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Estate Taxation with Warm-Glow Altruism*

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Abstract

This article examines the properties of the optimal fiscal policy in an economy with warm-glow altruism (utility interdependence) and heterogeneous individuals. We propose a new efficiency concept, D-efficiency, that considers an implicit constraint in the act of giving: donors cannot bequeath to donees more than their existing resources. Considering this constraint, we show that the market equilibrium is not socially efficient. The efficient level of bequest transfers can be implemented by the market with estate and labor-income subsidies and a capital-income tax. In the absence of lump-sum taxation, the government faces a trade-off between minimizing distortions and eliminating external effects. The implied tax policy differs from Pigovian taxation since the government's ability to correct the external effects is limited. Finally, we show that the efficiency-equity trade-off does not affect the qualitative features of the optimal distortionary fiscal policy.

Keywords: optimal taxation, altruism, dynamic general equilibrium.

J.E.L. classification codes: H21, H30, E62.

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1. Introduction

The existence and consequences of estate taxes have been debated recently in public domains. The supporters of estate taxation note that only a very small percentage of citizens pays this tax, mainly those with large estates. The rationale for a highly progressive tax is to reduce the concentration of wealth and provide equal opportunity for the newborn generations. The opponents claim that estate taxes slow economic growth, destroy small business, and generate large transaction costs and inefficiencies that households must incur to avoid estate taxation. The debate has resulted in a wide variety of proposals, ranging from the abolition of any source of estate or gift taxation and raising revenues through other taxes to high increases in the marginal rate of estate taxation. Just as Cremer and Pestieau (2006) suggest, the optimal estate tax should be judged, just like any other tax, against two criteria: efficiency and equity. Efficiency implies minimization of distortionary effects of taxation, whereas equity relies on some normative social preference for inter or intragenerational distribution.

The importance of altruism is evident at he aggregate level. The empirical studies of Kotlikoff and Summers (1981, 1986), McGarry and Schoeni (1995), and Davies and Shorrocks (2000) reveal that between 40 to 80 percent of wealth is transferred across generations. In particular, Gale and Scholz (1994) use direct measures of intergenerational links to attribute 63 percent of the current U.S. capital stock to bequests. Nonetheless, one of the most serious difficulties in studying this problem is that the empirical evidence is not conclusive on why individuals are altruistic. This fact can be summarized by the different class of models used to rationalize this behavior: dynastic, warm-glow or joy-of-giving, accidental, or strategic (see Laitner, 1997; for a detailed survey). Clearly, the implications of the estate taxation should depend on the bequest motive.

In this article, we consider a warm-glow altruism motive where in parents derive utility directly from giving bequests to their offspring, as in Yaari (1965). A large-scale version of this model, where generations live more than two periods,[1] is consistent with the observed wealth and income distribution in developed countries.[2] The introduction of this form of altruism has important

[1] In the analysis we use a two-period economy for two reasons. The first reason is to provide comparable results with previous work in the literature. Second, models with more than two periods impose some constraints in the set of fiscal instruments if age-specific taxes are not allowed (see Escolano, 1992; Garriga, 2000; and Erosa and Gervais, 2002). These restrictions usually imply capital-income taxes different from zero. Therefore, given that we want to study the pure effects of altruism, the driving forces of the main results should not depend on exogenous restrictions on the set of instruments that the government can use.

[2] Quadrini and Ríos-Rull (1997) find that the standard models with dynastic altruism cannot account for the observed wealth and income distribution. Nevertheless, de Nardi (2004) shows that warm-glow linkages are important to explain the emergence of large estates that characterize the upper tail of the wealth distribution observed in the

implications for the optimal fiscal policy in an otherwise standard life cycle model. In the presence of warm-glow altruism donors usually consider only the direct effect on their utility but they do not consider the indirect effect on the donee(s). This utility interdependence generates an external effect that confers a new role to estate and gift taxation.[3]

The article has two important contributions. The first one is to analyze the concept of Pareto efficiency in the presence of warm-glow altruism. Counting warm glow in the social welfare function raises a number of issues. Because bequests are not part of the resource constraint of the economy, utilitarian economists have claimed that they should be infinite, and, thus, individuals derive a non-bounded utility from giving at no real resource cost. To avoid this problem, a common strategy has been to eliminate any warm glow (or utility interdependence) in the notion of social optima.[4] Even though efficient allocations are well defined in this reduced context, the social planner ignores individual preferences and does not consider the indirect effect of the donor transfer on the donee. These two approaches ignore an implicit constraint in the act of giving: donors cannot bequeath to the donee more than their existing available resources. Therefore, efficiency should consider not only the presence of external effects and utilitarian social preferences, but also this constraint inherent to the act of giving. Moreover, the social planner should also have some ability to redistribute resources and attain the socially efficient level of altruism.We propose a new efficiency concept, D-efficiency, where D refers to distributional. Under the notion of D-efficiency, the income distribution is determined by the social planner, and the bounds on the act of giving are endogenous. Considering this constraint, we show that in general the market equilibrium is not socially efficient. The efficient level of bequests transfers can be implemented by the market with estate and labor-income subsidies and a capital-income tax.

In the absence of lump-sum taxation, estate subsidies must use distortionary taxation to be funded. We focus the analysis of distortionary taxation along two important dimensions. The first dimension is the trade-off between efficiency and eliminating the external effects. We show how the optimal fiscal policy equates these distortions at the margin and how the implied estate tax differs from the first-best policy. The second dimension, and our second contribution, is the efficiency-equity trade-off in the presence of heterogeneity (associated with different endowments

data for United States and Sweden, whereas a model with accidental bequests does not generate the observed wealth concentration.

[3] When bequests are accidental, a confiscatory estate tax is optimal. However, in the presence of dynastic altruism Cremer and Pestieau (2006) show that wealth transfers should not be taxed in the long run.

[4] Another alternative has been to use the standard infinite horizon model à la Barro-Becker and avoid double-counting by considering only the welfare of the first generation.

of efficiency units of labor or individual skills). We show that the qualitative features of the model without heterogeneity can be extended to the heterogeneity case regardless of the government's ability to condition taxes by the skill type.

