Negative Income Taxes, Inequality and Poverty

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February 25, 2011

Abstract

We use the heterogeneous agents model by Aiyagari and McGrattan (1998) to analyze the redistributive effects of a negative income tax (NIT), which combines a flat tax with a fully refundable credit ("demogrant"). This issue has been previously considered in the context of static partial equilibrium models. We show that changing the demogrant causes significant changes in the distribution of income. The demogrant and corresponding tax rate that eliminates relative poverty is numerically determined. In particular, we find that relative poverty (where the poverty line is set equal to 50% of the median post-tax income level) is eliminated when the demogrant-to-GDP ratio is 27% which requires the average income tax rate to be 58.52%.

1 Introduction

The persistently high poverty rate and rising income inequality in the U.S. has raised serious concerns among policymakers and academics. According to the 2010 U.S. Census, the number of people in poverty in 2009 was the largest in the 51 years that this agency has published its poverty estimates. Furthermore, data recently released by the Congressional Budget Office show that the gaps in after-tax income between the wealthiest 1 percent and the middle and poorest fifths more than tripled between 1979 and 2007.

In this paper, we consider a standard neoclassical growth model with heterogeneous agents as in Aiyagari and McGrattan (1998), henceforth AM. Our objective is to analyze the redistributive effects of a negative income tax (NIT) within a dynamic optimizing general equilibrium framework. A NIT is a flat rate tax system with a fully refundable credit or "demogrant". Using the same calibration scheme as in AM, we show that altering the demogrant-to-GDP ratio causes significant changes in the distribution of assets, income, consumption and labor (leisure). We also find the demogrant-to-GDP ratio and tax rate which eliminates relative poverty. This result is related to the arguments of Friedman (1962), Tobin (1968) and Rawls (1971) argument in favour of the NIT as a means of alleviating poverty.

In the past, the effects of various income tax reforms on the level of inequality and poverty have primarily been analyzed using static partial equilibrium models. In such models, it is typical for the wage distribution to be given exogenously, with agents choosing only how much labour to supply. For example, Lambert (1985) and Creedy (1997) use such models to examine the effects of flat tax reforms on the level of inequality. Creedy (1997) also considers the effect of such reforms on the level of poverty. Kanbur et al. (1994) use a similar model to find the non-linear income tax policy which minimizes poverty. While both Creedy (1997) and Kanbur et al (1994), focus on fixed poverty lines, Thompson (2011) considers the effect of various flat tax reforms on the level of poverty when the poverty line is relative (i.e., some fraction of either the mean or median post-tax income level).

More recently, income tax reforms have been considered in general equilibrium models with heterogenous agents by Castaneda et al. (1999), Benabou (2003), and Conesa and Krueger (2006), inter alia. While these authors do consider the effects of tax reforms on specific inequality measures (e.g., the Gini coefficient), they do not consider the impact of such reforms on the level of poverty.

The paper is organized as follows. Section 2 provides a description of poverty and income inequality in the U.S. over time. Section 3 describes the model used in our quantitative exercise. Section 4 discusses income inequality and poverty measurement. Section 5 presents our results. The final section concludes.

2 Poverty and Income Inequality in the U.S.

Based on the official measure used by the U.S. Census Bureau, 43.6 million people were in poverty in 2009.[1] This figure marked the third consecutive annual increase in the number of people in poverty, partially reflecting the impact of the 2007 downturn in the U.S. economy. The proportion of the population considered poor (the "headcount ratio") in 2009 was 14.3 percent. This was the third consecutive increase in the poverty rate and the second statistically significant increase since 2004. In addition, the 2009 poverty rate was the highest rate since 1994 when it was 14.5 percent.

From a historical perspective, both the number of people in poverty and the headcount ratio declined sharply between 1959 and the late 1960s. At this point, the common pattern in their trend breaks down. The number of people in poverty displays an increasing trend over time accompanied by substantial fluctuations around this trend. In contrast, the headcount ratio seems to have stabilized in the 11-15 percent range without exhibiting a clear upward or downward trend.

In terms of income inequality, the Congressional Budget Office (CBO)

[1] See U.S. Census Bureau (2010). Each year the U.S. Census Bureau uses a set of 48 dollar value thresholds that vary with family size and composition to determine the number of people that are officially considered to be in poverty. If the total money income of a family unit is less than the applicable threshold, then every member of this unit is considered to be in poverty. The definition of poverty that is officially applied uses money income before taxes and tax credits and excludes capital gains and non-cash benefits (such as Supplemental Nutrition Assistance Program benefits and housing assistance). Furthermore, the poverty thresholds are updated on an annual basis for inflation using the Consumer Price Index.

recently reported that the share of after-tax income in 2007 for the top 1 percent reached its highest level since 1979: it was 17.1% of total after-tax income while in 1979 it was only 7.5%.[2] In contrast, the share of the middle one-fifth during this period shrank to its lowest level from 16.5 in 1979 to 14.1 in 2007. Furthermore, the share of the bottom four-fifths (or 80 percent) of U.S. households declined from 58% of total after-tax income to 48% percent.

During this period, average after-tax incomes for the top 1 percent rose by 281% after adjusting for inflation (see Figure A). This corresponds to an increase in income of $973,100 per household from $346,600 in 1979 to $1,319,700 in 2007. The average after-tax income for the middle quintile increased by $11,200 or 25% (from $44,100 in 1979 to $55,300 in 2007), while for the lowest quintile it increased by $2,400 or 16% (from $15,300 in 1979 to $17,700 in 2007).

The number of households that belong to the bottom fifth increased by 6.7 million (or 37%) from 17.9 million in 1979 to 24.6 million in 2007. During the same period, the size of the middle fifth increased by 7.9 million (or 53%) from 15 million to 22.9. In sharp contrast, the number of households in the top 1 percent increased by only 300,000 (or 33%) from 0.9 million in 1979 to 1.2 million in 2007.

This data also show that the after-tax income gap between the wealthiest 1 percent and the other income groups has grown significantly in the last

[2]See Congressional Budget Office (2010).

three decades (see Figure B). The average after-tax income of the top 1 percent in 1979 was 7.9 times higher than that of the middle quintile. By 2007, the average after-tax income of the top earners was 23.9 times higher than that of the middle quintile which implies that the income gap has more than tripled. Furthermore, the gap between the top 1 percent and the lowest quintile widened even more sharply. The average after-tax income of the top 1 percent was 22.7 times higher than that of the bottom fifth in 1979. By 2007, the average after-tax income of the top earners was 74.6 times higher than that of the poorest fifth while implies that the income gap between rich and poor has more than tripled.

Piketty and Saez (2003) have used tax collection data to calculate the share of after-tax income for the wealthiest Americans since 1913.[3] Comparing with the CBO data discussed above, the findings of Piketty and Saez suggest a concentration of income at the top of the distribution that is the greatest than at any time since 1928 (see Figure C).

Saez (2010) examined the impact of the recent Great Recession on the pre-tax incomes of top earners relative to the other income groups. During the 2002-2007 expansion, the top 1 percent captured roughly two thirds of the growth in income after adjusting for inflation. However, the average income of this group fell by 19.7% between 2007 and 2008, in effect eliminating almost

[3]The authors use detailed Internal Revenue Service micro-files for available years and apply statistical techniques to extend the full series to 1913. Their tables have been updated through 2008 and are available at
http://emlab.berkeley.edu/users.saez/.

half of the gains it made between 2002 and 2007. In contrast, the average income of the bottom 90 percent fell by 7% between 2007 and 2008. This was the largest one-year drop for this income group since 1938. Furthermore, this income reduction in 2008 outweighed the gains made during the 2002-2007 expansion, leaving the average income for the bottom 90 percent at its lowest level since 1996. Finally, income kept remaining highly concentrated with the top 1 percent of households earning 21% of total income, which is still among the highest percentages since the late 1920s.

3 The Model

Consider a closed economy that consists of a large number of infinitely lived agents. These agents supply labor elastically and are subject to idiosyncratic shocks to their labor productivity. Let e_t denote an agent's labor productivity. We assume that this level of productivity is identically and independently distributed across all agents and follows a Markov process over time. Per capita labor productivity is normalized to unity, which implies that $E(e_t) = 1$. The saving behavior of these agents is heavily influenced by borrowing constraints and a precautionary savings motive. In the absence of insurance markets, agents try to smooth their consumption over time by trades in the two risk-free assets in the model: capital and government bonds.

The aggregate production function exhibits constant-returns to scale and is given by

$$Y_t = F(K_t, z_t N_t),$$

where Y_t denotes per capita output, K_t is the capital stock per capita and N_t is the per capita labor input. The exogenous labor-augmenting measure of technical progress z_t grows at rate g, which implies that $z_t = z_0 (1+g)^t$.

Note that there are no aggregate shocks. Along the balanced growth path equilibrium (BGP), there are fluctuations in an agent's assets, consumption, income and labor (leisure). However, per capita variables are growing at the constant rate g, with the exception of the per capita labor input (N) which remains constant. In addition, all cross-sectional distributions (relative to per capita values) are also constant over time in the balanced growth path equilibrium.

Assuming competitive product and factor markets the before-tax wage rate w_t and interest rate r_t are given by

$$w_t = z_t F_2(K_t, z_t N_t), \quad (1)$$

$$r_t = F_1(K_t, z_t N_t) - \delta, \quad (2)$$

where δ is the depreciation rate of capital. Note that along the BGP equilibrium, Y_t, K_t and Y_t are growing at the rate g, while N_t and r_t are constant: i.e., $N_t = N$ and $r_t = r$, $\forall\ t$.

Next, we describe the individual agent's problem. The agent derives utility in each period from consumption and leisure. Let c_t denote consumption in period t. Each period the agent has a fixed time endowment normalized to 1. Fraction l_t of this endowment is allocated to leisure and the remainder is allocated to supplying labor. The agent's assets at the beginning of period t are denoted by a_t. The agent chooses stochastic processes for consumption, leisure (labor) and asset holdings in order to maximize the expected discounted sum of utilities of consumption and leisure given some initial assets initial assets a_0 and an initial productivity shock e_0. The agent's objective function is formally given by

$$\max_{\{c_t, l_t, a_{t+1}\}} E\left[\sum_{t=0}^{\infty} \beta^t \frac{\left(c_t^{\eta} l_t^{1-\eta}\right)^{1-\mu}}{1-\mu} \middle| a_0, e_0\right], \tag{3}$$

where $\mu > 0$ is the coefficient of relative risk aversion and $0 < \eta < 1$ is the share of consumption in full-consumption.

