Charitable Giving in the German Welfare State: Fiscal Incentives and Crowding Out

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Charitable Giving in the German Welfare State: Fiscal Incentives and Crowding Out

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Abstract

Governmental activities in welfare states influence private charitable giving predominantly in two ways: (1) government spending on the provision of public goods may cause crowding out of private charitable contributions; and (2) tax incentives may boost private charitable giving. For a rich sample of German income tax returns, we estimate elasticities of charitable giving regarding tax incentives, income and governmental spending. Using censored quantile regression, we are able to derive results for different points of the underlying distribution of charitable giving. Assuming a world with impure altruism (Andreoni 1990), we find evidence for impurely altruistic giving behaviour. Taking crowding out into account, tax deductibility of charitable giving suffices to foster private giving to offset foregone tax revenues.

Key words: Charitable giving, crowding out, price and income elasticity, censored quantile regression, income tax return data

JEL codes: C31, H31, H53

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1 Introduction

In numerous economies, the provision of public goods like education, research, and culture relies on private contributions as well as on government spending. Thus, in order to encourage private funding, donations benefit from a favorable tax treatment in many countries. In addition, public-private co-funding of public goods might counteract these efforts as government spending addresses the issue of crowding out private contributions. Against this background, assessing the overall efficiency of tax treatment is therefore of critical interest to public policy. On that account, the last decades have seen a lively interest in the analysis of charitable giving among tax policy makers and researchers.

The scale to which tax incentives are suitable to boost donation depends whether they are price elastic and to what extent. Hence, estimating price and income elasticities of giving are useful to evaluate the effectiveness of tax reliefs and if they are eligible to offset forgone tax revenues, which could have been used to provide public goods directly (Feldstein 1980). Empirical evidence on this matter is not conclusive. Following Taussig's (1967) seminal study analysing US tax return data, numerous approaches were conducted. The review of 69 studies covering five decades Peloza and Steel (2005) led to ambiguous findings on price elasticity of giving due to heterogeneous data sources, the statistical methods applied and different periods under observation. In sum, their meta-analysis supports the hypothesis that tax deductions for charitable giving are treasury efficient. However, more recent studies have provided a different picture. Based on panel data, they find that previous studies might have overestimated price elasticity (Bakija and Heim forthcoming) or even that giving behaviour qualifies as price inelastic (Fack and Landais 2010).

The crowding out of private funding for a public good due to public spending is a well-developed field (e.g. Abrams and Schmitz 1978, Nyborg and Rege 2003). Theoretical framework provided by Samuelson (1954) with rational agents shows an under-provision of the public good. Moreover, the share of people contributing to the public good is decreasing in the number of agents, while government spending will completely crowd out private contributions. However, introducing the possibility to allow individuals to derive utility from the act of giving per se, leads to the impure altruism model of Andreoni (1990) and in this setting, government spending not necessarily results in a complete crowding out. In addition, incomplete crowding out also occurs in case of fiscal illusion or an endorsement effect (Eckel et al. 2005). The setting of incomplete crowding out is supported by empirical findings. Findings cover a wide range from 28 per cent (Abrams and Schmitz 1984) to 71 per cent (Andreoni 1993), whereas experiments show that (depending on the chosen set up) complete crowding out is possible (Eckel et al. 2005). Looking into the motives of giving, Crumpler and Grossman (2008) find that warm glow giving exists and that its magnitude is significant.

Overall, empirical research on giving behaviour has produced ambivalent results depending on the year and source of underlying data and econometric methods. The current study provides new empirical evidence on three key aspects of assessing whether this treatment of donations is efficient: estimates for income elasticities, price elasticities, and crowding out of private charitable contributions are provided for Germany. Deploying a rich sample of income tax return data for 1998, 2001 and 2004, we follow Fack and Landais (2010) in applying a non-parametric estimation technique of quantile regression to derive estimates at different points of the conditional distribution of charitable giving. In short, our approach is not restricted to answering whether current tax incentives are eligible to foster charitable giving but also aims at determining for whom tax incentives matter most. Therefore, the current study complements former research in two ways. First, the estimation technique helped us to establish estimates on income and price elasticities derived for the German case. Second, for the first time crowding out is introduced in this kind of econometric setting. The remainder of the article is organised as follows: in Section 2, the conceptual framework is discussed shortly. Section 3 describes the data and its preparation. Section 4 presents the main results for almost three million tax units. Section 5 concludes by reviewing key findings.

2 Conceptual framework

2.1 Impure altruism, crowding out and efficient design of tax incentives

The optimal theoretical design of tax incentives to encourage charitable giving depends on the modelling of philanthropy. As empirical evidence dissents the hypothesis of pure altruism regarding donations to charity, we start out assuming a world according to Andreoni's (1990) impure altruism model to define our efficient benchmark. In this world, individuals may not only derive utility from a public good G but also from the individual's contribution to the public good g_i. Three cases of altruistic behaviour can be distinguished: (1) Individuals are pure altruists and do not care for their individual contribution and g_i does not enter utility. (2) Individuals are only driven by warm-glow. Consequently, G is not part of individual utility. (3) Individuals derive utility from G and g_i and are considered impure altruists.

To evaluate the effectiveness of tax incentives in a theoretical framework with crowding out and warm glow, we turn to Saez (2004). In this framework the effectiveness of tax incentives can be easily evaluated. Assuming gross incomey_i to be derived from wealth w_i and earnings e_i, where the latter enters the utility function negatively to reflect that labor supply is costly. In this framework, individuals maximise

$$\max u_i = u(c_i, g_i, e_i, G) \qquad (1)$$

subject to the constraint

$$c_i + g_i p_i \leq y_i - T(x_i) + R \qquad (2)$$

Governmental activity is expressed by individual (proportional) taxes $T(x_i)$, tax price of giving p_i and a lump sum payment R. The tax price of giving mirrors the tax incentives. In the German case, the tax price of giving is $1 - \frac{\partial T(x_i)}{\partial x_i}$ where x_i denotes the tax unit's taxable income. In absence of any further deductions but donations, taxable income is defined as $x_i = y_i - g_i$. Furthermore, let the public good be co-financed by government spending G^{gov} and private donations $G^{prv} = \sum g_i$ such that

$$G = G^{gov} + G^{prv} \qquad (3)$$

We assume that the number of individuals is sufficiently large and G is fixed from an individual perspective. Hence, the individual private contribution is a function $g_i = g(y_i - T(x_i), p_i, R, G^{gov})$. For a given set of tax parameters, the crowding out of private contribution due to an increase in G^{gov} is $\frac{\partial g_i}{\partial G^{gov}} \leq 0$. If $\frac{\partial g_i}{\partial G^{gov}} > -1$, crowding out is incomplete. Next to impure altruism, other reasons like fiscal illusion or the endorsement effect (Eckel et al. *2005*) may induce incomplete crowding out. Fiscal illusion means that contributors are not aware of governmental welfare spending, resulting in a partial to zero crowding out effect, whereas an endorsement effect describes that individuals give (more) to charity because they are unaware of governmental transfers to the specific charity organisation. Furthermore, g_i is considered to be a normal good with $\frac{\partial g_i}{\partial y_i} > 0$ and $\frac{\partial g_i}{\partial p_i} < 0$.

Saez makes three assumptions in order to derive a convincing rule for assessing the tax treatment of charitable giving. (1) Increasing the lump sum payment R does not affect individual labour supply and thus has no income effect. (2) Aggregate earnings are not affected by the level of G and the tax rate on contributions. (3) While holding utility constant, compensated supply of contributions is not affected by the tax rate on earnings.

Under the assumptions (1)-(3), the optimal tax treatment of individual charitable giving is determined by the price elasticity of charitable giving:

$$\eta_i^p = \frac{\partial g_i}{\partial p_i}\frac{p_i}{g_i} = -\left(1 + \frac{\partial g_i}{\partial G^{gov}}\right) \qquad (4)$$

In absence of crowding out, the rule for assessing the effectiveness of tax incentives simplifies and corresponds to Feldstein's (1975) approach of 'treasury efficiency', indicating that the tax-defined price elasticity greater than one (in absolute value) offsets each dollar of tax revenue forgone and adds more than one dollar to the total spending.

If η_i^p is below one, tax incentives are not eligible to offsets forgone tax revenues. The rule derived in this framework allows the determination for each individual whether tax incentives should be increased or decreased. If tax policy makers were be able to query the individual tax price elasticities of giving, optimal tax incentives could be identified for each individual. However, this assumption is not realistic. If private charitable contributions are crowded out by governmental expenditures ($\frac{\partial g_i}{\partial G^{gov}} < 0$), the rule for optimal tax incentives will relax. In presence of crowding out, tax incentives are treasury efficient if $\eta_i^p$is lower than one in absolute value. Considering crowding out, it is important to determine the impact of public expenditures on individual giving behaviour. According to Abrams and Schmitz (1978), government expenditure absorbs private action of individuals and relieves them from their social responsibility of contributing. Moreover, governmental transfers based on tax revenues lower the taxpayers' disposable incomes and thus their willingness to contribute. To capture the influence of governmental social transfers on charitable giving, we construct G^{gov} encompassing information on governmental spending for different cultural and social purposes.[1]

2.2 Econometric methodology

Modelling charitable giving requires taking different econometric problems into account (e.g. heavy left-censoring and heterogeneity). They have important implications for determining the correct estimation strategy. Since a high fraction of tax units does not donate at all, tax return data contains corner solution responses for a nontrivial fraction of observations. In contrast to previous studies, we do not exclude censored observations from our samples. According to Randolph (1995), excluding censored data raises the issue of endogenous selection. Non-giving tax units can be easily included in our model by assigning a fictitious gift to all taxpayers who report no giving. Boskin and Feldstein (1977) discuss adjustments of charitable giving for econometric purposes. In order to obtain a tax price of giving for non-itemisers, they propose an assignment of 1 unit (1 € in prices of 2004).[2] This marginal data modification is reasonable since estimated price and income elasticities refer to marginal changes.

[1] See Section 3 for further details.

[2] The amount chosen is arbitrary. However, in a log specification 10 units will severely distort estimated giving behaviour. An addition of 1 units leads to a quite steep logarithmic transformation and yields high tax price elasticity for taxpayers who report no giving.

According to Feldstein and Lindsey (1981) and Fack and Landaise (2010), we allow price and income elasticities to depend on the amount given to charity. Therefore, modelling giving behaviour as homogeneous among tax units is too restrictive. We adopt a loose econometric specification, which allows for heterogeneous behavioural responses and covariates to influence the conditional distribution of the dependent variable.[3]

Quantile regression was first introduced by Koenker and Bassett (1978). It is a non-parametric estimation technique. Quantile regression allows for covariates to shift location, scale and shape of the distribution of the dependent variable. Moreover, the assumption of the unobservable error term to be normally distributed with $\varepsilon \sim N(0, \sigma^2) = 0$ is not needed, but only the much lesser constraint of being white noise with $E[\varepsilon] = 0$. It is assumed that the conditional quantile functions vary in the underlying quantile of the dependent variable. The θ-th quantile of the distribution of the dependent variable is a linear function of covariates $\mathbf{X}$ and can be expressed as:

$$Q_{g|\mathrm{X}}(\theta) = \mathrm{X}_i'\beta(\theta) \qquad (5)$$

$\mathbf{X}_i'$ is a matrix and includes continuous explanatory variables such as price, p_i, adjusted gross income,y_i, and government funding, G^{gov}. Both the dependent variable donations (g_i) and the explanatory variables are expressed as logs. Therefore, the estimated coefficients can be interpreted as elasticities. To control for socio-demographic variables, we include dummy variables for age, children, church membership, employment status and marriage. To control for differences in giving behaviour between the years, we include dummy variables indicating observations from 1998, 2001 and 2004. Table 1 gives an overview how variables included in our econometric equation are coded.