Finally, we present a numerical simulation of the optimal fiscal policy under different tax constraints. The objective is to illustrate the theory and its implications, not to develop a quantitative analysis. In the presence of homogenous consumers, we find that the model can generate relatively high capital-income taxes and estate and labor-income subsidies to implement the efficient level of bequests. In the second-best equilibrium, the government must balance the distortionary effects of the different tax instruments with the external effect of the bequests. This conflict is resolved with a higher positive capital-income tax and a lower estate subsidy. However, the labor-income tax becomes positive. In the presence of heterogeneity, we find that it is optimal for the government to implement a tax code with a large degree of progressivity across individual skills. However, the qualitative findings for the optimal tax rates are similar: a high estate subsidy, high capital-income tax, and a positive labor-income tax. When taxes cannot be conditioned by individual skills, the government faces a trade-off between efficiency (minimizing distortions) and equity (redistributing resources) because all households must pay the same tax rates. This solution could be interpret as a pooling equilibrium where individual skills and effort are not observable. The lack of progressivity reduces government's effectiveness in minimizing distortions, but the qualitative results are the same. Clearly, heterogeneity can imply important quantitative differences in terms of the optimal tax rates, but it does not affect the nature of the market inefficiencies associated with warm-glow altruism.

Several theoretical articles have studied the effects of the fiscal policy in economies with warm-glow altruistic agents. Michel and Pestieau (2004) show that, in the absence of cross elasticities, the capital-income tax might be higher than the estate tax if its own compensated elasticity was lower than that of bequests. When bequests are not part of the social utility function, clearly they must be taxed at a relatively high rate. The purpose of our article is to provide new insights on the optimal tax mix in the presence of warm-glow altruism by dealing directly with the presence of external effects. Hence, the inefficiency sources are highlighted. Finally, Blumkin and Sadka (2003) examine the optimal estate tax in an economy with altruistic and accidental bequests but with no annuity markets and without capital. They find that the estate tax is highly sensitive to the relative importance of the two bequest motives. In particular, the estate tax corrects the incompleteness of the insurance market. We believe our results complement their findings and highlight different aspects of estate taxation. Our model differs from theirs in several dimensions: we assume warm-glow altruism in the social utility function, that capital accumulates, markets are complete, and households have a certain life span.

The paper is organized as follows. Section 2 describes the market economy. Section 3 shows the efficient allocation. Section 4 analyzes the optimal policy with distortionary taxation, whereas section 5 illustrates the obtained results with a numerical example. Finally, section 6 summarizes and concludes our findings.

2. Market Economy with Production

Consider an overlapping generations economy with production and constant population. Aggregate output is produced with a constant returns to scale technology $F(K_t, N_t)$, where K_t and N_t are capital and labor, respectively. The production function F is concave, C^2, and satisfies the Inada conditions. Capital depreciates at a constant rate, $\delta \in [0, 1]$. With competitive factor markets, each input receives its marginal product, so that $r_t = F_{K_t} - \delta$ and $w_t = F_{N_t}$, where r_t is the return of capital net of depreciation and w_t is the wage. The economy resource constraint is

$$C_t + K_{t+1} - (1-\delta)K_t + G_t = F(K_t, N_t), \quad \forall t, \tag{1}$$

where C_t denotes aggregate consumption at period t, G_t is a non productive government expenditure, and $K_{t+1} - (1-\delta)K_t$ is the gross investment.

There are n types of households. Each type is endowed with different publicly observable levels of efficiency units of labor given by $\theta^i \in \{\theta^1, ..., \theta^n\}$, where $\theta^1 < \theta^2 < ... < \theta^n$. Let μ^i denote the measure of agents of type θ^i. Individuals live for two periods: young and old. Individuals born in period t are endowed with one unit of time that they allocate between leisure $(1 - l_t^i)$, and labor market activities l_t^i, where $w_t \theta^i l_t^i$ is the gross labor income. They also receive a physical bequest, b_t^i, from their parents. Then, they choose consumption, c_{1t}^i, and asset holdings, a_{t+1}^i. When individuals become old, they allocate the return from savings between consumption, c_{2t+1}^i, and bequests to their offspring, b_{t+1}^i. The warm-glow altruism implies that individuals derive utility from the bequest given to their offspring, but they do not derive it directly from their children happiness. We assume that parents value the after-tax bequest, otherwise estate taxation would be non distortionary.[5] In this environment, an individual type θ^i of the generation born in period

[5] If the donee is taxed, then we should assume that the donor is interested in the net bequest received by the

t chooses $x_t^i = \{c_{1t}^i, c_{2t+1}^i, a_{t+1}^i, l_t^i, b_{t+1}^i\}$ to solve

$$\max_{x_t^i} \; U(c_{1t}^i, l_t^i) + \rho V(c_{2t+1}^i, b_{t+1}^i), \tag{2}$$

$$s.to \qquad c_{1t}^i + a_{t+1}^i = (1 - \tau_t^{l^i}) w_t \theta^i l_t^i + b_t^i, \tag{3}$$

$$c_{2t+1}^i + (1 + \tau_{t+1}^{b^i}) b_{t+1}^i = a_{t+1}^i \left[1 + r_{t+1}(1 - \tau_{t+1}^{k^i}) \right], \tag{4}$$

where $l_t^i \in (0,1)$. The parameter $\rho > 0$ is the subjective time discount rate, and $\tau_t^{b^i}, \tau_t^{k^i}$, and $\tau_t^{l^i}$ are estate, capital, and labor-income proportional taxes at time t for the individual type θ^i, respectively. We purposely choose to define an equilibrium where tax rates can vary by skill type. In this set up the government can always choose to tax all individuals at the same rate; that is, $\tau_t^{l^i} = \tau_t^l$ for all i. Both period utility functions U and V are strictly concave, C^2, and satisfy the usual Inada conditions. At $t = 0$, there exists an initial generation that owns the initial stock of debt and capital and solves a similar problem.

Let $\pi = \{\{\tau_t^{b^i}, \tau_t^{k^i}, \tau_t^{l^i}, d_{t+1}^i\}_{i=1}^n\}_{t=0}^\infty$ be a fiscal policy and the period government budget be defined by

$$G_t + \sum_{i=1}^n \mu^i \left(R_t^i d_t^i - d_{t+1}^i \right) = \sum_{i=1}^n \mu^i \left(\tau_t^{k^i} r_t k_t^i + \tau_t^{l^i} w_t \theta^i l_t^i + \tau_t^{b^i} b_t^i \right), \quad \forall t, \tag{5}$$

where k_t^i and d_t^i denote the capital and debt own by the individual type θ^i at period t, respectively, and R_t^i is the return on government bonds paid to the individual type θ^i.[6] The aggregates are computed by summing up across different types. In particular, the aggregate consumption is $C_t = \sum_{i=1}^n \mu^i (c_{1t}^i + c_{2t}^i)$, the aggregate labor supply is $N_t = \sum_{i=1}^n \mu^i \theta^i l_t^i$, the aggregate capital is $K_t = \sum_{i=1}^n \mu^i k_t^i$, the aggregate bequest is $B_t = \sum_{i=1}^n \mu^i b_t^i$, and the government debt is $D_t = \sum_{i=1}^n \mu^i d_t^i$. The amount of government debt is bounded by a large positive constant to ensure that the government budget constraint is satisfied in present value. Finally, in the capital markets the aggregate level of asset holdings equals the stock of physical capital and government debt at $t+1$,

$$\sum_{i=1}^n \mu^i a_{t+1}^i = K_{t+1} + D_{t+1}, \quad \forall t. \tag{6}$$

Definition 1 (Market Equilibrium): *Given a fiscal policy π, and a sequence of government expenditure $\{G_t\}_{t=0}^\infty$, a market equilibrium are individual allocations $x = \{\{c_{1t}^i, c_{2t}^i, a_{t+1}^i, l_t^i, b_t^i\}_{i=1}^n\}_{t=0}^\infty$,*

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donee.

