Capital Taxation with Parental Incentives*

Yuta Saito Yosuke Takeda

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Abstract

This paper develops a theory of nonlinear capital income taxation in an economy where parents have paternalistic intergenerational transfer motives. Parents with a higher discount factor than their adult-children have an incentive to leave intergenerational transfers which enhance the kids' savings. There is a democratic government which respects the utilities of all individuals; hence the paternalistic motives indirectly affect the determination of public policies. We show that the marginal capital income tax is positive for the children with a paternalistic parent.

Keywords: Capital Taxation; Intergenerational Transfers; Exchange Model; Time-Preference; Paternalism

JEL Classification: D13; D91; H21; H24

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1 Introduction

Economists attempted to describe the intergenerational relations which influence the individual's preferences and economic activities. In one's infancy, children form their preferences and non-cognitive skills under the influences of their parents (Bhatt and Ogaki, 2012; Bisin and Verdier, 2001; Doepke and Zilibotti, 2017; Fernández et al., 2004). Even after the offsprings have grown up, parents usually leave altruistic, precautionary, strategic, or paternalistic motivated intergenerational money transfers, which affect the economic choices of the offsprings (Becker, 1974; Becker and Tomes, 1979; Becker, 1981; Bernheim et al., 1985; Chami, 1998; Cox, 1987; Cremere and Pestieau, 1996; Tomes, 1981). As a result, the aggregate economic variables, for instance, growth, savings, and inequality are affected by parents' influences on their children.

From a social planning standpoint, on the other hand, any policy has to take into account of it effect on the intergenerational connections since a policy has a power to influence both of the parents' and kids' behaviors. Without taking into consideration its effect on intergenerational relations, the impact of the policy might be misunderstood. This paper studies our theory focusing on the capital income taxation problem in an economy in which parents leave intergenerational monetary transfers to affect the children's economic choices. The origin of the intergenerational dis-agreement is the differences in the discount factors. Parents consider that their children are so impatient that they design the transfers to incentive their kids' saving motives. By observing the intergenerational linkages, the government designs a set of policies which maximizes the welfare from the government's perspectives under several constraints.

We work with a general model in which the parents' utilities contain both of altruistic and paternalistic elements à la Doepke and Zilibotti (2017). The altruistic component represents the parent's utility from the children's well-beings as in the Beckarian altruistic transfer theories (Becker, 1974, 1981; Becker and Tomes, 1979; Tomes, 1981). In a special case of a purely altruistic parent's decision, she simply wants to maximize the kid's utility and thus she has no incentive to distort her kid's saving. The paternalistic element captures the parent's enjoyment of the child's actions through the lens of the parent's preference. As in the exchange models, the paternalistic motive makes the parents to incentive the kids' consumption of *merit goods*, which is saving in our setting, and children to change their economic choices to obtain more transfer from the parents.

Knowing the intra-household policy making by parents, the government objects to maximize the some of the utilities of all people. Hence the government's time-preference is endogenously formed and is a function of the time-preferences of both of the parents and children. As a consequence, the government's discount factor is alway in the middle between those of parents and kids. The observation implies that government, children, and parents have different tastes, and so there is a room for both intra-household strategies and public policy interventions.

We found that the government designs positive marginal capital income taxes and the paternalistic parents set positive marginal transfer rules. The result is intuitive. The intergenerational disagreement on time-preference makes the parents and government have motives to increase the kid's savings. Thus, parents set positive marginal transfer rules which incentives the children's savings as in the exchange theories (Bernheim et al., 1985; Chami, 1998; Cox, 1987; Cremere and Pestieau, 1996). Especially, it will be a function of preference heterogeneity between parents and kids, and it is analytically delivered in the simple setting. The finding is consistent with empirical evidence, while it is different to the consequence from the Beckarian altruistic transfer models(Becker, 1974, 1981; Becker and Tomes, 1979; Tomes, 1981) which predicts the preference heterogeneity does not affect the intergenerational transfers. We explicitly show that the result is caused by the paternalistic motive of parents.

The positive marginal capital income tax also has a huge implication. By taking account of the parents' incentives, the government, in turn, considers the parents' disciplines are too much so the saving motives ought to be decreased. The government's motivation reflects the conclusion that the time-preference for government is always middle between those of parents and kids. As a result, the marginal taxes will be positive which disincentive the saving motivations. The findings will be a new explanation of positive capital taxes which numerous theories attempt to describe it.(Mankiw et al., 2009) We also show that the marginal tax is positive even in the first-best allocation with perfect information implying that the uniform commodity taxation theorem of Atkinson and Stiglitz (1976) does not hold due to the paternalistic motives.