The agents are subject to a proportional income tax τ. Let $\overline{w}_t$ and $\overline{r}$ denote the after-tax wage and interest rate, respectively. These rates are given by

$$\overline{w}_t = (1-\tau) z_t F_2 (K_t, z_t N) = (1-\tau) w_t, \tag{4}$$

$$\overline{r} = (1-\tau) (F_1 (K_t, z_t N) - \delta) = (1-\tau) r, \tag{5}$$

where the time subscripts on the interest rate and per capita labor input have been dropped because both variables are constant along the BGP equilibrium. Besides interest and wage income, the agent receives a "demogrant" every period D_t.

An agent's intertemporal optimization problem involves maximizing (3) subject to the sequence of budget constraints and nonnegativity constraints given by

$$c_t + a_{t+1} \leq \overline{w}_t e_t (1 - l_t) + D_t + (1 + \overline{r}) a_t, \tag{6}$$

$$c_t \geq 0, \ 0 \leq l_t \leq 1, \ a_t \geq 0. \tag{7}$$

Note that the constraint $a_t \geq 0$ prevents the agent from borrowing.

Let G_t represent per capita government consumption. Following AM, we assume that government consumption equals a fixed fraction γ of per capita output: i.e., $\gamma = G_t / Y_t$. Letting B_t denote the per capita stock of government debt at the beginning of period t, the government's budget constraint is given by

$$G_t + D_t + rB_t = B_{t+1} - B_t + \tau (w_t N + rA_t). \tag{8}$$

Next, let A_t denote the per capita assets held by the agents. The asset market equilibrium condition is

$$A_t = K_t + B_t. \tag{9}$$

In addition, the labor market clearing condition is given by

$$N = E [e_t (1 - l_t)]. \tag{10}$$

Note that, in a BGP equilibrium, D_t, B_t and A_t will also be growing at the constant rate g.

In solving the model, it is convenient to perform a stationary transformation by dividing all variables that grow at the rate g by output Y_t. Let

$$\begin{aligned} k &= \frac{K_t}{Y_t}, \overline{w} = \frac{\overline{w}_t}{Y_t} = \frac{(1-\tau) w_t}{Y_t}, \widetilde{c}_t = \frac{c_t}{Y_t}, \\ \widetilde{a}_t &= \frac{a_t}{Y_t}, b = \frac{B_t}{Y_t}, \overline{a}_t = \frac{A_t}{Y_t}, \chi = \frac{D_t}{Y_t}. \end{aligned} \tag{11}$$

Note that along the BGP, all variables included in the ratios above grow at rate g, which the growth rate of the exogenous labor-augmenting technical progress z_t.

The agent's problem now can be expressed as

$$\max_{\{e_t, l_t, \tilde{a}_{t+1}\}} \quad E\left[Y_0^{\eta(1-\mu)} \sum_{t=0}^{\infty} \left[\beta (1+g)^{\eta(1-\mu)}\right]^t \frac{\left(e_t^{\eta} l_t^{1-\eta}\right)^{1-\mu}}{1-\mu} \middle| \widetilde{a}_0, e_0\right],$$

subject to $\widetilde{c}_t + (1+g)\,\widetilde{a}_{t+1} \leq (1+\overline{r})\,\widetilde{a}_t + \overline{w}e_t\,(1-l_t) + \chi,$

$$\widetilde{c}_t \geq 0,\ 0 \leq l_t \leq 1,\ \widetilde{a}_t \geq 0.$$

Furthermore, by substituting for per capital assets from the asset market clearing condition (9) into the government's budget constraint (8) and using the optimality conditions for w_t from (1) and r from (2) along with the first-degree homogeneity property of the production function, allows us to rewrite the government's budget constraint as follows

$$\gamma + \chi + (\overline{r} - g)\, b = \tau\,(1 - \delta k)\,. \tag{12}$$

Finally, dividing through the asset market equilibrium condition (9) by Y_t yields

$$\overline{a} = k + b. \tag{13}$$

3.1 Solution Procedure

Using the equation for the after-tax interest rate (5), we can express the capital stock per unit of effective labor $K_t/(z_t N)$ as a function of the before-tax interest rate r. From the properties of the production function, it follows then that the capital-output ratio along the BGP $k = K_t/Y_t$ can be written as a function of r. Letting this function be denoted as $\kappa(r)$, we have

$$k = \kappa(r). \tag{14}$$

Furthermore, using equation (1) we can express the share of wage income $\widetilde{w} = w_t N/Y_t$ as a function of r. Letting this function be denoted as $\omega(r)$, we have

$$\widetilde{w} = \omega(r). \tag{15}$$

It follows then from (4) that

$$\overline{w} = (1-\tau)\,\omega(r)/N, \tag{16}$$

where $\overline{w} = \overline{w}_t/Y_t$.

The steady state is fully characterized by an interest rate r^* and a per capita effective labor input N^* that solve

$$\overline{a}(r, N; \gamma, b, g, \chi) = \kappa(r) + b, \tag{17}$$

$$\overline{\varphi}(r, N; \gamma, b, g, \chi) = N. \tag{18}$$

Equation (17) corresponds to the asset market equilibrium condition (13). The lefthand side of this equation represents the per capita demand for assets by the individuals relative to output per capita. The righthand side represents the per capita supply of assets relative to per capita output. The supply of assets equals the sum of capital $\kappa(r)$ and government bonds b.

The lefthand side of (17) is obtained as follows. Solving the household's problem yields a decision rule for the optimal asset accumulation that can be expressed as $\widetilde{a}_{t+1} = \alpha(\widetilde{a}_t, e_t; r, N, \gamma, b, g, \chi)$. Given a Markov process for the labor productivity shock e_t, this decision rule can be used to compute the stationary joint distribution of assets and the productivity shock denoted by $H(\widetilde{a}, e; r, N, \gamma, b, g, \chi)$. This stationary distribution can be used to calculate per capita assets as $\overline{a} = \int \int \widetilde{a} dH = \overline{a}(r, N; \gamma, b, g, \chi)$, which provides us with the lefthand side of (17). The righthand side of (17) is obtained from (13) using (14).

Equation (18) represents the per capita effective labor supplied by the individuals. This expression is obtained as follows. From (10), we know that $N = 1 - E(e_t l_t)$. After deriving the first-order condition with respect to leisure from the household's problem and taking expected values, we can express $E(e_t l_t)$ as a function of $E(\widetilde{c}_t)$ and $\overline{w}$ from (16). Consolidating the budget constraints of the individuals and the government's budget constraint yields the economy's resource constraint. This constraint allows us to express per capita consumption $E(\widetilde{c}_t)$ as a function of parameters of the model such as γ and g, as well as r. Combining $E(\widetilde{c}_t)$ with $\overline{w}$ yields $E(e_t l_t)$ and, hence, N.

Given values for r, N, γ, b, g and χ, the government's budget constraint (12) can be solved to yield τ. Then, $\overline{r}$ and $\overline{w}$ can be determined from (5) and (16), respectively. The household's problem is then solved by obtaining the decision rules for consumption, leisure and assets by applying the finite element method.[4]

In terms of calculating welfare, we use the same criterion as AM which is given by

$$W = \int \int V(a, e)\, dH(a, e), \tag{19}$$

where $V(a, e)$ is the optimal value function and H is the stationary joint distribution of assets and the idiosyncratic labor productivity shock.

3.2 Parameterization

We use the same parameterization scheme as AM. The production function is assumed to Cobb-Douglas with θ denoting the share of capital. In terms of the idiosyncratic productivity shock e_t, it is assumed that it follows the process

$$\ln(e_t) = \rho \ln(e_{t-1}) + v_t,$$

[4] McGrattan (1996) provides a detailed description of the finite element method that can be used in solving dynamic stochastic general equilibrium models.

where $E(v_t) = 0$ and $\mathrm{Var}(v_t) = \sigma^2$. This autoregression is approximated using the method of Tauchen (1986) with a first-order Markov chain that has seven states. The parameters for this Markov process are the values for the seven states and a probability transition matrix, π.

All parameters are calibrated to the post-WWII U.S. economy. The growth rate g is set equal to the annual growth rate of per capita GDP which is 1.85%. The ratio of government spending to GDP γ is set equal to its post-war average which is 21.7%. The share of capital income θ is set equal to 0.30. This implies that the share of labor income is 70%, which is consistent with the value found if one divides the compensation of employees by GDP, less the proprietors' income and less the indirect business tax.

The depreciation rate δ is set equal to 0.075, which is consistent with the post-war average depreciation rate of fixed capital plus consumer durables. The autocorrelation coefficient ρ of the process for the labor productivity shock is set equal to 0.6, while the standard deviation of the error term σ is set equal to 0.3. For the risk-aversion coefficient μ, AM chose a value of 1.5, while the discount factor β was set equal to 0.991. Assuming a labor elasticity of 2%, the implied value for η is 0.328. Note that the calibrated values of β, g, η and μ imply an effective discount factor of 0.988 in the stationary economy.

Based on their benchmark parameterization for the U.S. economy, AM find that a debt-GDP ratio of 66% is optimal in the sense of maximizing welfare given by (19). This is actually the average level of GDP for the post-war U.S. economy. Furthermore, AM perform a sensitivity analysis with respect to some key parameters in their model in order to determine the robustness of their results. In many cases, the observed debt-GDP ratio for the U.S. economy actually falls below the optimum level. However, in all cases that they consider they find insignificant welfare gains from being at the optimum level rather than the observed U.S. level. For this reason, in our simulations we set $b = 2/3$ and let the value of the demogrant-GDP ratio χ to vary.

4 Inequality and Poverty Measurement

In this section, we briefly review some basic concepts surrounding inequality and poverty measurement that will be used in analyzing the results of our model.[5]

In measuring inequality, we will utilize the Lorenz curve, which indicates the share of total income earned by any quantile of the population. Formally, letting $p = F(x)$, where F is the distribution function, the Lorenz curve at point p is defined as

$$L(p) = \frac{1}{\mu} \int_0^x t f(t) dt,$$

where $\mu = \int x f(x) dx$. Specifically, to compare the levels of inequality for two different distributions, we will use the concept of Lorenz dominance. We

[5]See, e.g., Sen (1997) for a more thorough survey of this topic.

say that distribution A Lorenz dominates distribution B if

$$L_A(p) \geq L_B(p)$$

for all p, with strict inequality holding for at least some p.