[6] Because the government may condition the taxes to the individual type θ^i, then it may condition the net return on government debt to the type, too.

production plans $\{K_t, N_t\}_{t=0}^{\infty}$, and prices $p = \{\{R_t^i\}_{i=1}^n, r_t, w_t\}_{t=0}^{\infty}$, such that i) x solves the households problem, ii) the production plans solve the firms' problem, iii) markets clear, and iv) the government budget constraint holds.

The first-order conditions of the optimization problem for a newborn generation of type θ^i yield the following:

$$\frac{U_{c_{1t}^i}}{\rho V_{c_{2t+1}^i}} = 1 + r_{t+1}(1 - \tau_{t+1}^{k^i}), \quad \forall i, t, \tag{7}$$

$$-\frac{U_{l_t^i}}{U_{c_{1t}^i}} = (1 - \tau_t^{l^i}) w_t \theta^i, \quad \forall i, t, \tag{8}$$

$$\frac{V_{b_{t+1}^i}}{V_{c_{2t+1}^i}} = 1 + \tau_{t+1}^{b^i}, \quad \forall i, t, \tag{9}$$

together with an arbitrage condition between the net return on government bonds and capital, i.e., $R_{t+1}^i = 1 + r_{t+1}(1 - \tau_{t+1}^{k^i})$. Eq. (7) and Eq. (8) are the standard intertemporal and intratemporal first-order conditions.[7] Eq.(9) determines the optimal bequest and shows that donors consider only the direct effect of the bequest in their utility function but do not consider the indirect effect on the donee.

3. First-Best Policy

In the previous section, we showed that the donor first-order condition without proportional estate taxes is

$$V_{c_{2t+1}^i} = V_{b_{t+1}^i}, \quad \forall i, t. \tag{10}$$

In general, the market solution might fail to be efficient because the donor considers only the direct effect of the bequest in the utility function, but fails to consider the indirect effect on the donee. The main problem in calculating the degree of market failure in the presence of warm-glow altruism is that individuals assign utility to the bequest, which is not properly a commodity and, consequently, it does not affect the aggregate resource constraint.[8] When there exists a choice variable that does not appear in the resource constraint, we might need additional information to

[7] As in Michel and Pestieau (2004), we exclude non-interior solutions for the leisure decision. The decision to work or not has been studied in more detail by Michel and Pestieau (1999).

[8] This is not an important challenge for the definition of second-best allocations because they explicitly deal with the individual budget constraint. However, it can create some important problems in defining first-best or Pareto efficient allocations.

determine its value. In the presence of altruism, the act of giving (choice variable) is bounded by the amount of individuals' resources determined by their budget constraint. Consequently, individuals' cannot promise and transfer more resources to another individual than the available income or wealth. The social planner should respect this constraint inherent to the act of giving, but it should also have some ability to redistribute resources (i.e., make the donor relatively wealthier) and attain the socially efficient level of altruism. Hence, the bounds on the act of giving and the implied income distribution are determined by the social planner.

One way to think about the determination of each individual share on income is to view the social planner as the agent that assigns resources to the production process. In our particular case, young individuals provide labor units to produce, whereas old individuals provide capital units. Therefore, the production process has some implications in the income and consumption distributions because individuals who provide labor units are entitled to receive labor earnings, and individuals who provide capital are entitled to receive capital earnings. Consequently, the determinants of the socially efficient income distribution are the same as in the market economy. Thus, a social planner whose social preferences represent individual preferences should consider not only the external effects, but also the effect the income distribution.

Usually, the concept of Pareto efficiency is silent about the income distribution. We propose a new efficiency concept, D-efficiency, where D refers to distributional,[9] that considers both the presence of external effects and the income distribution. Under the notion of D-efficiency, the income distribution is determined by the social planner (since it can use lump-sum taxes), and the bounds on the act of giving are endogenous. A social planner problem consists of maximizing a social welfare function subject to the sequential individual constraints, the firms' optimal conditions, the market clearing conditions, and the government budget constraint. Adding these constraints gives the resource constraint of the economy. When markets are competitive and there are no market failures in the economy, it is easy to prove that the solution to the original problem coincides with the solution of the maximization of the social welfare function subject to the resource constraint. However, this is not necessarily the case if some type of market failure exists. Because this is also our case, we use the original problem.

[9] This concept is similar to the efficiency concept proposed by Dávila et al. (2007), where the income distribution becomes a state variable of the social planner's problem.

Definition 2 (D-efficiency): *A Pareto-efficient allocation m solves*

$$\max_{m} \sum_{t=0}^{\infty} \sum_{i=1}^{n} \beta^t \mu^i \left[U(c_{1t}^i, l_t^i) + \rho \beta^{-1} V(c_{2t}^i, b_t^i) \right], \tag{11}$$

$$s.to \quad c_{1t}^i + a_{t+1}^i = F_{N_t}(K_t, N_t) \theta^i l_t^i + b_t^i - T_t^i, \quad \forall i, t, \tag{12}$$

$$c_{2t}^i + b_t^i = a_t^i (1 - \delta + F_{K_t}(K_t, N_t)), \quad \forall i, t, \tag{13}$$

$$\sum_{i=1}^{n} \mu^i a_{t+1}^i = K_{t+1}, \quad \forall t, \tag{14}$$

$$\sum_{i=1}^{n} \mu^i \theta^i l_t^i = N_t, \quad \forall t, \tag{15}$$

$$\sum_{i=1}^{n} \mu^i T_t^i = G_t, \quad \forall t, \tag{16}$$

where $l_t^i \in (0,1)$ *for all* i.