[Table 1 about here]

According to Koenker and Hallock (2001), sample regression quantiles are defined as the solution to:

$$\min_{\beta} \sum_{i=1}^{n} \rho_\theta (g_i - \mathrm{X}_i'\beta) \qquad (6)$$

[3] An alternative approach focuses on log-log specification and assumes homogeneous giving behaviour (e.g. Feldstein and Taylor 1976). However, if ex-ante determination of homogenous of giving behaviour is required, it does not allow for varying price and income elasticities.

Different quantile functions are estimated by minimising an asymmetrically weighted sum of absolute errors where ρ_θ is the tilted absolute value function. For $\theta\,\theta$ = 0.5 the quantile regression estimator minimises the sum of absolute values of error. Censored data can be easily taken into account within this framework. Because of censoring, our dependent variable g_i is only partially observable. It is assumed that the latent variable

$$g_i^* = \omega_i'\beta + \varepsilon_i \tag{7}$$

is only observable for values above the censoring point g^0 with $g_i = g_i^*$ if $g_i^* > g^0$ and $g_i = g^0$ else. To account for heavy censoring with known censoring points and heterogeneous giving behaviour, we implement a simple and well-behaved three-step estimation procedure according to Chernozhukov and Hong (2002). Their approach provides an easily computable and robust estimator. The first step is to estimate a probability model:

$$\delta_i = pr(\mathrm{X}_i'\gamma) + u_i \tag{8}$$

to select a subset of observations with $\mathrm{X}_i'\beta(\theta) > 0$. δ_i indicates not-censored observations. We use a probit model to estimate the probability of giving. To identify our subset J_0, we include all observations where $pr(g_i^* > 0) = pr(\mathrm{X}_i'\hat{\gamma}) > 1 - \theta + c$, where c is a trimming constant between 0 and θ and accounts for the size of excluded observations. Chernozhukov and Hong (2002) propose to choose c such that $pr(\mathrm{X}_i'\hat{\gamma}) > 1 - \theta + c$ seems to be reasonable. We choose c =10$^{\text{th}}$ quantile of all $pr(\mathrm{X}_i'\hat{\gamma})$. The second step is to derive the initial (inefficient) estimator $\hat{\beta}_0(\theta)$ for J_0 by running quantile regression (7), which only asymptotically selects those observations with covariates such that $\mathrm{X}_i'\hat{\beta}(\theta) > 0$. The third step ensures efficiency of our estimates. Efficient estimates $\hat{\beta}_1(\theta)$ can be derived by running quantile regression (7) for a redefined sample J_1. It is the largest subset possible with observations such that $\mathrm{X}_i'\hat{\beta}(\theta) > 1 - \theta + c$ and $\mathrm{X}_i'\hat{\beta}_0(\theta) > 0$. Our final estimates are obtained as a solution to:

$$\min_\beta \sum_{i \in J_1}^{n} \rho_\theta(g_i - \mathrm{X}_i'\beta) \tag{9}$$

3 Data and data processing

All information generated in the process of taxation is documented in the tax unit's income tax return. It contains all relevant information on the family situation, the declaration of income from different sources, granted deductions and exemptions, calculation of taxable income and personal income tax payment.

In each year of assessment, roughly 30 million tax units file income tax returns. For every third year, starting in 1992, the German Federal Statistical Office assembles the official income tax returns electronically as *Income Tax Statistic*. Available in form of scientific-use-files are years 1998, 2001 and 2004, drawn as 10% stratified random samples from all filed income tax returns in the respective assessment year.[4] Hence, scientific-use-files contain about 3 million tax units per year stripped of identifying information. The three scientific-use-files form our database. In the course of stripping the data of identifying information, knowledge is limited to some tax units with high gross income. Therefore, these cases are excluded from our database. Our analysis considers only cases with a positive taxable income and complete information regarding socio-demographic variables.

The German Tax Code contains a blanket allowance for personal expenses. For every tax unit, we identify whether deductions are itemised or are below the blanket allowance. Tax units that do not itemise, are assigned a tax-defined price of giving of 1 €. For non-itemizers, there is no fiscal incentive to give. We must also account for another subpopulation of tax units. The subpopulation of *borderline itemizers* is excluded from our sample. *Borderline itemizers* are tax units who exceed their blanket allowance just because of their charitable contributions. Then, charitable contributions can be at least partially deducted from taxable income.

However, calculatingp_i, based on $\frac{\partial T(x_i)}{\partial x_i}$ for the first Euro given, leads to p_i = 1 for *borderline itemizers*. p_i = 1 implies that there is no fiscal incentive to give at all. Thus, p_i = 1 is no valid measure of tax incentives for *borderline itemizers*. In order to avoid distorted price elasticities, *borderline itemizers* are not included in our sample.

When interpreting $1 - \frac{\partial \mathrm{T(x_i)}}{\partial \mathrm{x_i}}$ as a measure for tax-defined prices of giving, a brief discussion about endogeneity is needed. Endogeneity arises when marginal tax rates are used to analyse human behaviour. Tax units are able to influence their marginal tax rate through economic activity (Triest 1998). Tax deductibility of charitable contributions affects taxable income and thus the marginal tax rate. Hence, p_i is determined by tax units, at least to a certain extent. The more an individual gives, the lower $\frac{\partial T(x_i)}{\partial x_i}$ will be. However, if economic theory holds, high tax-defined prices of giving lead to small contributions. To avoid $\frac{\partial T(x_i)}{\partial x_i}$ varying with the

[4] The stratification cells are chosen according to gross taxable income and other tax-relevant characteristics. The procedure aims at minimising the standard error with respect to taxable income. The sample includes all tax units with high incomes or high income losses.

amount given, $\frac{\partial T(x_i)}{\partial x_i}$ is applied for the first (marginal) unit of charitable contribution. Hence, g_i is added to x_i.[5]

All in all, our final samples contain 967,631 tax units for 1998, 1,050,292 for 2001 and 835,897 for 2004. To complete our dataset, assessment years 1998, 2001 and 2004 are pooled, leaving us with 2,853,820 income tax records. Table 2 presents descriptive statistics for each wave and the pooled sample. The share of donors is given for single assessment cases, joint assessment cases and overall cases of each sample.[6]

[Table 2 about here]

In order to calculate the tax-defined price of giving, it is necessary to account for some special treatments favouring certain tax units and kinds of income. The German Income Tax Code exempts several types of earnings, e.g. unemployment benefits or foreign income, from regular taxation. Although these earnings are not included in the tax base, they have an impact on average and marginal tax rates, which are applied to the tax base. On the basis of these earnings and the regular tax base, a fictitious tax rate will be calculated. This tax rate is then applied to the actual tax base of a tax unit.

Furthermore, German married couples benefit from a special taxation treatment, the splitting tax schedule. If taxable income is unevenly divided between the two spouses, married couples who opt for joint assessment can reduce their marginal tax rate. Hence, joint assessment favours married couples by reducing the income tax liability in comparison to single taxpayers or unmarried couples with an identical household income but different individual taxable income. In order to compute reliable tax prices of giving, all special treatments have to be accounted for.

[Figure 1 about here]

Figure 1 depicts German tax-defined prices of giving for 1998, 2001 and 2004 as function of taxable income x_i separately for the tax schedule according to single and joint assessment. All values reported are in real terms to the base of 2004. The tax-defined price of giving p_i is equal to 1 for taxable incomes below the basic tax-free allowance. Due to lower marginal tax rates, p_i is higher for joint assessed tax units than for basic tax schedule cases. Progressive marginal tax rates lead to different net costs for two identical tax units, only varying in their

[5] It is also possible to apply marginal tax rates for the last marginal unit. However, these marginal tax rates can be easier manipulated by tax units. Therefore, our estimates are based on marginal tax rates for the first unit of charitable contributions.

[6] Detailed descriptive statistics are provided in the appendix A1.

taxable income. The net cost of charitable contribution will be lowered by high marginal tax rates. Taxpayers with higher incomes (and higher marginal tax rates) will benefit from higher tax savings and thus from smaller prices. The lowest tax price of giving applies for taxable incomes above € 54,998 (p_i = 0.47) in 1998, € 61,375 (p_i = 0.515) in 2001 and € 52,152 (p_i = 0.55) in 2004.

To analyse the impact of the tax unit's income on the giving behaviour, it is useful to construct an income concept which is a better proxy for the actual consumption possibilities than the (tax code based) income aggregates provided in the data. Due to various tax reliefs and different tax exemptions, income aggregates conceal the actual spending power of a tax unit. Hence, we construct an adjusted gross income. The underlying data contains detailed information to adjust taxable income for tax reliefs, allowances, specific depreciations, several tax free earnings and just tax motivated losses. Similarly to the approaches from Bach et al. (2009), we derive an adjusted gross income (y_i) from the information contained in the income tax statements.[7]

To capture the influence of governmental welfare expenditures on charitable giving, we use data on federal state and municipal welfare spending, including expenditures for education and science, cultural affairs, social family and youth transfers, governmental transfers for impacts of war or political occurrences, health care, sports and environmental expenditures. Information is available for 1998, 2001 and 2004. G_{ij}^{gov} denotes the net governmental welfare spending per capita for each federal state and is also adjusted for inflation. G_{ij}^{gov} is assigned to every tax unit i in federal state j. The ratio can be interpreted as public-sector charity per capita and serves as comprehensive and appropriate substitute for the wide range of public goods to which taxpayers donate. Table 3 depicts federal state welfare expenditures per capita for all three years.

[Table 3 about here]

4 Results

All results presented in this section are based on the pooled sample, which is comprised of almost three million tax units.[8] Figure 2 graphically summarizes the main results of our empirical model: the quantile coefficient estimates for price, income and governmental expenditures. Lower and upper confidence intervals are indicated by a grey shaded area. Due

[7] Further information on the adjusted gross income construction is provided in Appendix A2.
[8] Respective cross-section results for each single wave are consistent with regard to the magnitude of the estimates for the pooled sample and provided in the supplementing materials.

to heavy left censoring, estimation starts with coefficients for the 0.46th quantile.[9] All estimates for price and income are significant at the 1% level of confidence. The shape of the quantile functions supports the non-parametric regression approach and rejects the assumption of constant price and income elasticities for different amounts of giving. There is a positive but no monotonic relationship between income and giving. The income effect is positive for all quantiles. However, lower contributors are more income elastic than higher contributors. This result is consistent with a more pronounced income effect for tax units with low adjusted gross income.[10] Hence, income elastic tax units are eager to donate even more relative to an increase in income. From the 0.95th quantile on, income elasticity is smaller than 1, qualifying high giving tax units as income inelastic. We observe that tax units do not enhance their amount given to charity in proportion to their increased adjusted gross income, indicating a decreasing marginal utility of giving. Therefore, the assumption that charitable giving is a normal good holds true for the entire population of donors. However, our results also imply that tax units take their absolute amount given to charity into account rather than the amount relative to their income. It can be assumed that tax units have an individual upper threshold when deciding about their amount given. The gap between the actual amount given and upper threshold may differ for high and low contributors. For low contributors, the scope appears to be bigger until reaching their individual threshold. Therefore, tax units with small contributions are more elastic than tax units with high contributions.

