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Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI)
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Lars Kunze[1]

Like Father, Like Son: Inheriting and Bequeathing

Abstract

Empirical evidence suggests that parents who have themselves inherited from their own parents are more likely to leave an estate to their children even after controlling for income, wealth and education. This implies an indirect reciprocal behavior between three generations by transmitting the attitude towards bequeathing from one generation to the next. We incorporate such an intergenerational chain into an overlapping generations model and show that the economy might be characterized by multiple steady states involving poverty traps. Individuals will not leave bequests unless per capita income levels exceed a threshold level. In such a situation, an unfunded social security security programme may help to overcome poverty by providing additional old age income out of which to bequeath.

JEL Classification: D64, D91, H55

Keywords: Capital accumulation; indirect reciprocity; overlapping generations; unfunded social security

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1 Introduction

There is a longstanding debate in the economic literature about the relative importance of bequests in capital accumulation. Empirical evidence suggests that at least 80% of US capital stock is accumulated through intergenerational transfers (Kotlikoff and Summers, 1981)[1], and that 50% of individuals save in order to leave an estate (Laitner and Justner, 1996). From a theoretical point of view, several bequest motives have been proposed to explain such altruistically motivated transfers[2], e.g. parents may care about their direct descendants' utility (Barro, 1974), their descendants' income level (Lambrecht et al., 2006) or about the bequest flow itself (Andreoni, 1989). In these models, altruism is typically exogenously given, thus neglecting its source and evolutionary development[3].

However, it is by now well accepted that preferences, norms and cultural attitudes are partly formed as the result of heritable genetic traits (see e.g. Heckman (2006)), and partly transmitted through generations by a learning and socialization process or the imitation of role models (see e.g. Bisin and Verdier (2006, 2011)). With regard to altruism and bequeathing behavior, empirical evidence suggests that inheritances and intended bequests are indeed positively and significantly related even after controlling for a number of household characteristics, most importantly household net worth (Cox and Stark, 2005; Arrondel and Grange, 2007). This point is illustrated in Figure 1, which presents nonparametric regression results of the binary variable for bequest intention on household net worth. Clearly, there is a stronger intent to bequeath among inheritors than among non-inheritors[4].

[Insert Figure 1 here]

Having received an inheritance from one's parents may therefore not only increase the probability of leaving a bequest by enhancing the disposable net wealth but also by shaping the attitude towards the pleasure of giving and towards leaving a bequest to one's own children. The relationship between received inheritance and one's own bequest has likewise been studied by Arrondel et al. (1997) and Arrondel and Grange (2006) who find that the existence of transfers received from one's parents increases the probability to make the same kind of transfer to one's children.[5] Consequently, transmission patterns and the

[1]Note, however, that recent estimates are somewhat more moderate, see e.g. DeLong (2005, Fig.2-1) who estimates the share of bequest in total wealth to be 43%.

[2]For a comprehensive survey of different altruistic bequest motives see Michel et al. (2006).

[3]A notable exception is the study by Rapoport and Vidal (2007) which examines the relationship between endogenous intergenerational altruism and long run growth.

[4]Obviously, this conclusion does not hold for individuals in the lowest quartile. However, for this subgroup, there are only few observations of individuals having actually inherited and differences in the bequeathing-intention are not statistically significant.

[5]Furthermore, Arrondel and Masson (2006) and Wilhelm et al. (2008) show that generosity, which is closely linked to any form of altruistically motivated behavior, is positively correlated within families across generations. For example, Arrondel and Masson (2006) demonstrate that individuals who have received a donation are twice as likely to give one themselves, and that the probability of helping one's children financially is 50% higher for individuals who

attitudes towards them seem to be strongly correlated across generations and tend to be reproduced from one generation to the next.

Such a behavior is difficult to explain with standard models of family transfers which typically consider only two generations (parents and children). Rather, the intergenerational transmission of attitudes towards leaving bequest represents an example of indirect reciprocity, where an individual does not directly reciprocate to the behavior of another person, but instead reciprocates indirectly to a third party.[6] This kind of interaction has been found to be particularly important within family relations (Kohli and Künemund, 2003). In the context of bequeathing behavior this means that the cultural transmission of attitudes, values and norms across generations creates a pattern of behavior in which parents support their own children in a way similar to the way their parents treated them. People do not directly reciprocate for the inheritance they have received from their own parents, but rather repay it by leaving an estate to their own children. Hence, the more inheritance parents have received themselves, the more they are willing to bequeath to their children. In this way leaving a bequest does affect the immediate recipient, i.e. the next generation, as well as future generations.

The previous argument is further supported by empirical findings related to wealth inequality and its persistence, see e.g. Bowles and Gintis (2002). Economic outcomes in terms of personal wealth accumulation are not only very similar across generations but also tend to be highly persistent over time. Recent estimates of intergenerational elasticities of wealth are in the order of 0.22, 0.37 or 0.32 to 0.43 for co-existing generations, i.e. before any transmission of wealth has taken place, see Arrondel (2011), Charles and Hurst (2003) and Mulligan (1997), respectively.[7] However, while standard explanatory factors such as educational attainment, income or personal wealth may account for a large fraction of variation, still, 'almost 35 percent of the intergenerational wealth elasticity remains unexplained after income, propensity to own assets, education, gifts, and expected bequests are controlled for' (Charles and Hurst, 2003, p.1157). Similarly, Arrondel (2011) finds that those standard explanatory factors account for only 73% of total variation in intergenerational wealth elasticities. Therefore, taking into account the transmission of attitudes and traits towards bequeathing behavior may help to grasp a better understanding of individual behavior and also contributes to explaining persistence of wealth inequality across generations.