The initial distribution of entitlements at $t = 0$ is exogenously given $\{a_0^i\}_{i=1}^n$, T_t^i is a lump-sum tax paid by the young individuals, the relative weight that the government assigns present and future generations is captured by $\beta \in (0,1)$, and $m = \{\{c_{1t}^i, c_{2t}^i, a_{t+1}^i, l_t^i, b_t^i, T_t^i\}_{i=1}^n\}_{t=0}^{\infty}$. For simplicity, we assume $\mu^i = \mu = 1$. Separating the income source for each individual constrains the act of giving. Note that a_{t+1}^i should be interpreted as entitlements for the utilization of the capital stock in the next period. Also note that adding Eq. (12) and Eq. (13) for all i and using Eqs. (14)-(16), we have the resource constraint. Therefore, intergenerational transfers are possible. The social planner understands that next-period aggregate capital stock requires a consumption sacrifice by the young generations. More important, the planner uses the distribution of entitlements to determine next-period efficient allocation between consumption and bequests that is likely to differ from that implied by the market. The efficient distribution of entitlements (savings) can be decentralized as a market solution with the appropriate tax/subsidy policy.

In this problem, the social planner not only takes into account the external effects, but it also takes into account the impact of the labor supply and the entitlements on its respective marginal productivities. Individuals in the market are price takers, and they will not take this effect into account. Formally, the social planner solves

$$\max_{m} \sum_{t=0}^{\infty} \sum_{i=1}^{n} \beta^t \left[U(F_{N_t} \left(\sum_{j=1}^{n} a_t^j, \sum_{j=1}^{n} \theta^j l_t^j \right) \theta^i l_t^i + b_t^i - T_t^i - a_{t+1}^i, l_t^i) + \right.$$

$$\rho\beta^{-1}V(a_t^i\left[1-\delta+F_{K_t}\left(\sum_{j=1}^{n}a_t^j,\sum_{j=1}^{n}\theta^j l_t^j\right)\right]-b_t^i,b_t^i)\right], \tag{17}$$

$$s.to \quad \sum_{i=1}^{n}T_t^i=G_t, \quad \forall t. \tag{18}$$

The first-order conditions with respect to b_t^i, a_{t+1}^i, l_t^i, and T_t^i are, respectively,

$$U_{c_{1t}^i}+\rho\beta^{-1}(-V_{c_{2t}^i}+V_{b_t^i})=0, \quad \forall i,t, \tag{19}$$

$$\beta\sum_{j=1}^{n}U_{c_{1t+1}^j}\theta^j l_{t+1}^j F_{N_{t+1}K_{t+1}}+\rho V_{c_{2t+1}^i}(1-\delta+F_{K_{t+1}})+\sum_{j=1}^{n}\rho V_{c_{2t+1}^j}a_{t+1}^j F_{K_{t+1}K_{t+1}}-U_{c_{1t}^i}=0, \quad \forall i,t, \tag{20}$$

$$U_{c_{1t}^i}F_{N_t}+\sum_{j=1}^{n}U_{c_{1t}^j}\theta^j l_t^j F_{N_tN_t}+\frac{U_{l_t^i}}{\theta^i}+\sum_{j=1}^{n}\rho\beta^{-1}V_{c_{2t}^j}a_t^j F_{K_tN_t}=0, \quad \forall i,t, \tag{21}$$

and

$$U_{c_{1t}^i}=U_{c_{1t}^j}, \quad \forall i\neq j, \quad \forall t. \tag{22}$$

Rearranging terms, we can rewrite the efficient bequest decision as

$$V_{c_{2t}^i}=V_{b_t^i}+\underbrace{\frac{\beta}{\rho}U_{c_{1t}^i}}_{\text{External effect}}, \qquad \forall i,t. \tag{23}$$

The social planner equates the marginal cost from giving an additional unit of consumption from the donor's perspective with the social marginal benefit of giving a bequest. That includes the direct effect on the donor's utility function and the indirect effect on the donee budget set. A socially efficient allocation reduces the marginal utility of giving a bequest, $V_{b_t^i}$, by considering its direct and indirect cost, $V_{c_{2t}^i}-\frac{\beta}{\rho}U_{c_{1t}^i}$. In general, the market outcome is socially inefficient unless we consider efficient solutions wherein the social planner sets $\beta=0$, and only worries about the current old generation.

The implied tax policy can be obtained by combining the first-order conditions of the social planner problem with the market conditions.

Proposition 1: *The efficient fiscal policy from $t>0$ requires*

$$\tau_t^{b^i}=-\frac{\beta}{\rho}\frac{U_{c_{1t}^i}}{V_{c_{2t}^i}}<0, \quad \forall i,t. \tag{24}$$

$$\tau_t^{k^i} = \frac{F_{N_t K_t} \sum_{j=1}^{n} V_{b_t^j} \theta^j l_t^j - \sum_{j=1}^{n} V_{c_{2t}^j} \left(F_{N_t K_t} \theta^j l_t^j + F_{K_t K_t} a_t^j \right)}{V_{c_{2t}^i} (F_{K_t} - \delta)}, \quad \forall i, t, \tag{25}$$

$$\tau_t^{l^i} = -\frac{\rho \beta^{-1} F_{K_t N_t} \sum_{j=1}^{n} V_{b_t^j} a_t^j + \sum_{j=1}^{n} U_{c_{1t}^j} \left(F_{N_t N_t} \theta^j l_t^j + F_{K_t N_t} a_t^j \right)}{U_{c_{1t}^i} F_{N_t}}, \quad \forall i, t. \tag{26}$$

The implied estate tax is always negative, even in steady state, and it depends on the size of the bequest, the endogenous income distribution, and the ratio of discount rates (individual and planning weights). The objective of the estate subsidy is to reduce the relative price of the bequest and induce a higher level of transfers in the market. The capital and labor-income taxes are set to induce the efficient level of savings and labor supply. Individual lump-sum taxes are calculated given the individual collected taxes, the social planner allocation, and Eq. (18) and Eq. (22).[10]

When individuals are homogeneous, $n = 1$. Then, using the property of homogeneity of degree zero of the derivatives of the production function and suppressing the individual type superscript, $a_t = K_t$, $\theta l_t = N_t$; then, the optimal capital-income tax is $\tau_t^k = \frac{V_{b_t}}{V_{c_{2t}}} \frac{N_t F_{N_t K_t}}{(F_{K_t} - \delta)} > 0$, whereas the optimal labor-income tax is $\tau_t^l = -\frac{\rho}{\beta} \frac{V_{b_t}}{U_{c_{1t}}} \frac{K_t F_{K_t N_t}}{F_{N_t}} < 0$. It is important to mention that if the social planner does not consider the impact of capital and labor supply decisions on each individual compensations, then the implied tax rates are zero. Also, if there was no external effect (i.e., $V_{b_t} = 0$), then we would recover the typical first-best result where $\tau_t^k = \tau_t^l = 0$ for all t, and we could have added all the constraints into the resource constraint.

