	0.50	0.28	0.17	0.08	0.03	0
Spain	1.00	0.50	0.12	0.10	0.05	0.03	0
United Kingdom	1.00	0.50	0.71	0.62	0.47	0.27	2
Sweden	1.00	0.00	0.50	1.15	0.79	0.60	3
Estonia	1.00	0.50	0.03	0.02	0.01	0.01	0
Hungary	1.00	1.71	0.50	0.17	0.08	0.03	2
Poland	1.00	0.50	-0.04	0.12	0.14	0.09	4
United States	1.00	0.50	0.11	0.06	0.04	0.02	0

Note: Weights calculated based on estimates for various countries in Bargain et al. (2014a). Parametrization: $\gamma = 2$; θ such that weight of Group 0 is twice the weight of Group 1, except for Belgium, Germany, Denmark, Ireland, Sweden, and Hungary, where the weight for Group 0 is calibrated to twice that of Group 2.

In contrast, we obtain strictly decreasing weights, i.e., weights that decrease starting from group 0, for the *absolute tax burden* approach for half of the countries in the sample (Table 3; Austria, Finland, France, Greece, the Netherlands, Portugal, Spain, Estonia, and the United States of America). Even in the group of countries with weights not declining throughout, we obtain decreasing weights for Groups 2-5 for Denmark, Germany, the United Kingdom, and Hungary. For these countries, marginal welfare weights for the working poor in group 1 reported in Bargain et al. (2014a) are either extremely low or, in the case of Hungary, of similar magnitude as the marginal welfare weights for the other income groups. For Germany, Bargain et al. (2014a) report a marginal welfare weight of zero for Group 1. The reason is the relatively high participation tax rate in combination with a high estimated labor supply elasticity of 0.38 for this group, the fourth highest in their sample of 18 countries.[14] Further, we obtain decreasing weights for Groups 3-5 for Belgium, Ireland, Italy, and Sweden. For these countries Bargain et al. (2014a) obtain low marginal welfare weights for Group 2 because marginal tax rates or labor supply elasticities are relatively high for this group. Weights based on the *absolute tax burden* approach are non-decreasing for the top 3 income groups only in Poland. This is the only country, for which Bargain et al. (2014a) report that the tax schedule is partially on the right-hand side of the Laffer curve, implying a negative marginal social welfare weight of Group 2.

For many countries, for instance, for the United States, Bargain et al. (2014a) report virtually constant marginal welfare weights across groups 1-5. In contrast, we obtain decreasing weights over all income groups for the United States. We conclude that, in contrast to the standard welfarist approach, tax-transfer system in a large group of European countries and the United States can be rationalized with the *absolute tax burden* approach and decreasing weights for most income groups.

5 Alternative Beliefs of the Social Planner

5.1 Justness Functions for the Inequality Neutral Planner

In this subsection we solve for the values of γ and θ (see equations (6) and (8)) that minimize the sum of squared deviations of relative weights μ_i/μ_0 from one and calculate the corresponding values of the relative weights. The aim of this exercise is to show whether the *absolute* or *relative tax burden* principles can be calibrated such that they are approximately in line with an inequality neutral social planner, i.e., one who simply aims at reducing relative or absolute tax burdens, independent of the income group.

The function parameters that minimize the sum of squared deviations of relative weights from one can be estimated using nonlinear least squares. To this end, start with equation (1) and divide both sides through the marginal social justness weight of Group 0, μ_0, to obtain relative weights,

$$\frac{g_i}{\mu_0} = \frac{\mu_i f_i}{\mu_0}. \tag{16}$$

Use equation (1) to substitute μ_0 for g_0/f_0 on the left-hand side of equation (16), define $\mu_i/\mu_0 \equiv 1 + \varepsilon_i$, and rearrange to obtain

$$1 = \frac{g_i f_0}{g_0 f_i} - \varepsilon_i. \tag{17}$$

[14] The only other country with such a combination of high participation tax rate and high labor supply elasticity is Belgium, were the marginal welfare weight of Group 1 is zero too.