It is interesting to note that, if distribution A Lorenz dominates distribution B, any inequality measure satisfying the widely-accepted Pigou-Dalton 'principle of transfers' (e.g., the Gini coefficient, $G = 1 - 2\int_0^1 L(p)dp$, or the coefficient of variation, $CV = \sigma/\mu$, where $\sigma^2 = \int(x-\mu)^2 f(x)dx$), will be lower for distribution A than for distribution B.[6] Thus, if (and only if) distribution A Lorenz dominates distribution B, we will say that the level of inequality in distribution A is *unambiguously* lower than in distribution B. Of course, when the Lorenz curves for two distributions intersect, we can not use the concept of Lorenz dominance to rank them, even though some particular inequality measure may be higher for one of them. That is, we may be able to rank distributions using, e.g., the Gini coefficient, but not using Lorenz dominance. In such cases, however, it is possible that one inequality measure is higher for one of the distributions, but that another inequality measure is higher for the other distribution (creating an *ambiguous* inequality comparison).

In measuring poverty, we assume that the poverty line is relative (i.e.,

[6] An inequality measure is said to satisfy the Pigou-Dalton 'principle of transfers' if it increases in response to a regressive transfer (i.e., a transfer from a poorer individual to a richer individual) and decreases in response to a progressive transfer (i.e., a transfer from a richer individual to a poorer individual).

some fraction of either the mean or median income level). The level of poverty will then be measured using the Foster et al. (1984) class of measures,

$$P(\gamma) = \int_0^z \left(\frac{z-x}{z}\right)^\gamma dx,$$

where γ is a parameter representing the degree of poverty aversion. For example, $P(0) = F(z)$ is the well-known headcount ratio (i.e., the proportion of the population which is poor), while $P(1)$ is the so-called income gap ratio (i.e., the mean distance below the poverty line for the entire population). More generally, higher values of γ put greater emphasis on individuals who are further below the poverty line. Note that, as $\gamma \to \infty$, rankings based on $P(\gamma)$ are equivalent to those using the maxi-min criterion of Rawls (1971).

5 Results

Our results are summarized in Table 1 and in Figures 1-12. In Table 1 we consider the following values for the demogrant-to-GDP ratio $\chi = D_t/Y_t$: $0, 0.1, 0.2$ and 0.27, which is the value of χ that eliminates poverty. Table 1 contains the following variables: the tax rate, aggregate hours, wage, capital stock, the interest rate, social welfare and various statistics on wage, capital and total income.

From the government's flow budget we observe that by keeping the debt-to-GDP and government spending-to-GDP ratios constant a rise in the demogrant-to-GDP ratio causes an increase in the average tax rate. In turn, the increase in the tax rate distorts the labor-leisure choice and results in a fall in aggregate labor supply. The reduction in aggregate hours causes an increase in the pre-tax wage rate. However, the increase in the tax rate is sharp enough that the post-tax wage rate falls. These effects are depicted in Figure 1. Although the pre-tax wage rate increases, the decrease in aggregate hours is so severe that the mean, median and the 25th and 75th percentiles of pre-tax wage income all decrease as it is shown in Figure 2. Figure 3 displays the same statistics for after-tax wage income which are falling as both hours and the after-tax wage rate are decreasing.

Figure 4 contains the Gini coefficient for wage income. The Gini measure is the same for the pre- and post-tax wage income, since one is a linear transformation of the other. The rising wage income inequality can be explained by the fact that although all individuals reduce their labor supply, the larger opportunity cost of leisure for higher productivity individuals causes them to reduce their labor supply by a lesser amount compared to lower productivity individuals.

The rising tax rate caused by the increase in the demogrant distorts investment resulting in lower capital stock accumulation. As shown in Figure 5, due to a decrease in investment, the interest rate (both pre- and post-tax) increases. Although the pre- and post-tax interest rates increase, the decrease in the capital stock is sharp enough that the mean, median and the 25th and 75th percentiles of pre and post-tax capital income all decrease as it is shown in Figures 6 and 7.

Figure 8 displays the Gini coefficient for capital income. As with wage income, the Gini coefficient is the same for the pre- and post-tax capital income. Although investment in physical capital falls for all individuals, it falls by less for the higher productivity individuals who work more relative to the lower productivity individuals and, thus, have more disposable income to invest.

Following the pattern of pre-tax wage and capital income, the mean, median and the 25th and 75th percentiles of pre-tax total income are all falling, as shown in Figure 9. Note that total post-tax income includes post-tax wage and capital incomes, as well as the demogrant. Although the demogrant is increasing, the mean, median and the 25th and 75th percentiles of post-tax total incomes are all falling as shown in Figure 10.

Figure 11 displays the Gini coefficient for pre- and post-tax total income. In contrast to wage and capital income inequality, the Gini coefficient for pre- and post-tax total income is different. The reason for this is the inclusion of the demogrant in total income (this makes post-tax total income an affine function of pre-tax total income). The increase in the pre-tax total income Gini coefficient follows directly from the combined behavior of the Gini coefficients for wage and capital income. The effect of the increasing demogrant is strong enough to cause the Gini coefficient for post-tax total income to fall.

Figure 12 displays the pre- and post-tax income headcount ratios relative to the demogrant. The pre-tax headcount ratio remains relatively unchanged, while the post-tax headcount ratio falls sharply due to the increased demogrant. As seen in Figure 12, poverty is eliminated when the demogrant-to-GDP ratio is 27% which requires a tax rate of 58.52% (See Table 1).

6 Conclusion

In this paper we use the heterogeneous agents model by Aiyagari and McGrattan (1998) to analyze the redistributive effects of a negative income tax. This tax combines a flat tax with a demogrant, which is a fully refundable credit. The model is calibrated to the post-WWII U.S. economy. We show that a change in the demogrant has a significant impact on the distribution of assets, income, consumption and hours. The optimal tax policy that minimizes relative poverty is numerically determined. In particular, we find that poverty is eliminated when the demogrant-to-GDP ratio is 27% which requires the income tax rate to be 58.52%.

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Figure A: Percentage Change in After-Tax Income 1979-2007