Corollary 1: *If individuals are homogeneous, then the efficient fiscal policy from $t > 0$ requires positive capital-income taxes and negative estate and labor-income taxes.*

If the government does not have access to lump-sum taxation, it needs to consider and prioritize the distortions when choosing the optimal fiscal policy.

[10] Note that Eq. (22) crucially depends on the weights assigned to each individual type by the social planner.

4. The Government Problem and Second-Best Policy

In this, section we state and solve the government problem. We consider a government that chooses a fiscal policy, π, to maximize the welfare of all present and future generations.[11] To solve the government problem we use the primal approach of optimal taxation proposed by Atkinson and Stiglitz (1980).[12] The characterization of this problem includes a larger set of constraints than the social planner problem defined in the previous section. Therefore, the solution of the second-best policy cannot yield utility higher than the first-best allocation.

Definition 3 (Government Problem): *Given an initial distribution of tax rates,* $\{\tau_0^{k^i}\}_{i=1}^n$*, and a distribution of wealth,* $\{a_0^i\}_{i=1}^n$*, the allocation* y *associated with the optimal fiscal policy,* π*, is derived by solving*

$$\max_y \sum_{t=0}^{\infty}\sum_{i=1}^{n} \beta^t \left[U(c_{1t}^i, l_t^i) + \rho\beta^{-1} V(c_{2t}^i, b_t^i)\right] \tag{27}$$

$$s.to \quad c_{1t}^i U_{c_{1t}^i} + l_t^i U_{l_t^i} + \rho\left(c_{2t+1}^i V_{c_{2t+1}^i} + b_{t+1}^i V_{b_{t+1}^i}\right) = b_t^i U_{c_{1t}^i}, \quad \forall i, t, \tag{28}$$

$$c_{20}^i V_{c_{20}^i} + b_0^i V_{b_0^i} = V_{c_{20}^i}\left[1 + (1-\tau_0^{k^i})(F_{K_0} - \delta)\right] a_0^i, \quad \forall i, \tag{29}$$

$$\sum_{i=1}^{n}(c_{1t}^i + c_{2t}^i) + K_{t+1} - (1-\delta)K_t + G_t = F(K_t, \sum_{i=1}^{n}\theta^i l_t^i), \quad \forall t, \tag{30}$$

where $l_t^i \in (0,1)$ *for all* i*,* $a_0^i = \left(k_0^i + d_0^i\right)$*, and* $K_0 = \sum_{i=1}^{n} k_0^i$*.*

Note that in this case we can add all the restrictions in the resource constraint because the implementability constraint, Eq. (28), contains the effects of individual decisions and income distribution by the government. In particular, the external effects are taken into account in the right-hand side of the implementability constraint for newborn cohorts. Using the primal approach, it is straight

[11] Throughout the article we assume that the government can commit to the optimal policy, and thus time-consistency issues are ignored.

[12] This approach is based on characterizing the set of allocations that the government can implement for a given fiscal policy π. The set of implementable allocations is described by a sequence of resource and implementability constraints. The implementability constraints are the households' present value budget constraints, after substituting in the first-order conditions of the consumers' and the firms' problems. These constraints capture the direct effect of fiscal policy on agents' decisions and an indirect effect on prices. Thus, the government problem amounts to maximizing a social welfare function over the set of implementable allocations. From the optimal allocations we can decentralize the economy, finding the prices and the optimal fiscal policy. The implementability constraint can be easily derived combining the first-order conditions of the consumer problem with the intertemporal budget constraint (see Chari and Kehoe, 1999, for a detailed derivation).

forward to shoe that the allocations in a market equilibrium satisfy the set of implementable allocations defined by Eqs. (28)-(30). Moreover, if an allocation $y = \{\{c_{1t}^i, c_{2t}^i, l_t^i, b_t^i\}_{i=1}^n, K_{t+1}\}_{t=0}^{\infty}$ is implementable, then we can construct a fiscal policy, π, and market prices, p, such that the allocation together with the prices, p, and the tax policy, π, constitute an equilibrium as defined in the second section.[13]

In the absence of lump-sum taxation, the government faces a trade-off between distortions and external effects. We assume that $n = 1$ and thus we suppress the individual type superscript. We will show that all findings can be generalized provided the government can observe either the labor supply and/or the skill type and therefore the optimal tax rates can be conditioned on observables $\pi(\theta^i)$. When taxes cannot be conditioned on skills, the government faces a trade-off between efficiency and redistribution. However, in the next section we use a numerical example to show that the qualitative properties of a pooling equilibrium in which all individual types pay the same tax rates are similar.

To derive a solution to the previous problem, we redefine the government objective function by introducing the implementability constraint of each generation. For a newborn generation the government period utility becomes

$$W(e_t, \eta_t) = U(c_{1t}, l_t) + \rho V(c_{2t+1}, b_{t+1}) + \eta_t \underbrace{\left[(c_{1t} - b_t)U_{c_{1t}} + l_t U_{l_t} + \rho \left(c_{2t+1} V_{c_{2t+1}} + b_{t+1} V_{b_{t+1}}\right)\right]}_{\text{Effect distortionary taxation}}, \tag{31}$$

where $e_t = (c_{1t}, l_t, c_{2t+1}, b_{t+1})$, and η_t is the Lagrange multiplier associated with the implementability constraint of a generation born at period t. The additional term measures the effect of distortionary taxes on the utility function. The optimal conditions for $t > 0$ are characterized by[14]

$$-\frac{W_{l_t}}{W_{c_{1t}}} = F_{N_t}\theta, \tag{32}$$

$$\frac{W_{c_{1t}}}{\rho W_{c_{2t+1}}} = 1 - \delta + F_{K_{t+1}}, \tag{33}$$

[13] The presence of debt allows the government to redistribute resources across generations and attain the modified golden-rule. We assume that the initial capital-income tax, $\left\{\tau_0^{k^i}\right\}_{i=1}^n$, is inherited by the government. For economies in which agents live a finite number of periods, this assumption is not very important because taxes at $t = 0$ cannot be used to mimic lump sum and obtain a first-best assignment.

