# The Crucial Role of Social Welfare Criteria and Individual Heterogeneity for Optimal Inheritance Taxation [*]

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## Abstract

This paper extends the calibrations of Piketty and Saez (2013) to unveil the importance of the assumed social welfare criteria and its interplay with individual heterogeneity on optimal inheritance taxation. I calibrate the full social optimal tax rate and find that it is highly sensitive to the assumed social welfare criteria. The optimal tax rate ranges from negative (under a utilitarian criterion) to positive and large (even assuming joy of giving motives). A decreasing marginal utility of consumption does not affect the results qualitatively given the underlying distribution of wealth and income. I also calibrate the optimal tax rate by percentile of the distribution of bequest received, as in Piketty and Saez, but accounting for heterogeneity in wealth and labor income. This leads to significant variation in the optimal tax rate among zero-bequest receivers, contrary to their finding of a constant tax rate.

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# 1  Introduction

Taxation of wealth is currently at the center of many academic and political debates. For the case of inheritance taxation, policy makers are discussing reforms across many European countries, and in the U.S. the estate tax has been modified almost every year since 2001, currently operating with a 40% top marginal rate. This paper presents a positive analysis of two crucial features that underlie the design of optimal inheritance taxation, namely the assumed preference for redistribution (the social welfare function —SWF—) and the large variation across individuals regarding their preferred optimal tax rate (the underlying individual heterogeneity).

Most studies on inheritance taxation assume a utilitarian SWF. While this is a standard approach in the literature of optimal taxation, it has important consequences, as noted by Fleurbaey and Maniquet (2018) for the case of labor income taxation. I show that inheritance taxation is particularly affected by this assumption due to the interaction between the positive externalities that can arise from joy of giving bequest motives and the high concentration of bequests at the top of the distribution.

The model derived by Piketty and Saez (2013) —henceforth PS13— allows for different SWFs, which can be used to calibrate the optimal tax rate under different social welfare criteria. However, they opt for calibrating the optimal tax rate from the perspective of each percentile of the distribution of bequest received rather than the full social optimum under standard social welfare criteria. While their approach is informative of the role of heterogeneity in bequests received on inheritance taxation, it does not result in a single tax rate applicable to the entire population, and it does not fully capture heterogeneity in wealth and labor income.

This paper presents two contributions. First, I show that different assumptions on the SWF lead to very different full social optimal tax rates due to the high concentration of bequests at the top of the distribution and the existence of positive externalities. To do so, I revisit the model of PS13 and calibrate their optimal tax formula for the U.S.

under three different standard social welfare criteria.[1] I obtain that under a utilitarian criterion the optimal tax rate is always negative, even with fully accidental bequests. Under the responsibility and compensation criterion, the optimal tax rate is positive and very sensitive to other parameters of the model, particularly to the bequest elasticity. Under a Rawlsian criterion the optimal tax rate is positive and large, solely limited by the bequest elasticity. Interestingly, the concavity of the individual utility function does not have a qualitatively important impact on the optimal tax rate, due to offsetting effects from the underlying distribution of wealth and labor income and the trade-off between bequest and labor taxes.

Second, I extend the calibration by percentile of the distribution of bequest received to include heterogeneity in wealth and labor income. I find that the optimal tax rate for those who do not receive any bequests (70% of the population) varies significantly, from an 83.3% tax rate for the worst-off individuals to negative tax rates for those who, despite not having received any bequest, have accumulated wealth through high labor income. This result differs from the one obtained by PS13, in which the tax rate remains fairly constant around 50% for all zero-bequest receivers.

Altogether, these results show that the optimal inheritance tax rate depends heavily on the assumed SWF and the underlying distribution of bequests, income, and wealth. These two findings are crucial for the design of optimal inheritance taxes. Policy makers must account for the effect of different SWFs and the utilitarian framework is not a neutral benchmark. The percentile calibrations show a large variation on the optimal tax rate from the individual point of view. This helps to explain the public debate around inheritance taxation given the large heterogeneity in individual preferences and highlights its dependence on the social planner's welfare function.

The paper proceeds as follows: Section 2 introduces the literature on inheritance taxation with a focus on the assumed bequest motives and social welfare criteria. Section 3 summarizes the model of Piketty and Saez (2013). Section 4 presents the results from calibrating the full social optimal tax rate under standard social welfare criteria. Section

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[1] PS13 (p.15 of supplementary material) write: "It would be interesting to use our estimates to compute the full social optimum implied by various SWFs ..."

5 presents the results from calibrating the optimal tax by percentiles accounting for heterogeneity in wealth and labor income. Section 6 concludes.

## 2   Review of the literature

The study of optimal inheritance taxation needs to account for two relevant features of inheritance taxation. This section presents an overview of how they have been addressed in the literature. The first feature is the bequest motive, that is, the motivation for the donor to leave a bequest. With *altruistic* motives, donors care about the lifetime utility of their heirs and therefore internalize the effects of bequests on the donees. Under *joy of giving* motives, the donors' utility function depends on the after-tax bequest left, but not on the utility of the donees, which can lead to a positive externality because donors do not internalize the effect of their actions on the donees.[2] Finally, *accidental* motives lead to unplanned bequests and in this case the tax rate has no effect on the donors' utility.[3]

A second crucial feature for the study of optimal inheritance taxation is the assumption imposed on how individual utilities are weighted in the SWF. Frequently a utilitarian criterion is assumed. This turns out to be particularly relevant due to the high concentration of bequests at the top of the distribution and the presence of externalities of giving that increase proportionally with the amount bequeathed. Hence, even small variations in the social weights of individuals at the top of the distribution can cause significant changes in the optimal tax.

These two features are unremarked in the most prominent results of the literature. For example, the model of Atkinson and Stiglitz (1976) has been extrapolated to the study of inheritance taxation reinterpreting consumption of different commodities as consumption at different points in time, and taxation of future consumption as a tax on bequests, which should therefore be zero. This model implicitly assumes joy of giving bequest motives because it is the bequests left, and not the utility of the heirs, that enters the utility of the first generation. The social planner of this model maximizes a utilitarian SWF.

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[2] This 'externality of giving' differs from a standard atmospheric externality because it is interpersonal, requiring differentiated Pigouvian taxes.

[3] Kopczuk and Lupton (2007) estimate that over 30% of bequests are accidental.

Chamley (1986) and Judd (1985) study capital taxation using an infinite-life model, measuring social welfare from the first generation. They assume altruistic bequest motives and since it is a representative agent model, the implicit SWF is utilitarian. They conclude that the optimal tax rate is zero, however Straub and Werning (2020) have overturned this result, obtaining a positive tax rate.

Farhi and Werning (2010) extend the model of Atkinson and Stiglitz (1976) to explicitly model inheritance taxation considering two generations. The first generation of donors have joy of giving motives and starts with no wealth inequality but heterogeneous productivity, so that the inheritance received by the second generation and labor inequality are perfectly correlated. The second generation only consumes what they inherited and do not work. If the social planner (with a utilitarian SWF) only considers the utility of the first generation, the optimal tax rate is zero. However, when the utility of the second generation is included in the social welfare the optimal inheritance tax rate becomes negative to correct for the positive externality caused by joy of giving motives.

Cremer and Pestieau (2011) use an overlaping generations model based on Diamond (1965) and extend it to model inheritances, showing how the optimal inheritance tax rate depends on the bequest motives. If bequests are fully accidental, a tax rate of 100% is optimal. If bequest motives are altruistic, the utility function of the representative individual fully captures the utility of next generations internalizing the positive externality of giving. In this case, the optimal tax rate in the long run is zero. With joy of giving motives, the positive externality appears and the optimal tax rate is negative. Note, however, that in all these cases the SWF is utilitarian.