It is also shown that both of the marginal capital income taxes and the marginal parental transfers will be zero for the households which hold the following extreme features: (i) parents and kid have the same time-preference; (ii) parents are purely altruistic, and (iii) parents have neither altruism nor paternalism. In those households, any intergenerational conflict does not occur so that the parents and government do not distort the children's decisions. The finding suggests that capital income tax depends on the not only the preferences of the payers, but also their parents if they are paternalistic.

The same result occurs if the parents have a zero intra-household bargaining power in which children could choose their efficient inter vivos rules.

On the contrary, we also show that the marginal saving taxes would be negative for the individuals whose parents are credit-rationed. Since such children have not received any transfer, their savings are not influenced by their parents. By deliberating it, the government sets the negative marginal income taxes to increase the savings for them. The finding suggests that the capital income taxes should be designed to contingent on whether the individual received inter vivos transfers or not. If an individual received strategic transfers, the marginal capital income tax should be positive, while it will be negative if he does not receive it. Further, we explicitly show that the taxes on inter vivos transfers do not substitute for such state-contingency of capital income taxation. Intuitively, parents leave the inter vivos transfer to achieve the efficient set of parent's and kids' consumptions in the current period. Hence, the tax on the family transfer reflect the characteristics of parent's altruism, not the preferences on savings.

Related Literature. Our paper related to the four branch of pieces of literature. First, it complements a recent literature on the dynamic nonlinear capital income taxation.[1] Golosov et al. (2013) studies the model with heterogeneity in time-preferences and concludes that optimal capital income tax so little that we could ignore. Diamond and Spinnewijna (2011) study more clear framework of preference heterogeneity and finds that saving taxation improve the welfare. Tenhunen and Tuomala (2010) numerically study the dynamic income taxation with heterogeneous time-preferences and concludes the efficiency of positive saving taxation. Interestingly, they compare the two types of government: welfarist and paternalistic government. The welfarist government has a utilitarian objective which simply sums the utilities of all individuals. Then the government prefers to respect each's own preference and does not willing to distort one's economic choices. The paternalistic government has an own efficient discount factor which affects the resultant tax policies. For example, if the government believe that people should save more, it will set the lower taxes on saving to induce the saving and vice versa. Comparing to Tenhunen and Tuomala's model, the government of our model endogenously forms its paternalistic discount factor, and we'll see the consequence of it to the resultant taxes and parental transfers.

The discussion of the paternalism of government is also related to our theory. Most

[1]The literature of dynamic nonlinear income taxation extends Mirrlees (1971) model of income taxation to a dynamic setting. See e.g. Golosov et al. (2006); Kocherlakota (2010) for more details.

famously, Ramsey (1928) argues that discounting the future well-being is "ethically indefensible." From a behavioral viewpoint, Thaler and Sunstein (2003) discuss that the paternalistic policies may ensure the freedom of choice of the behavioral individuals who cannot choose their best option. Kotlikoff and Razin (1988) suggest that there may be fewer needs for the government if the parent's implicit tax, which disciplines the child's behavior, is socially desirable. If not, however, there may be more needs for the government to remove an insufficient parent's discipline to the children, as our model illustrates. Comparing to the above discussions, our theory positively investigates the endogenous formation of government's paternalism and its consequence on capital income taxes.

We also make contact with the literature on parental transfers and other types of intergenerational connections. It is well known that the gifts before death are unequally divided among children than inheritances (Bernheim and Severinov, 2003; Dunn and Phillips, 1997). Theoretically, the Beckarian altruistic transfer models(Becker, 1974, 1981; Becker and Tomes, 1979; Tomes, 1981) predict that parental transfers are negatively correlated with the kid's income level, while the exchange transfer models(Bernheim et al., 1985; Chami, 1998; Cox, 1987; Cremere and Pestieau, 1996) expect that the transfers may be positively correlated with the recipient's earnings to incentives the children's consumption of merit goods. Doepke and Zilibotti (2017) develops a theory of endogenous parenting style. In their model, parents and children have preference disagreements, and relatives endogenously choose whether educate the children or directly restrict their choices. Pavoni and Yazici (2017) study optimal Ramsey taxation in a life-cycle model where individuals face self-control problems due to the quasi-hyperbolic discounting. They show that whenever offspring are impatient on parents' viewpoint, optimal policy involves a positive tax on parental transfers. Bhatt and Ogaki (2012) develop an altruistic transfer model in which the children's lifetime discount factors are influenced by the amount of childhood consumption. Parents have a constant higher discount factor, so an exogenous change in a kid's discount factor leads the parents to incentive the child's saving by changing the transfer strategy. Like our theory, they predict that parental transfer will be decreased when the child's discount factor falls.