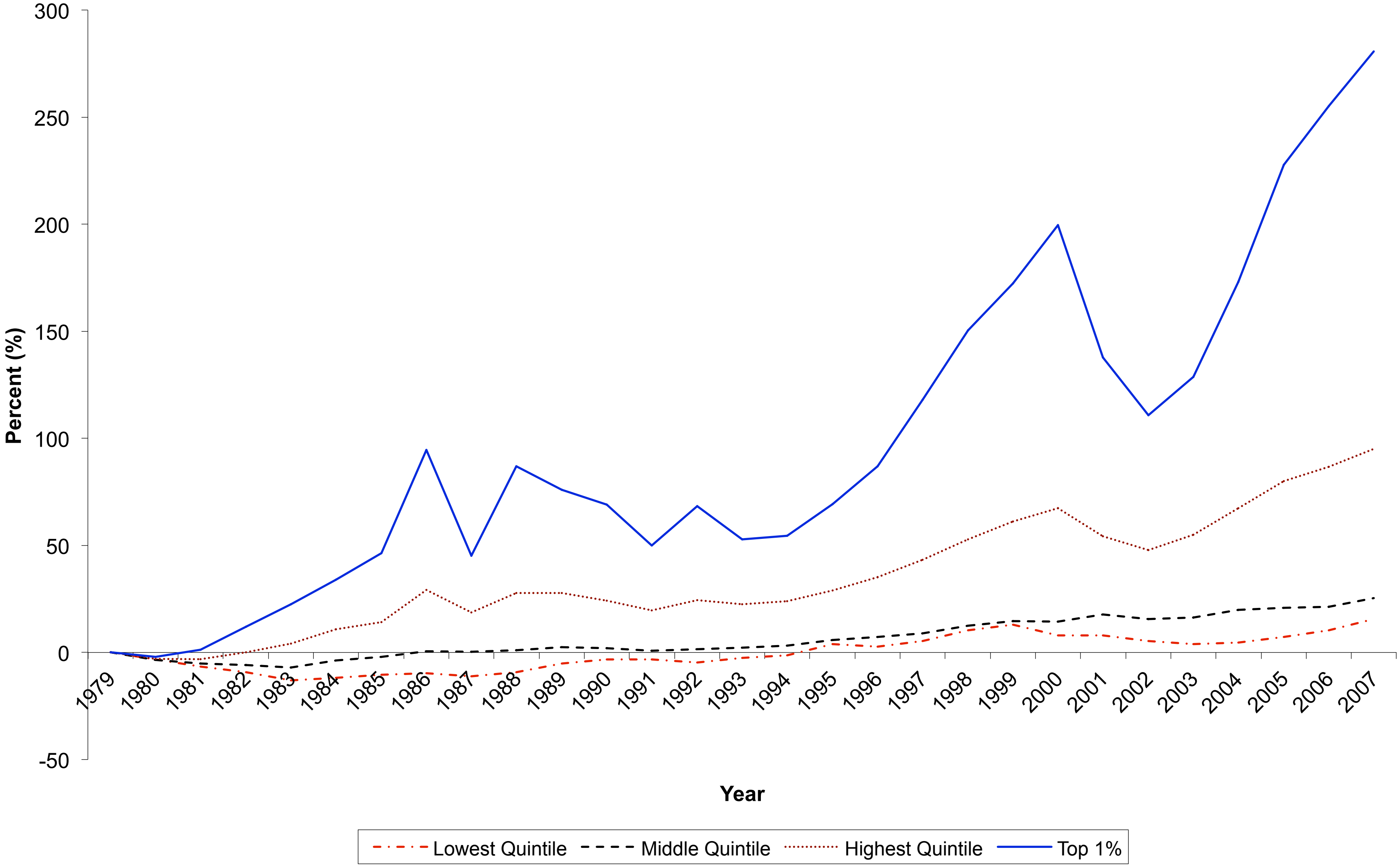

Figure B: Income Gap 1979-2007

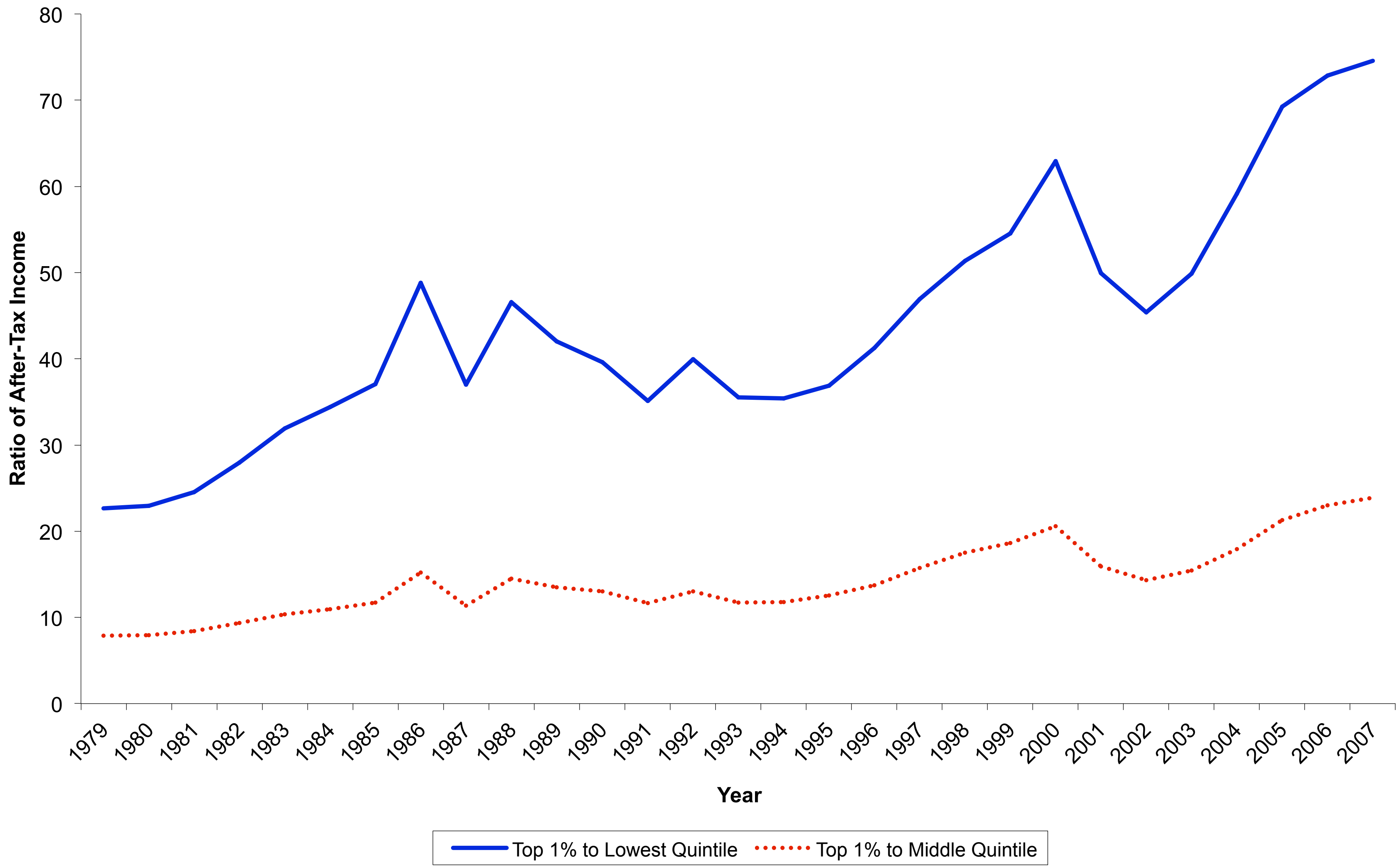

Figure C: Share of Total Pre-Tax Income Accruing to Top 1 Percent 1913-2008

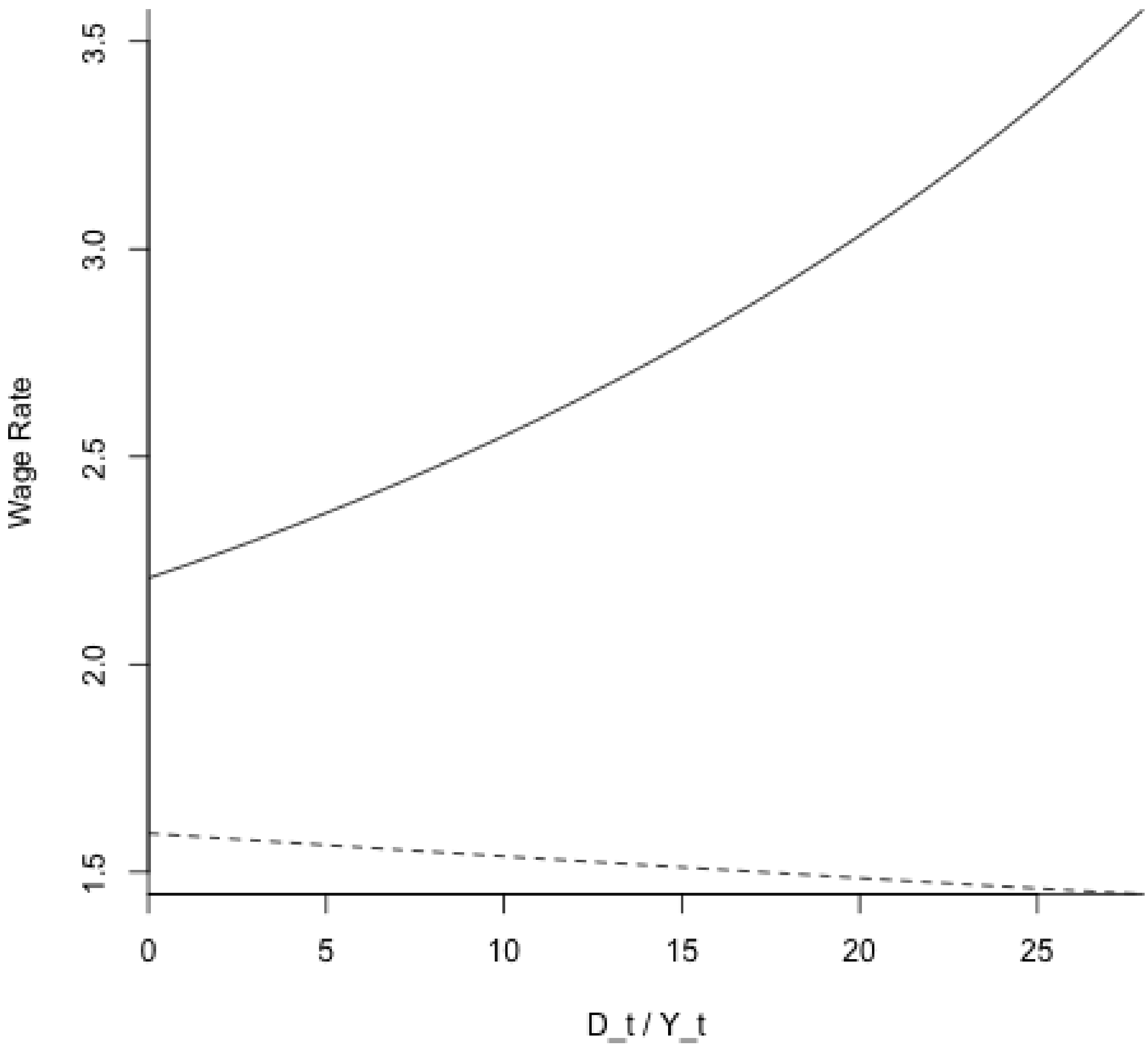

Figure 1: Wage rate: Solid line is pre-tax, dashed line is post-tax

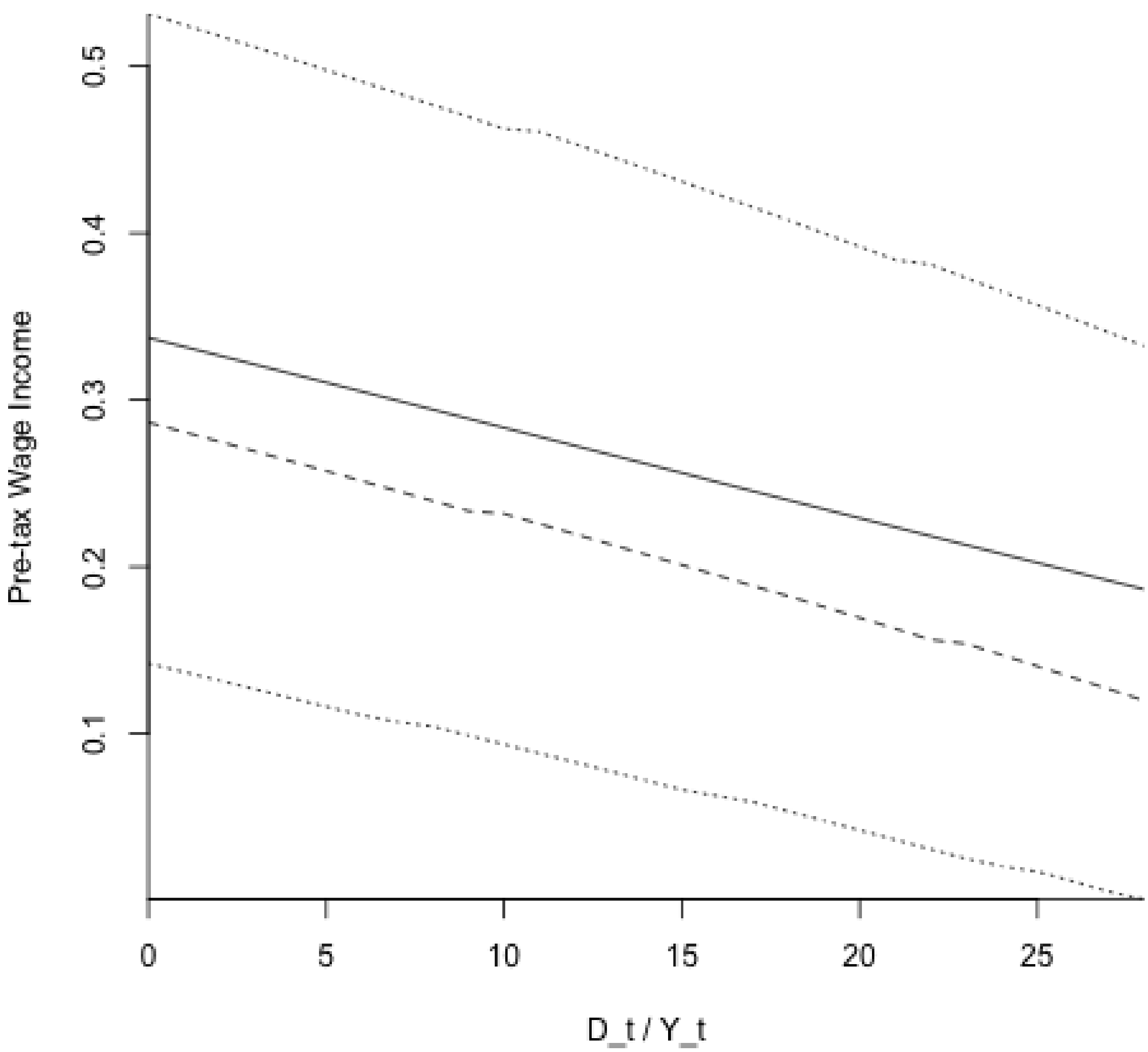

Figure 2: Pre-tax wage income: Solid line is mean, dashed line is median, dotted lines are 25th and 75th percentiles