Brunner and Pech (2012a) and Brunner and Pech (2012b) improve upon previous models by including initial wealth inequality. They find that the optimal tax can increase social welfare if initial wealth and earning abilities are correlated. They consider altruistic and joy of giving motives, but control for double-counting of utilities between generations. They assume that the SWF puts more weight on low ability individuals to ensure a preference for redistribution but the implications of this assumption are not further explored.

Recent contributions to the literature of inheritance taxation emphasize the labor supply response of inheritors. Kopczuk (2013) finds that an increase on bequests will reduce total labor supply and revenue from labor income taxes, generating a negative 'fiscal externality' that can be counteracted with a tax on bequests. In this line, Kindermann et al. (2018) further develop and calibrate a life-cycle model that accounts for the labor supply of heirs and find sizable 'fiscal externalities'. Both models assume joy of giving motives and utilitarian SWF.[4]

Closely related to this paper is the model of Farhi and Werning (2013), which introduces heterogeneity in altruistic motives and also considers different SWFs. They find that "optimal estate taxes depend crucially on redistributive objectives. Different welfare criteria lead to results ranging from taxes to subsidies" (p.490). Their results therefore constitute a theoretical basis for the empirical calibrations that I present here, based on the model of PS13.

# 3 The model of Piketty and Saez

The model of PS13 contributes to the literature allowing for alternative SWFs and for a combination of bequest motives. The authors present a dynamic stochastic model with a discrete set of generations that do not overlap, with heterogeneous bequest tastes and labor productivities. There is labor augmenting economic growth at rate $G > 1$ per generation. The government has a given budgetary need $E$ that is financed with linear taxes on labor income at rate $\tau_{Lt}$ and on capitalized bequest at rate $\tau_{Bt}$. This revenue is then equally distributed across individuals as a lump-sum grant per individual, $E_t$.

Each individual, $ti$, lives in generation $t$ and belongs to dynasty $i$. Each receives a pre-tax bequest $b_{ti}$ that earns an exogenous gross rate of return $R$ and at death leaves a pre-tax bequest $b_{t+1i}$ to the next generation. There is an unequal initial distribution of bequests $b_0$ given exogenously. Each individual works $l_{ti}$ hours at a pre-tax wage rate $w_{ti}$ drawn from an arbitrary but stationary distribution, earning $y_{Lti} = w_{ti}l_{ti}$.

Individuals have a utility function $V^{ti}(c_{ti}, b, \underline{b}, l_{ti})$, increasing in consumption $c_{ti}$, in

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[4] Elinder et al. (2012) provide empirical evidence on such labor supply responses to inheritances.

pre-tax bequest left $b$ (capturing accidental motives), and in after-tax capitalized bequest left $\underline{b} = R \cdot b_{t+1i}(1 - \tau_{Bt+1})$ (capturing joy of giving motives[5]) and decreasing in labor $l_{ti}$. Note that the donor's utility function includes the after-tax capitalized bequest left but not the utility of the bequest receivers, resulting in a positive externality. Individuals use their net-of-taxes lifetime resources on consumption $c_{ti}$ and bequest left $b_{t+1i}$. Hence, the individual maximization problem is

$$\max_{l_{ti}, c_{ti}, b_{t+1i} \geq 0} V^{ti}(c_{ti}, b, \underline{b}, l_{ti}) \qquad \text{s.t.} \tag{1}$$

$$c_{ti} + b_{t+1i} = Rb_{ti}(1 - \tau_{Bt}) + w_{ti}l_{ti}(1 - \tau_{Lt}) + E_t$$

The utility functions $V^{ti}$ and the wage rates $w_{ti}$ are assumed to follow an ergodic stochastic process such that with constant tax rates $\tau_B$ and $\tau_L$, and government revenue $E$, the economy converges to a unique ergodic steady-state equilibrium independent of the initial distribution of bequests $b_{0i}$. In equilibrium individuals maximize utility as in (1) and this results in a steady-state ergodic equilibrium distribution of bequests and earning $(b_{ti}, y_{Lti})$.

The steady-state SWF is defined as the sum of individual utilities weighted by Pareto weights $\omega_{ti} \geq 0$. Hence, a normative social welfare criterion must be assumed. The government must solve

$$SWF = \max_{\tau_L, \tau_B} \int_i \omega_{ti} V^{ti}(c_{ti}, b, \underline{b}, l_{ti}) \qquad \text{s.t.} \tag{2}$$

$$E = Rb_t \tau_B + w_t l_t \tau_L$$

The derivation of the optimal tax rate on bequests $\tau_B$ takes the linear marginal tax on labor income $\tau_L$ as given. In the steady-state equilibrium the government's financial needs $E$ will be constant $(dE = 0)$ and with no government debt, the two taxes, $\tau_B$ and $\tau_L$, will be linked to each other in order to satisfy the government's budget constrain. The

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[5] PS13 denote these bequests as altruistic (as opposed to accidental), however it corresponds to joy of giving motives as defined above.

optimal linear tax on bequests that maximizes steady-state social welfare is

$$\tau_B = \frac{1 - \left[1 - \dfrac{e_L \tau_L}{1 - \tau_L}\right] \cdot \left[\dfrac{\bar{b}^{\text{received}}}{\bar{y}_L}(1 + \hat{e}_B) + \dfrac{\nu}{R/G}\dfrac{\bar{b}^{\text{left}}}{\bar{y}_L}\right]}{1 + e_B - \left[1 - \dfrac{e_L \tau_L}{1 - \tau_L}\right]\dfrac{\bar{b}^{\text{received}}}{\bar{y}_L}(1 + \hat{e}_B)} \tag{3}$$

where $\nu$ is the share of joy of giving bequests and $e_B$ and $e_L$ are the long-run elasticities that capture behavioral responses of bequest flows $b_t$ and of the aggregated labor supply in terms of earning $y_{Lt}$ with respect to the corresponding net-of-tax rates $(1 - \tau_B)$ and $(1 - \tau_L)$. Because the two taxes, $\tau_B$ and $\tau_L$, are linked to satisfy the government budget constraint, the elasticities capture the effect of a joint and budget-neutral change in both taxes. The elasticities are defined as

$$e_B = \frac{1 - \tau_B}{b_t}\frac{db_t}{d(1 - \tau_B)}\bigg|_E \qquad \text{and} \qquad e_L = \frac{1 - \tau_L}{y_{Lt}}\frac{dy_{Lt}}{d(1 - \tau_L)}\bigg|_E \tag{4}$$

The distributional parameters $\bar{b}^{\text{received}}$, $\bar{b}^{\text{left}}$ and $\bar{y}_L$ capture two elements. First, the degree of inequality of bequests received, bequests left, and labor income observed in the data. And second, the normative weighting of the individuals in the SWF.

$$\bar{b}^{\text{received}} = \frac{\int_i g_{ti} b_{ti}}{b_t} \quad , \qquad \bar{b}^{\text{left}} = \frac{\int_i g_{ti} b_{t+1i}}{b_{t+1}} \qquad \text{and} \qquad \bar{y}_L = \frac{\int_i g_{ti} y_{Lti}}{y_{Lt}} \tag{5}$$

The three parameters are defined as the ratios of the population average weighted by the social welfare weights $g_{ti}$ (defined below) to the unweighted population averages. The ratios will be smaller than 1 if the social welfare weights $g_{ti}$ put more weight on individuals that are worse-off and will be equal to 1 when these weights are equally distributed.