Despite this overall persuasive empirical evidence, there are almost no theoretical models capturing the idea of preference and attitude transmission within families. A notable exception is the recent study by Kirchsteiger and Sebald

were gift beneficiaries themselves.

[6]See Arrondel and Masson (2006) for a survey of the literature. They note that indirect reciprocities provide a 'dynamic synthesis of altruism and exchange allowing [...] to introduce intermediate motivations for transfers which better fit the data'.

[7]Early studies however provide even larger intergenerational elasticities of wealth, see e.g., Harbury and Hitchins (1979) and Menchik (1979) who find estimates of 0.50 for the UK and 0.70 for the US, respectively.

(2010) who incorporate indirect reciprocities with regard to educational investments into an overlapping generations model and examine their impact on human capital formation, well-being and education policies. By contrast, the aim of this paper is to explore theoretically the role of intergenerational transmission of attitudes towards leaving bequest. To do so, we incorporate the idea that having received an inheritance from one's parents positively shapes the attitude towards leaving a bequest to one's own children into an otherwise standard overlapping generations model where parents are concerned about the flow of bequest itself, as in Andreoni (1989).

Using this framework, we show that the transmission of attitudes may give rise to the existence of multiple steady states involving poverty traps. Bequeathing behavior depends both on income and on the experience of inheriting wealth: If per capita income levels are low, individuals are primarily focussed on satisfying their own consumption needs and bequests are absent. This in turn shapes the attitude of the descendants in a similar way, thereby reproducing the low per capita income level in the next generation as savings and, in particular, wealth accumulation are completely neglected. By contrast, if per capita income levels are sufficiently high, individuals save to leave a bequest in order to 'repay' their children for having inherited from their own parents. Hence, the economy is characterized by high levels of capital accumulation and per capita income. In such a situation, the provision of public pension benefits may help to overcome a poverty trap as it provides additional old age income out of which to bequeath. However, it is also shown that a pay-as-you-go pension programme is at best neutral to capital accumulation and growth in the long run. Specifically, public pensions are diametral to capital accumulation if bequests are inoperative[8] whereas there is an additional positive effect stemming from the transmission of attitudes towards bequeathing behavior if bequests are operative: A higher pension level increases the amount of bequest individuals receive from their parents, which in turn positively affects the children's attitude towards leaving a bequest to their own children thereby increasing individuals' savings and capital accumulation. As a result, the Ricardian equivalence[9] holds in the present model, despite the fact that the bequest motive itself does not take into account the descendants economic situation.

Finally, we consider a heterogenous population and show by means of simulation that an unequal distribution of initial inheritance endowments may lead to a permanent split of society for otherwise identical individuals. Our model may therefore endogenously explain why some households save in order to leave a bequests while other do not (Laitner and Justner, 1996) and also why income inequality is highly persistent across generations (Bowles and Gintis, 2002).

In a broader sense, our research is related to an emerging field of economics that seeks to understand where preferences come from. In fact, the issue of

[8]In this case the provision of public pensions negatively affects the youngs' motivation to save, since part of their old age consumption is financed by next period's pensions. Consequently, capital accumulation and economic growth declines, as has, for example, been argued by Feldstein (1974).

[9]See for example the seminal paper by Barro (1974) for a further discussion of this issue.

preference formation has recently received much attention in the context of time-preference, consumption expenditure, labor hours or risk and trust attitudes Becker and Mulligan (1997); Waldkirch et al. (2004); Toledo (2006); Dohmen et al. (2008). For example, Dohmen et al. (2008) provide evidence suggesting that parents who are more willing to take risks, or more willing to trust others, have children who are similarly risk tolerant and trusting. Consequently, attitudes and traits with regard to different economic key factors are determined to a substantial degree by an individual's parents. The current paper contributes to this strand of literature by exploring theoretically the role of indirect reciprocities with regard to bequeathing behavior.[10]

The remainder of this paper is organized as follows. Section 2 presents the basic model. Section 3 characterizes the dynamics of the economy, studies the existence of steady states and examines the impact of an unfunded social security programme on bequeathing behavior and capital accumulation. Section 4 introduces heterogeneity into the model and shows that initial endowments of bequests may lead to a permanent split of society in the long run. Section 5 concludes.

2 The model

The basic framework is an overlapping-generation model in the tradition of Diamond (1965), in which parents have an altruistic concern for their children. Specifically, we assume that individuals are joy-of-giving altruists and derive utility from the amount of bequest itself (Andreoni, 1989). However, in contrast to most of the existing literature, we further assume that the altruistic concern is positively related to the amount of inheritance parents have received from their own parents. Such a specification allows one to study the role of intergenerational transmission of attitudes towards leaving bequests. Moreover, markets are competitive, and the size of population is assumed to be constant.

2.1 Firms

On the production side of the model, perfect competition between a large number of identical firms is assumed. A representative firm in period t produces a homogenous output good according to a (normalized) Cobb–Douglas production function with capital K_t and homogeneous labour L_t as inputs:

$$Y_t = K_t^{\alpha} L_t^{1-\alpha}, \tag{1}$$

where $1 > \alpha > 0$ is the share parameter of capital.

Each firm maximizes profits under perfect competition, implying that, in equilibrium, production factors are paid their marginal products:

$$w_t = (1-\alpha) K_t^{\alpha} L_t^{-\alpha} = (1-\alpha) k_t^{\alpha} \tag{2}$$

[10] It should be clear, however, that our results are positive, not normative, since we only examine the long run effects of attitude formation with respect to bequeathing behavior and the impact of public pensions and do not assess their welfare effects.

and

$$r_t = \alpha K_t^{\alpha-1} L_t^{1-\alpha} = \alpha k_t^{\alpha-1} \tag{3}$$

where $k_t = K_t/L_t$ is the capital intensity.