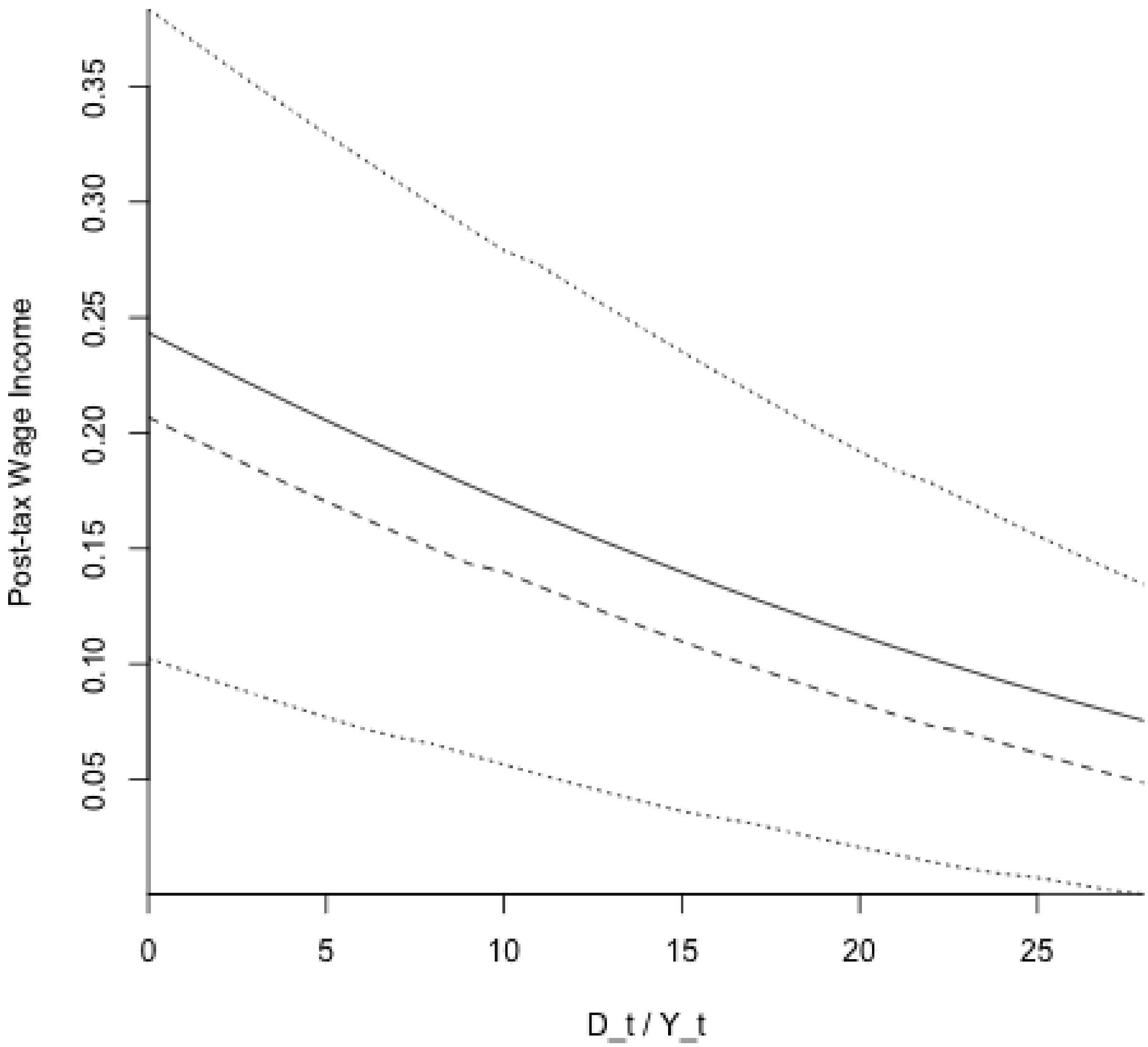

Figure 3: Post-tax wage income: Solid line is mean, dashed line is median, dotted lines are 25th and 75th percentiles

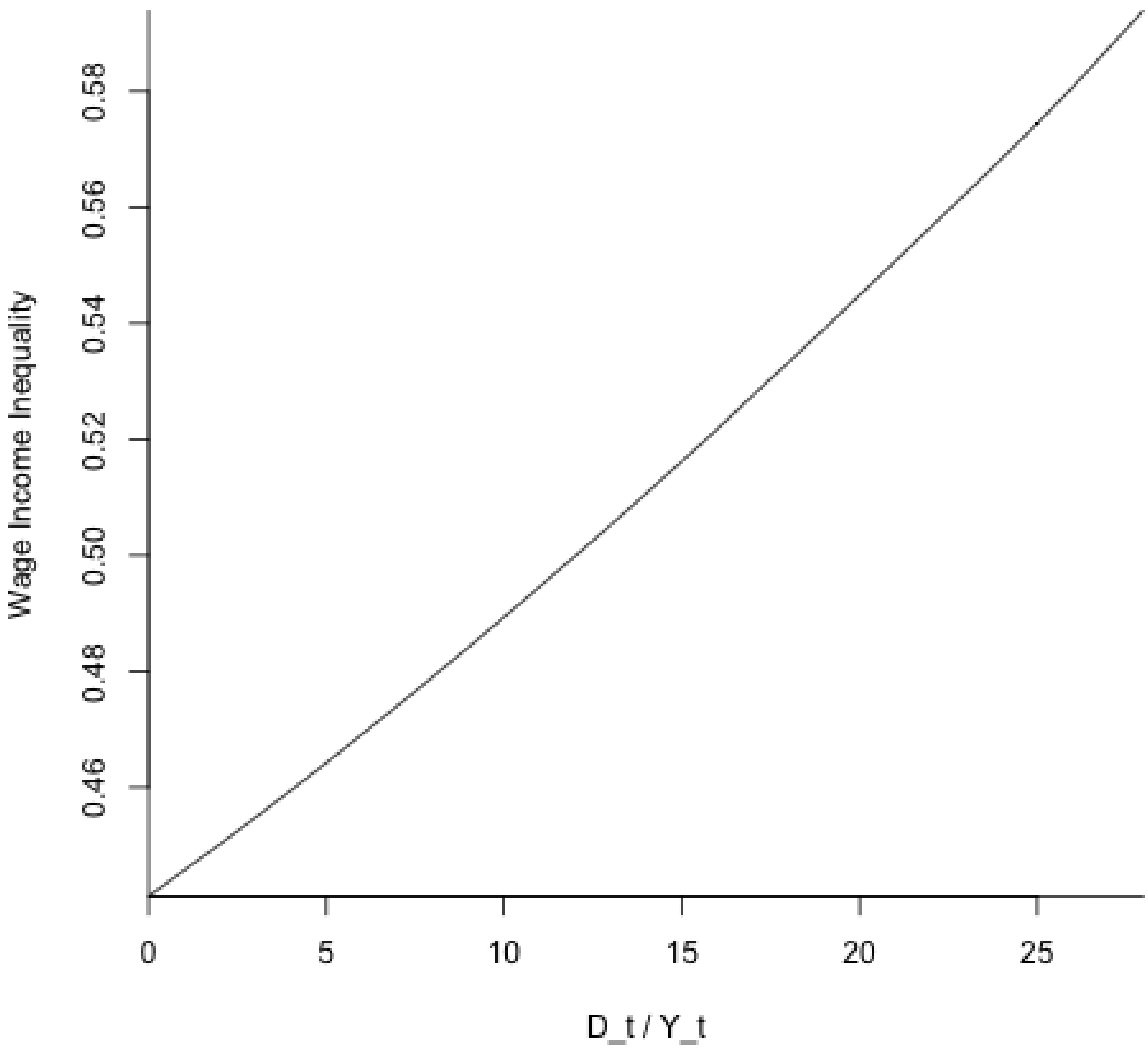

Figure 4: Gini coefficient for wage income; pre- and post-tax are indentical since one is a linear transformation of the other