[Figure 2 about here]

Regarding the tax-defined price of giving, our findings are in line with the theoretical framework since the relationship is negative. Again, the quantile function is non-monotonic. We are able to identify three different groups of contributors: (1) price elastic tax units with low contributions (46th to 50th quantile), (2) price inelastic tax units with medium to higher contributions (55th to 95th) and (3) price elastic tax units with the highest contributions (99th quantile). For the first group, our point estimate for tax price elasticity amounts to $\hat{\beta}^{p}_{0.46}$ = 1.439 within a confidence interval between -1.469 and -1.409. For the 46th conditional quantile of the distribution, a 1% increase in the tax price of giving reduces the amount given to charity by 1.439%. If the tax price of giving increases, they will reduce their contributions disproportionately. Regarding the bulk of tax units (medium and higher contributions), we observe that giving is far from being price elastic. The point estimates range from -0.786 to -0.449. We consider these tax units to be ordinary contributors. In this range our findings indicate that giving is not primarily driven by tax incentives but rather by altruistic motives.

[9] See Appendix A3 for detailed estimation results.
[10] The Pearson correlation coefficient between charitable giving and adjusted gross income amounts to 0.40.

For this group, varying the tax price of giving will only slightly affect its decision as to how much money is given to charity.

For the highest contributors (0.99th quantile), we have identified a price elastic behaviour. Our point estimate amounts to $\hat{\beta}^{p}_{0.99}$ = -1.140. Here, the decision to donate is highly sensitive to tax incentives and appears to be a strategy for tax planning (minimising personal income tax). Using donations as an instrument to shift their tax base, these tax units will strongly react to variations of tax incentives.

Our last main results concerns crowding out. Our findings support the hypothesis that public sector charity crowds out private philanthropy at every level of giving. However, crowding out is not constant but varies with the level of individual giving. The quantile function is monotonically decreasing in absolute value. Lower quantiles react to governmental social transfers much stronger than upper quantiles. From the 46th to the 70th, we observe a more than complete crowding out of charitable giving with estimates ranging from $\hat{\beta}^{G}_{0.46}$ = -1.359 to $\hat{\beta}^{G}_{0.70}$ = -1.151. These findings indicate that tax units with scarce resources are very well aware of government funding and withdraw the respective resources. Incomplete crowding out is observed for higher/highest contributions (75th to 99th quantiles), ranging from $\hat{\beta}^{G}_{0.75}$ = -0.995 to $\hat{\beta}^{G}_{0.99}$ = -0.138. For the highest contributors, a 1% increase in governmental funding diminishes private contributions by 0.138%, which indicates that their donations are almost unaffected by public sector expenditure. It appears that the highest contributors are driven by warm glow or are not aware of government funding. In sum, crowding out estimates are quite stable over time but heterogeneous within a year. We find that the magnitude depends on the amount of giving. Although we find strong evidence that government welfare expenditure crowds out private philanthropy, we must be cautious about our findings. Our findings indicate that public-sector charitable giving attenuates private philanthropy, causality is not guaranteed. It could be argued that lowered private charitable giving may result in increased government expenditure (Abrams and Schmitz 1978).

To evaluate the overall effectiveness of tax incentives in the presence of crowding out, we have to combine the crowding out and price elasticity according to equation (4). For the overall efficiency of tax treatment, we can state that the combination of tax price elasticity and crowding out leads to an elastic behaviour for all considered quantiles and; therefore, tax incentives are efficient.

[Figure 3 about here]

All in all, our main results lead in some aspects to different conclusions regarding previous studies. This is attributed to the estimation strategy applied. For instance, our findings challenge the overall effectiveness of tax incentives to boost giving if only price elasticity is considered. Our results imply that the majority of donators is not price elastic. This challenges former findings of price elastic behaviour for the US[11] and Germany.[12] Based on OLS or Tobit regression models, these studies estimate average price elasticities. Since quantile regression aims at determining the relation between the price and giving at different points in the conditional distribution, quantile regression estimates are not directly comparable with these results. Our results support more recent findings by Bakija and Heim (forthcoming) and Fack and Landaise (2010), whose estimates are in the lower range of former results. Moreover, our results indicate that giving is heterogeneous among taxpayers and confirm findings for the French case. It is possible that part of the differences between our estimates and former findings result from different samples of the underlying income distribution. Our sample contains more tax units with middle and upper-middle income, whereas US studies are based on richer tax units, which react more to tax incentives.

The bulk of empirical studies on the crowding out effect find a negative connection between private charitable giving and public sector expenditure.[13] Our findings divide the giving population into pure and impure altruists or tax units which are aware of government funding. Our estimation approach allows us to estimate the impact of government expenditure on giving behaviour across the underlying population. According to Andreoni's (1990) impure altruism approach, we find that small and lower medium donors are pure altruists (complete crowding out effect), whereas upper medium and higher contributors are impure altruists. The latter derive utility both from their individual contribution and from the overall level of giving. In addition to the impure altruism approach, our finding of a partial crowding out effect can either be result from fiscal illusion or an endorsement effect (Eckel et al. 2005).

[Figure 4 about here]

To complete the picture, we provide estimates for the socio-demographic control variables in Figure 4. Giving to charity strongly depends on age. Younger tax units give ceteris paribus less, older tax units give more. Children, church membership and marriage mainly have a

[11] See e.g. Schwartz (1970), Feldstein (1975), Feldstein and Taylor (1976), Feldstein and Clotfelter (1976), Boskin and Feldstein (1977), Clotfelter (1980), Clotfelter and Steuerle (1981), Barrett (1991), Randolph (1995), as well as Reece (1979) and Auten et al. (2002).

[12] Paqué (1986) deploys time-series data for the period from 1961 to 1980. Analysing 55 observations, Paqué quantifies giving as price and income elastic. Deploying a sample of German income tax return data for 1998 and using Tobit regression model, von Auer and Kalusche (2007) find that giving behaviour in Germany is price elastic but not income elastic.

[13] Clotfelter (1985) reports an average crowding out of only about 5%. Kingma (1989) finds crowding out of 13.5%. Khanna and Sandler (2000) prove evidence for crowding in between 13% and 89%. Ribar and Wilhelm (2002) find that crowding out is not significantly different from zero. Andreoni and Payne (2009) indicate two crowding out effects. Distinguishing between the classic crowding out of donors and the crowding out of fund raising by government grants, they find that crowding out is primarily due to reduced fund-raising and ranges from 70% to 100%, whereas classic crowding out amounts to only 30%.

positive effect on giving behaviour. Tax units whose income is predominantly based on employment income donate less than tax units that mainly derive other types of income. The year dummies or 1998 and 2001 are of comparable magnitude for all quantiles and negative, this may point to the income effect exceeding the price effect of changes in tax schedule (see Figure 1). Furthermore, the functions are monotonically decreasing in the absolute value of donations and indicate an economically small but significant difference in giving behaviour over the period under consideration.

5 Conclusions

We have examined a rich body of income tax return data on philanthropic activity. Our estimations refer to a representative sample of German taxpayers. Contrary to the vast majority of empirical studies but similar to more current approaches, e.g. Fack and Landaise (2010), we assume non-constant price and income elasticities. Censored quantile regression is eligible to deal with heavy-censoring and allows for heterogeneity in giving behaviour. Our findings challenge the view that the tax deductibility of charitable contributions is overall treasury efficient unless crowding out is taken into account. If there are to be any fiscal incentives, they are appropriate to activate tax units who have not given yet. Furthermore, tax units with very generous donations are highly responsive to tax incentives due to low prices of giving. From a public-finance point of view, our results imply that there should be a differentiation between 'good' (price elastic) and 'bad' (price inelastic) tax units to allocate tax incentives more effectively. Although our findings qualify tax reliefs for charitable giving as ineffective for the majority of tax units, they do not necessarily imply that tax incentives are useless and should be abolished. In particular, if crowding is taken into account our results confirm the treasury efficiency of the current tax treatment. Furthermore, there may be several more reasons to justify the current system.

From a political perspective, existing tax incentives for charitable giving set a clear signal for codetermination. Taxpayers are required to reveal their preferences and decide on their own scarce resources for financing desired public goods. Furthermore, it is possible that the elimination of tax incentives will cause considerable public and political pressure. Lobbyists of charity groups will insist on maintaining tax reliefs for charitable giving and highlight their positive external effects on social well-being. Moreover, they may argue that removing tax incentives for charitable giving will be seen as a harsh blow against private philanthropy and codetermination.

Assuming that public goods can be provided at different public and private opportunity costs, it might be reasonable to foster private philanthropy through tax incentives. The greater the comparative advantage of private provision, the better the case for granting tax reliefs for charitable giving. Private charity organisations must be competitive and transparent to acquire new funds. Due to lean structures and competitive markets, private provision appears to be more effective than public provision. Hence, forgone tax revenues resulting from tax reliefs might be smaller than wasted tax revenues resulting from ineffective public provision.

Overall, our empirical results must be interpreted with caution. Although the data contains detailed information of German taxpayers and is a convenient source for tax policy research, the age of the data may hamper the analysis of today's charitable giving behaviour. Furthermore, our analysis is constrained to cross-section data and a pooled sample. There is a wide variety of panel data methods to investigate tax policy over time. Recent US studies (e.g. Bakija and Heim forthcoming) present new and lower estimations for tax panel data. A German taxpayer panel as well as matching the current data with panel data would be powerful sources to carry out further tax policy research and provide valuable insights into tax incentives in general.

Our study uses an established approach to evaluate the effectiveness of current German tax incentives for different points of the conditional distribution of charitable giving. The current deductibility of charitable contributions from taxable income distinguishes between taxpayers with low and high marginal tax rates. There are various suggestions on how to reform the current method. Theoretical (Saez 2004) as well as experimental research (Eckel and Grossman 2003) provide interesting results on how tax treatment of charitable giving can be improved. Furthermore, we believe that less aggregative data would be helpful to boost further research. The highly aggregative data may conceal substantially both different tax price elasticities and different crowding out effects for particular types of charitable contributions. Garrett and Rhine (2009) were the first to analyse different categories of charitable giving and government spending. Therefore, further research would give valuable insights on if and how different types of charitable contributions react to tax deductibility and public-sector expenditure. The government could take more specific and effective action to promote charitable giving.