2.2 Consumers

At each period in time, there exist a number of young (N_t) and a number of old individuals (N_{t-1}). When young, each individual inelastically supplies one unit of labour and receives the wage w_t. She also receives a nonnegative bequest, b_t. Income is spent on consumption c_t and savings s_t:

$$(1-\tau)w_t + b_t = c_t + s_t. \tag{4}$$

where τ is the contribution rate to the pay-as-you-go pension programme. When old, each individual allocates the return to savings $(r_{t+1}s_t)$[11] plus the pension benefit (θ_{t+1}) to second-period consumption (d_{t+1}) and to a nonnegative bequest to the offspring (b_{t+1}). The second period's budget constraint is thus

$$d_{t+1} = r_{t+1}s_t + \theta_{t+1} - b_{t+1}, \tag{5}$$

Individual preferences are of the Cobb-Douglas type and depend on first- and second-period consumption and on the amount of bequest devoted to the children. Consequently, the life-cycle utility function of an individual born in t is

$$U(c_t, d_{t+1}, b_{t+1}) = \ln c_t + \beta \ln d_{t+1} + \lambda(b_t) \ln b_{t+1} \tag{6}$$

where $\beta > 0$ is a discount factor, and λ the degree of altruism which measures individual's attitude towards leaving bequest. In order to formalize the transmission of attitudes and traits with regard to leaving bequests, we build on the empirical findings described in the introduction that parents willingness to leave bequest to their children strongly depends on their own experience with regard to having received inheritance. If parents have received bequest from their parents, they attach more importance to and feel more responsible for passing on bequest to their own children. We capture this relation by an attitude function which describes how the inheritance a parent has received from his own parents relates to the importance he attaches to his own bequeathing behavior:

$$\lambda : [0, \infty) \rightarrow \mathbb{R}_+^0, \tag{7}$$

with $\lambda(b_t)$ denoting the attitude of a parent having received a bequest b_t from his own parent. We assume that $\lambda(b_t)$ is continuous and differentiable with

$$\lambda(0) = 0 \tag{8}$$

and

$$\frac{\partial \lambda(b_t)}{\partial b_t} > 0. \tag{9}$$

[11] For reasons of simplicity, we assume that capital depreciates completely in one period.

If a parent has not received any inheritance himself, he is not willing to leave a bequest to his child. Furthermore, the attitude function is monotonically increasing in the amount of inheritance a parent has received himself.

Each individual maximizes the utility (6), subject to the constraints (4), (5) and to the nonnegativity of bequests ($b_{t+1} \geq 0$), by choosing c_t, s_t, d_{t+1}, and b_{t+1}. The first-order conditions of this maximization problem are

$$\frac{\partial U_t}{\partial s_t} = -\frac{1}{c_t} + \frac{\beta r_{t+1}}{d_{t+1}} = 0 \tag{10}$$

$$\frac{\partial U_t}{\partial b_{t+1}} = -\frac{\beta}{d_{t+1}} + \frac{\lambda(b_t)}{b_{t+1}} = 0 \tag{11}$$

The first equation is the standard condition over the life cycle, determining optimal savings. The second one gives the optimal amount of bequests.

3 Dynamics and steady states

We are now able to define the intertemporal equilibrium of the economy. Given a fiscal policy (the contribution rate τ) and initial values of the capital stock $k_0 = K_0/N_{-1} = s_{-1}$ and the amount of bequest b_0, a perfect-foresight intertemporal equilibrium is characterized by a sequence of quantities and prices:

$$\{c_t,\ d_t,\ k_t,\ s_t,\ b_t;\ w_t,\ r_t\}_{t\geq 0}.$$

Individuals maximize utility and the government's budget is balanced in each period t, i.e.

$$\theta_{t+1} = \tau w_{t+1}. \tag{12}$$

Factor markets are competitive, and all markets clear. Moreover, population size will be normalized to one throughout this subsection.

The dynamics of the model are fully characterized by the first order conditions (10) and (11). Insert the household's budget constraints ((4) and (5)), factor prices ((2) and (3)) and the capital market clearing condition ($k_{t+1} = s_t$) into the first order conditions and rearrange terms, to obtain

$$k_{t+1} = \frac{\alpha\beta}{(1+\beta)\alpha + \tau(1-\alpha)} \left[(1-\tau)(1-\alpha)k_t^{\alpha} + b_t + \frac{b_{t+1}}{\alpha\beta k_{t+1}^{\alpha-1}} \right] \tag{13}$$

$$b_{t+1} = \frac{\lambda(b_t)}{\beta + \lambda(b_t)} \left[\alpha + \tau(1-\alpha)\right] k_{t+1}^{\alpha} \tag{14}$$

It is well known that for a fixed and strictly positive altruistic degree, i.e. for an exogenously given $\bar{\lambda} > 0$, there exists a unique interior steady state which is globally stable:

$$\bar{k} = \left(\frac{\alpha(\beta(1-\alpha)(1-\tau) + \bar{\lambda})}{\alpha(1+\beta+\bar{\lambda}) + \tau(1-\alpha)} \right)^{\frac{1}{1-\alpha}} \tag{15}$$

As will be shown below, however, this result stands in sharp contrast with those of an economy with an endogenous bequeathing attitude, i.e. of an economy where parents' degree of altruism depends on the inheritance they have received from their own parents.