Finally, our theory is also relevant to the discussion on positive capital taxation. The well-known result of the Ramsey linear capital taxation problem is tax rate should be zero in the long-run (Chamley, 1986; Judd, 1985) while more realistic setting makes the optimal tax to be positive. (e.g. in a life-cycle setting Conesa et al., 2009 or with uninsured idiosyncratic income risk Aiyagari, 1995) From the Mirrleesian approach, which allows the nonlinear income taxation, Golosov et al. (2003) show that an optimal capital income taxes are ex-post different from zero but equal to zero in expectation, while numerous papers extend the model and derive several non-zero or progressive marginal taxes (e.g. by adding education finance Benabou, 2002 or politico-economic constraint Farhi and Werning, 2012).

The structure of this paper is as follows. Section 2 we set up our two-period economy. Section 3 describes the main results of the paper. Section 4 extends our model by several ways. Finally, Section 5 summarizes and concludes the paper.

2 The Economy

The economy is populated by continuum and measure one generations: "parents (p)" and "kids (k)." Parents have an discount factor $\beta^p \in [0,1]$, each of them has exactly one kid, and live in period $t = 1,$. Kids are heterogeneous in time preference $\beta^k \in [0,1]$ and live in $t = 1, 2$.

At the beginning of $t = 1$, each kid is endowed an identical amount of wealth $I^k \in \mathbb{R}_{++}$. Let X be her economic choice set $X := \{c_1^k, c_2^k\}$ where $c_t^k \in \mathbb{R}_{++}$ denotes the kid's consumption at period t. Then, the utility for a kid whose time preference is β^k, $U^k(\beta^k)$, is given by:

$$U^k(\beta^k) = u(c_1^k) + \beta^k u(c_2^k). \tag{1}$$

We suppose that u is twice differentiable, concave and satisfies the Inada conditions: $\lim_{c\to 0} u'(c) = \infty$ and $\lim_{c\to\infty} u'(c) = 0$.

Parents are identically endowed wealth holdings $I^k \in \mathbb{R}_{++}$ and decide the amount of own consumption $c_1^p \in \mathbb{R}_{++}$ and money transfers to kids $b \in \mathbb{R}_+$, and deliver utilities from their consumptions and their children' s utilities. We specify the utility for a parent, whose kid has β^k, $U^p(\beta^k)$, is given by:

$$U^P(\beta^k) = \alpha W(\beta^k) + u(c_1^P), \tag{2}$$

where $\alpha \in \mathbb{R}_+$ captures the degree of altruism. Here $W(\beta^k)$ captures the parent's utility derived from the kid's decisions:

$$W(\beta^k) = \gamma U^k(\beta^p) + (1-\gamma)U^k(\beta^k). \tag{3}$$

Intuitively, Eq.(3) contains both of paternalistic and altruistic elements. The first term captures the parent's paternalistic component, which evaluates the kid's experiences from the parent's perspective β^p. The second term values the kid's utility by respecting the child's own time-preference β^k. The parameter $\gamma \in [0,1]$ captures the degree of the paternalism of the parents. In the extreme case with $\gamma = 0$, for instance, the parents are purely altruistic and don't have any incentive to distort their kids' choices as in the Beckarian altruistic models (Becker, 1974, 1981; Becker and Tomes, 1979; Tomes, 1981). Instead, we suppose that $\gamma > 0$, implying parents have motives to change the economic actions of kids as similar to exchange transfer theories (Bernheim et al., 1985; Chami, 1998; Cox, 1987; Cremere and Pestieau, 1996). Hence γ captures the tendency for parents to have the exchange motives to the Beckarian altruistic motives.
In our setting, $U^p(\beta^k)$ is rewritten as:

$$U^p(\beta^k) = \alpha\left[u(c_1^k) + \beta^{p,k}u(c_2^k)\right] + u(c_1^p) \tag{4}$$

where

$$\beta^{p,k} = \gamma\beta^p + (1-\gamma)\beta^k. \tag{5}$$

Here $\beta^{p,k}$ captures the parent's discount factor given β^k. In our setting, the degree of paternalism γ captures how much parents put emphasis on their own time-preference.