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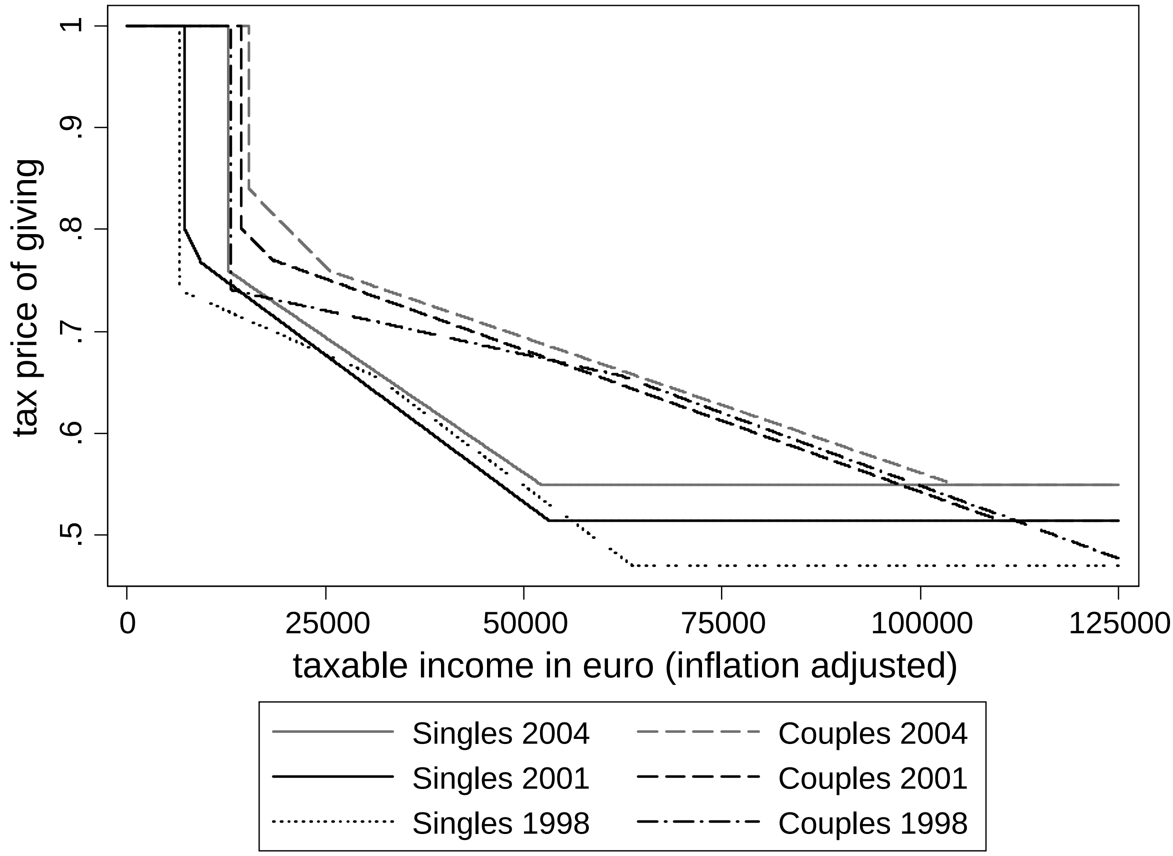
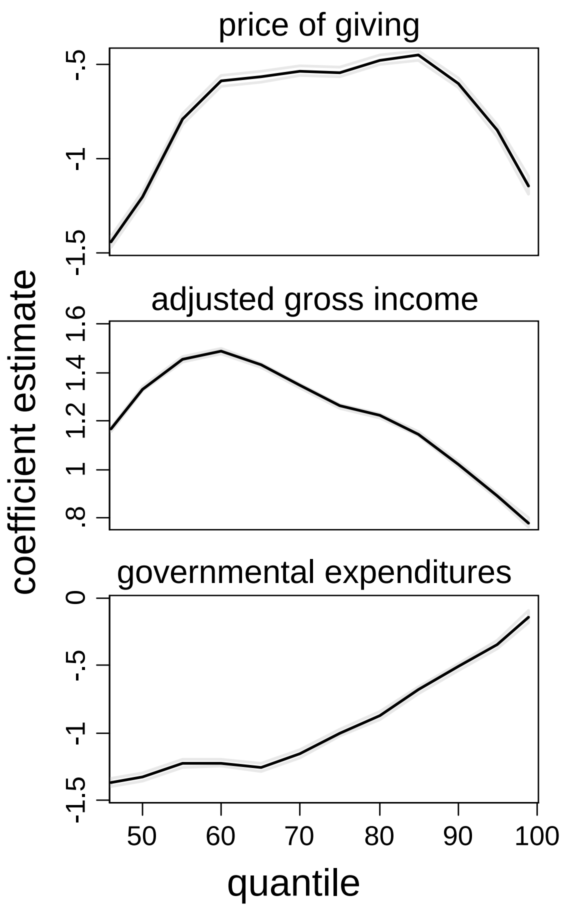
Figure 1. Tax prices of giving in 1998, 2001, 2004



Note: Price of giving according to German Income Tax Code. Due to the income tax arrangement for married couples in case of a joint assessment, prices for single and couples differ.

Figure 2. Estimates for income, price and social governmental expenditures, pooled data



Note: Solid lines denote point estimates for the respective quantile; grey areas denote the 95th confidence interval.

Figure 3. Estimates for price of giving and social governmental expenditures combination, pooled data

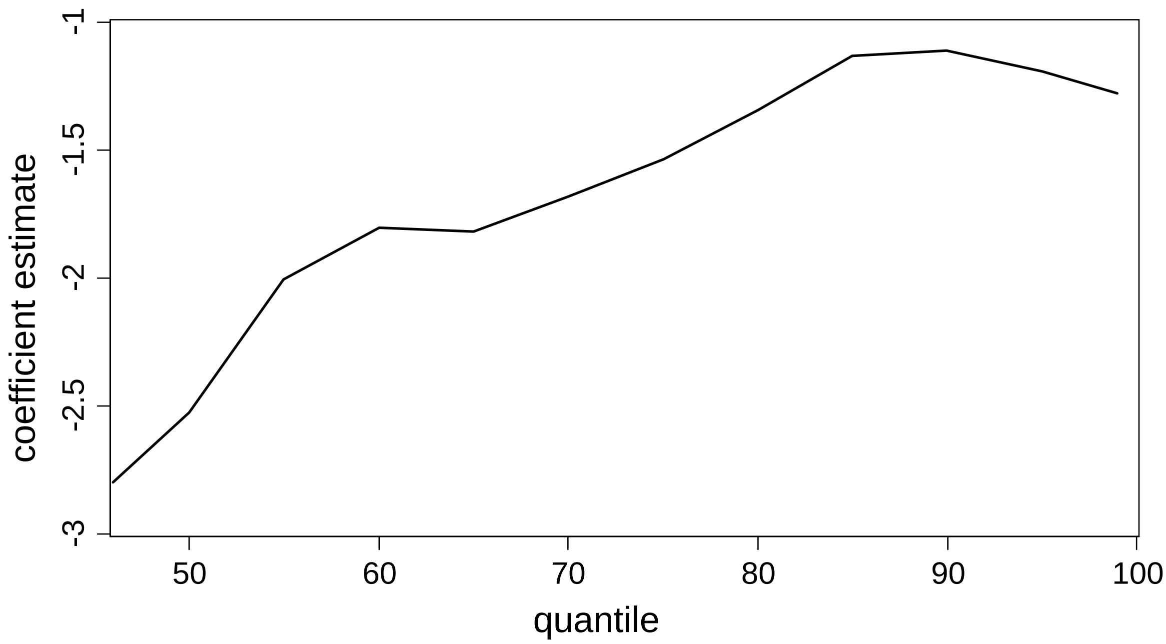
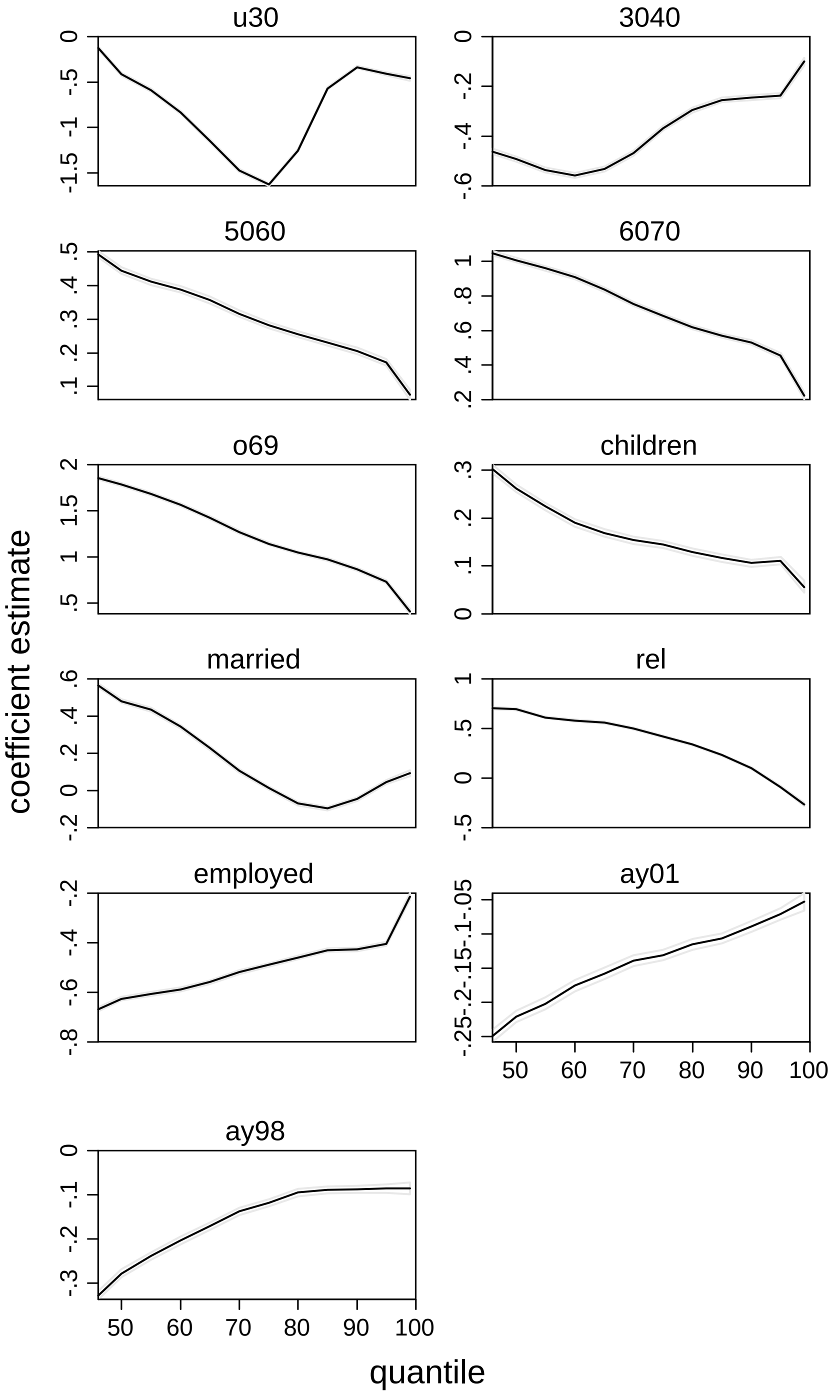


Figure 4. Estimates for socio-demographic factors, pooled data



Note: Solid lines denote point estimates for the respective quantile; grey areas denote the 95th confidence interval.

Table 1. Dependent variable and covariates

Variable	Description	Coding/ Construction
g_i	charitable giving plus 1 Euro	Log of charitable giving
y_i	aggregated gross income	Log of aggregated gross income
p_i	tax defined price of giving	Log of tax defined price of givng
G_{ij}^{gov}	Governmental spending	Log of per capita social transfers to income ratio in Federal State j.
$d\_children$	Children	Dummy variable (1 = children; 0 = else).
d_age	age cohort (in years: 0-29;30-39; 40-49; 50-59; 60-69; 70 and above)	Dummy variables (1= age cohort applies; 0 = else), reference category: 40 – 49.
$d\_married$	church membership	Dummy variable (1 = church member; 0 = else).
d_church	married/ joint assessment	Dummy variable (1 = married; 0 = else).
d_employ	mainly income from employment	Dummy variable (1 = status applies; 0 = else).
d_year	assessment year	Dummy variable (1 = 2001; 0 = 1998).