The social welfare weights $g_{ti}$ (Saez and Stantcheva, 2016) are defined as each individual's marginal utility of consumption, $V_c^{ti}$, weighted by the Pareto weight $\omega_{ti}$ and divided by the weighted average of the marginal utility of consumption for the entire population to normalize them. They measure the social value of increasing consumption of individual

*ti* by one unit relative to distributing that unit equally across all individuals.

$$g_{ti} = \frac{\omega_{ti} V_c^{ti}}{\int_j \omega_{tj} V_c^{tj}} \tag{6}$$

*Calibration*

The strategy followed by PS13 for the calibration of the optimal tax rate is to calibrate it for each percentile of the distribution of bequest received. In other words, they sequentially calibrate the optimal tax from the perspective of each 1% interval of the distribution of bequest received, as if the social planner only cared for those individuals. In terms of the social welfare weights, $g_{ti}$, their approach is equivalent to recursively setting the weights of all individuals to zero except for those belonging to percentile $p$.[6],[7]

Using U.S. micro-data from the Survey of Consumer Finances (SCF) 2010 and focusing on individuals aged 70+, PS13 obtain the optimal tax rate by percentile of bequest received, which is shown in figure 1a along with my own replication.[8] The figure reports the optimal linear tax rate $\tau_B$ from the point of view of each percentile of bequest receivers based on (3) and given the benchmark parameters $e_b = 0.2$, $e_L = 0.2$, $\tau_L = 30\%$, $\nu = 1$, $R/G = 1.8$ and a capitalization rate $r = 3$. We observe that the optimal tax rate remains constant around 50% until percentile 70, corresponding to individuals who have not received any bequest. It then drops rapidly as the inheritance received, and to a lesser extent wealth and income, increase. For percentiles above 85 the optimal tax turns negative (a subsidy), growing to minus infinity. Note that the figure is constructed with a lower bound of $-20\%$.

In figure 1b I show the three distributional parameters $\bar{b}_p^{\text{received}}$, $\bar{b}_p^{\text{left}}$, and $\bar{y}_{Lp}$ that underlie my replication of the optimal tax rate. We observe that they remain fairly constant until percentile 70, causing the constant 50% optimal tax rate for the first 70 percentiles. In Section 5, I account for heterogeneity in wealth and labor income, obtaining a different result.

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[6] In their own words: "To be agnostic and explore heterogeneity in optimal $\tau_B$ across the distribution, we consider percentile $p$-weights which concentrate uniformly the weights $g_{ti}$ on percentile $p$ of the distribution of *bequest received*." (PS13, p.1873).

[7] PS13 also calibrate the optimal tax rate for larger groups of de distribution of bequest received (0-50, 50-70, 70-90 and 90-95).

[8] Note that the replication for the first 70 percentiles cannot be exact because individuals are randomly assigned to each percentile, as discussed in Section 5.
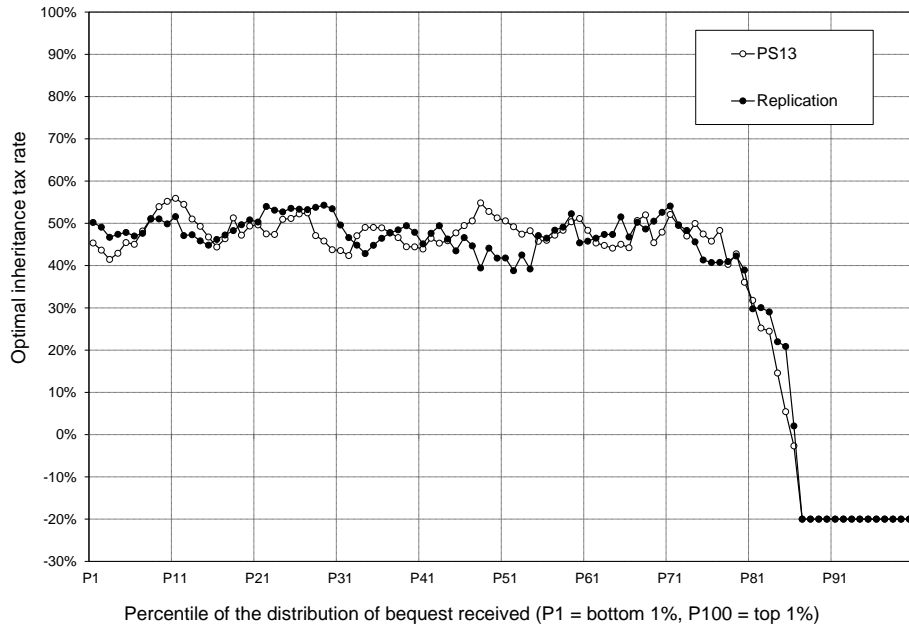
(a) Optimal linear inheritance tax rate by percentile of bequest received. Calibration of PS13 for the U.S. and replication.
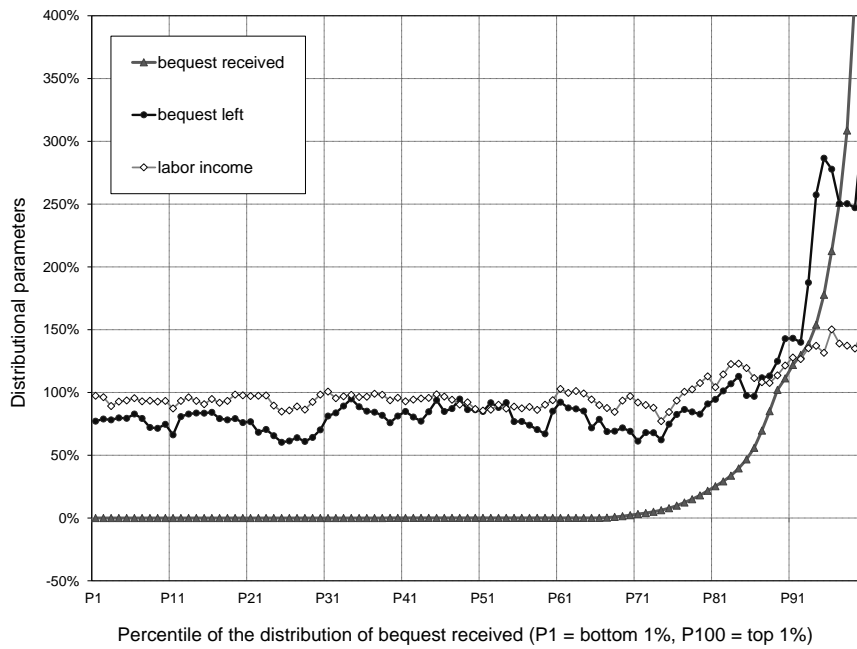


(b) Distributional parameters by percentile of bequest received for the U.S. using data from SCF 2010. Own calculation.

Figure 1: Replication of the optimal tax rate by percentile of bequest received and distributional parameters.

# 4  Calibration of the Full Social Optimum

This section shows the results from calibrating the full social optimal tax rate under three standard social welfare criteria. First, the *utilitarian* criterion, which corresponds to a social planer with no preference for redistribution that weights individuals equally in the SWF, with $\omega_{ti}$ equally distributed. Second, the *responsibility and compensation criterion*, which sets $\omega_{ti}$ to 1 for individuals who did not receive any bequests, and to zero for those who did, arguing that this source of inequality is unmerited. And third, the *Rawlsian* criterion, which has the strongest preference for redistribution, considering only the worst-off individual in the SWF, and setting $\omega_{ti}$ to zero for all individuals except for the individual with the lowest utility.[9]

The individual utility $V^{ti}$ enters the social welfare weights $g_{ti}$ through the individual marginal utility of consumption $V_c^{ti}$. I consider a utility function that is additively separable in consumption $c_{ti}$, i.e. $V^{ti}(c_{ti}, b, \underline{b}, l_{ti}) = u(c_{ti}) + h^{ti}(b, \underline{b}, l_{ti})$. First, I consider $u(c_{ti})$ being linear and hence a marginal utility $V_c^{ti} = \alpha$.[10] Second, I consider $u(c_{ti})$ being isoelastic, with $V_c^{ti} = c_{ti}^{-\rho}$ which is strictly concave for $\rho > 0$. I evaluate this function for a range of values of $\rho$ between 0 and 1.4 based on the estimates of Chetty (2006).