In order to illustrate the different possible outcomes, we assume a simple linear attitude function in the following, namely

$$\lambda(b_t) = \frac{1}{\delta} b_t \tag{16}$$

where δ measures the strength of the transmission of attitudes from parents to children with respect to their bequeathing behavior. Given this simple attitude function, we derive the following conditions for possible interior steady states (ignore the period indices in equations (13) and (14) and rearrange terms):

$$k_* = \frac{\alpha\beta}{(1+\beta)\alpha + \tau(1-\alpha)} \left[(1-\tau)(1-\alpha)k_*^\alpha + \left(1 + \frac{k_*^{1-\alpha}}{\alpha\beta}\right) b_* \right] \tag{17}$$

$$b_* = [\alpha + \tau(1-\alpha)]\, k_*^\alpha - \delta\beta \tag{18}$$

Further analysis of equation (18) reveals:

Proposition 1 *Bequests will be operative in the long run if and only if the capital-labour ratio is sufficiently large, i.e.*

$$k_* > \left(\frac{\beta\delta}{\alpha + \tau(1-\alpha)} \right)^{\frac{1}{\alpha}} \equiv \hat{k} \tag{19}$$

The occurrence of altruistically motivated bequests turns out to be sensitive to conditions related to the state of economic development: Bequests will be positive in the long run only if per capita income exceeds a certain threshold level[12]. This threshold can be interpreted as some minimal level of income beyond which individuals have satisfied their own consumption needs and start devoting resources to their descendants.

The nature of this result is similar to the one found by Rapoport and Vidal (2007) where the accumulation of altruism occurs only if parents' disposable income is sufficiently large. However, in their model individuals may choose to acquire and accumulate altruism whereas our model concerns the transmission of attitudes towards bequeathing. Furthermore, the above result contrasts sharply with that of an economy with an exogenous altruistic degree $\bar{\lambda}$. In such a framework, bequests will always be operative in the long run as long as parents' degree of altruism is positive $\bar{\lambda} > 0$.

Importantly, the threshold level is endogenously determined and can be traced back to economic fundamentals: It is positively related to individual's

[12] Note that population size is normalized to one. Therefore, per capita income equals the capital labor ratio in the present model.

patience ($\partial\hat{k}/\partial\beta > 0$) and negatively to the strength of the transmission process ($\partial\hat{k}/\partial\delta > 0$). Moreover, a higher pension level reduces the threshold level ($\partial\hat{k}/\partial\tau < 0$) as it provides individuals with additional retirement income out of which to bequeath.

In a next step, we study the existence of steady states and their stability properties. If per capita income levels are sufficiently low, i.e. $k_* < \hat{k}$, bequests are inoperative in the long run and it is easy to see from equation (17) that there exists at least one steady state:

$$k_* = \left(\frac{\alpha\beta(1-\tau)(1-\alpha)}{(1+\beta)\alpha + \tau(1-\alpha)} \right)^{\frac{1}{1-\alpha}}. \tag{20}$$

Such a steady state is characterized by a situation where bequests are absent so that the transmission of wealth across generations is completely neglected: Economic conditions prevent grandparents from leaving a bequest to their children, which in turn shapes the attitude of the grandchildren in a similar way. As a result, there is a stickiness of poverty across generations which partly results from the absolute poverty of the parents in terms of low per capita income levels, and partly from the parents' own inheritance experience. However, whether the economy in fact converges to this steady state crucially depends on the existence of other steady states and its stability properties as well as the economy's initial endowments of capital and bequest.

The following proposition establishes that the economy may indeed be characterized by multiple steady states:

Proposition 2 *There exists a critical strength of the transmission process, i.e.*

$$\hat{\delta} \equiv \frac{\alpha + \tau(1-\alpha)}{\beta} \left(\frac{\beta\alpha(1-\tau)(1-\alpha)}{(1+\beta)\alpha + \tau(1-\alpha)} \right)^{\frac{\alpha}{1-\alpha}} \tag{21}$$

such that the following holds.
If $\delta < \hat{\delta}$, then there exists a unique interior steady state with operative bequests. By contrast, if $\delta > \hat{\delta}$, then there either exists a unique steady state with inoperative bequests (a poverty trap) or there are three steady states, one featuring inoperative bequests whereas in the remaining two bequests are positive.
Proof: *See the Appendix.*

Simulation results suggest that if there exists a unique steady state (with either operative or inoperative bequests), this steady state is globally stable. By contrast, if there are two interior steady states, one of them and the steady state with inoperative bequests are locally stable. For example, assume that $\alpha = 0.4$, $\beta = 0.5$ and $\tau = 0.2$. Figure 2 shows simulation results for varying initial levels of per capita income and bequest with $\delta = 0.33$. For these parameter choices the critical value of the strength of the transmission process equals $\hat{\delta} \approx 0.27$, so that $\delta > \hat{\delta}$ and the system converges globally towards the steady state $k_* = 0.0348$ with inoperative bequests, $b_* = 0$.

[Insert Figure 2 here]

By contrast, assuming $\delta = 0.275$, the model exhibits two interior steady states. In Figure 3 we report simulation results for different initial conditions. Clearly, depending on the initial level of per capita income and the endowment of bequest, the system either converges towards the steady state $k_* = 0.0593$ with operative bequests, $b_* = 0.0305$, or to the steady state $k_* = 0.0348$ with inoperative bequests, $b_* = 0$.

[Insert Figure 3 here]

Finally, for a sufficiently strong transmission process, i.e. $\delta = 0.25 < \hat{\delta}$, the system converges to the globally stable interior steady state $k_* = 0.1368$ and $b_* = 0.1097$ as can be inferred from Figure 4.