Assumption 1. *It holds that $\beta^k \subseteq [0, \beta^p]$ for all households.*

For simplicity, we focus on the case where parents are more patient than children. In this case, it holds that $\frac{d\hat{\beta}^p(\beta^k)}{d\gamma} \geq 0$ implying that more paternalism a parent has, the more discount factor she face.

There is a democratic government, indexed by g, which respects each individual with a same degree.[2] The government's objective for the household given a kid with

[2]We interpret it as the government's objective is formed as a result of the probabilistic voting game (Lindbeck and Weibull, 1987) in which all individual have same relative weight. For the application of the probabilistic voting game for capital taxation problem, see for instance Farhi and Werning (2012).

β^k, $U^g(\beta^k)$, is given by:

$$U^g(\beta^k) = \frac{1}{2}U^p(\beta^k) + \frac{1}{2}U^k(\beta^k) \tag{6}$$

which can be written as:

$$U^g(\beta^k) = (1+\alpha)\left[u(c_1^k) + \beta^{g,k}u(c_2^k)\right] + u(c_1^p) \tag{7}$$

where

$$\beta^{g,k} = \frac{\alpha\beta^{p,k} + \beta^k}{1+\alpha}. \tag{8}$$

Hence $\beta^{g,k}$ captures the discount factor for a household with β^k from the government's perspective. Notice that a rise in altruism increases $\beta^{g,k}$, $\frac{d\beta^{g,k}}{d\alpha} \geq 0$, by increasing the offsprings' weights on the social welfare objective.

Proposition 1. *Then, the discount factors for kids, parents, and government satisfy:*

$$\beta^k \leq \beta^{g,k} \leq \beta^{p,k} \leq \beta^p \; \forall \beta^k \in [0, \beta^p]$$

and the equalities hold if and only if $\beta^k = \beta^p$.

The result implies that the government has innate tendency to want the savings of the child, and the parents have it more than the government.

Definition 1. *For each player* $i \in \{k, p, g\}$, *for any* $\beta^k \in [0, \beta^p]$ *and for any kid's economic decision* $\{c_1^k(\beta^k), c_2^k(\beta^k)\}$, *we define the capital wedge ,* $\tau^i(\beta^k)$ *as:*

$$\tau^i(\beta^k) = 1 - \frac{\frac{\partial U^i(\beta^k)}{\partial c_1^k}}{\frac{\partial U^i(\beta^k)}{\partial c_2^k}}.$$

Here the capital wedge captures the intertemporal distortion from the player i's perspective. Since an efficient intra-household allocation for a household with β^k does not distort the intertemporal consumption choice, we have the following result:

Proposition 2. *Foe each player $i \in \{k, p, g\}$, we say the an allocation for a kid with β^k is efficient from the player i's perspective if:*

$$\tau^i(\beta^k) = 0.$$

Conversely, $\tau^i(\beta^k) \neq 0$ means that the saving decision of β^k is not efficient from i's perspective. Note that a positive (negative) capital wedge implies that the saving is too small (large) for i, and the absolute value of $\tau^i(\beta^k)$ captures the magnitude of the distortion i faces. In our setting with $\beta^k \leq \beta^p$, the capital wedges are ordered as follows.

Proposition 3. *For any kid's economic decisions $\{c_1^k(\beta^k), c_2^k(\beta^k)\}$, the capital wedges satisfy*

$$\tau^k(\beta^k) \leq \tau^g(\beta^k) \leq \tau^p(\beta^k) \ \forall \beta^k \in [\underline{\beta}, \beta^p].$$

and the equalities hold if and only if $\beta^k = \beta^p$.

The the capital wedge for the government is always on the middle between those of parents and kids. The finding is guaranteed by the government's objective which respects the preferences of every individual.[3] Note that *laissez-faire* is efficient from both parent's and government's perspectives if and only if $\beta^k = \beta^g$.