The social welfare weights $g_{ti}$ resulting from the different combinations of the three social welfare criteria and the different utility functions are shown in the appendix (figure A1).[11] These welfare weights are then used to compute the distributional parameters of bequest received, bequest left, and labor income, defined in (5), which determine the full social optimal tax rate defined in (3).

*Utilitarian*

Table 1 presents the resulting full social optimal tax rates. The first panel shows the results under the utilitarian criterion and different levels of concavity of the individual utility function. Under the utilitarian criterion, the pareto weights $\omega_{ti}$ are equally distributed for

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[9] PS13 calibrate the optimal tax rate under a "meritocratic Rawlsian" criterion, which is equivalent to the responsibility and compensation criterion but setting the welfare weights to zero for about half the population.

[10] In this case, the marginal utility of bequest left must be non-constant to obtain an interior solution.

[11] Note that under a Rawlsian criterion, the welfare weights are the same for all specifications of individual utilities, since only one individual has positive weight.

all individuals and the welfare weights $g_{ti}$ are only unequally distributed when the utility function is strictly concave. I obtain that under the utilitarian criterion the optimal tax rate is negative irrespective of the concavity of the functional form.

This negative-tax result is caused by the positive externality that originates in the joy of giving motive. Note that $V^{ti}(c_{ti}, b, \underline{b}, l_{ti})$ increases with the after-tax bequest left $\underline{b}$, that is, the utility of the donors increases due to the act of bequeathing alone, regardless of its positive effect on the utility of the donees. In a steady-state equilibrium with a social planner that cares about the utility of all generations, this produces a positive externality and the optimal tax rate internalizes it by means of a negative tax.

Importantly, the negative-tax result hinges also on the assumption of a utilitarian SWF. The reason is that the positive externality grows proportionally with bequest received and the latter is highly concentrated at the top of the distribution, leading to very large positive externalities for individuals who receive the largest bequests. Because all individuals are weighted equally by the utilitarian criterion, the positive externality present at the top of the distribution dominates the full social optimum. Therefore, when the full social optimum derived by PS13 is calibrated under a utilitarian criterion it reaches the same result as previous models who derived the optimal tax rate under joy of giving motives and a utilitarian criterion (Farhi and Werning, 2010).[12]

The result that the tax rate becomes more negative as the utility function becomes more concave might be counter-intuitive at first sight. If we increase the welfare weights of the poor, shouldn't the bequest subsidy decrease? However, the government's margin of decision is to trade off tax rates on labor income and on inheritances, conditional on raising the revenue $E_t$. Therefore, individuals with high marginal utility of consumption (who are the ones with less income)[13] will be weighted more by the government and these

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[12]Note that strictly speaking, under a utilitarian criterion with linear individual utility the first best solution would be to use a lump-sum tax rather than a distortive labor income tax to finance the bequest subsidy . In this case, however, the lump-sum grant would not be optimal. We must hence assume that in a second-best world even a government with equal welfare weights is forced to use labor income taxation to collect a given amount $E$.

[13]In the absence of consumption data, I use labor income as a proxy for consumption. An alternative would be to construct a measure of overall budget combining lifetime income and wealth. Both measures, however, are likely to incur in some measurement error that will be concentrated at the top and bottom percentiles of the distribution.

individuals prefer a high rate on labor rather than on bequests. Crucially, this statement hinges on the underlying distribution of income and wealth observed in the data. If we look at the distributional parameter reported in the central columns of Table 1 we observe that as the concavity of the utility function increases, the distributional parameter of labor income decreases more than that of bequest received and bequest left. In other words, the labor incomes that the government weights in its welfare function represent a decreasing share. The distributional parameters of bequest received and bequest left also decrease, but less so, leading to a decrease in the tax, that is, an increase in the subsidy.

Table 1: Full social optimal tax rate under different welfare criteria

| Welfare criterion | Utility | $\bar{b}_p^{\text{received}}$ | $\bar{b}_p^{\text{left}}$ | $\bar{y}_{Lp}$ | Optimal tax rate |
|---|---|---|---|---|---|
| Utilitarian | $\rho = 0$ (linear) | 1.00 | 1.00 | 1.00 | -582.3% |
| | $\rho = 0.3$ | 0.99 | 0.88 | 0.91 | -5040.1% |
| | $\rho = 0.7$ | 0.92 | 0.77 | 0.80 | -10000.0% |
| | $\rho = 1.4$ | 0.78 | 0.71 | 0.61 | -10000.0% |
| Resp. & compens. | $\rho = 0$ (linear) | 0.00 | 0.83 | 0.99 | 48.1% |
| | $\rho = 0.3$ | 0.00 | 0.72 | 0.91 | 50.0% |
| | $\rho = 0.7$ | 0.00 | 0.63 | 0.79 | 49.9% |
| | $\rho = 1.4$ | 0.00 | 0.64 | 0.60 | 38.5% |
| Rawlsian | linear = isoel. | 0.00 | 0.00 | 0.23 | 83.3% |

Note: Own calculations using SCF 2010. Lower bound -10000%.
Benchmark parameters: $e_b = 0.2$, $e_L = 0.2$, $\tau_L = 30\%$, $\nu = 1$, $R/G = 1.8$.

*Responsibility and compensation*

Under the responsibility and compensation criterion, individuals who received a positive bequest (around 30%) are weighted out of the SWF, and those who did not, have positive weights either equally distributed when the utility function is linear or diminishing in labor income when the utility function is isoelastic. Under this criterion the optimal tax rate becomes positive and, for the linear utility case, equal to 48.1%.

The positive-tax result highlights the importance of the SWF for the optimal tax rate. By excluding individuals from the top percentiles the externality of giving disappears and the optimal tax rate becomes positive. This is driven by the distributional parameter of bequest received which, by definition, drops to zero.

Interestingly, the concavity of the utility function impacts the optimal tax rate non-monotonically, and this is driven by the distribution of wealth, which does not increase monotonically with labor income (and hence with the marginal utility of consumption). With bequest receivers weighted out of the social welfare function, the ratio between the distributional parameters of bequest left and labor income ($\bar{b}_p^{\text{left}}/\bar{y}_{Lp}$) is what determines the government's choice of taxes on bequests and labor income. In this case, moving from a linear utility function to a slightly concave function ($\rho = 0.3$) reduces that ratio, therefore the share of wealth that the government cares about (the one weighted in its social welfare function) decreases less than the share of labor income that the government weights in. However, for further degrees of concavity the effect is the opposite and the ratio increases, leading to a decrease in the optimal tax rate.

As an illustration of these forces, note that the distributional parameter of bequest left decreases as $\rho$ goes from 0 to 0.3 and to 0.7, but then increases when $\rho = 1.4$. In this later case, the weight given to the individuals at the bottom of the income distribution is an order of magnitude of 10 times the weight when $\rho = 0.7$. These individuals have a comparatively high net wealth (see percentile 1 of figure 3a) which makes them prefer a low or even negative tax on wealth despite not having received any bequest. This increases the ratio $\bar{b}_p^{\text{left}}/\bar{y}_{Lp}$ and pushes the full social optimal tax rate down.