[Insert Figure 4 here]

As a result, the multiplicity of steady states may be used to explain why societies that differ with regard to their initial level of per capita income and/or their initial endowment of bequests end up at different steady states where bequests are either operative and the level of capital accumulation is therefore relatively large or bequests are inoperative and individuals are primarily focussed on satisfying their own consumption needs which in turn implies low levels of savings and capital accumulation. In the latter situation, successive generations are trapped in poverty.

According to proposition 1, a pay-as-you-go pension programme may help to overcome poverty traps as it reduces the threshold level of per capita income above which bequests will be operative in the long run by providing individuals with additional old age income out of which to bequeath. However, a public pension programme also tends to reduce capital accumulation. In fact, there are two opposing effects: On the one hand, a public pension programme reduces private savings and capital accumulation as it negatively affects the youngs' motivation to save. On the other hand, a higher pension level increases the amount of bequest individuals receive from their parents, provided per capita income levels are sufficiently large. This in turn positively affects the children's attitude towards leaving a bequest to their own children which increases individual savings and which is therefore beneficial for capital accumulation

The following proposition establishes that a public pension programme is either neutral with respect to capital accumulation or reduces the accumulation depending on whether bequests are operative or inoperative in the long run:

Proposition 3 *Suppose that bequests are operative in the long run before and after the policy change. Then, an increase in the public pension programme has no impact on capital accumulation.*
By contrast, if bequests are inoperative before and after the policy change, an

increase in the public pension programme unambiguously reduces capital accumulation.

Proof: *If bequests are inoperative, the steady state capital stock is given by equation (20). Straightforward calculations show that* $\partial k_*/\partial \tau < 0$*. To study the case of operative bequests, insert (18) into (17) and rearrange terms to obtain*

$$\frac{\alpha\beta(k_* - k_*^{\alpha})}{(1+\beta)+\tau(1-\alpha)} + \frac{\alpha\beta^2\delta}{(1+\beta)\alpha+\tau(1-\alpha)} + \frac{\beta\delta k_*^{1-\alpha}}{(1+\beta)\alpha+\tau(1-\alpha)} = 0 \quad (22)$$

which is equivalent to $k_* - k_*^{\alpha} + \beta\delta + \delta k_*^{1-\alpha}/\alpha = 0$*. Consequently, the steady state capital stock with operative bequests is independent of the social security tax rate.*

Proposition 3 demonstrates that, in the present model, Ricardian equivalence may hold even if parents are concerned about the flow of bequest itself and not about the well-being of their descendants. These findings contrast sharply with those derived from the standard joy-of-giving model by Andreoni (1989) suggesting that public transfers have real effects. Hence, taking into account the connection between received inheritance and own bequest may lead to interesting new policy conclusions with regard to the impact of fiscal policy on capital accumulation and long run growth.

So far, however, our results refer to an economy with a homogenous population where each member of the first generation is endowed with the same amount of physical capital and bequest. Consequently, descendants' individual choices are identical and the possible multiplicity of stable steady states refers to the economy as a whole. Yet, one might wonder, whether differences in initial endowments for otherwise identical members of the first generation lead to different economic outcomes for the descendants in the long run or whether such differences will be washed out. To answer this question, the following section introduces heterogeneity into the model.

4 Heterogenous Individuals

In this section we assume that individuals differ with regard to their initial endowment of inheritance they have received from their parents. More specifically, we consider two types of individuals, A and B, with initial endowment of bequest b_t^A and b_t^B. Except for these different endowments, individuals are assumed to be identical[13]. Let s denote the share of type A in the population. Then, the production function is given by

$$Y_t = \left(sK_t^A + (1-s)K_t^B\right)^{\alpha} L_t^{1-\alpha} \quad (23)$$

[13]Note that one may easily introduce additional sources of heterogeneity as for example different strengths of the transmission process, i.e. $\delta_A \neq \delta_B$, or wage differentials due to skill differentials. We conjecture however that this would only strengthen our results.

and perfect competition implies that each individual receives the same wage and interest rate:

$$w_t = (1-\alpha)(sk_t^A + (1-s)k_t^B)^\alpha \tag{24}$$

$$r_t = \alpha(sk_t^A + (1-s)k_t^B)^{\alpha-1} \tag{25}$$

where $k_t^A = K_t^A/L_t$ and $k_t^B = K_t^B/L_t$.

The dynamics of the model with a heterogenous population are fully characterized by the households' first order conditions for each of the two types. Specifically, insert the attitude function (16), the household's budget constraints ((4) and (5)) and factor prices ((24) and (25)) into (10) and (11), make use of $k_{t+1}^I = s_t^I$, $I = A, B$, and rearrange terms, to obtain

$$k_{t+1}^A = \frac{\beta}{1+\beta}\left[(1-\alpha)(sk_t^A + (1-s)k_t^B)^\alpha + \frac{b_{t+1}^A}{\beta\alpha(sk_{t+1}^A + (1-s)k_{t+1}^B)^{\alpha-1}}\right] - \frac{\tau(1-\alpha)}{(1+\beta)\alpha}(sk_{t+1}^A + (1-s)k_{t+1}^B) \tag{26}$$

$$b_{t+1}^A = \frac{b_t^A}{\delta\beta + b_t^A}\left[\alpha(sk_{t+1}^A + (1-s)k_{t+1}^B)^{\alpha-1}k_{t+1}^A + \tau(1-\alpha)(sk_{t+1}^A + (1-s)k_{t+1}^B)^\alpha\right] \tag{27}$$