Table 2. Share of donors

Sample	Tax unit type	No. of tax units	Share of donors
Single assessment	2004	287,400	42%
	2001	388,539	40%
	1998	409,478	38%
	Pooled Sample	1,085,417	40%
Joint assessment	2004	548,497	66%
	2001	661,753	64%
	1998	558,153	61%
	Pooled Sample	1,768,403	64%
All	2004	835,897	58%
	2001	1,050,292	55%
	1998	967,631	51%
	Pooled Sample	2,853,820	55%

Table 3. Governmental expenditures per capita

Federal state	1998	2001	2004
Baden-Wuerttemberg	2,904.82	2,974.46	2,919.23
Bavaria	2,982.00	2,990.52	2,979.11
Berlin	4,713.93	4,617.36	4,251.16
Brandenburg	3,022.20	2,823.76	2,761.17
Bremen	4,362.06	4,358.18	4,180.55
Hamburg	4,263.31	4,169.54	4,123.95
Hesse	3,286.82	3,310.90	3,322.88
Lower Saxony	2,937.04	3,042.81	2,925.33
Mecklenburg Western Pomerania	3,380.94	3,281.35	3,213.26
Northrhine-Westphalia	3,126.64	3,173.78	3,210.71
Rhineland Palatinate	2,821.95	2,814.56	2,711.58
Saarland	2,825.63	2,847.14	2,810.59
Saxony	3,007.40	2,861.57	2,797.92
Saxony-Anhalt	3,504.08	3,349.74	3,424.19
Schleswig Holstein	3,096.98	3,006.07	2,925.72
Thuringia	2,732.07	3,150.56	3,076.07

Note: All monetary values in EUR and inflation-adjusted.

Appendix

A1. Descriptive Statistics

Table A1. Charitable giving by tax unit type

Tax unit type	Sample selection	Year	All tax units	Donors
Single assessment	Mean contribution	2004	170	403
		2001	148	367
		1998	116	306
	Standard deviation	2004	735	1091
		2001	667	1,012
		1998	467	720
	Median contribution	2004	0	111
		2001	0	107
		1998	0	112
Joint assessment	Mean contribution	2004	353	533
		2001	321	502
		1998	276	454
	Standard deviation	2004	964	1144
		2001	929	1,123
		1998	757	927
	Median contribution	2004	82	198
		2001	63	160
		1998	54	140

Note: All monetary values in EUR and inflation-adjusted.

Table A2. Charitable Giving by age

Tax unit type	Age	Year	< 30	30-39	40-49	50-59	60-69	>= 70
Single assessment	Share of donors	2004	18.5%	35.2%	43.9%	48.5%	56.1%	62.4%
		2001	19.5%	32.4%	41.2%	49.2%	57.5%	64.7%
		1998	20.6%	30.7%	38.9%	47.3%	54.6%	63.0%
	Mean contribution	2004	28	101	170	216	266	334
		2001	28	83	135	201	265	359
		1998	28	67	111	166	198	279
	Mean income	2004	17,134	39,282	49,577	50,645	42,634	39,276
		2001	19,371	36,578	43,672	48,135	44,079	44,395
		1998	17,786	30,548	36,130	40,853	38,036	38,485
Joint assessment	Share of donors	2004	32.6%	57.2%	66.0%	68.7%	69.1%	75.2%
		2001	35.0%	52.7%	63.1%	67.4%	71.2%	77.0%
		1998	33.7%	50.0%	60.1%	64.7%	67.3%	75.3%
	Mean contribution	2004	89	231	317	354	441	678
		2001	96	200	289	338	437	640
		1998	83	173	258	304	340	495
	Mean income	2004	47,264	82,015	87,849	89,751	77,539	73,985
		2001	49,046	77,978	85,607	84,733	76,631	78,077
		1998	41,694	67,367	77,056	76,393	67,361	69,380

Note: All monetary values in EUR and inflation-adjusted.

Table A3. Charitable Giving by Federal State in 2001

Federal state	Year	Donor quote	Mean contribution	Std. deviation	Mean income
Baden-Wuerttemberg	2004	64.2%	371	1073	77,507
	2001	61.2%	331	1,093	74,208
	1998	56.1%	269	773	62,447
Bavaria	2004	69.6%	354	969	78,015
	2001	67.7%	318	904	72,234
	1998	63.9%	267	728	59,847
Berlin	2004	47.1%	239	803	59,296
	2001	43.5%	207	717	58,716
	1998	40.3%	168	598	50,265
Brandenburg	2004	37.7%	147	567	52,166
	2001	35.9%	135	543	52,085
	1998	31.2%	108	451	46,446
Bremen	2004	43.7%	177	615	45,898
	2001	42.3%	173	606	48,369
	1998	39.8%	142	480	42,870
Hamburg	2004	49.8%	268	990	65,404
	2001	45.9%	229	870	60,418
	1998	43.4%	189	650	53,221
Hesse	2004	59.2%	315	977	70,859
	2001	55.8%	274	883	67,601
	1998	52.4%	227	702	56,683
Lower Saxony	2004	56.4%	249	780	65,075
	2001	52.3%	215	736	60,754
	1998	46.8%	166	560	49,947
Mecklenburg Western Pomerania	2004	35.6%	135	497	48,362
	2001	35.9%	130	499	49,771
	1998	34.0%	106	409	45,791
Northrhine-Westphalia	2004	58.4%	177	615	45,890
	2001	53.5%	294	929	74,989
	1998	48.2%	248	758	63,683
Rhineland Palatinate	2004	55.6%	245	756	62,138
	2001	52.3%	217	679	60,963
	1998	49.0%	180	564	50,627
Saarland	2004	84.0%	209	591	49,287
	2001	85.7%	195	496	48,337
	1998	85.3%	176	407	41,272
Saxony	2004	46.5%	199	700	52,749
	2001	46.2%	178	646	51,545
	1998	43.9%	139	483	46,416
Saxony-Anhalt	2004	38.4%	136	495	49,862
	2001	36.4%	123	454	51,520
	1998	35.2%	111	414	45,233
Schleswig Holstein	2004	48.7%	218	771	62,800
	2001	49.7%	190	665	59,372
	1998	51.5%	159	528	52,301
Thuringia	2004	40.0%	140	494	47,434
	2001	42.5%	137	470	47,716
	1998	40.1%	115	430	46,978
Germany	2004	57.9%	290	896	69,214
	2001	55.1%	256	846	65,805
	1998	51.2%	209	655	55,374

Note: All monetary values in EUR and inflation-adjusted.

Table A4. Charitable Giving by tax unit size

Tax unit type	Children	Year	no children	1 child	2 children	3 children	4 or more children
single assessment	Share of donors	2004	41.5%	40.8%	47.6%	52.9%	54.3%
		2001	40.9%	37.3%	40.5%	43.9%	43.6%
		1998	38.8%	35.2%	37.1%	38.6%	40.3%
	Mean contribution	2004	169	146	194	265	253
		2001	163	107	130	171	184
		1998	126	88	101	132	149
	Mean Income	2004	36,342	45,608	56,583	62,726	66,808
		2001	37,600	37,379	42,094	46,790	47,347
		1998	31,009	32,465	35,545	38,600	40,193
joint assessment	Share of donors	2004	64.1%	63.3%	68.9%	73.3%	73.4%
		2001	63.5%	59.7%	65.9%	70.5%	71.5%
		1998	60.9%	57.4%	62.3%	66.9%	68.3%
	Mean contribution	2004	362	293	332	459	617
		2001	333	255	306	431	597
		1998	276	228	278	389	530
	Mean income	2004	77,737	86,663	89,613	95,087	96,764
		2001	78,815	77,332	86,932	91,817	92,051
		1998	69,660	69,173	77,565	81,043	82,588

Note: All monetary values in EUR and inflation-adjusted.

Table A5. Charitable Giving by church membership

Tax unit type	Church membership	Year	Donor quote	Mean contribution	Std. deviation	Mean income
single assessment	Church	2004	37.6%	167	767	44,899
		2001	35.4%	145	700	42,552
		1998	33.2%	115	503	37,387
	No church	2004	43.7%	171	723	37,696
		2001	41.7%	148	655	37,175
		1998	39.1%	116	457	30,709
joint assessment	Church	2004	52.5%	349	1196	78,616
		2001	51.7%	328	1,113	77,523
		1998	47.9%	274	888	70,459
	No church	2004	68.7%	354	915	85,860
		2001	65.9%	320	896	82,580
		1998	62.8%	278	735	72,769

Note: All monetary values in EUR and inflation-adjusted.

A2: Adjusted Gross Income

Table 6 presents the adjustments made to derive the Adjusted Gross Income. Bach et al. (2009) give more detailed information about adjusted gross income. At some points, our calculations differ from their approach.

Table A6. Adjusted gross income

Income from business activity (including income from agriculture and forestry, from unincorporated business enterprise and from self-employed activities)
+ wage income, income from renting and leasing and other income
+ earnings from capital investments (imputation of missing data on an average level)
+ all tax reliefs and tax allowances for income from business activity as far as identifiable
+ allowable expenses for wage and other income (consumptive character)
+ age relief
+ tax-exempted income from foreign countries
+ loan and income indemnification
+ life annuity income less income component (flat 70% of life annuity income)
+ tax shelters: losses from equity holdings
+ losses from business activity income and renting and leasing income, if the modified income class and the sum of income until this point is still negative (negative consumption is not possible)
- fixed income tax and solidarity surcharge
- alimony / child support
+ child benefit
= Adjusted Gross Income

A3: Estimation results

Table A7. Quantile regression estimates pooled sample, 46th -70th quantile

Covariate	Quantile					
	46th	50th	55th	60th	65th	70th
y_i	1.164***	1.333***	1.456***	1.488***	1.430***	1.345***
	(-0.005)	(-0.005)	(-0.005)	(-0.005)	(-0.005)	(-0.004)
p_i	-1.439***	-1.203***	-0.786***	-0.587***	-0.565***	-0.532***
	(-0.015)	(-0.014)	(-0.014)	(-0.014)	(-0.014)	(-0.013)
G_{ij}^{gov}	-1.359***	-1.325***	-1.219***	-1.218***	-1.251***	-1.151***
	(-0.015)	(-0.014)	(-0.015)	(-0.014)	(-0.014)	(-0.014)
d_age_{0-29}	-0.122***	-0.413***	-0.587***	-0.835***	-1.144***	-1.475***
	(-0.008)	(-0.008)	(-0.008)	(-0.007)	(-0.007)	(-0.007)
d_age_{30-39}	-0.462***	-0.491***	-0.536***	-0.558***	-0.533***	-0.469***
	(-0.005)	(-0.005)	(-0.005)	(-0.005)	(-0.005)	(-0.004)
d_age_{50-59}	0.494***	0.444***	0.411***	0.388***	0.357***	0.316***
	(-0.005)	(-0.004)	(-0.005)	(-0.004)	(-0.005)	(-0.004)
d_age_{60-69}	1.046***	1.005***	0.958***	0.908***	0.834***	0.752***
	(-0.006)	(-0.006)	(-0.006)	(-0.006)	(-0.006)	(-0.006)
d_age_{70+}	1.855***	1.786***	1.685***	1.564***	1.425***	1.268***
	(-0.008)	(-0.008)	(-0.008)	(-0.008)	(-0.008)	(-0.007)
$d\_children$	0.302***	0.261***	0.223***	0.190***	0.168***	0.153***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.003)
$d\_married$	0.564***	0.480***	0.434***	0.343***	0.229***	0.106***
	(-0.005)	(-0.005)	(-0.005)	(-0.005)	(-0.005)	(-0.004)
d_church	0.706***	0.694***	0.613***	0.580***	0.560***	0.501***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.004)
d_employ	-0.669***	-0.625***	-0.606***	-0.588***	-0.559***	-0.518***
	(-0.004)	(-0.003)	(-0.003)	(-0.003)	(-0.003)	(-0.003)
d_year_{98}	-0.248***	-0.220***	-0.201***	-0.175***	-0.157***	-0.138***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.004)
d_year_{01}	-0.327***	-0.277***	-0.238***	-0.203***	-0.171***	-0.137***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.004)
$\_cons$	-0.313*	-1.952***	-3.485***	-3.311***	-1.937***	-1.329***
	(-0.137)	(-0.131)	(-0.132)	(-0.053)	(-0.132)	(-0.126)

Note: Standard errors of coefficient estimates in brackets. Asterisks denote the respective significant level at 95% (*), 99% (**) and 99.9 (***).