*Rawlsian*

The Rawlsian criterion assigns the full Pareto weight $\omega_{ti}$ to the worst-off individual and sets it to zero elsewhere. Since only one individual has positive weight, the specification of this individuals's utility function is redundant, and therefore the welfare weights $g_{ti}$ are identical for both the linear and the isoelastic specifications. Hence, the full social optimal tax rate under any specification of the individual utility is the same, in this case, 83.3%. Note that even though this worse-off individual does not receive or leave any bequest, the optimal tax rate from his/her perspective is not 100% because with a positive bequest elasticity bequests would drop to zero and the revenue loss would have to be compensated with a rise in the labor income tax rate.

Overall, these empirical calibrations are consistent with the findings of Farhi and

Werning (2013). With an utilitarian SWF they find a negative optimal tax rate.[14] Under a Rawlsian (maxmin) criterion, they obtain a positive tax rate. The responsibility and compensation, with a more intermediate preference for redistribution, is not evaluated in Farhi and Werning (2013) and in our calibrations it leads to a positive tax rate that is closer to the rates observed in current legislation.

*Variants of the benchmark case*

Table 2 presents the full social optimal tax rate with linear utility calibrated under different values of the benchmark parameters used in table 1.

Table 2: Variants of the full social optimum

|  | Utilitarian | Resp. & compens. | Rawlsian |
|---|---|---|---|
| **Benchmark** | **-582.3%** | **48.1%** | **83.3%** |
| $e_B = 0$ | -485.4% | 57.7% | 100.0% |
| $e_B = 0.3$ | -619.5% | 44.4% | 76.9% |
| $e_B = 0.7$ | -724.7% | 33.9% | 58.8% |
| $e_B = 1$ | -776.0% | 28.8% | 49.9% |
| $e_B = 3$ | -921.3% | 14.4% | 24.9% |
| $e_B = 5$ | -969.8% | 9.6% | 16.6% |
| $e_B = 30$ | -1047.9% | 1.8% | 3.1% |
| $e_L = 0.1$ | -1310.3% | 46.4% | 83.3% |
| $e_L = 0.3$ | -339.6% | 49.7% | 83.3% |
| $e_L = 0.5$ | -145.5% | 53.0% | 83.3% |
| $\nu = 0.7$ | -435.9% | 58.7% | 83.3% |
| $\nu = 0.2$ | -192.0% | 76.3% | 83.3% |
| $\nu = 0$ | -94.4% | 83.3% | 83.3% |

Note: Own calculations using SCF 2010.
Benchmark parameters: $e_b = 0.2$, $e_L = 0.2$, $\tau_L = 30\%$, $\nu = 1$, $R/G = 1.8$.

The first panel shows the full social optimal tax rate under different bequest elasticities, $e_b$.[15] Estimations by Kopczuk and Slemrod (2001) find this elasticity to be around 0.2 and PS13 consider that a value of 1 is implausibly high. However some theoretical models

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[14]In Farhi and Werning (2013) this result holds only when the utility of both parents and children is included in the SWF, and the optimal tax rate is zero when only the utility of parents is considered. In PS13 each generation is both a bequest leaver and receiver.

[15] Note that the elasticities $e_b$ and $e_L$ are defined with respect to the net-of-tax rates $(1 - \tau_B)$ and $(1 - \tau_L)$ and therefore take positive values.

such as Chamley (1986) and Judd (1985) are derived under a setup where the elasticity of bequests is infinite. I therefore consider higher elasticities as well.

Higher bequest elasticities reduce the optimal tax rate on bequests. Under the utilitarian criterion the negative tax increases in absolute value. Under the responsibility and compensation criterion and under the Rawlsian criterion the tax rate decreases with the bequest elasticity and it converges to 0% as the elasticity increases. Note that under the Rawlsian criterion with an elasticity $e_B = 0$ the optimal tax rate is 100%, since the social planner only cares about the worst-off individual and there are no efficiency costs from taxing bequests due to the zero elasticity. However, so long as the elasticity of bequests is larger than zero, the optimal tax is smaller than 100%.

The second panel of table 2 shows the effect on the optimal tax rate of different labor supply elasticities to labor income taxes, $e_L$. We observe that higher labor elasticities increase the optimal tax rate on bequests. The intuition for this result is that the higher the elasticity of labor supply, the larger the efficiency loss from taxing labor income. Hence, to satisfy the government's budget constraint for a given labor income tax rate, a higher tax rate on bequests is needed. Under the utilitarian criterion the optimal subsidy decreases sharply as $e_L$ increases because the large subsidy for the top bequest receivers is now more costly to finance. Under the responsibility and compensation criterion the sensitivity of the optimal tax rate to changes in $e_L$ is moderate, and this result holds across different values of $e_B$. Under the Rawlsian criterion the optimal tax rate is unaffected by changes in $e_L$. Actually, under this criterion the only parameter that affects the optimal tax rate is the elasticity of bequest, as discussed above, because the distributional parameters of bequest received and bequest left are equal to zero and the optimal tax formula (3) is reduced to $\tau_B = \frac{1}{1+e_B}$.

The third panel shows the sensitivity of the optimal tax rate to bequest motives. As the share of accidental bequests increases (lower $\nu$) the optimal tax rate under the utilitarian and responsability and compensation criteria increases. This is because taxation of accidental bequests does not impact the utility of the donors since the after-tax bequests left $b$ do not enter their utility function.

Note that for the three social welfare criteria, when bequest motives are fully accidental ($\nu = 0$), the optimal tax rate remains under 100%. This result differs from previous models, like Cremer and Pestieau (2011), in which fully accidental bequest motives are taxed at a 100% rate. The reason is that the flexibility of the model of PS13 allows for the unconventional case where bequest motives are fully accidental but the bequest elasticity is positive. However, if the bequest elasticity is zero the optimal tax rate becomes 100% under the three criteria.

*Final remarks*

From these calibrations we conclude that the main determinant of the optimal tax rate is the assumed social welfare criterion. Positive full social optimal tax rates under PS13's framework appear only when wealthier individuals are weighted less in the SWF. A second determinant of the optimal tax rate are the ratios between the distributional parameters of bequest received or left and of labor income. These ratios capture the government's social preferences regarding the trade-off between labor and bequest taxes, which depends on the welfare weights and the underlying distribution of wealth and income.

A more concave individual utility function increases the subsidy under the utilitarian criterion because individuals with low labor income (who therefore prefer high taxes on labor) are weighted more, since they have higher marginal utility of consumption. Under the responsibility and compensation criterion, however, a higher concavity of the utility function has non-monotonic effects on the optimal tax on bequests. This is because individuals with low income can have high wealth, so the ratio between the distributional parameters of bequest left and labor income that determine the optimal tax rate on bequests are also non-monotonic as the concavity of the utility increases. From these results we conclude that, conditional on the distribution of the data, the concavity of the individual utility does not have a qualitatively significant impact on the optimal inheritance tax rate.

Finally, we observe that criteria with an intermediate preference for redistribution, such as responsibility and compensation, are the most sensitive to variations of the benchmark parameters such as the elasticities of bequests and labor income and the share of accidental

bequests.

# 5  Introducing heterogeneity in wealth and labor income

The calibration approach of PS13 exploits heterogeneity in bequests received, ordering individuals by the amount of bequest received and calculating the optimal tax rate from the perspective of each percentile. In doing so, the large share of individuals who did not receive any bequest, about 70%, are randomly assigned to each of the first 70 percentiles. These individuals differ in accumulated wealth (future bequests left) and in labor income, but since they are ordered randomly, the average value of wealth and labor income becomes approximately the same for each of the first 70 percentiles and so do the two corresponding distributional parameters and the resulting optimal tax rate. This leads PS13 to conclude that the optimal tax rate by percentile is constant for the first 70 percentiles (see figures 1a and 1b).

In this section, I further exploit individual heterogeneity by sub-ordering individuals by their wealth and labor income. This avoids the random assignment of non-receivers across the 70 first percentiles and offers a more realistic description of the different optimal tax rates from the perspective of each percentile and about the drivers of the optimal tax across the population of non-receivers. This leads to an optimal tax rate that varies significantly among the non-receivers.