$$k_{t+1}^B = \frac{\beta}{1+\beta}\left[(1-\alpha)(sk_t^A + (1-s)k_t^B)^\alpha + \frac{b_{t+1}^B}{\beta\alpha(sk_{t+1}^A + (1-s)k_{t+1}^B)^{\alpha-1}}\right] - \frac{\tau(1-\alpha)}{(1+\beta)\alpha}(sk_{t+1}^A + (1-s)k_{t+1}^B) \tag{28}$$

$$b_{t+1}^B = \frac{b_t^B}{\delta\beta + b_t^B}\left[\alpha(sk_{t+1}^A + (1-s)k_{t+1}^B)^{\alpha-1}k_{t+1}^B + \tau(1-\alpha)(sk_{t+1}^A + (1-s)k_{t+1}^B)^\alpha\right] \tag{29}$$

For identical initial endowments of bequest, i.e. $b_t^A = b_t^B$, it is easy to see that the dynamics are equivalent to those of a homogenous population model. Therefore, any steady state in the latter model also constitutes a steady state of the heterogenous population model. However, there are additional steady states where the population is permanently split into two subgroups: One group in which individuals leave bequests and experience high levels of per capita income and a second group in which individuals are trapped in poverty and where per capita income levels are low. Assume for example the following parametrization of the model: $\alpha = 0.4$, $\beta = 0.5$, $\tau = 0.2$ and $\delta = 0.275$. For these parameters, the model with a homogenous population exhibits the steady states $k_* = 0.0593$, $b_* = 0.0305$ and $k_* = 0.0348$, $b_* = 0$, as has been shown above. Figure 5 presents simulation results for varying initial endowments of bequests for both types and an initial capital stock of $k_t^A = k_t^B = 0.05$.

Insert Figure 5 here.

Clearly, whenever the initial amount of bequests of type A is sufficiently large and exceeds the corresponding amount of type B, the economy converges towards the unegalitarian steady state $k_*^A = 0.2236$, $b_*^A = 0.2147$ and $k_*^B = 0.0448$, $b_*^B = 0$. This steady state is symmetric with respect to the individual's type[14].

Hence, depending on the initial conditions and on the parameter values of the model, a society may be permanently split into two subgroups, despite the fact that all agents face the same interest and wage rate. Poverty gets 'inherited' from generation to generation, preventing convergence of the two population groups.

5 Conclusions

Standard models of bequests and family transfers typically consider only two generations (parents and children). They are thus not able to take into account the specific influence of past inheritance received from parents on bequest to children that has been found in the data (Cox and Stark, 2005; Arrondel and Grange, 2007). Therefore, the aim of the present paper was to set up a theoretical model of indirect reciprocities between three generations, which may replicate the same type of transfer from one generation to the next.

Specifically, we have incorporated the idea that having inherited from one's own parents positively affects the attitude towards leaving a bequest to the own children into an overlapping generations model. It is then shown that this mechanism of indirect reciprocity gives rise to the existence of poverty traps as bequeathing behavior depends both on income and on the experience of inheriting wealth. In such a situation, poverty may be overcome with the help of publicly provided pension benefits which increase old age income and therefore the amount of bequest old individuals devote to their children. However, an unfunded pension programme turns out to be at best neutral to capital accumulation if bequests are operative whereas it unambiguously reduces capital accumulation when bequests are inoperative. In the first case, Ricardian equivalence holds in the present model despite the fact that the bequest motive is independent of the descendants' well-being. Allowing for heterogeneity, simulations suggest that an unequal distribution of initial inheritances may lead to a permanent split of society for otherwise identical individuals. Our model therefore contributes to explaining the persistence of income inequality across generations and differences in individual savings behavior in order to leave a bequest, see Bowles and Gintis (2002) and Laitner and Justner (1996), respectively.

Finally, the present analysis could be extended by introducing human capital accumulation which would allow one to study the effects of endogenous attitude formation towards bequeathing *and* educating children (see Kirchsteiger and Sebald (2010) for a separate analysis of the latter issue). This however would further increase analytical tractability.

[14]Note also that these findings can be shown to be robust against small changes in the parameter values.

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Appendix

In a first step, we study the properties of the functions

$$F(k) = k - \frac{\alpha\beta(1-\tau)(1-\alpha)}{(1+\beta)\alpha + \tau(1-\alpha)} k^{\alpha} \tag{30}$$

and

$$G(k) = \frac{\alpha\beta}{(1+\beta)\alpha + \tau(1-\alpha)} \left[k - k^{\alpha} + \beta\delta + \frac{\delta}{\alpha} k^{1-\alpha} \right] \tag{31}$$

which result from setting $b_* = 0$ in equation (17) and from inserting equation (18) into (17), respectively. The domain of both functions is restricted to the interval $[0, \infty($. It is then straight forward to show that F has a local minimum at $\tilde{k} = \left(\frac{\alpha^2\beta(1-\tau)(1-\alpha)}{(1+\beta)\alpha+\tau(1-\alpha)} \right)^{\frac{1}{1-\alpha}}$. Moreover, we have $F(0) = 0$, $F(k_*) = 0$ with $k_* = \left(\frac{\alpha\beta(1-\tau)(1-\alpha)}{(1+\beta)\alpha+\tau(1-\alpha)} \right)^{\frac{1}{1-\alpha}}$ and $\lim_{k\to\infty} F(k) = \infty$.
Now consider the function G. Possible roots of G are implicitly given by the solutions of the following equation