Social marginal welfare weights g_i are the ones obtained in Section 4.1. Estimating equation (17) by nonlinear least squares yields the parameter values of the parameters of function F that minimize the sum of squared deviations of μ_i/μ_0 from one. The number of observations equals the number of groups $I+1$. For the *absolute* and *relative tax burden* principles, γ is identified through groups that pay net taxes. If the parameter is larger than one, the social planner is increasingly averse to increasing taxes for a specific group, the higher their absolute or relative tax liability, respectively. In principle, δ and θ are identified through groups that receive net transfers, see equations (6) and (8). As only Group 0 receives net transfers in our main sample, only one of these parameters can be estimated. We set $\delta = 1$ and estimate θ. As these parameters just scale the weight of Group 0 relative to that of the other groups, setting θ and estimating δ would yield the same parameter estimates for γ and the same values for the relative weights.

Table 4: Estimation of Function Parameters

	I	II	III	IV
Group	Gross Income	Net Income	Tax burden Abs.	Tax burden Rel.
0	0	625	1.00	1.00
1	1137	949	0.96	1.08
2	2082	1452	1.06	0.80
3	2697	1755	1.00	0.78
4	3472	2170	1.05	0.96
5	5458	3257	0.93	1.24
γ			1.13	2.93
θ			7.30	3.71
c_v			0.05	0.18

Note: German single households; own calculations based on the SOEP and the STSM. Relative weights μ_i/μ_0. c_v denotes the coefficient of variation of relative weights.

Table 4 shows the resulting relative weights as well as the estimated function parameters. Two observations are worth noting. First, for both the *absolute* and the *relative tax burden* principle, quadratic deviations of relative weights from one are minimized with $\gamma > 1$. Thus, the pay-off of decreasing taxes for a specific group in terms of the social planner's objective function is increasing with the tax burden. Under the *relative tax burden* principle, with $\gamma = 2.93$ it would be relatively inexpensive to increase F_2 and F_3 implying relatively low weights for groups 2 and 3. For groups 4 and 5 it becomes more expensive to do so, implying higher weights at relatively high incomes. Second, the weights according to the *absolute tax burden* principle are much closer to one than those according to the *relative tax burden* principle, their coefficients of variation (c_v) are 0.05 and 0.18. Thus, even though only one parameter, γ, determines the magnitude of weights of the five net tax-payer groups relative to one another, the *absolute tax burden* principle can be calibrated such that it is very much in line with a social planner who puts the same weight on every income group and is thus inequality neutral.

5.2 Sensitivity to Parameters

We analyze the robustness of the obtained social weights reported in Section 4.1 for the *absolute tax burden* principle to different values of γ (Table B.1 in the Online Appendix B). As in the main application, we calibrate θ such that the weight of Group 1 is 0.5. As before, keep in mind that there is only one group that consists of net transfer recipients. Therefore, changing δ has no impact on results as long as θ is calibrated in this way. The result that social weights decline with income is robust to a wide range of calibrations of γ. Table B.2 in the Online Appendix reports results for the *relative tax burden* principle for different values of γ. The *relative tax burden* principle can rationalize the current tax schedule with decreasing weights only when calibrating γ to very high values, which imply a quickly increasing distaste for high average tax rates. For instance, with $\gamma = 7$, the penalty on the social planner's objective function of an average tax rate of 0.3 is 17.1 times as large as that of an average tax rate of 0.2. With $\gamma = 2$, the penalty of an average tax rate of 0.3 is 2.25 times as large as that of an average tax rate of 0.2. In an additional exercise, we set the intensive and extensive elasticities of all groups to 0.1 and show the results for all concepts of justness (Table B.3 in the Online Appendix B). The results are very close to the main results. This shows that the main result is not driven by the parameter choice and elasticities.

6 Conclusion

In this paper, we reconcile a puzzling contrast between current tax transfer practice in many countries and the common approach in the optimal taxation literature. The literature commonly assumes some degree of inequality aversion, where the social planner values an additional unit of income for poor households more than an additional unit of income for higher income households. The widely observed high transfer withdrawal rates, however, are only optimal if social weights of the working poor are very small. A potential explanation for this discrepancy is that societies are averse to very high tax burdens. This view is in line with survey evidence according to which respondents believe that individuals are to some degree entitled to their market income. We show that the current German tax transfer system is optimal if the social planner is both inequality averse and increasingly averse to increasing taxes for those with a high tax burden.