[14] It is important to note that, given the nature of this problem, the first-order conditions together with the transversality condition might not be sufficient to characterize a solution; that depends on the properties of the implementability constraint, which might fail to be convex. A detailed discussion of this problem can be found in Lucas and Stokey (1983).

$$W_{c_{1t}} = \frac{\rho}{\beta} W_{c_{2t}}, \tag{34}$$

$$W_{b_t} = \frac{\eta_t \beta}{\rho} U_{c_{1t}}, \tag{35}$$

where the term W_x denotes the derivative of the objective function with respect to x.[15] The Lagrange multiplier in Eq.(35) captures the external effect on the budget constraint of the younger generations. Clearly, the first-order conditions of the government problem and the social planner are different. In particular, if we combine Eqs. (34) and (35), we can derive an expression similar to Eq. (19),

$$V_{c_{2t}} - \left[V_{b_t} + \frac{\beta}{\rho} V_{c_{1t}} \right] = H_t \equiv \frac{\beta}{\rho} \eta_t Z_{1t} + \eta_{t-1} Z_{2t}, \tag{36}$$

where the terms Z_{it} capture the distortionary effects of estate taxation for the individual of age i at time t.[16] The incentives to reduce the external effect need to be balanced with the negative impact of raising additional distortions in both existing generations. The negative impact is captured by the Lagrange multiplier of the implementability constraint, η_t, for all t, and the impact on the optimal decisions of each cohort Z_{it} for $i = 1, 2$. In the presence of lump-sum taxation, the Lagrange multiplier of the implementability constraint is zero; i.e., $\eta_t = 0$ for all t. However, in the absence of lump-sum taxation the implementability constraint is binding. To characterize the optimal fiscal policy we combine the optimal conditions of the government's problem together with the consumer's and the firms' optimal conditions.

Proposition 2: *The optimal fiscal policy from $t > 0$ under π requires*

$$\tau_t^l = 1 - \frac{W_{c_{1t}}}{W_{l_t}} \frac{U_{l_t}}{U_{c_{1t}}}, \tag{37}$$

[15] Formally,

$$W_{c_{1t}} = U_{c_{1t}} + \eta_t \left[U_{c_{1t}} + (c_{1t} - b_t) U_{c_{1t}c_{1t}} + l_t U_{l_t c_{1t}} \right],$$
$$W_{l_t} = U_{l_t} + \eta_t \left[U_{l_t} + l_t U_{l_t l_t} + (c_{1t} - b_t) U_{c_{1t} l_t} \right],$$
$$W_{c_{2t}} = V_{c_{2t}} + \eta_{t-1} [V_{c_{2t}} + c_{2t} V_{c_{2t}c_{2t}} + b_t V_{b_t c_{2t}}],$$
$$W_{b_t} = V_{b_t} + \eta_{t-1} [V_{b_t} + b_t V_{b_t b_t} + c_{2t} V_{c_{2t} b_t}].$$

The additional terms on the marginal utilities capture the efficient distortion, in terms of allocations, chosen by the government. At $t = 0$, these expressions include additional terms that account for the initial income distribution.

[16] Formally,

$$Z_{1t} = (c_{1t} - b_t) U_{c_{1t}c_{1t}} + l_t U_{l_t c_{1t}},$$
$$Z_{2t} = V_{b_t} + b_t V_{b_t b_t} + (c_{2t} - b_t) V_{c_2 b_t} - V_{c_{2t}} - c_{2t} V_{c_{2t}c_{2t}}.$$

$$\tau_t^b = -\frac{\beta}{\rho}\frac{U_{c_{1t}}}{V_{c_{2t}}} - \frac{H_t}{V_{c_{2t}}}, \tag{38}$$

and

$$\tau_t^k = 1 - \left(\frac{\frac{U_{c_{1t-1}}}{\rho V_{c_{2t}}} - 1}{\frac{W_{c_{1t-1}}}{\rho W_{c_{2t}}} - 1} \right). \tag{39}$$

The trade-off between efficiency and external effects is captured by the term $H_t \neq 0$, and the optimal estate tax differs from the efficient one obtained in the previous section. In general, the presence of warm-glow altruism implies estate and capital-income taxes different from zero. We state without proof the next corollary, which shows a sufficient condition for uniform taxation in this economy.

Corollary 2: *If the utility function satisfies the following condition:*

$$\frac{(c_{1t} - b_t)\, U_{c_{1t}c_{1t}} + l_t U_{l_t c_{1t}}}{U_{c_{1t}}} = \frac{c_{2t+1} V_{c_{2t+1}c_{2t+1}} + b_{t+1} V_{c_{2t+1}b_{t+1}}}{V_{c_{2t+1}}}, \tag{40}$$

then the optimal policy implies setting $\tau_t^k = 0$ *from* $t > 1$.

In general, standard preferences used in the macroeconomics and public finance literature do not satisfy this condition. Consequently, the presence of this form of altruism can lead to new roles for capital-income and estate taxation. These results differ from the standard model with dynastic altruism. In particular, Cremer and Pestieau (2006) show that in the dynastic altruism model the government would set capital-income and estate taxation to zero in the long run.

Because estate subsidies might be difficult to implement and could require high administrative costs of monitoring the actual transfer, we consider the case where the government faces a non-negativity constraint on estate taxation. Formally, this amounts to imposing an additional constraint in the government problem. In particular, second-best allocations need to satisfy $\tau_t^b = V_{b_t}/V_{c_{2t}} - 1 \geq 0$. When this constraint binds the restricted fiscal policy becomes $\pi_R = \{\tau_t^k, \tau_t^l, d_{t+1}\}_{t=0}^{\infty}$, and the intergenerational distribution becomes a constraint that the government can only indirectly influence through capital-income taxation. The associated optimal conditions for $t > 0$ are

$$-\frac{W_{l_t}}{W_{c_{1t}}} = F_{N_t}\theta, \tag{41}$$

$$\frac{W_{c_{1t}}}{[\rho W_{c_{2t+1}} + Q_{t+1}]} = 1 - \delta + F_{K_{t+1}}, \tag{42}$$

where Q_{t+1} is an additional term that captures the impact of the tax restrictions on the marginal utility of consumers.[17] The next proposition characterizes the optimal fiscal policy in the absence of estate taxes.

Proposition 3: *The optimal fiscal policy from $t > 0$ under $\widehat{\pi}_R$ requires*

$$\tau_t^l = 1 - \frac{W_{c_{1t}}}{W_{l_t}} \frac{U_{l_t}}{U_{c_{1t}}}, \tag{43}$$

$$\tau_t^k = 1 - \left(\frac{\frac{U_{c_{1t-1}}}{\rho V_{c_{2t}}} - 1}{\frac{W_{c_{1t-1}}}{\rho W_{c_{2t}} + Q_t} - 1} \right). \tag{44}$$

In the presence of estate taxes the government has some degree of flexibility to separate the external effects and minimize distortions on the consumer decisions. When the estate taxes are not available, the implied optimal capital-income tax must consider this effect. The effect is captured by the Q_{t+1} term in the first-order conditions of the government's problem and, as a result, the optimal fiscal policy differs from the previous case where estate taxes were available.