Figure 1 graphically displays the intuition of Proposition 3 when the government achieves the efficient intra-household allocations for all households, i.e. $\tau^g(\beta^k) = 0$ for all β^k. The distortions that kids and parents face are both decreasing in the preference heterogeneities. Only in the household without conflicts, in which $\beta^k = \beta^p$ holds, all of the kid, parent, and government think the realized intra-household allocation is efficient. In other words, it is impossible to achieve the government's efficient intra-household allocation for a household with $\beta^k \neq \beta^p$ without distorting the saving decisions from the perspectives of the parent and kid.

The finding establishes an implication for the capital income taxation and intergenerational transfers. In our economy, departing from the Atkinson-Stiglitz and Becker's prescriptions, both of the tax and transfer should not be zero and depend on the pref-

[3]The result is robust even if a political weight for each generation is different while such a weight changes the proportion of the absolute values of the capital wedges.

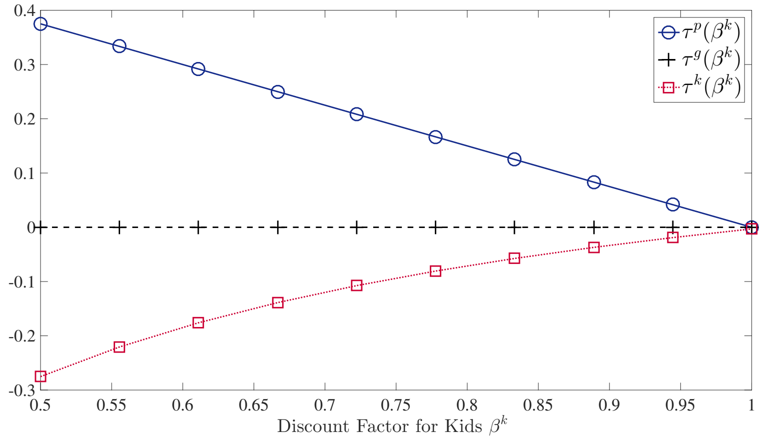


Figure 1: Capital Wedges at the First-Best Allocation ($\beta^k \in [0.5, 1]$, $\beta^p = 1$, $u(c) = \ln c$)

erence heterogeneity of the household. The result is assured by the paternalism which incentives parents to leave transfers to distort the savings of their children. In the next section, we study the properties of taxes and transfers in detail.

3 Capital Income Taxation

This section presents the main results on nonlinear capital income taxes and associated with the inter vivos transfers. Our goal is to find the tax structure that implements the results of the social planning problem. After characterizing the socially efficient allocation, we illustrate the way to implement it by designing the nonlinear capital income taxes.

3.1 Socially Efficient Allocations

We consider the economies with and without information problems. In a economy with symmetric information, the government can use lump-sum taxes since individuals' preferences are publicly observable. In the setting, the socially efficient allocation is delivered by solving the problem as follows.

Problem 1.

$$\max_{\left\{c_1^p(\beta^k), c_1^k(\beta^k), c_2^k(\beta^k), s(\beta^k)\right\}} \int_{\beta^k} U^g(\beta^k) dF(\beta^k) \tag{9}$$

subject to the resource constraints in $t = 1, 2$:

$$\int c_1^p(\beta^k)dF(\beta^k) + \int c_1^k(\beta^k)dF(\beta^k) + \int s(\beta^k)dF(\beta^k) \leq I^k + I^p, \tag{10}$$

$$\int c_2^k(\beta^k)dF(\beta^k) \leq R \int s(\beta^k)dF(\beta^k). \tag{11}$$

where s is saving and $R > 0$ is its gross rate of return. We call that resultant allocation of this problem as the *first-best*. The first order necessary conditions of the problem imply that

$$\frac{u'(c_1^k(\beta^k))}{Ru'(c_2^k(\beta^k))} = \beta^g(\beta^k), \tag{12}$$

$$\frac{u'(c_1^p(\beta^k))}{Ru'(c_1^k(\beta^k))} = 1 + \alpha. \tag{13}$$

Eq.12 reveals the first-best combination of $\{c_1^k(\beta^k), (c_2^k(\beta^k)\}$ while Eq.(13) shows that of $\{c_1^k(\beta^k), (c_1^p(\beta^k)\}$ for each household. As a corollary of the uniform-tax result by Atkinson and Stiglitz (1976), Eq.(12) yields the following proposition:

Proposition 4. *Let $\{c_1^k(\beta^k), c_2^k(\beta^k)\}$ be a first-best allocation. Then it holds that:*

$$\tau^g(\beta^k) = 0 \; \forall \beta^k.$$

Notice that in the first-best allocation, the parents and children with $\beta^k \neq \beta^p$ face non-zero capital wedges as we have seen in Figure 1. While Problem 1 simply delivers the intuition of the model, it may be more realistic to suppose that parents know their children's preferences more than the government. In the next setting, we suppose that the government cannot observe every kid's time-preference while his/her parent can. We also suppose that the distribution of β^k, F, is publicly known. In the setting, the government faces the following problem with incentive compatibility constraints:

Problem 2.

$$\max_{\left\{c_1^p(\beta^k), c_1^k(\beta^k), c_2^k(\beta^k), s(\beta^k)\right\}} \int_{\beta^k} U^g(\beta^k)dF(\beta^k) \tag{14}$$

subject to the resource constraints in $t = 1, 2$:

$$\int c_1^p(\beta^k)dF(\beta^k) + \int c_1^k(\beta^k)dF(\beta^k) + \int s(\beta^k)dF(\beta^k) \leq I^k + I^p, \tag{15}$$

$$\int c_2^k(\beta^k)dF(\beta^k) \leq R\int s(\beta^k)dF(\beta^k). \tag{16}$$

the standard incentive compatibility constraints for kids:

$$u(c_1^k(\beta^k)) + \beta^k u(c_2^k(\beta^k)) \geq u(c_1^k(\beta^{k'})) + \beta^k u(c_2^k(\beta^{k'}))\ for\, all\, \beta^k, \beta^{k'}. \tag{17}$$

The incentive compatibility constraints state that any kid with β^k prefers the consumption bundle which is allocated by the government, $\left\{c_1^k(\beta^k), c_2^k(\beta^k)\right\}$, to any other bundles. We call the resultant allocation of Problem 2 as *second-best*. Since it is not analytically solvable, we provide results of the numerical example of Problem 2. The details of numerical computation is discussed in Appendix A: Numerical Simulation.

4 Implementation by Taxes and Transfers

4.1 Inter Vivos Transfers

We now solve the set of capital income taxes and parental transfers which implement the efficient allocation for the government by backward induction. Note that we allow that the parental transfer b and capital income tax T can be contingent on β^k. Given $T(Rs)$, $b(RS)$, and tax on transfer $T(b)$, the kid β^k maximizes her utility: $U^k(\beta^k)$ subject to her budget constraints

$$c_1^k + c_2^k + s \leq I^k + b(Rs) - T(b), \tag{18}$$

$$c_2^k \leq Rs - T(Rs). \tag{19}$$

The resulting first order conditions can be arranged to the following Euler equation:

$$\frac{u'(c_1^k)}{u'(c_2^k)} = \beta^k \left(\frac{1 - T_s^{'}}{1 - (1 - T_b^{'})b'}\right), \tag{20}$$

where $b^{'} := \frac{db}{ds}$ denotes the marginal transfer rule and $T_x^{'} := \frac{dT_x}{dx}$ denotes the marginal tax on $x \in \{s, b\}$. Eq.(20) implies that the kid's consumption path is affected by $T_s^{'}$, $T_b^{'}$ and $b^{'}$.

Grasping the above decision rules, each parent designs b which implements her efficient intra-household allocation. Given tax policies, an efficient intra-household allocation for a parent with a kid β^k maximizes her utility: $U^p(\beta^k)$ subject to her budget constraint

$$c_1^p + b \leq I^p, \tag{21}$$

and her kid's one:

$$c_1^k + s \leq I^k + b(Rs) - T_b, \tag{22}$$

$$c_2^k \leq Rs - T_s. \tag{23}$$

By rewriting the first order conditions with respect to c_1^k, c_2^k, and k_2 of parent's problem, we obtain that:

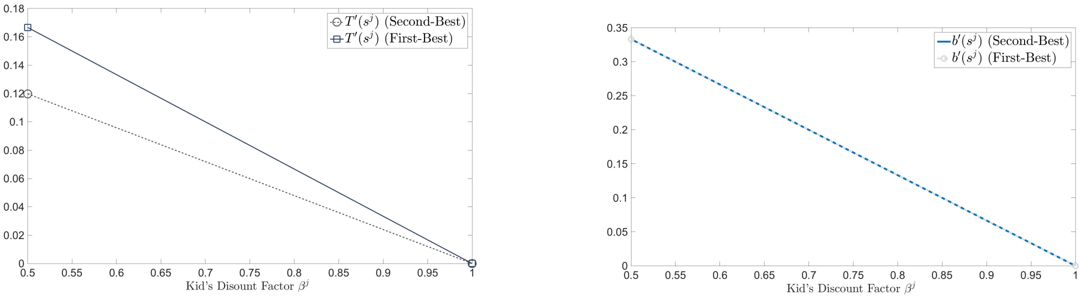
$$\frac{u'(c_1^k)}{u'(c_2^k)} = \beta^{p,k}(1 - T_s^{'}) \tag{24}$$