To this end, we formulate the problem of a social planner for two distinct concepts of justness: the welfarist approach, where the social planner maximizes the weighted sum of utility; alternatively, the tax burden concept where the social planner minimizes the weighted sum of increasing functions of absolute or relative tax liabilities. The latter concept formalizes the ideas that taxes for groups with already high tax liabilities should rather not be increased further. This point is often made in public debates but does not follow from classical welfarist considerations. In our approach these concepts are captured by loss functions that impose a penalty on the social planner's objective function, which increases with the tax liability. This penalty is then weighted with a subjective weight, which might capture other concerns of the social planner such as inequality aversion. Decreasing weights for the *absolute tax burden* approach imply that the social planner is wary of increasing the tax burden for those who already pay a lot of taxes—but less so, the higher their net income. Of course, all approaches maintain budget neutrality and account for labor supply reactions.

Like the existing literature, we find that the 2015 German tax and transfer system implies very low marginal social welfare weights for the working poor according to the welfarist criterion. The social planner values redistributing one Euro to the working poor 0.75 times as much as increasing the income of top earners by one Euro. This implies that marginal consumption for the working poor is valued less than marginal consumption of top income earners.

In contrast, the current tax-transfer practice can be reconciled as optimal and in line with decreasing social weights under the *absolute tax burden* principle, under which the social planner minimizes a function that puts an increasing penalty on tax liabilities. In this case, the social planner is indifferent between a slight increase in the tax burden penalty function for the working poor and imposing four times this additional increase in the loss function on the middle class. This result implies both a reluctance to increase taxes for those with a high tax burden and some degree of inequality aversion. In addition, we build on previous estimates by Bargain et al. (2014a) and show that the *absolute tax burden* approach is consistent with an inequality averse social planner in the United States of America as well as several European countries. In contrast, the welfarist approach does not imply strictly decreasing weights for any of these countries.

A mixed objective of the social planner is in line with the result of a survey by Saez and Stantcheva (2016), where both net income and the current tax liability play a role for whether respondents deem someone worthy of a tax break. Policy makers who respect gross incomes as reference points of tax payers are a potential explanation for a tax-transfer schedules that are only optimal if tax liabilities play a role. Experimental evidence (Charité et al. 2015) suggests that individuals respect reference points of the wealthy when choosing tax schedules, which limits redistribution even in the absence of moral hazard. The welfare implications of this finding are not clear-cut. On the one hand, a non-welfarist tax schedule might simply be thought of as being caused by bias on the side of policy makers. Then the tax-transfer system should be reformed to more closely resemble one implied by the welfarist optimal taxation literature. On the other hand, citizens might actually prefer a tax system that respects gross incomes as reference points. In that case, the status quo is preferable.

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Appendix

A Optimal Tax Formulae in the General Model

Behavioral reactions imply that h_i changes in case of a change in T_i. Using the product rule and assuming that marginal movers do not impact the objective function, the first order condition with respect to T_i is obtained as

$$\int\limits_M G'_m d\nu(m) = \lambda \left(h_i - \sum_{j=0}^{I} T_j \frac{\partial h_j}{\partial c_i} \right), \tag{18}$$

where λ is the multiplier of the budget constraint. Reorganizing (18) and using the definition (3) yields

$$(1-g_i)h_i = \sum_{j=0}^{I} T_j \frac{\partial h_j}{\partial c_i}. \tag{19}$$

The assumption of no income effects implies that only h_{i-1}, h_i, h_{i+1}, and h_0 change when T_i changes. If we assume that h_i can be expressed as a function depending on the difference to the the adjacent income groups and the unemployed $h_i(c_{i+1}-c_i, c_i-c_{i-1}, c_i-c_0)$, equation (19) simplifies to

$$\begin{aligned}(1-g_i)h_i &= T_0 \frac{\partial h_0}{\partial(c_i-c_0)} + T_i \frac{\partial h_i}{\partial(c_i-c_0)} - T_{i+1} \frac{\partial h_{i+1}}{\partial(c_{i+1}-c_i)} - T_i \frac{\partial h_i}{\partial(c_{i+1}-c_i)} \\ &+ T_i \frac{\partial h_i}{\partial(c_i-c_{i-1})} + T_{i-1} \frac{\partial h_{i-1}}{\partial(c_i-c_{i-1})}.\end{aligned} \tag{20}$$