We can extend these results to the case of $n > 1$ as long as the government can condition taxes on individual skills. In this case, the government can implement the second-best allocations focusing on efficiency and ignoring any equity considerations. Nevertheless, when taxes cannot be conditioned on skills, the government faces a trade-off between efficiency and equity. This trade-off can imply tax rates that differ from the obtained in propositions 2 and 3.[18] We explore all these issues in the next section.

5. A Numerical Example

In general, it is difficult to characterize the properties of the optimal fiscal policy beyond the functional form because the optimal tax mix depends on the relative magnitude of the compensated

[17] Formally,

$$Q_{t+1} = \frac{V_{c_{2t+1}c_{2t+1}} - V_{c_{2t+1}b_{t+1}}}{V_{b_{t+1}b_{t+1}} - V_{c_{2t+1}b_{t+1}}} (\rho W_{b_{t+1}} - \beta \eta_{t+1} U_{c_{1t+1}}).$$

[18] This solution could be interpreted as a pooling equilibrium in which where individual skills and effort are not observable. In a separating equilibrium the government would offer a menu of contracts that satisfies the incentive compatibility constraint of each type. We do not explore this possibility in this paper because we want to avoid the effect of informational frictions and focus only on efficiency considerations.

elasticities. In the absence of a closed-form solution, we present a numerical simulation of the optimal tax policy under different tax constraints. The objective is to illustrate a case example and its implications, not to develop a quantitative analysis on normative estate taxation. We solve numerically a steady-state equilibrium of the government problem for a given choice of functional forms and parameters and compare the outcomes with the first-best allocations.[19] We also consider an extension that includes heterogeneous consumers.

We consider a standard constant returns to scale production function, $F(K_t, N_t) = K_t^{\alpha} N_t^{1-\alpha}$, and preferences of the form

$$\frac{[c_{1t}^{\omega_1}(1-l_t)^{1-\omega_1}]^{1-\sigma}}{1-\sigma} + \rho \frac{[c_{2t+1}^{\omega_2} b_{t+1}^{1-\omega_2}]^{1-\sigma}}{1-\sigma},$$

where when $\sigma = 1$ the utility function becomes logarithmic. The parameter values used in the simulation are summarized in Table 1.[20]

Table 1: Parameter values (yearly)

α	δ	β	ρ	σ	ω_1	ω_2	θ	G/Y
0.4	0.06	0.968	0.95	3.5	0.3	0.85	1	0.20

Table 2 displays the numerical solutions of the optimal tax rates for different sets of instruments.

Table 2: Optimal fiscal policy (n = 1)

	First-Best	Second-Best	Second-Best ($\tau_b \geq 0$)
Capital-income tax (%)	37.9	54.8	33.3
Estate tax (%)	−73.3	−50.0	0.0
Labor-income tax (%)	−46.4	28.1	28.4
Consumption equivalent variation (%)	-	1.17	1.20

The first column in Table 2 describes the optimum first-best policy where the government has access to lump-sum taxes. The second and third columns show the numerical solution when the

[19] We assume that the sequence of government expenditure converges in the long-run to a constant level G. In an infinitely lived consumer model, the initial level of debt affects the tightness of the implementability constraint and therefore the optimal fiscal policy. In this economy, the steadystate is independent of the initial conditions, because the level of debt at $t = 0$ only appears in the implementability constraint of the initial old, but not in the newborn generations. Hence, we can study the optimal fiscal policy regardless of the initial conditions.

[20] In the numerical simulations, the parameters δ, β, and ρ have been adjusted to consider that one period in the model consists of 30 years.

government has access only to distortionary linear taxes and when estate taxes are restricted to be non-negative, respectively. The last row measures the welfare cost of distortionary taxation using the equivalent variation in consumption.

A close inspection of Table 2 shows that the market equilibrium is suboptimal and that the model can be consistent with large labor-income and estate subsidies and capital-income taxes. The larger capital-income tax is consistent with preferences that violate Eq. (40) and is not related to dynamic inefficiencies because the economy satisfies the modified golden rule; see Eqs. (33) and (34).

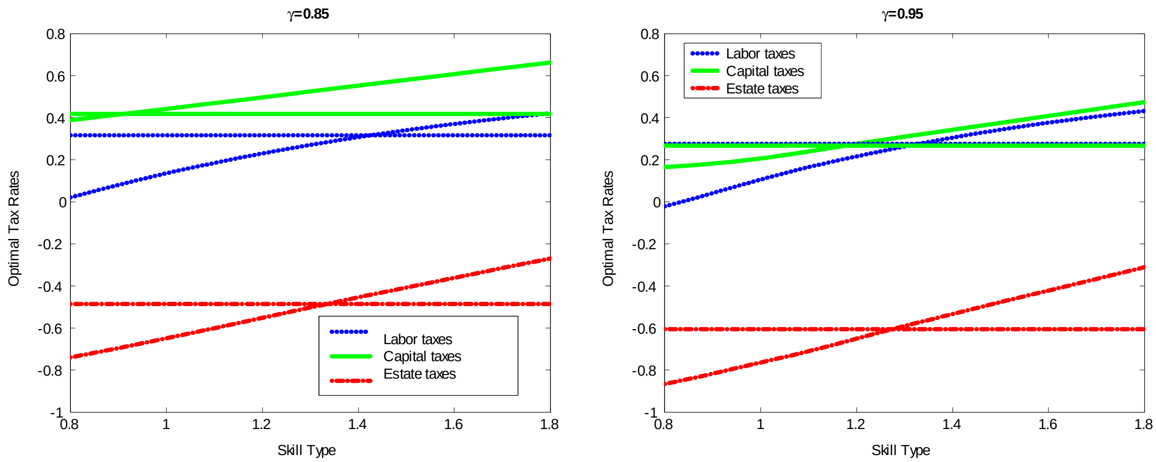
When lump-sum taxes are not available the government must balance the distortionary effects of taxation with the external effect associated with bequests. This trade-off is resolved with a higher positive capital-income tax and a lower estate subsidy. The absence of lump-sum taxation requires a change in the sign and the magnitude of the labor-income tax; in this case, the government policy is even more restricted. When the non-negativity constraint in estate taxation binds, the government resolves the trade-off between the external effects and efficiency with a lower capital-income tax and almost the same labor-income tax. Because estate transfers are not subsidized, there is no need for high capital-income taxation. This is the qualitative effect of the term Q_{t+1} in the Euler equation of the government problem in Eq. (42). The trade-off between efficiency and external effects implies a utility loss for the newborn cohort.