Table A8. Quantile regression estimates pooled sample, 75th -99th quantile

Covariate	Quantile					
	75th	80th	85th	90th	95th	99th
y_i	1.260***	1.221***	1.144***	1.020***	0.890***	0.779***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.005)	(-0.009)
p_i	-0.540***	-0.476***	-0.449***	-0.599***	-0.849***	-1.140***
	(-0.012)	(-0.013)	(-0.012)	(-0.013)	(-0.015)	(-0.024)
G_{ij}^{gov}	-0.995***	-0.869***	-0.680***	-0.510***	-0.342***	-0.138***
	(-0.013)	(-0.014)	(-0.013)	(-0.013)	(-0.015)	(-0.022)
d_age_{0-29}	-1.629***	-1.253***	-0.569***	-0.335***	-0.411***	-0.459***
	(-0.007)	(-0.007)	(-0.007)	(-0.007)	(-0.008)	(-0.012)
d_age_{30-39}	-0.367***	-0.295***	-0.254***	-0.245***	-0.237***	-0.100***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.005)	(-0.007)
d_age_{50-59}	0.281***	0.255***	0.229***	0.206***	0.171***	0.074***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.005)	(-0.007)
d_age_{60-69}	0.683***	0.619***	0.570***	0.531***	0.455***	0.224***
	(-0.005)	(-0.006)	(-0.005)	(-0.006)	(-0.006)	(-0.010)
d_age_{70+}	1.144***	1.046***	0.973***	0.866***	0.733***	0.409***
	(-0.007)	(-0.007)	(-0.007)	(-0.007)	(-0.008)	(-0.013)
$d\_children$	0.144***	0.128***	0.116***	0.105***	0.110***	0.056***
	(-0.003)	(-0.003)	(-0.003)	(-0.003)	(-0.004)	(-0.006)
$d\_married$	0.014**	-0.068***	-0.096***	-0.045***	0.045***	0.093***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.005)	(-0.008)
d_church	0.421***	0.338***	0.234***	0.100***	-0.088***	-0.263***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.007)
d_employ	-0.489***	-0.460***	-0.430***	-0.427***	-0.403***	-0.214***
	(-0.003)	(-0.003)	(-0.003)	(-0.003)	(-0.004)	(-0.006)
d_year_{98}	-0.130***	-0.115***	-0.106***	-0.088***	-0.070***	-0.053***
	(-0.003)	(-0.004)	(-0.003)	(-0.004)	(-0.004)	(-0.006)
d_year_{01}	-0.117***	-0.095***	-0.088***	-0.087***	-0.086***	-0.085***
	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.004)	(-0.006)
$\_cons$	-1.198***	-1.310***	-1.533***	-1.113***	-0.491***	0.039
	(-0.120)	(-0.123)	(-0.120)	(-0.123)	(-0.061)	(-0.206)

Note: Standard errors of coefficient estimates in brackets. Asterisks denote the respective significant level at 95% (*), 99% (**) and 99.9 (***).

Supplementary Materials

Table S1. Quantile regression estimates for 1998, 49th -70th quantile

Covariate	Quantile					
	49th	50th	55th	60th	65th	70th
y_i	1.104***	1.148***	1.298***	1.349***	1.326***	1.263***
	(-0.008)	(-0.008)	(-0.008)	(-0.009)	(-0.009)	(-0.009)
p_i	-1.262***	-1.186***	-0.876***	-0.632***	-0.562***	-0.546***
	(-0.022)	(-0.021)	(-0.022)	(-0.023)	(-0.024)	(-0.023)
G_{ij}^{gov}	-1.276***	-1.278***	-1.291***	-1.302***	-1.425***	-1.448***
	(-0.022)	(-0.022)	(-0.023)	(-0.025)	(-0.025)	(-0.025)
d_age_{0-29}	-0.242***	-0.299***	-0.571***	-0.841***	-1.142***	-1.460***
	(-0.012)	(-0.011)	(-0.012)	(-0.013)	(-0.013)	(-0.013)
d_age_{30-39}	-0.434***	-0.461***	-0.556***	-0.637***	-0.617***	-0.505***
	(-0.008)	(-0.008)	(-0.008)	(-0.009)	(-0.009)	(-0.009)
d_age_{50-59}	0.608***	0.592***	0.538***	0.475***	0.420***	0.355***
	(-0.008)	(-0.008)	(-0.008)	(-0.009)	(-0.009)	(-0.009)
d_age_{60-69}	1.153***	1.130***	1.054***	0.946***	0.840***	0.746***
	(-0.011)	(-0.010)	(-0.011)	(-0.012)	(-0.012)	(-0.012)
d_age_{70+}	1.953***	1.923***	1.795***	1.632***	1.459***	1.281***
	(-0.013)	(-0.013)	(-0.013)	(-0.014)	(-0.015)	(-0.014)
$d\_children$	0.239***	0.240***	0.250***	0.231***	0.221***	0.202***
	(-0.006)	(-0.006)	(-0.006)	(-0.007)	(-0.007)	(-0.007)
$d\_married$	0.605***	0.594***	0.542***	0.473***	0.346***	0.195***
	(-0.008)	(-0.008)	(-0.008)	(-0.009)	(-0.009)	(-0.009)
d_church	0.585***	0.586***	0.579***	0.572***	0.575***	0.522***
	(-0.008)	(-0.007)	(-0.008)	(-0.008)	(-0.009)	(-0.008)
d_employ	-0.757***	-0.749***	-0.722***	-0.698***	-0.657***	-0.594***
	(-0.006)	(-0.006)	(-0.006)	(-0.007)	(-0.007)	(-0.007)
$\_cons$	-0.281	-0.607**	-1.522***	-1.409***	0.342	1.738***
	(-0.203)	(-0.197)	(-0.206)	(-0.223)	(-0.229)	(-0.224)

Note: Standard errors of coefficient estimates in brackets. Asterisks denote the respective significant level at 95% (*), 99% (**) and 99.9 (***).

Table S2. Quantile regression estimates for 1998, 75th -99th quantile

Covariate	**Quantile**					
	75th	80th	85th	90th	95th	99th
y_i	1.196***	1.177***	1.078***	0.971***	0.848***	0.722***
	(-0.008)	(-0.008)	(-0.007)	(-0.008)	(-0.009)	(-0.014)
p_i	-0.556***	-0.478***	-0.522***	-0.658***	-0.899***	-1.227***
	(-0.021)	(-0.021)	(-0.020)	(-0.021)	(-0.024)	(-0.036)
G_{ij}^{gov}	-1.296***	-1.155***	-0.916***	-0.666***	-0.402***	-0.165***
	(-0.023)	(-0.023)	(-0.022)	(-0.023)	(-0.025)	(-0.035)
d_age_{0-29}	-1.583***	-1.052***	-0.426***	-0.251***	-0.376***	-0.444***
	(-0.012)	(-0.012)	(-0.011)	(-0.012)	(-0.013)	(-0.020)
d_age_{30-39}	-0.366***	-0.280***	-0.240***	-0.232***	-0.225***	-0.099***
	(-0.008)	(-0.008)	(-0.008)	(-0.008)	(-0.009)	(-0.013)
d_age_{50-59}	0.315***	0.288***	0.259***	0.226***	0.215***	0.084***
	(-0.008)	(-0.008)	(-0.008)	(-0.008)	(-0.009)	(-0.013)
d_age_{60-69}	0.670***	0.606***	0.565***	0.508***	0.443***	0.209***
	(-0.011)	(-0.011)	(-0.011)	(-0.011)	(-0.012)	(-0.018)
d_age_{70+}	1.142***	1.041***	0.971***	0.845***	0.710***	0.343***
	(-0.013)	(-0.013)	(-0.013)	(-0.013)	(-0.015)	(-0.022)
$d\_children$	0.185***	0.164***	0.154***	0.133***	0.136***	0.068***
	(-0.006)	(-0.007)	(-0.006)	(-0.006)	(-0.007)	(-0.010)
$d\_married$	0.071***	-0.036***	-0.064***	-0.010	0.097***	0.139***
	(-0.008)	(-0.008)	(-0.007)	(-0.008)	(-0.009)	(-0.014)
d_church	0.446***	0.360***	0.236***	0.095***	-0.092***	-0.256***
	(-0.008)	(-0.008)	(-0.007)	(-0.008)	(-0.008)	(-0.013)
d_employ	-0.555***	-0.516***	-0.486***	-0.477***	-0.444***	-0.222***
	(-0.006)	(-0.006)	(-0.006)	(-0.006)	(-0.007)	(-0.011)
$\_cons$	1.733***	1.320***	0.926***	0.530*	0.316	0.714*
	(-0.206)	(-0.211)	(-0.201)	(-0.207)	(-0.227)	(-0.328)

Note: Standard errors of coefficient estimates in brackets. Asterisks denote the respective significant level at 95% (*), 99% (**) and 99.9 (***).

Table S3. Quantile regression estimates for 2001, 45th -70th quantile

Covariate	Quantile					
	45 th	50 th	55 th	60 th	65 th	70 th
y_i	1.183***	1.352***	1.460***	1.525***	1.452***	1.365***
	(-0.009)	(-0.009)	(-0.009)	(-0.009)	(-0.009)	(-0.008)
p_i	-1.298***	-0.946***	-0.663***	-0.444***	-0.470***	-0.436***
	(-0.026)	(-0.024)	(-0.025)	(-0.026)	(-0.025)	(-0.023)
G_{ij}^{gov}	-1.739***	-1.589***	-1.450***	-1.430***	-1.435***	-1.290***
	(-0.026)	(-0.024)	(-0.025)	(-0.026)	(-0.025)	(-0.023)
d_age_{0-29}	-0.042**	-0.306***	-0.528***	-0.814***	-1.102***	-1.471***
	(-0.015)	(-0.013)	(-0.014)	(-0.014)	(-0.013)	(-0.012)
d_age_{30-39}	-0.516***	-0.536***	-0.568***	-0.584***	-0.563***	-0.494***
	(-0.008)	(-0.008)	(-0.008)	(-0.008)	(-0.008)	(-0.007)
d_age_{50-59}	0.581***	0.507***	0.465***	0.422***	0.394***	0.351***
	(-0.008)	(-0.007)	(-0.008)	(-0.008)	(-0.008)	(-0.007)
d_age_{60-69}	1.145***	1.045***	0.997***	0.925***	0.864***	0.778***
	(-0.011)	(-0.010)	(-0.010)	(-0.011)	(-0.010)	(-0.010)
d_age_{70+}	1.929***	1.801***	1.710***	1.566***	1.445***	1.288***
	(-0.014)	(-0.013)	(-0.013)	(-0.014)	(-0.013)	(-0.013)
$d\_children$	0.326***	0.252***	0.226***	0.185***	0.175***	0.157***
	(-0.007)	(-0.006)	(-0.006)	(-0.007)	(-0.006)	(-0.006)
$d\_married$	0.528***	0.510***	0.450***	0.325***	0.213***	0.091***
	(-0.009)	(-0.008)	(-0.008)	(-0.008)	(-0.008)	(-0.008)
d_church	0.774***	0.682***	0.604***	0.569***	0.543***	0.483***
	(-0.008)	(-0.007)	(-0.007)	(-0.008)	(-0.007)	(-0.007)
d_employ	-0.677***	-0.638***	-0.618***	-0.589***	-0.562***	-0.523***
	(-0.006)	(-0.006)	(-0.006)	(-0.006)	(-0.006)	(-0.006)
$\_cons$	2.186***	-0.151	-1.825***	-2.102***	-0.804***	-0.512*
	(-0.236)	(-0.215)	(-0.224)	(-0.232)	(-0.226)	(-0.212)

Note: Standard errors of coefficient estimates in brackets. Asterisks denote the respective significant level at 95% (*), 99% (**) and 99.9 (***).