Using the facts that $\frac{\partial h_i}{\partial(c_i-c_0)} = -\frac{\partial h_0}{\partial(c_i-c_0)}$, $\frac{\partial h_{i+1}}{\partial(c_{i+1}-c_i)} = -\frac{\partial h_i}{\partial(c_{i+1}-c_i)}$, and $\frac{\partial h_i}{\partial(c_i-c_{i-1})} = -\frac{\partial h_{i-1}}{\partial(c_i-c_{i-1})}$, we can write after rearranging

$$(1-g_i)h_i = (T_i-T_0)\frac{\partial h_i}{\partial(c_i-c_0)} - (T_{i+1}-T_i)\frac{\partial h_{i+1}}{\partial(c_{i+1}-c_i)} + (T_i-T_{i-1})\frac{\partial h_i}{\partial(c_i-c_{i-1})}. \tag{21}$$

Using the definition of the elasticities (11) and (12), we obtain for each group after reorganizing

$$\frac{T_i-T_{i-1}}{c_i-c_{i-1}} = \frac{1}{\zeta_i h_i}\left\{(1-g_i)h_i - \eta_i h_i \frac{T_i-T_0}{c_i-c_0} + \zeta_{i+1}h_{i+1}\frac{T_{i+1}-T_i}{c_{i+1}-c_i}\right\}. \tag{22}$$

Note that, by setting $\psi_0 = \psi_i = 0$, we obtain the Laffer-condition

$$\frac{T_i-T_{i-1}}{c_i-c_{i-1}} = \frac{1}{\zeta_i} + \frac{\zeta_{i+1}h_{i+1}}{\zeta_i h_i}\frac{T_{i+1}-T_i}{c_{i+1}-c_i} - \frac{\eta_i}{\zeta_i}\frac{T_i-T_0}{c_i-c_0}. \tag{23}$$

Substituting the equivalent of (22) for the next group $i+1$ in (22) and simplifying gives

$$\begin{aligned}\frac{T_i-T_{i-1}}{c_i-c_{i-1}} &= \frac{1}{\zeta_i h_i}\Bigg\{(1-g_i)h_i + (1-g_{i+1})h_{i+1} \\ &\quad -\eta_i h_i \frac{T_i-T_0}{c_i-c_0} - \eta_{i+1}h_{i+1}\frac{T_{i+1}-T_0}{c_{i+1}-c_0} + \zeta_{i+2}h_{i+2}\frac{T_{i+2}-T_{i+1}}{c_{i+2}-c_{i+1}}\Bigg\}.\end{aligned} \tag{24}$$

Recursive insertion and simplifying gives the I formulae (13) that must hold if function (2) is optimized.

B Optimal Welfarist Tax Schedule

Table B.5 shows the optimal welfarist tax schedule, where, following Saez (2002), implicit welfare weights are set according to the formula

$$g_i = \frac{1}{\lambda c_i^{0.25}} \tag{25}$$

and the shares of income groups are determined endogenously by

$$h_i = h_i^0 \left(\frac{c_i - c_0}{c_i^0 - c_0^0} \right)^{\eta_i}, \tag{26}$$

where the superscript 0 denotes values in the status quo. The simulation was done achieving budget neutrality and setting net income of Group 0 to the status quo, as a deviation from this is not politically feasible.

Table B.5: Optimal Welfarist Tax Schedule

Group	Gross Income	Net Income	Share	Optimal Net Income	Optimal Share	Welfarist Weight
0	0	625	0.11	625	0.09	1
1	1,137	949	0.19	1,260	0.20	0.84
2	2,082	1,452	0.17	1,629	0.17	0.79
3	2,697	1,755	0.19	1,837	0.19	0.76
4	3,472	2,170	0.17	2,047	0.17	0.74
5	5,458	3,257	0.18	2,826	0.18	0.69

Note: German single households; own calculations based on the SOEP and the STSM. Relative weights μ_i/μ_0.