Finally, we want to illustrate the effects of introducing intragenerational heterogeneity.[21] Estate taxation is considered an important redistributive fiscal instrument given the documented significance of wealth transfers across generations and the skewness of the wealth distribution. We show that if the government can condition the tax rates on the individual types, then the qualitative results presented in the previous section remain unchanged. Nevertheless, the actual rates could substantially vary by skill type. Figure 1 shows the distributions of taxes across individual types (or productivity levels) when taxes can be conditioned on skills $\pi(\theta^i)$ or not π_{NS}. The subcript NS denotes that the tax policy does not depend on individual skills. Each graph is calculated using a different relative weight for bequests in the utility function. The optimal tax rates can vary substantially with a small change in parameter values, but the qualitative results discussed in the previous sections remain unchanged. As both graphs show, the implied tax policy across individual types is highly progressive and, as a result, households with a higher level of skills pay substantially

[21]We have approximated a continuous distribution of individual types $\theta^i \in [0.8, 1.8]$ using a discrete number of types and then interpolating on the decision rules.

higher taxes.

Figure 1: Optimal fiscal policy with heterogeneous types $\pi(\theta^i)$ and π_{NS}



When government cannot condition taxes on individual types, all households must pay the same tax rates regardless of skill type. In this case, the government faces a trade-off between efficiency (minimizing distortions) and equity (redistributing resources), and the optimization problem requires additional restrictions to ensure that the marginal rates of substitution across households are equated to the same after-tax prices. In this particular example, the trade-off implies deviations from the average tax rate for labor and capital-income taxes. However, estate taxes are roughly set to the average value. In essence, the qualitative features of the theoretical findings from the previous section remain unaltered, but the lack of progressivity reduces the government effectiveness to minimize distortions. Clearly, heterogeneity can imply important quantitative differences in terms of the optimal tax rates, but it does not affect the nature of the market inefficiencies associated with warm-glow altruism.

6. Conclusions

This paper analyzes the effect of warm-glow altruism on the optimal fiscal policy in an economy with heterogeneous consumers. We explicitly consider an implicit constraint in the act of giving: donors cannot bequeath to the donee(s) more than their existing available resources. We show that the socially efficient level of bequests might be different than that implemented by the market allocation. The external effect leads to an inefficient level of altruistic transfers that can be corrected with a estate and labor-income subsidies and a capital-income tax.

In analyzing the second-best tax policy, the government faces a trade-off between efficiency and external effects. Hence, the optimal tax policy equates these distortions at the margin. A quantitative example shows that the estate subsidy is lower and the capital-income tax is higher than in the first-best policy, whereas the labor-income tax changes the sign and becomes positive.

Finally, we show that the qualitative features of the model without heterogeneity can be extended to the heterogeneous case when the government can condition taxes by the individual type. However, the optimal policy can generate a large degree of tax progressivity across types. Nevertheless, when taxes cannot be conditioned by the individual type, the government faces a trade-off between efficiency (minimizing distortions) and equity (redistributing resources) since all households have to pay the same tax rates. The lack of progressivity reduces the government effectiveness to minimize distortions, but the qualitative results are the same. Clearly, heterogeneity can imply important quantitative differences in terms of the optimal tax rates, but it does not affect the nature of the market inefficiencies associated to warm-glow altruism.

References

Atkinson AB, Stiglitz B (1980) Lectures on public economics. McGraw-Hill, New York.

Blumkin T, Sadka E (2003) Estate taxation with intended and accidental bequests. J Public Econ 88:1-21.

Chari VV, Kehoe PJ (1999) Optimal fiscal and monetary policy. In: Taylor JB, Woodford M (eds) Handbook of macroeconomics, vol. Ic. North-Holland, Amsterdam, pp 1671-1743.

Cremer H, Pestieau P (2006) Wealth transfer taxation: a survey of the theoretical literature. In: Kolm S-C, Ythier JM (eds) Handbook on the economics of giving: altruism and reciprocity, vol. 2. North-Holland, Amsterdam, pp 1107-1134.

Davies JB, Shorrocks AF (2000) The distribution of wealth. In: Atkinson AB, Bourguignon F (eds.) Handbook of income distribution, vol 1. North-Holland, Amsterdam, pp. 605-676.

Dávila J, Hong JH, Krusell P, Ríos-Rull JV (2007) Constrained efficiency in the neoclassical growth model with uninsurable idiosyncratic shocks. Mimeo, University of Pennsylvania.

de Nardi C (2004) Wealth inequality and intergenerational links. Rev Econ Stud 71:743-768.

Erosa A, Gervais M (2002) Optimal taxation in life-cycle economies. J Econ Theory 105:338-369.

Escolano J (1992) Essays on fiscal policy, intergenerational transfers and distribution of wealth. PhD Dissertation, University of Minnesota.

Gale WG, Scholz JK (1994) Intergenerational transfers and the accumulation of wealth. J Econ Perspect 8:145-160.

Garriga C (2000) Optimal fiscal policy in overlapping generations models. Working Paper N. 0105, Centre de Recerca en Economia del Benestar (CREB).

Kotlikoff LJ, Summers LH (1981) The contribution of intergenerational transfers in aggregate capital accumulation. J Polit Econ 89:706-732.

Kotlikoff LJ, Summers LH (1986) The contribution of intergenerational transfers to total wealth. NBER Working Paper 1827.

Laitner J. (1997) Intergenerational and interhousehold economic links. In: Rosenzweig MR, Stark O (eds.) Handbook of population and family economics, vol. 1a. 5: 189-238. North-Holland, Amsterdam.

Lucas RE Jr, Stokey NL (1983) Optimal fiscal and monetary policy in an economy without capital. J Monetary Econ 12:55-93.

McGarry K, Schoeni RF (1995) Transfer behavior: measurement and the redistribution of resources within the family. J Human Resour 30:S184-S226.

Michel P, Pestieau P (1999) Fiscal policy when individuals differ regarding altruism and labor supply. J Public Econ Theory 1:187-203.

Michel P, Pestieau P (2004) Fiscal policy in an overlapping generations model with bequest-as-consumption. J Public Econ Theory 6:397-407.

Quadrini V, Ríos-Rull JV (1997) Understanding the U.S. distribution of wealth. Federal Reserve Bank of Minneapolis Quarterly Review 21:22-36.

Yaari ME (1965) Uncertain lifetime, life insurance, and the life of consumer. Rev Econ Stud 32:137-150.