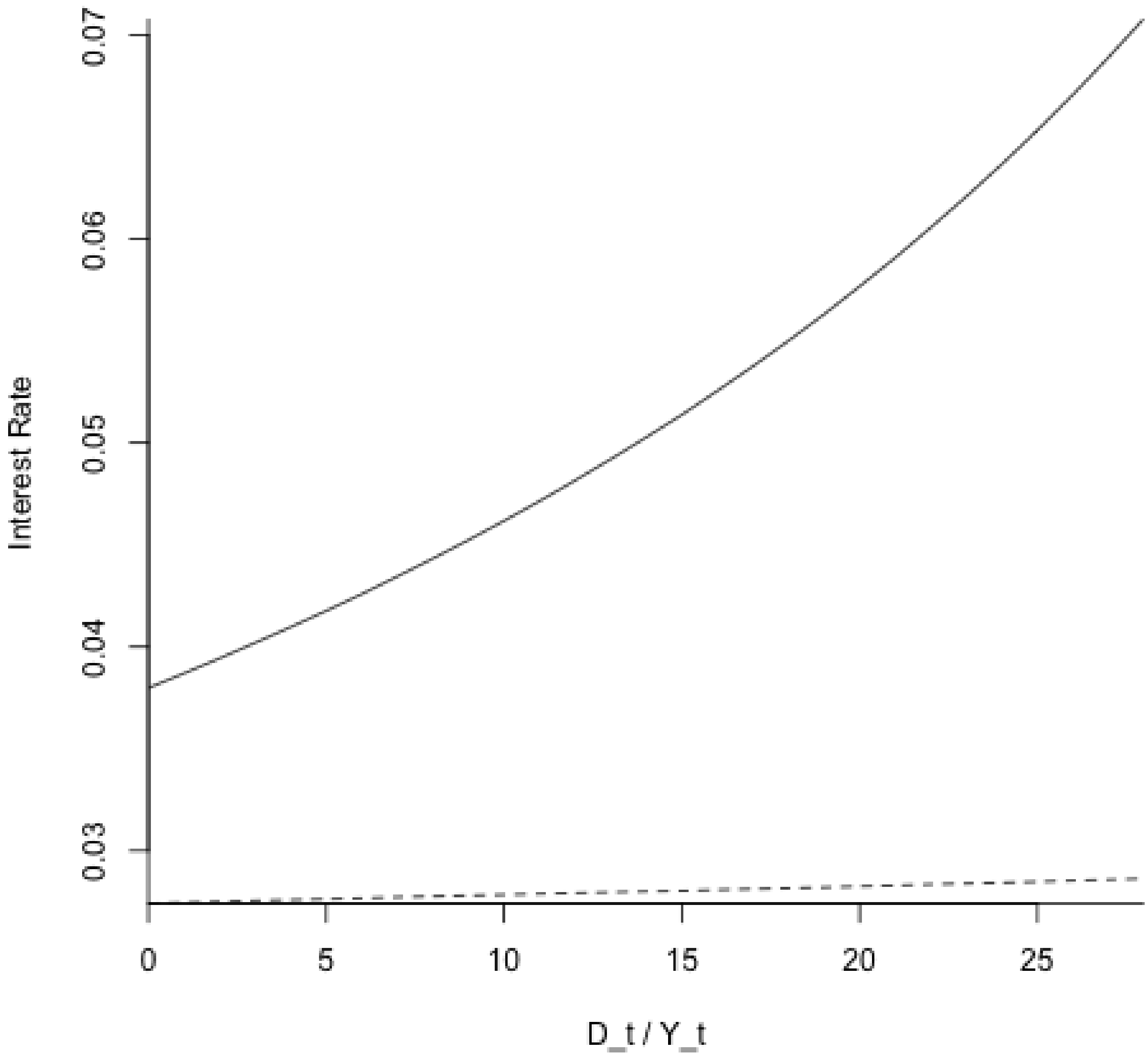

Figure 5: Interest rate: Solid line is pre-tax, dashed line is post-tax

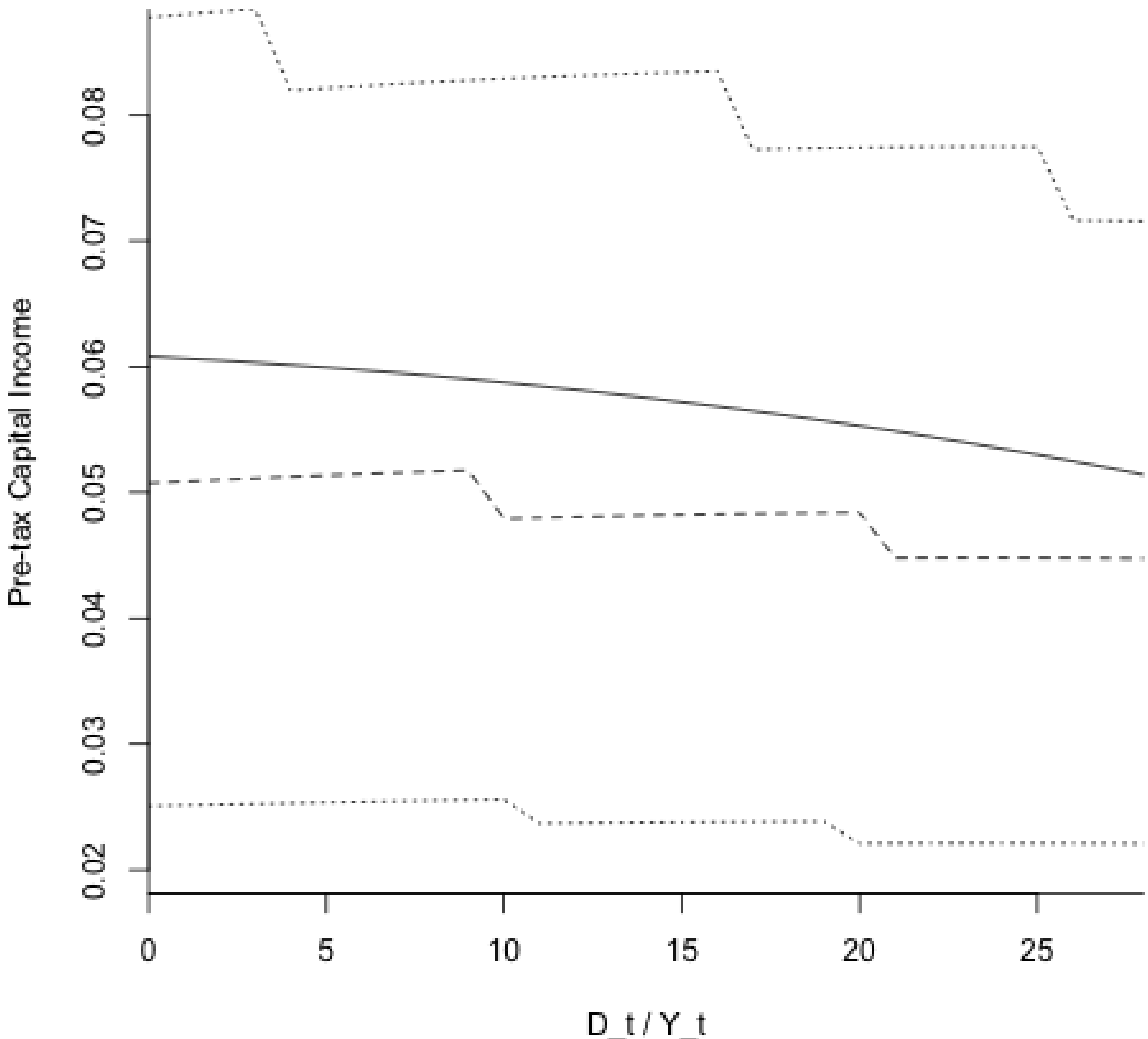

Figure 6: Pre-tax capital income: Solid line is mean, dashed line is median, dotted lines are 25th and 75th percentiles

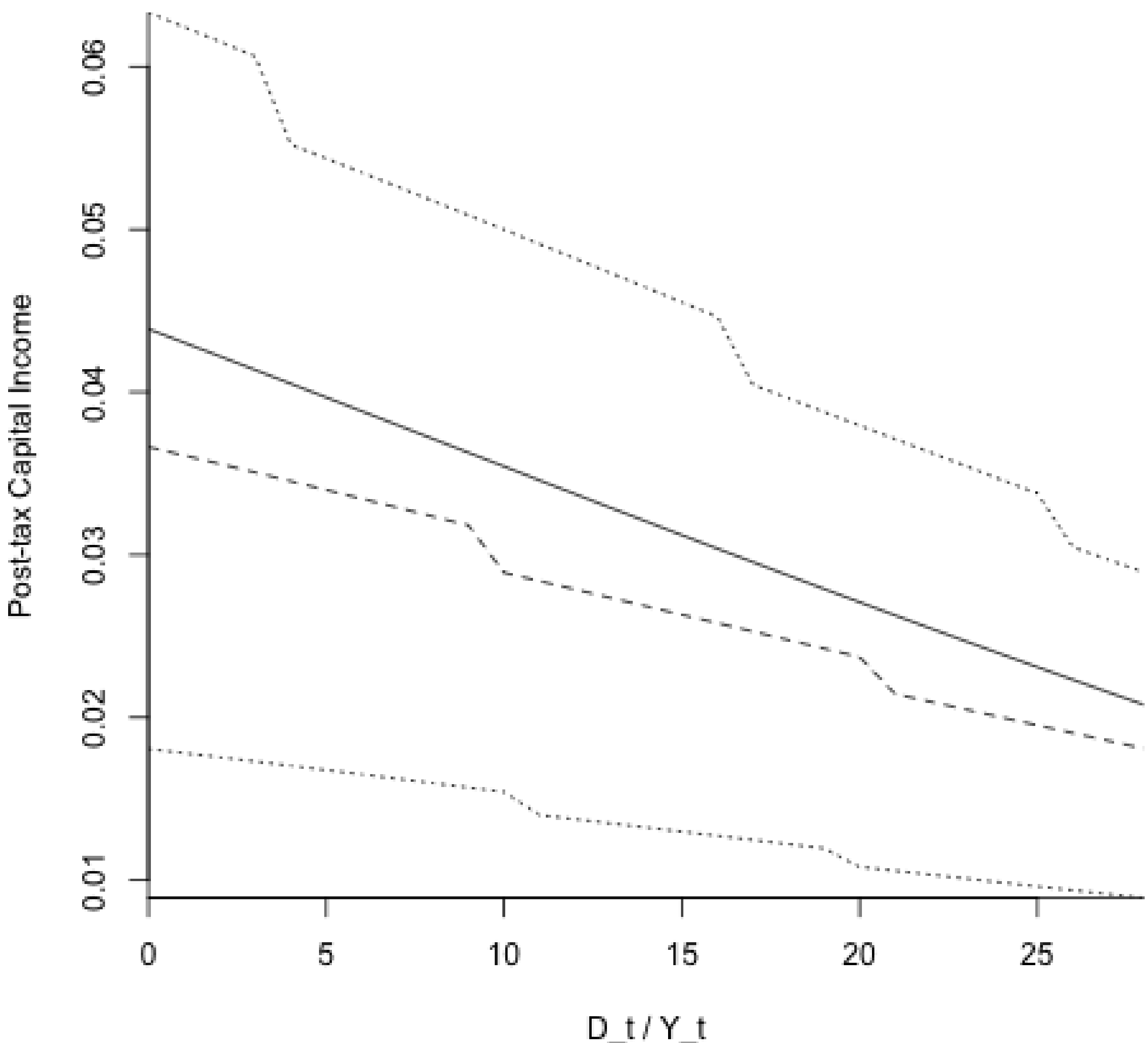

Figure 7: Post-tax capital income: Solid line is mean, dashed line is median, dotted lines are 25th and 75th percentiles