Online Supplementary Material

A Results for Subsamples

To explore whether the 2015 tax transfer schedule was designed according to a particular concept of justness with focus on a specific group in mind, we split the sample into different groups. These groups differ substantially regarding the income distribution and elasticities, which might lead to different social weights.

First, the sample is split into females and males. We find that women have a more elastic labor supply than men and lower incomes (see Tables A.1 and A.2 in Appendix A). In the welfarist case, weights of working groups are higher relative to the unemployed for men than for women. This is caused by lower elasticities, which lead to men being further on the left of the Laffer curve. Nevertheless, the working poor again have the lowest weight in both samples. The finding that marginal social justness weights in the *absolute tax burden* case decrease with income holds for women and men as well. As in the welfarist case, the weight of the working poor is higher for men than for women because male elasticities are lower. Again, in the *relative tax burden* case, weights are broadly increasing with income.

Second, we present results for East Germans and West Germans, respectively. These two groups lived under different political systems for more than 40 years. As expected West Germans have higher incomes and less unemployment than East Germans (see Table A.4 and Table A.3 in Appendix A). The welfarist weights are highest for the unemployed and lowest for the working poor (Group 1 in the West, groups 1 and 2 in the East). The relative weights of the four (three for East Germany) higher income groups are very similar and higher than the weights for the working poor. As in our main findings, optimal marginal social justness weights under the *absolute tax burden* approach are decreasing in both samples.[15] This shows that the *absolute tax burden* principle with decreasing weights is in line with the 2015 German tax and transfer system for East and West Germans. Results for the *relative tax burden* principle show that weights are increasing with income in both East and West Germany.

As in the main sample, we find in all subsamples that the *absolute tax burden* principle is in accordance with declining social weights in the status quo. Therefore, we cannot find evidence

[15] Note that as Group 1 in East Germany consists of transfer net recipients, $f_0 = f_1$ (see equation (6)) for this group and thus the relative weight of Group 1 is the same as in the welfarist and *relative tax burden* cases.

that the 2015 tax transfer schedule was designed according to a particular concept of justness with focus on a specific group.

Table A.1: Resulting Relative Weights for Different Justness Concepts for Women without Children

	I	II	III	IV	V	VI	VII	VIII
Group	Gross Income	Net Income	Share	η	ζ	Welfarist	Tax Burden Abs.	Tax Burden Rel.
0	0	615	0.05	—	—	1.	1.	1.
1	976	872	0.19	0.09*	0.09*	0.13	0.41	0.22
2	1,903	1,331	0.20	0.12	0.10	0.17	0.09	0.20
3	2,548	1,705	0.19	0.10	0.10	0.20	0.08	0.29
4	3,342	2,079	0.23	0.07	0.10	0.18	0.05	0.31
5	4,948	3,011	0.15	0.06	0.12	0.18	0.03	0.44

Note: German single households; own calculations based on the SOEP and the STSM. Relative weights μ_i/μ_0.
*Overall elasticity of group one is 0.18.

Table A.2: Resulting Relative Weights for Different Justness Concepts for Men without Children

	I	II	III	IV	V	VI	VII	VIII
Group	Gross Income	Net Income	Share	η	ζ	Welfarist	Tax Burden Abs.	Tax Burden Rel.
0	0	627	0.15	—	—	1.	1.	1.
1	1,265	1,038	0.17	0.08*	0.08*	0.49	0.71	0.85
2	2,228	1,520	0.18	0.10	0.08	0.52	0.24	0.89
3	2,875	1,837	0.16	0.09	0.07	0.53	0.17	1.03
4	3,622	2,279	0.17	0.07	0.06	0.56	0.14	1.35
5	6,124	3,581	0.16	0.05	0.08	0.53	0.07	1.9

Note: German single households; own calculations based on the SOEP and the STSM. Relative weights μ_i/μ_0.
*Overall elasticity of group one is 0.10.