In a way, this approach makes each percentile more representative of the different individuals of the population, incorporating the heterogeneity present in all the variables of PS13's model. Also, this calibration approach is consistent with the assumptions of the model, which explicitly includes heterogeneous wealth and wages, and emphasizes the connection between these variables (e.g. individuals accumulate wealth through labor income, which is likely to be bequeathed) and between their taxes (which must fulfill the government's budgetary needs).

An alternative approach for ordering individuals is to use their total budget (bequest received plus income) or their total budget extended (adding wealth). These two measures have the advantage of capturing individual heterogeneity jointly for bequests, income and wealth leading to a more realistic distribution of the optimal tax rate across the

population. However, this approach makes it harder to learn about the drivers of the optimal tax rate by percentile because individuals with a similar budget might have very different bequests, income and wealth. The results from this alternative approach are reported in the appendix figures A2 and A3.

The methodology followed to calculate the new distributional parameters is the same as in PS13, that is, giving uniform social welfare weights $g_{ti}$ to all individuals within each percentile. The distributional parameters $\bar{b}^{\text{received}}$, $\bar{b}^{\text{left}}$ and $\bar{y}_L$ are then the average of bequest left, bequest received, and labor income for each percentile relative to population averages. The change with respect to PS13's calibration is that the individuals included in each percentile are now different, as a result of the different ordering.

Figures 2b and 2a show the optimal tax rate and the distributional parameters resulting from sub-ordering by wealth. Compared to the original calibrations of PS13 we observe that the optimal tax rate is not constant for the first 70 percentiles, and neither are the distributional parameters of bequest left, which by construction increases monotonically for the first 70 percentiles, and labor income. Now the optimal tax rate decreases for the first 70 percentiles, as the individuals' wealth rises. It starts with an optimal tax rate of 83.3% for the bottom 1% (coinciding with the Rawlsian full social optimum) and turns negative, about -14%, for percentiles 66 to 70. This evolution reflects the intuitive idea that those individuals who did not receive any inheritance but have accumulated wealth (which they will probably bequeath) might prefer a low or even negative inheritance tax rate. On the other hand, individuals from the bottom percentiles who own no wealth but earn labor income prefer a tax on inheritances that collects as much as possible (only bounded by the elasticity of bequests), since the remaining financial needs of the government will have to be covered by a rise in labor income taxes.

The results from sub-ordering individual observations by labor income are presented in figures 3a and 3b. In this case the distributional parameter that increases monotonically until percentile 70 is labor income. The distributional parameter of bequest left also tends to increase, but it oscillates more, causing the optimal tax rate to behave more erratically. This shows that the behavior of the distributional parameter of bequest left dominates the
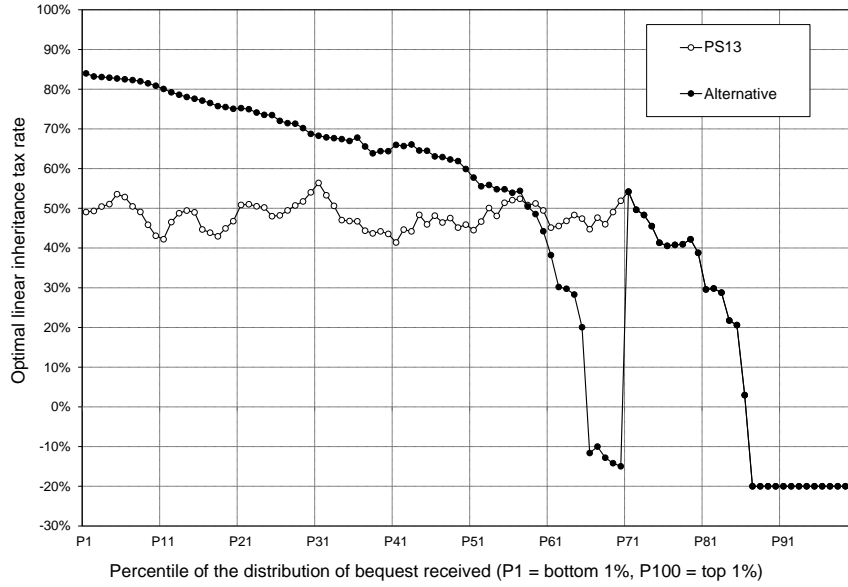
(a) Optimal inheritance tax rate by percentile of bequest received sub-ordering by wealth. Compared to PS13.
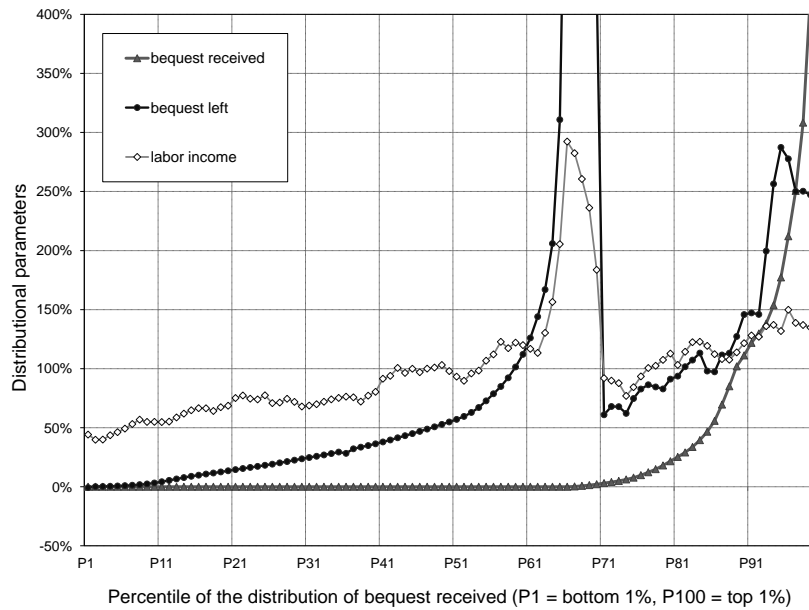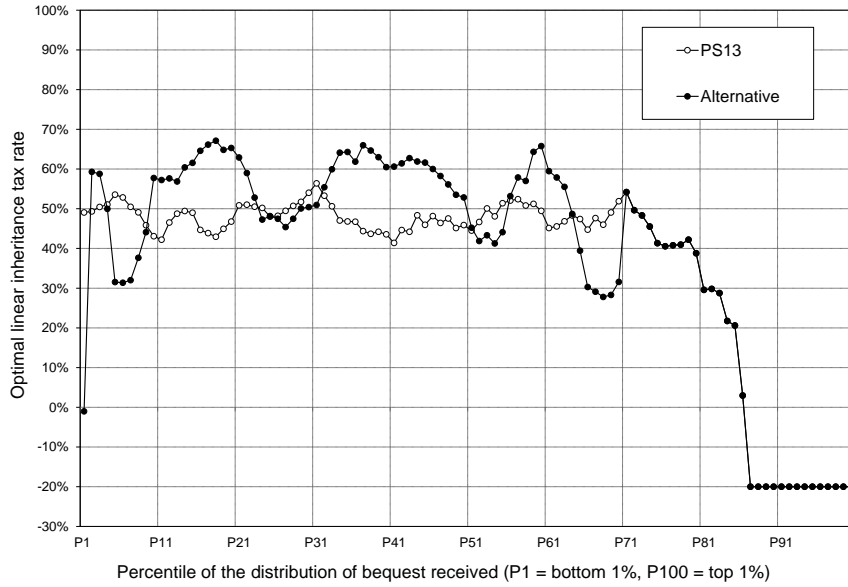