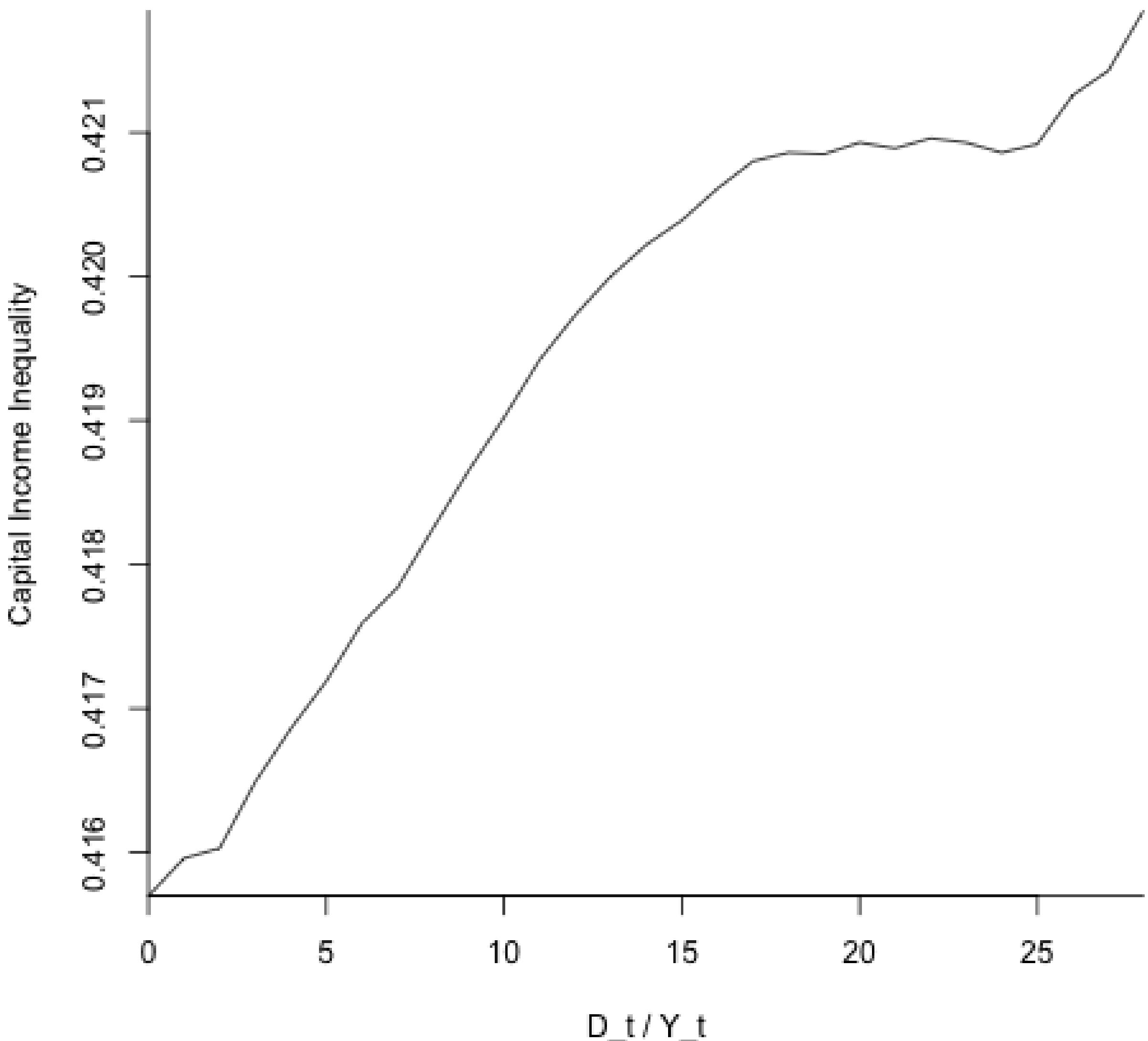

Figure 8: Gini coefficient for capital income; pre- and post-tax are indentical since one is a linear transformation of the other

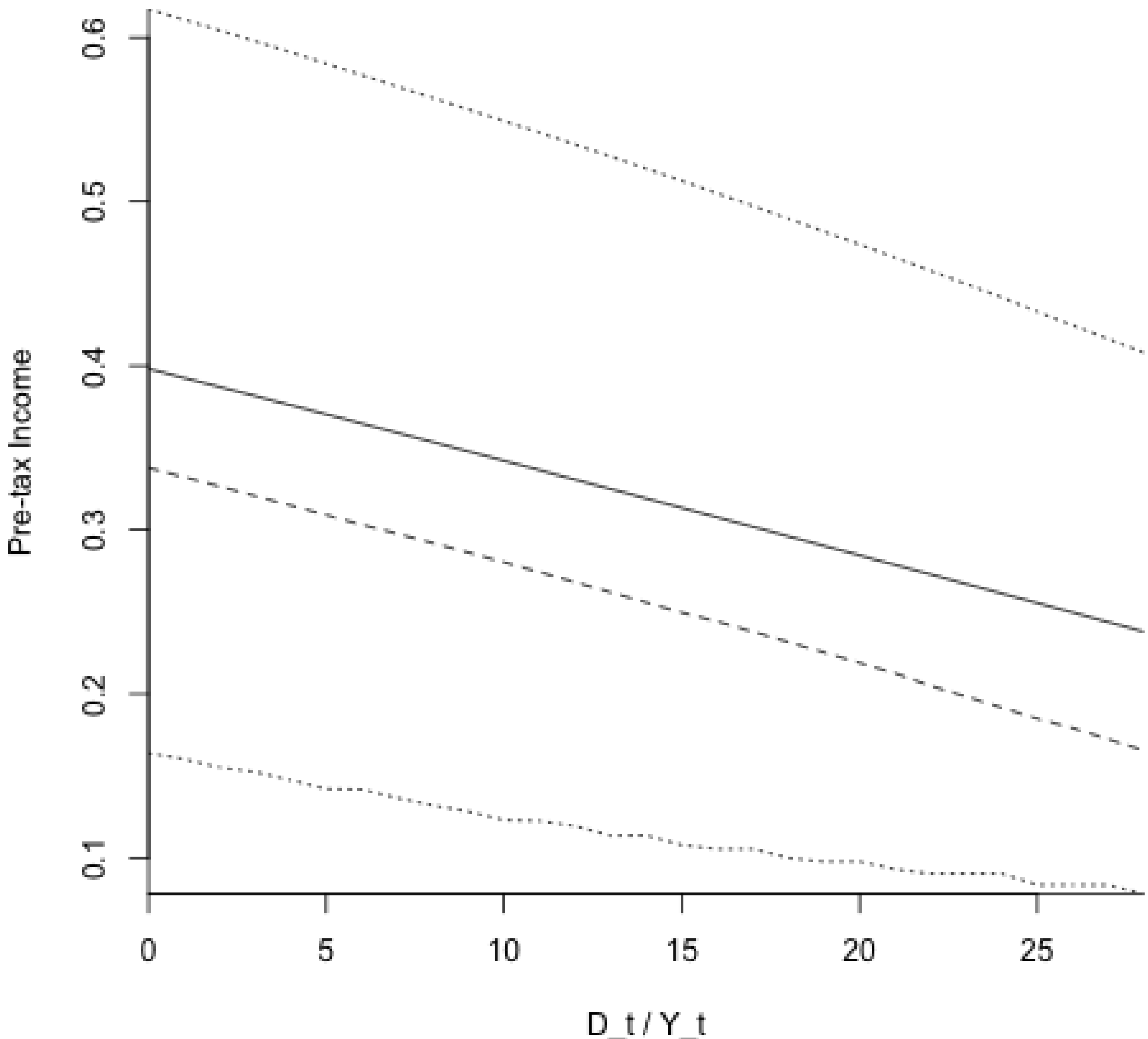

Figure 9: Pre-tax total income: Solid line is mean, dashed line is median, dotted lines are 25th and 75th percentiles

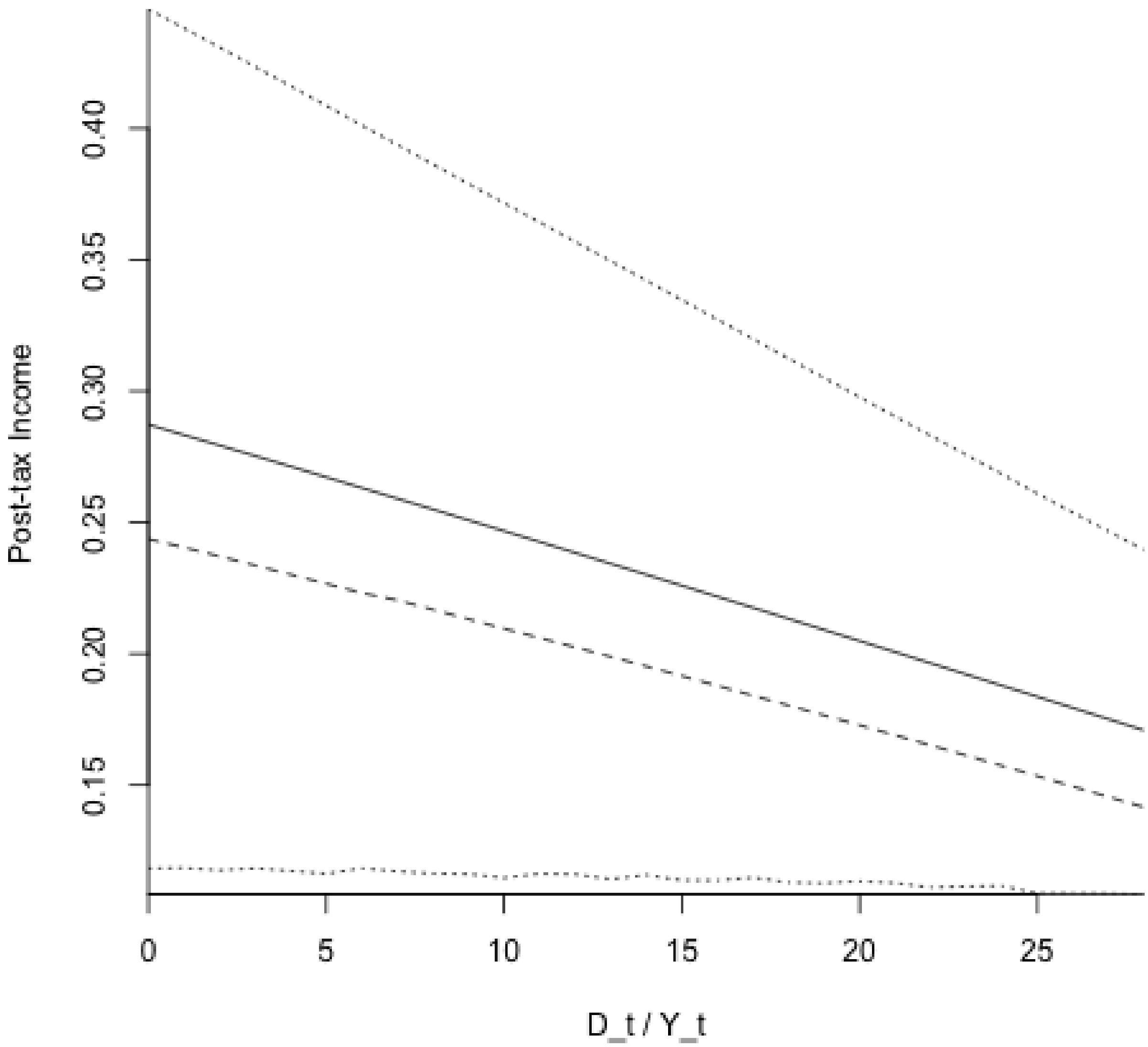

Figure 10: Post-tax income: Solid line is mean, dashed line is median, dotted lines are 25th and 75th percentiles