Table A.3: Resulting Relative Weights for Different Justness Concepts for East Germany

	I	II	III	IV	V	VI	VII	VIII
Group	Gross Income	Net Income	Share	η	ζ	Welfarist	Tax Burden	
							Abs.	Rel.
0	0	596	0.18	—	—	1.	1.	1.
1	774	851	0.17	0.10*	0.10*	0.30	0.30	0.52
2	1,581	1,222	0.18	0.16	0.08	0.34	0.28	4.18
3	2,200	1,594	0.17	0.13	0.08	0.41	0.21	5.91
4	2,808	1,920	0.14	0.11	0.07	0.43	0.15	6.78
5	4,039	2,625	0.16	0.09	0.08	0.40	0.08	8.15

Note: German single households; own calculations based on the SOEP and the STSM. Relative weights μ_i/μ_0.
*Overall elasticity of group one is 0.20.

Table A.4: Resulting Relative Weights for Different Justness Concepts for West Germany

	I	II	III	IV	V	VI	VII	VIII
Group	Gross Income	Net Income	Share	η	ζ	Welfarist	Tax Burden	
							Abs.	Rel.
0	0	653	0.08	—	—	1.	1.	1.
1	1,408	1,072	0.21	0.07*	0.07*	0.27	0.26	0.46
2	2,324	1,549	0.16	0.09	0.08	0.32	0.13	0.65
3	2,907	1,857	0.19	0.08	0.08	0.32	0.10	0.74
4	3,699	2,321	0.19	0.06	0.06	0.35	0.08	1.01
5	6,010	3,519	0.17	0.05	0.08	0.32	0.04	1.36

Note: German single households; own calculations based on the SOEP and the STSM. Relative weights μ_i/μ_0.
*Overall elasticity of group one is 0.14.

B Sensitivity Checks

Table B.1: Resulting Relative Weights for Absolute Tax Burden for Different Values of γ ($\delta = 1$)

	I	II	III	IV
Group	$\gamma = 1.5$	$\gamma = 2$	$\gamma = 3$	$\gamma = 5$
0	1	1	1	1
1	0.50000	0.50000	0.50000	0.50000
2	0.35453	0.19367	0.05779	0.00515
3	0.28695	0.12819	0.02558	0.00102
4	0.26735	0.10159	0.01467	0.00031
5	0.19446	0.05683	0.00485	0.00004

Note: German single households; own calculations based on the SOEP and the STSM. Relative weights μ_i/μ_0. Values for θ : 35; 649; 182482; 1.075×10^{10}; see Section 2.2, paragraph *parametrization*.

Table B.2: Resulting Relative Weights for Relative Tax Burden for Different Values of γ ($\delta = 1$)

	I	II	III	IV
Group	$\gamma = 1.5$	$\gamma = 2$	$\gamma = 6$	$\gamma = 7$
0	1	1	1	1
1	0.500	0.500	0.500	0.500
2	0.878	0.649	0.058	0.032
3	1.048	0.721	0.036	0.017
4	1.427	0.947	0.036	0.016
5	2.045	1.310	0.037	0.015

Note: German single households; own calculations based on the SOEP and the STSM. Relative weights μ_i/μ_0. Values for θ : 35; 649; 182482; 1.075×10^{10}; see Section 2.2, paragraph *parametrization*.

Table B.3: Resulting Relative Weights for Different Justness Concepts with Elasticities set to 0.1

	I	II	III	IV	V
Group	η	ζ	Welfarist	Tax Burden	
				Abs.	Rel.
0	—	—	1	1	1
1	0.1*	0.1*	0.22	0.50	0.50
2	0.1	0.1	0.33	0.22	0.76
3	0.1	0.1	0.32	0.14	0.81
4	0.1	0.1	0.33	0.11	1.02
5	0.1	0.1	0.31	0.06	1.38

Note: German single households; own calculations based on the SOEP and the STSM. *Overall elasticity of group one is 0.2. Relative weights μ_i/μ_0. Values for θ : 847.46 (abs. tax burden) and 2.27 (rel. tax burden); see Section 2.2, paragraph *parametrization*.