(b) Distributional parameters by percentile of bequest received sub-ordering by wealth.
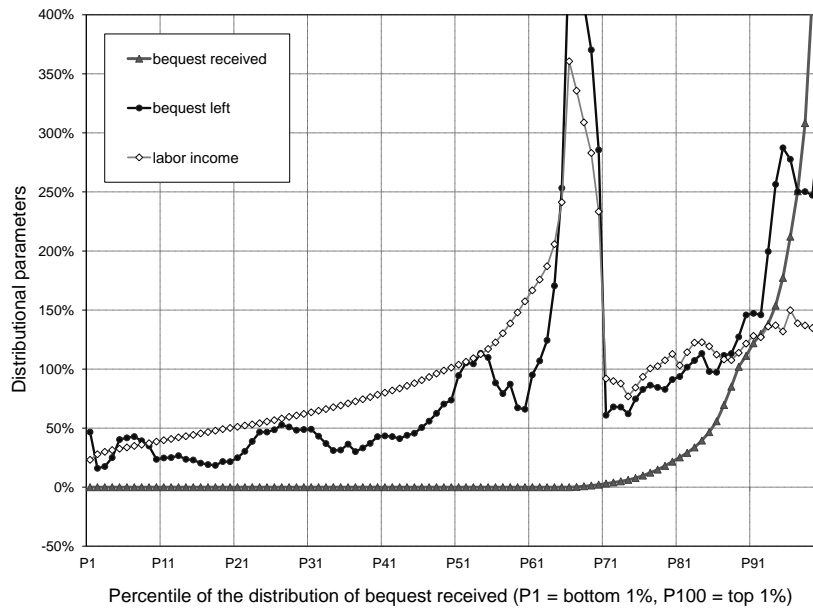
Figure 2: Optimal tax and distributional parameters sub-ordering by wealth.

effect of the distributional parameter of labor income, as we observed when calibrating the different full social optima.

Unlike the case where individuals were sub-ordered by bequest left, now there are no

(a) Optimal inheritance tax rate by percentile of bequest received sub-ordering by labor income. Compared to PS13.



(b) Distributional parameters sub-ordering by labor income.

Figure 3: Optimal tax and distributional parameters sub-ordering by labor income.

percentiles within the first 70 that would prefer a negative inheritance tax. The reason is again that the main driver of that result is the distributional parameter of bequest left but its effect is now more diluted among different percentiles due to sub-ordering by labor income. The only exemption to this is the first percentile, which has a negative tax rate

caused by individuals who have accumulated wealth despite not earning labor income (through prizes or reducing their reported income using capital losses). These individuals are willing to take a very high tax on labor income as long as the tax rate on bequests is reduced.

# 6   Conclusion

This paper shows the crucial role of the assumed social welfare function —SWF— and of individual heterogeneity for the derivation of the optimal inheritance tax rate, which can range from negative to positive and large. Inheritance taxation is particularly sensitive to the choice of SWF due to the positive externalities that arise from joy of giving motives and how they interact with the heterogenous distribution of bequests, which are highly concentrated at the top of the distribution.

Under a utilitarian criterion the optimal inheritance tax rate is always negative. On the other hand, under social welfare criteria that favor redistribution the tax rate becomes positive. For example, under the responsibility and compensation criterion, which weights out of the SWF the 30% of individuals who received positive bequests, the optimal tax rate is about 50%. Under this criterion, the elasticity of bequests to taxation and the share of accidental bequests become relevant determinants of the optimal tax rate. Under a Rawlsian criterion, the optimal tax rate rises to 83.3%, bounded only by the elasticity of bequests to taxation. These findings match and explain the different results obtained by previous literature, and provide an empirical illustration.

In their paper, PS13 opt for calibrating the optimal tax rate from the perspective of each percentile of the distribution of bequest received. This approach leads the authors to conclude that the optimal tax rate by percentile remains fairly constant for the first 70 percentiles (those who do not receive any bequests). However, extending this methodology to also account for heterogeneity in wealth and in labor income, the optimal tax rate obtained for the same 70 percentiles is not constant, varying from 83% for percentile 1 to a negative tax rate of -14% for percentile 70. This new approach offers a richer description of the heterogeneous individuals of the population, in line with the assumptions of PS13's

model, which considers the interrelation between bequest received, bequest left, and labor income.

These two findings are crucial for the design of optimal inheritance taxes. Policy makers must account for the effect of different SWFs and the utilitarian criterion is not a neutral benchmark. Models that assume utilitarian SWF lead to inheritance subsidies, but relatively small modifications of the SWF can lead to more realistic tax rates. In addition, the percentile calibrations show a large variation on the optimal tax rate from the individual point of view. This helps explain the public debate around taxation of inheritances given the large variation in preferences that we find.