Table S4. Quantile regression estimates for 2001, 75th -99th quantile

Covariate	**Quantile**					
	75 th	80 th	85 th	90 th	95 th	99 th
y_i	1.258***	1.199***	1.121***	0.993***	0.872***	0.776***
	(-0.008)	(-0.008)	(-0.007)	(-0.008)	(-0.010)	(-0.018)
p_i	-0.473***	-0.463***	-0.448***	-0.600***	-0.843***	-1.090***
	(-0.022)	(-0.022)	(-0.021)	(-0.023)	(-0.028)	(-0.045)
G_{ij}^{gov}	-1.108***	-0.954***	-0.734***	-0.529***	-0.372***	-0.119**
	(-0.023)	(-0.023)	(-0.022)	(-0.024)	(-0.027)	(-0.038)
d_age_{0-29}	-1.696***	-1.350***	-0.597***	-0.350***	-0.408***	-0.537***
	(-0.012)	(-0.012)	(-0.012)	(-0.013)	(-0.014)	(-0.022)
d_age_{30-39}	-0.399***	-0.319***	-0.281***	-0.266***	-0.252***	-0.103***
	(-0.007)	(-0.007)	(-0.007)	(-0.007)	(-0.009)	(-0.012)
d_age_{50-59}	0.310***	0.280***	0.252***	0.223***	0.172***	0.068***
	(-0.007)	(-0.007)	(-0.007)	(-0.007)	(-0.009)	(-0.012)
d_age_{60-69}	0.702***	0.643***	0.591***	0.559***	0.475***	0.232***
	(-0.009)	(-0.009)	(-0.009)	(-0.010)	(-0.011)	(-0.016)
d_age_{70+}	1.163***	1.074***	1.001***	0.912***	0.762***	0.420***
	(-0.012)	(-0.012)	(-0.012)	(-0.013)	(-0.015)	(-0.022)
$d\_children$	0.154***	0.141***	0.125***	0.108***	0.106***	0.048***
	(-0.006)	(-0.006)	(-0.005)	(-0.006)	(-0.007)	(-0.010)
$d\_married$	0.006	-0.063***	-0.083***	-0.024**	0.059***	0.091***
	(-0.007)	(-0.007)	(-0.007)	(-0.008)	(-0.009)	(-0.015)
d_church	0.401***	0.324***	0.221***	0.082***	-0.105***	-0.253***
	(-0.007)	(-0.007)	(-0.006)	(-0.007)	(-0.008)	(-0.012)
d_employ	-0.497***	-0.470***	-0.444***	-0.437***	-0.419***	-0.215***
	(-0.005)	(-0.005)	(-0.005)	(-0.006)	(-0.007)	(-0.010)
$\_cons$	-0.360	-0.497*	-0.948***	-0.758***	-0.105	-0.111
	(-0.206)	(-0.206)	(-0.197)	(-0.217)	(-0.248)	(-0.362)

Note: Standard errors of coefficient estimates in brackets. Asterisks denote the respective significant level at 95% (*), 99% (**) and 99.9 (***).

Table S5. Quantile regression estimates for 2004, 43th -70th quantile

Covariate	Quantile						
	43 th	45 th	50 th	55 th	60 th	65 th	70 th
y_i	0.927***	1.142***	1.399***	1.499***	1.503***	1.424***	1.344***
	(-0.010)	(-0.010)	(-0.010)	(-0.009)	(-0.009)	(-0.009)	(-0.008)
p_i	-2.437***	-2.007***	-1.436***	-1.124***	-1.005***	-0.952***	-0.898***
	(-0.034)	(-0.032)	(-0.031)	(-0.029)	(-0.030)	(-0.029)	(-0.027)
G_{ij}^{gov}	-1.150***	-1.047***	-0.903***	-0.813***	-0.753***	-0.648***	-0.543***
	(-0.034)	(-0.032)	(-0.030)	(-0.029)	(-0.029)	(-0.028)	(-0.027)
d_age_{0-29}	-0.078***	-0.282***	-0.475***	-0.639***	-0.844***	-1.127***	-1.410***
	(-0.018)	(-0.017)	(-0.016)	(-0.015)	(-0.015)	(-0.015)	(-0.014)
d_age_{30-39}	-0.461***	-0.457***	-0.448***	-0.438***	-0.420***	-0.414***	-0.408***
	(-0.011)	(-0.010)	(-0.010)	(-0.009)	(-0.009)	(-0.009)	(-0.009)
d_age_{50-59}	0.381***	0.347***	0.296***	0.269***	0.278***	0.262***	0.246***
	(-0.010)	(-0.009)	(-0.009)	(-0.008)	(-0.008)	(-0.008)	(-0.008)
d_age_{60-69}	0.882***	0.870***	0.869***	0.869***	0.872***	0.82***	0.768***
	(-0.013)	(-0.012)	(-0.011)	(-0.011)	(-0.011)	(-0.011)	(-0.010)
d_age_{70+}	1.742***	1.710***	1.669***	1.612***	1.544***	1.421***	1.297***
	(-0.017)	(-0.015)	(-0.014)	(-0.014)	(-0.014)	(-0.014)	(-0.013)
$d\_children$	0.387***	0.340***	0.264***	0.203***	0.158***	0.136***	0.113***
	(-0.009)	(-0.008)	(-0.007)	(-0.007)	(-0.007)	(-0.007)	(-0.007)
$d\_married$	0.722***	0.586***	0.421***	0.328***	0.226***	0.138***	0.049***
	(-0.010)	(-0.009)	(-0.009)	(-0.009)	(-0.009)	(-0.009)	(-0.008)
d_church	0.809***	0.822***	0.724***	0.642***	0.610***	0.559***	0.508***
	(-0.009)	(-0.009)	(-0.008)	(-0.008)	(-0.008)	(-0.008)	(-0.007)
d_employ	-0.650***	-0.585***	-0.529***	-0.508***	-0.490***	-0.471***	-0.452***
	(-0.008)	(-0.008)	(-0.007)	(-0.007)	(-0.007)	(-0.007)	(-0.006)
$\_cons$	-0.238	-2.986***	-6.128***	-7.315***	-7.372***	-6.867***	-6.361***
	(-0.301)	(-0.279)	(-0.265)	(-0.255)	(-0.257)	(-0.249)	(-0.240)

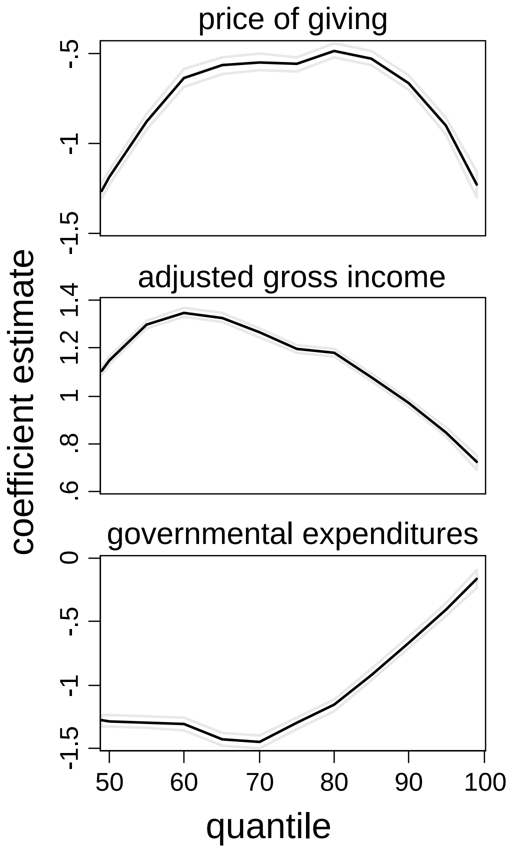
Note: Standard errors of coefficient estimates in brackets. Asterisks denote the respective significant level at 95% (*), 99% (**) and 99.9 (***).

Table S6. Quantile regression estimates for 2004, 75th -99th quantile

Covariate	Quantile					
	75 th	80 th	85 th	90 th	95 th	99 th
y_i	1.278***	1.248***	1.219***	1.078***	0.937***	0.813***
	(-0.008)	(-0.008)	(-0.007)	(-0.008)	(-0.010)	(-0.018)
p_i	-0.797***	-0.648***	-0.454***	-0.604***	-0.881***	-1.225***
	(-0.026)	(-0.025)	(-0.025)	(-0.026)	(-0.031)	(-0.054)
G_{ij}^{gov}	-0.446***	-0.360***	-0.312***	-0.243***	-0.209***	-0.107*
	(-0.026)	(-0.026)	(-0.026)	(-0.027)	(-0.031)	(-0.047)
d_age_{0-29}	-1.571***	-1.425***	-0.829***	-0.460***	-0.464***	-0.382***
	(-0.014)	(-0.014)	(-0.014)	(-0.014)	(-0.016)	(-0.026)
d_age_{30-39}	-0.335***	-0.283***	-0.244***	-0.238***	-0.234***	-0.104***
	(-0.008)	(-0.008)	(-0.008)	(-0.009)	(-0.010)	(-0.016)
d_age_{50-59}	0.226***	0.204***	0.184***	0.173***	0.137***	0.073***
	(-0.007)	(-0.007)	(-0.007)	(-0.008)	(-0.009)	(-0.014)
d_age_{60-69}	0.694***	0.617***	0.559***	0.526***	0.450***	0.242***
	(-0.010)	(-0.010)	(-0.010)	(-0.010)	(-0.012)	(-0.019)
d_age_{70+}	1.172***	1.050***	0.963***	0.863***	0.750***	0.479***
	(-0.013)	(-0.012)	(-0.013)	(-0.013)	(-0.016)	(-0.025)
$d\_children$	0.096***	0.074***	0.061***	0.070***	0.082***	0.051***
	(-0.006)	(-0.006)	(-0.006)	(-0.007)	(-0.008)	(-0.012)
$d\_married$	-0.027***	-0.097***	-0.144***	-0.101***	-0.022*	0.043**
	(-0.008)	(-0.007)	(-0.007)	(-0.008)	(-0.009)	(-0.015)
d_church	0.433***	0.343***	0.253***	0.132***	-0.058***	-0.274***
	(-0.007)	(-0.007)	(-0.007)	(-0.007)	(-0.008)	(-0.014)
d_employ	-0.426***	-0.405***	-0.368***	-0.370***	-0.346***	-0.211***
	(-0.006)	(-0.006)	(-0.006)	(-0.006)	(-0.008)	(-0.012)
$\_cons$	-5.923***	-5.764***	-5.289***	-3.901***	-2.078***	-0.592
	(-0.231)	(-0.228)	(-0.227)	(-0.235)	(-0.274)	(-0.426)

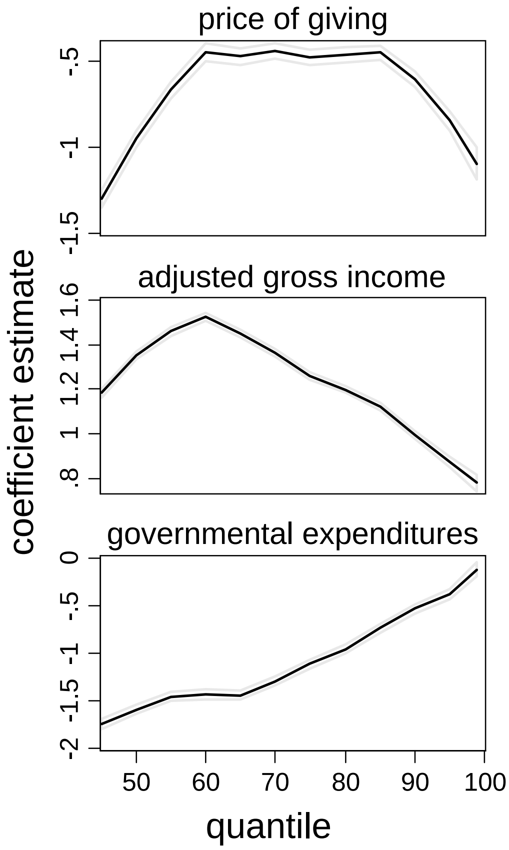
Note: Standard errors of coefficient estimates in brackets. Asterisks denote the respective significant level at 95% (*), 99% (**) and 99.9 (***).