$$LHS(k) \equiv k^{\alpha} - k = \delta \left(\beta + k^{1-\alpha}/\alpha \right) \equiv RHS(k) \tag{32}$$

with $LHS(0) = 0$, $\lim_{k\to\infty} LHS(k) = -\infty$, $RHS(0) > 0$ and $\lim_{k\to\infty} RHS(k) = \infty$. Furthermore, LHS has a local maximum at $\tilde{\tilde{k}} = \alpha^{\frac{1}{1-\alpha}}$ whereas RHS is strictly concave, i.e. $RHS''(k) = -\delta(1-\alpha)k^{-(1-\alpha)} < 0$. Consequently, depending on the parameters of the model, G has either no roots or two. Moreover, it is straight forward to show that $G(0) > 0$ and $\lim_{k\to\infty} G(k) = \infty$.
In a second step, we consider the piecewise function

$$H(k) = \begin{cases} F(k), & k < \hat{k} \\ G(k), & k > \hat{k} \end{cases} \tag{33}$$

on the domain $[0, \infty($ with $\hat{k}$ being defined in proposition 1. $H(k)$ accounts for the fact that bequests can not be negative and its roots correspond to the steady states of our model. Straight forward calculations show that $F(\hat{k}) = G(\hat{k})$. Given the properties of the functions F and G, it follows that there exists a unique steady state with operative bequests whenever $F(\hat{k}) < 0$. By contrast, there may be either one steady state with inoperative bequests or three steady states if $F(\hat{k}) > 0$. The latter inequality can be rewritten as follows:

$$F(\hat{k}) \gtrless 0 \quad \Leftrightarrow \quad \left(\frac{\beta\delta}{\alpha + \tau(1-\alpha)} \right)^{\frac{1}{\alpha}} - \frac{\alpha\beta(1-\tau)(1-\alpha)}{(1+\beta)\alpha + \tau(1-\alpha)} \frac{\beta\delta}{\alpha + \tau(1-\alpha)} \gtrless 0 \tag{34}$$

$$\Leftrightarrow \quad \delta \gtrless \frac{\alpha + \tau(1-\alpha)}{\beta} \left(\frac{\beta\alpha(1-\tau)(1-\alpha)}{(1+\beta)\alpha + \tau(1-\alpha)} \right)^{\frac{\alpha}{1-\alpha}} \equiv \hat{\delta} \tag{35}$$

By example we show that both cases, one steady state or three steady states, are indeed feasible. Consider the following parameterizations: $\alpha = 0.4$, $\beta = 0.5$,

$\tau = 0.2$ and $\delta = 0.33$, $\delta = 0.275$ or $\delta = 0.25$, respectively. In the first case ($\delta = 0.33$), $H(k)$ has a unique root at $k^* = 0.0348$ whereas for $\delta = 0.275$ $H(k)$ exhibits three roots at $k^* = 0.0348$, $k^* = 0.0465$ and $k^* = 0.0593$. Finally, for $\delta = 0.25$ there is exactly one root at $k^* = 0.1368$. These results are illustrated in Figure 4.

[Insert Figure 6 here]

Figures

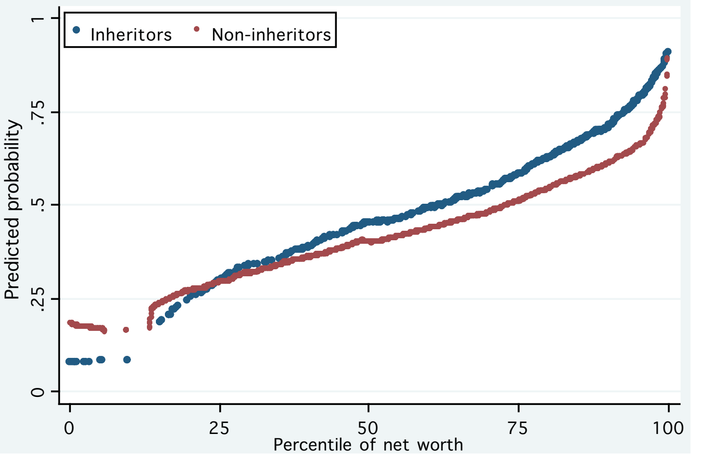

Figure 1: Intentions to bequeath and net worth: inheritors versus non-inheritors
Source: Cox and Stark (2005)

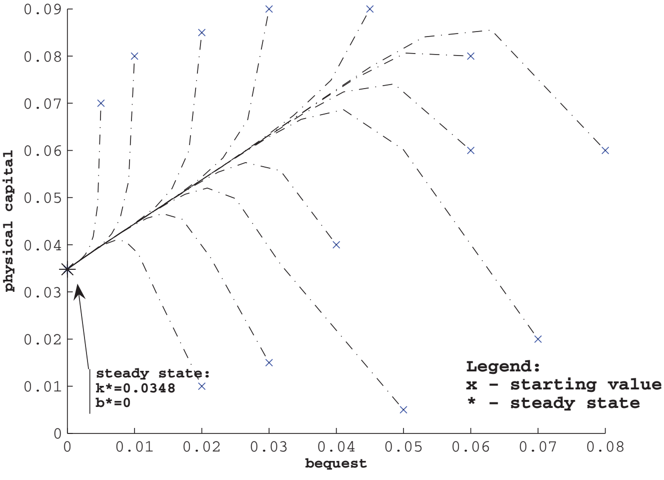

Figure 2: Endogenous bequeathing attitude with $\delta > \hat{\delta}$ and no interior steady state