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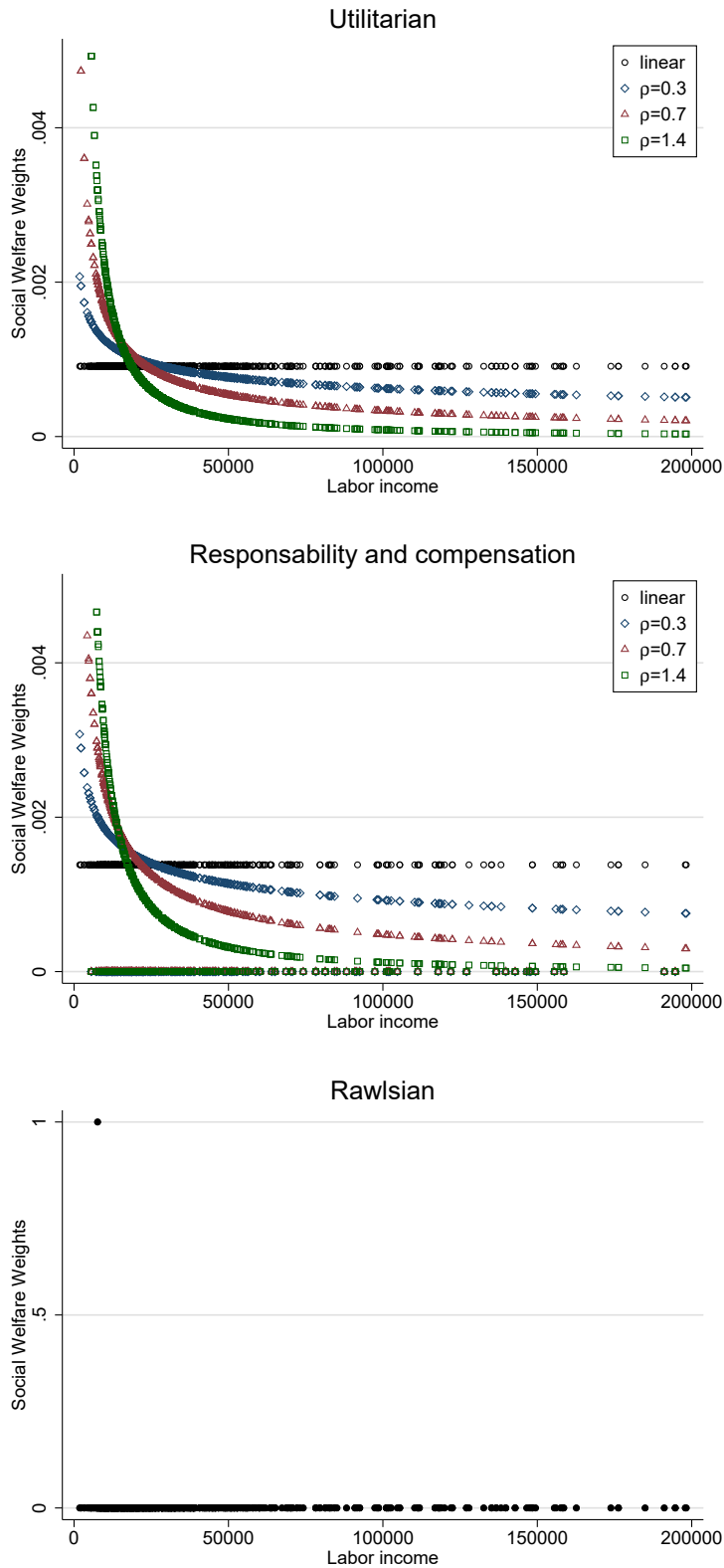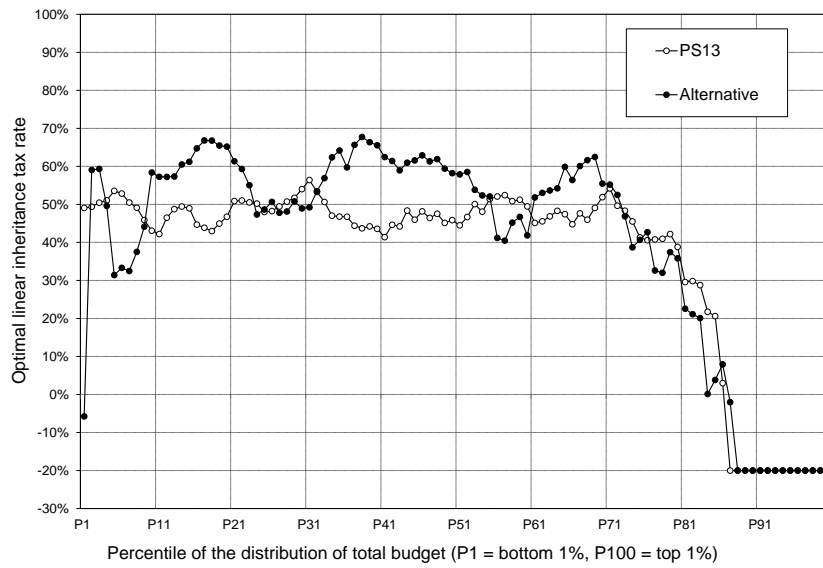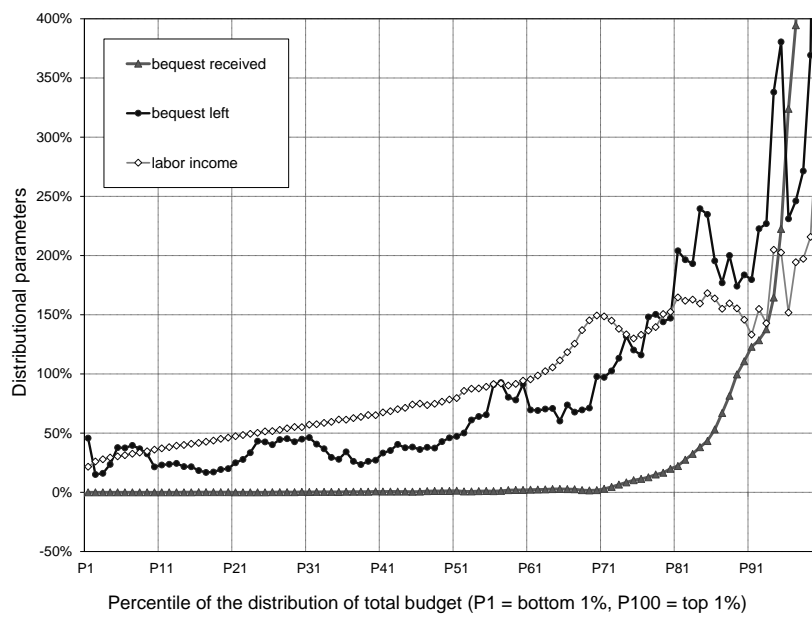
# A  Appendix



Figure A1: Social welfare weights for each individual under different SWF and concavities of the individual utility function. Under a Rawlsian criterion the welfare weights are independent of the individual utility assumed. Figures are truncated at 0.005 and 200000.
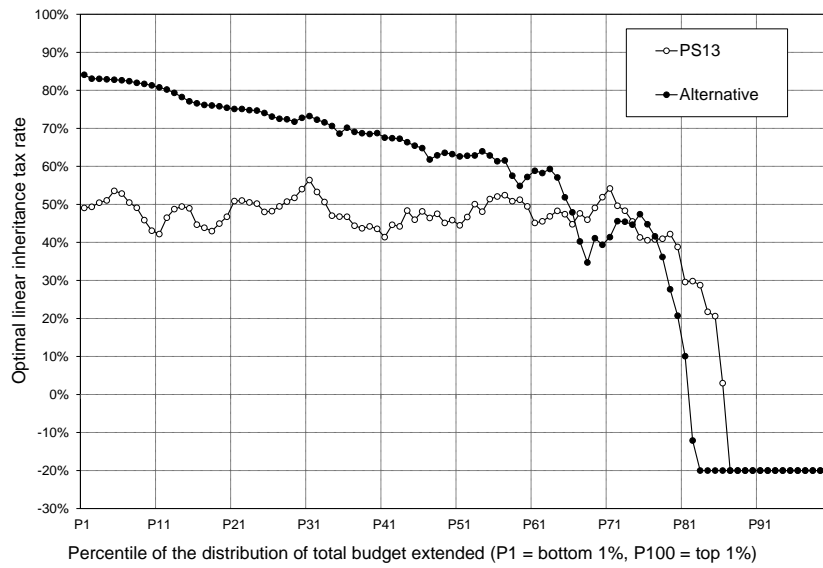
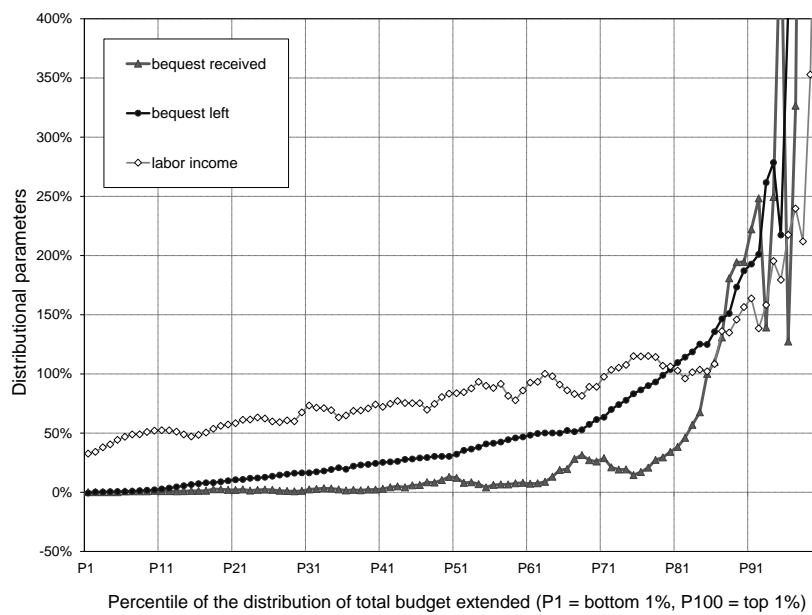(a) Optimal inheritance tax rate by percentile of total budget. Compared to PS13.



(b) Distributional parameters by percentile of total budget.

Figure A2: Optimal tax and distributional parameters sub-ordering by total budget (inheritance received + labor income).

(a) Optimal inheritance tax rate by percentile of total budget extended.
Compared to PS13.



(b) Distributional parameters by percentile of total budget extended.

Figure A3: Optimal tax and distributional parameters sub-ordering by total budget
extended (inheritance received + labor income + wealth).