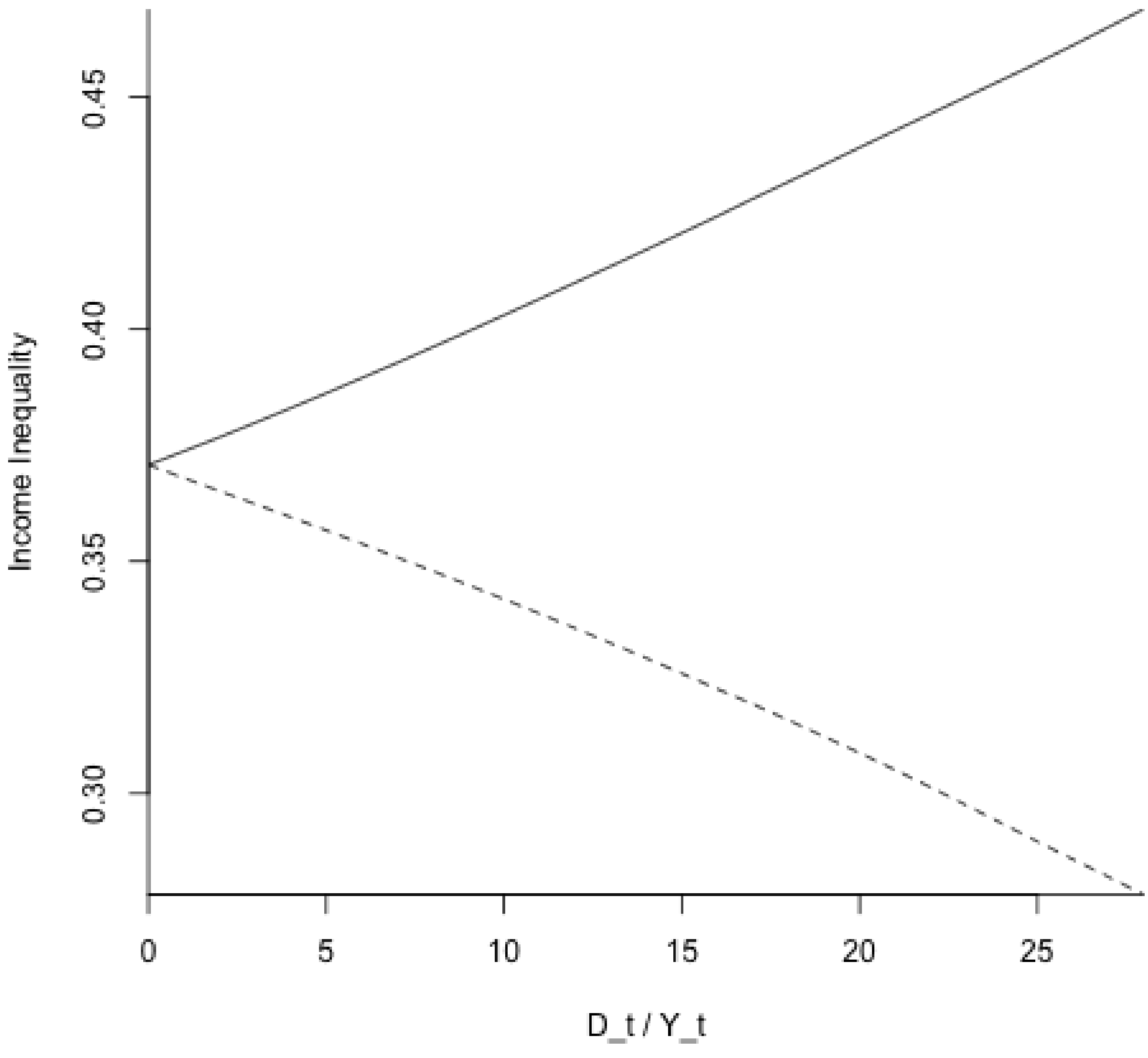

Figure 11: Gini coefficient for total income: Solid line is pre-tax, dashed line is post-tax

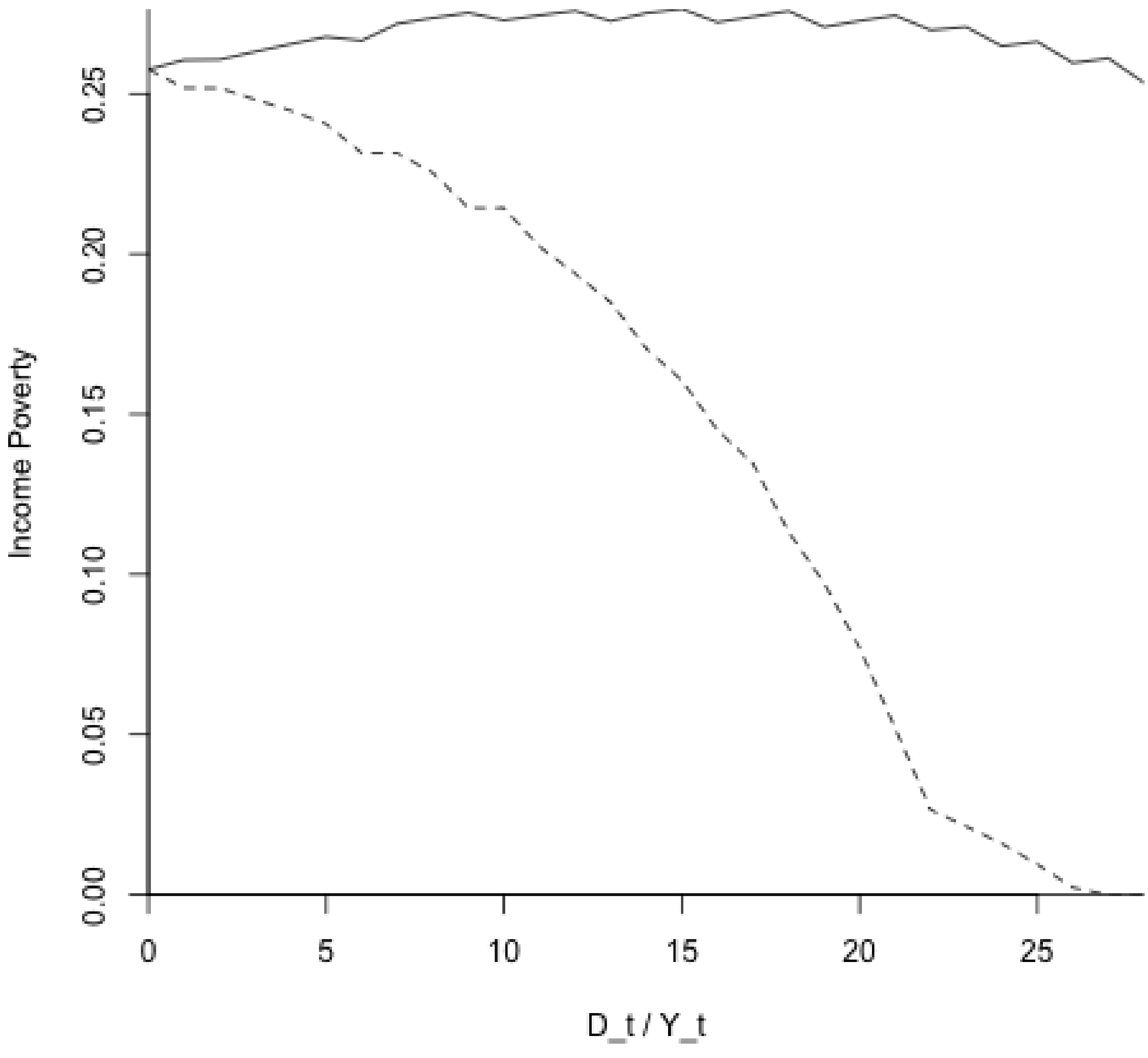

Figure 12: Headcount ratio for total income: Solid line is pre-tax, dashed line is post-tax

	Demogrant-to-GDP ratio (D_t/Y_t)			
	0.00	0.10	0.20	0.27
Tax rate	0.2784	0.3969	0.5100	0.5852
Aggregate hours	0.3170	0.2745	0.2308	0.2000
Wage rate				
Pre-tax	2.2077	2.5499	3.0322	3.4989
Post-tax	1.5931	1.5378	1.4858	1.4513
Wage income				
Mean, pre-tax	0.6999	0.6999	0.6999	0.6995
Mean, post-tax	0.5051	0.4221	0.3430	0.2901
Median, pre-tax	0.5850	0.5619	0.5175	0.4474
Median, post-tax	0.4222	0.3389	0.2536	0.1856
Gini coefficient†	0.4158	0.4643	0.5200	0.5635
Capital stock	2.6551	2.4755	2.2613	2.0848
Interest rate				
Pre-tax	0.0380	0.0462	0.0577	0.0689
Post-tax	0.0274	0.0279	0.0283	0.0286
Interest income				
Mean, pre-tax	0.1262	0.1451	0.1688	0.1895
Mean, post-tax	0.0911	0.0875	0.0827	0.0786
Median, pre-tax	0.1053	0.1184	0.1478	0.1633
Median, post-tax	0.0760	0.0714	0.0724	0.0677
Gini coefficient†	0.4081	0.4117	0.4137	0.4141
Total income*				
Mean, pre-tax	0.8261	0.8450	0.8688	0.8891
Mean, post-tax	0.5961	0.6096	0.6257	0.6388
Median, pre-tax	0.7089	0.7024	0.6805	0.6462
Median, post-tax	0.5115	0.5236	0.5334	0.5380
Gini coefficient, pre-tax	0.3601	0.3942	0.4316	0.4591
Gini coefficient, post-tax	0.3601	0.3296	0.2936	0.2650
Headcount ratio, post-tax	0.2030	0.1792	0.1045	0.0000
Poverty gap ratio, post-tax	0.0889	0.0523	0.0131	0.0000
Welfare loss (utilitarian)	0.0000	-1.7335	-7.1120	-13.4013

*Total income equals income from wages, interest, and the demogrant.

†The Gini coefficient for pre- and post-tax wage (or interest) income are the same, since one is a linear (not affine) function of the other.