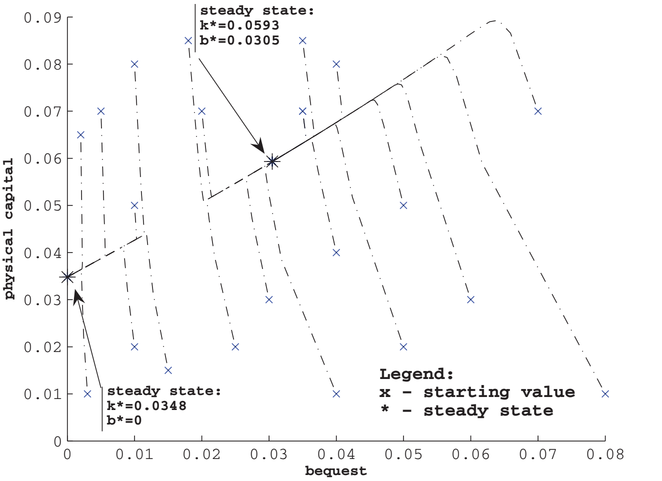

Figure 3: Endogenous bequeathing attitude with $\delta > \hat{\delta}$ and two interior steady states

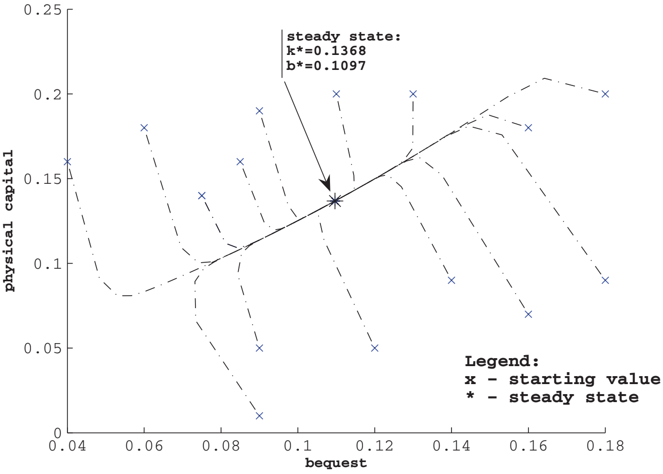

Figure 4: Endogenous bequeathing attitude with $\delta < \hat{\delta}$

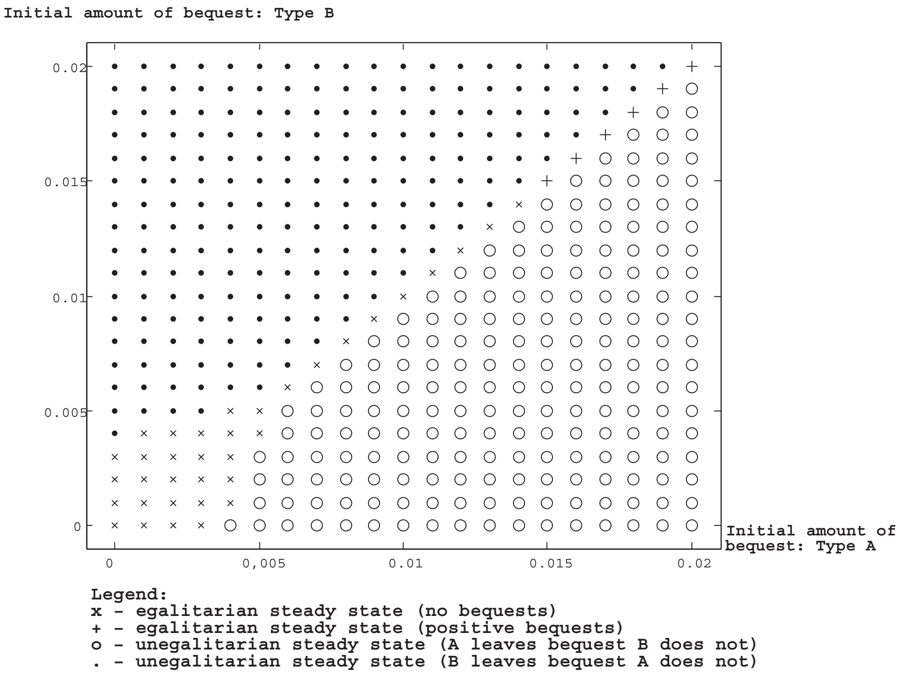

Figure 5: Heterogeneous initial levels of bequests: $s = 0.5$, $\alpha = 0.4$, $\beta = 0.5$, $\tau = 0.2$ and $\delta = 0.275$

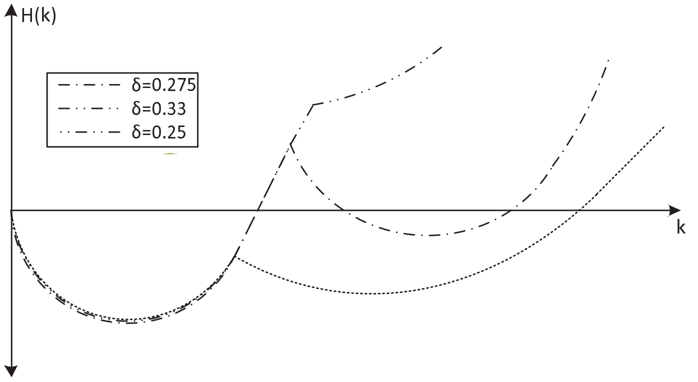

Figure 6: Endogenous bequeathing attitude with $\alpha = 0.4$, $\beta = 0.5$, $\tau = 0.2$ and $\delta = 0.33$, $\delta = 0.275$, $\delta = 0.25$