Figure S1. Quantile coefficient estimates for 1998



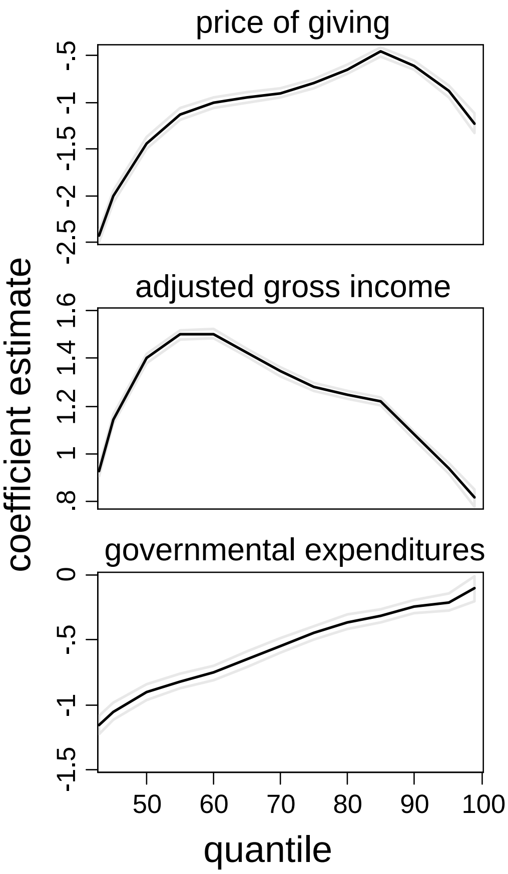
Note: Solid lines denote point estimates for the respective quantile; grey areas denote the 95th confidence interval.

Figure S2. Quantile coefficient estimates for 2001



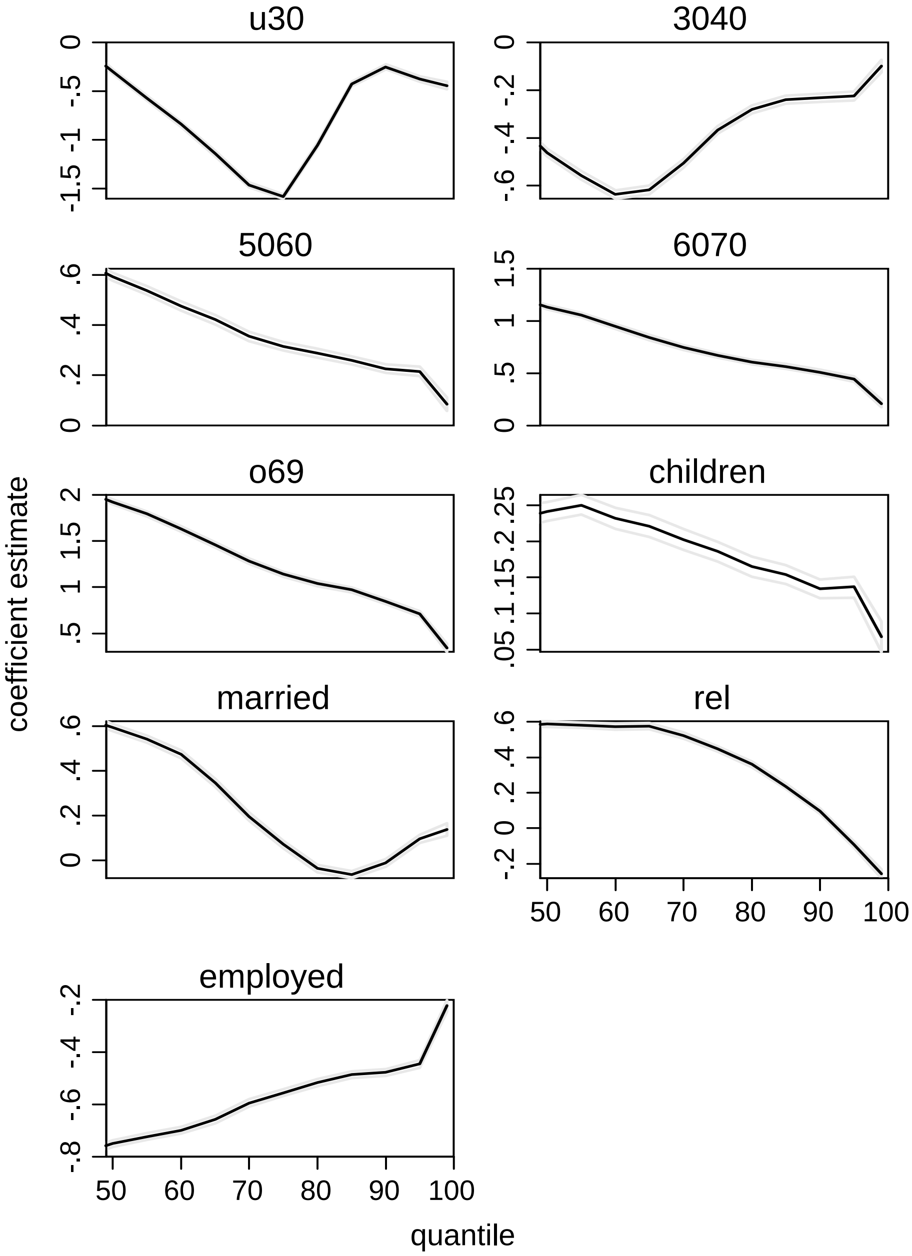
Note: Solid lines denote point estimates for the respective quantile; grey areas denote the 95th confidence interval.

Figure S3. Quantile coefficient estimates for 2004



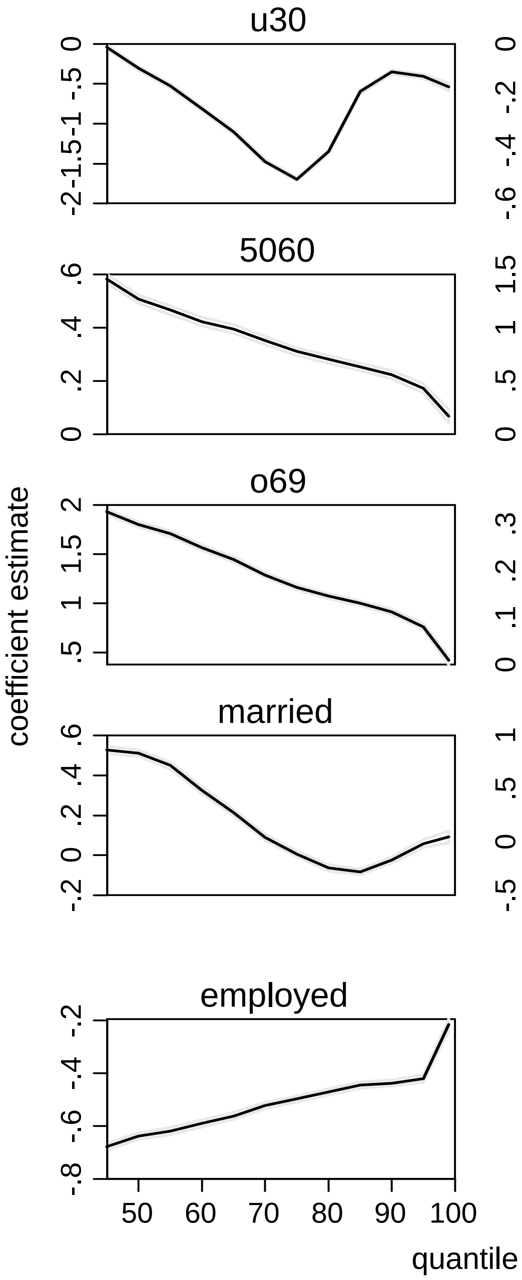
Note: Solid lines denote point estimates for the respective quantile; grey areas denote the 95th confidence interval.

Figure S4. Estimates for socio-demographic factors for 1998



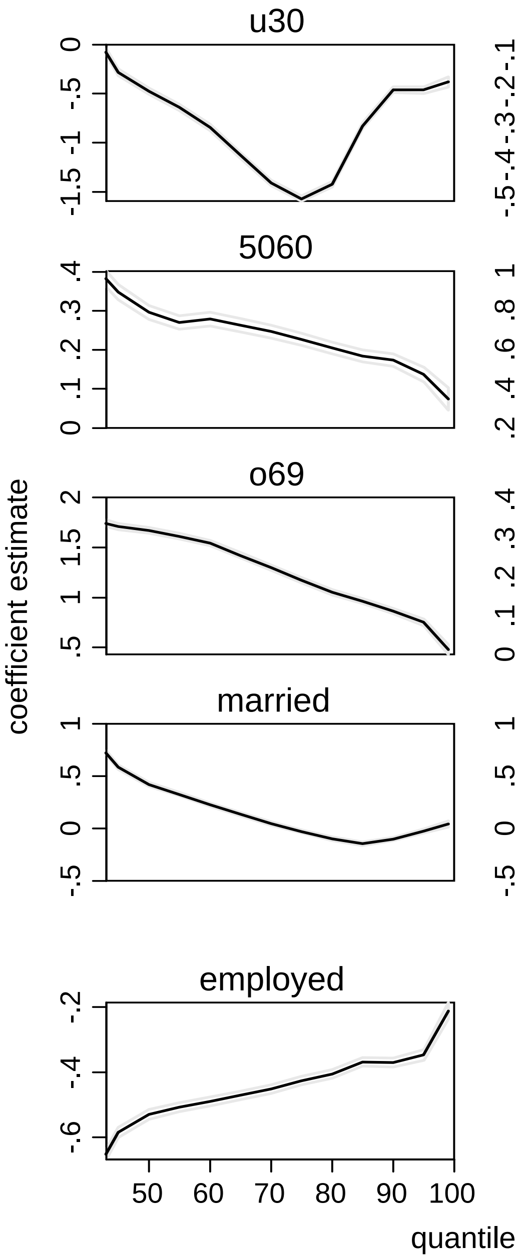
Note: Solid lines denote point estimates for the respective quantile; grey areas denote the 95th confidence interval.

Figure S5. Quantile estimates for socio-demographic factors for 2001



Note: Solid lines denote point estimates for the respective quantile; grey areas denote the 95th confidence interval.

Figure S6. Quantile estimates for socio-demographic factors for 2004



Note: Solid lines denote point estimates for the respective quantile; grey areas denote the 95th confidence interval.

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