Giving Eq.(20), Parents set $b^{'}$ such that the parents' efficient set of $\{c_1^k, c_2^k\}$ are realized. we obtain that b' in Problem 1 by equating the RHSs of Eqs.(20) and (24):

$$b^{'} = \frac{1}{1 - T_b^{'}} \left(\frac{\beta^{p,k} - \beta^k}{\beta^{p,k}} \right). \tag{25}$$

Here b' takes positive value if $T_b^{'} < 1$. The result is intuitive. First, it is increasing in $T_b^{'}$ which decreases the impact of b' on the children's saving decisions as seen from Eq. (20). Second, b' is a function of the preference heterogeneity between the parent and her kid, and a more heterogeneity increases the value of $b^{'}$. Intuitively, parents set b' to remove the differences of time-preferences and a positive $b^{'}$ implies it is used to enhance the savings. This is a huge departure from the traditional altruistic transfer models which predict that the intergenerational transfers are independent on the children's time-preferences while empirical evidence do not support (Bhatt, 2011; Hao et al., 2008; Weinberg, 2001).[4] Finally, with the first-best transfer rule Eq. (25), all children have automatically choose the consumption paths which their parents prefer. Thus, unlike the traditional taxation theories without parents' effects, the government need to deal with the parents' preference heterogeneities, not the children's. However, this finding is not a general implication to policy-making. For instance, if a parent is credit-rationing, or purely altruistic, the result will be different.

[4]We can obtain the same result by assuming $\gamma = 0$ implying that parents do not have the paternalistic motive.



(a) Marginal Capital Tax

(b) Marginal Parental Transfer

Figure 2: Marginal Taxes and Marginal Parental Transfer

4.2 Capital Income Taxes

We now describe the tax systems on capital income which implement the socially efficient allocations. Knowing the decision rule for parents and kids, the government sets an appropriate values of $T_s^{'}$, which equalizes the government's efficient intra-household allocations and those of the parents. In Problem 1, such $T_s^{'}$ equates the RHSs of Eqs.(12) and (24):

$$T_s^{'} = \frac{\beta^{p,k} - \beta^{g,k}}{\beta^{p,k}}. \tag{26}$$

The result includes several economic implications. Firstly, the first-best optimal marginal capital tax rate depends $\beta^{p,k}$ and $\beta^{g,k}$ implying it is set to remove the differences in preferences between the government and each parent. The kid's preference does not directly appear in the formula, while it contributes to the formation of $\beta^{p,k}$ and $\beta^{g,k}$. Secondly, unlike the role of b', it disincentives savings for kids. Intuitively, the government knows that parents enhance their kids' savings too much from the government's viewpoint; thus the taxes are set to remove too large savings due to paternalistic transfers. Trivially, the tax rate will be zero if $\beta^k = \beta^p$ since the government has no incentive to distort their savings. Finally, it does not fully remove the paternalistic effect of the transfers: the kids' savings are distorted even after-taxed. Recall the government has a higher discount factor than kids (Proposition 1), which implies that the democratic government is also partly paternalistic. As a consequence, the paternalistic motives of parents indirectly affect the saving decisions of offsprings, by endogenously forming the government's preference which settles the tax structure in equilibrium.

Figure 2 describes the marginal capital income taxes and marginal inter vivos transfers that implement the efficient allocations. The marginal taxes are positive and decreasing in since the parents have less discipline incentive for the kids with a higher value of β^k. The marginal inter vivos transfers are also positive which incentive the savings. Similar to the marginal taxes, the households with fewer conflicts face the smaller values of the marginal transfers.[5] The implication of the second-best results are discussed in Appendix.

Discussion. Our finding provides implications for the debate on the policy coordination. The results in Section 3.2 shows that capital income tax should depend on the preferences. Thus a policy coordination among the countries, or among states, may cause a massive distortion since people tend to have different tastes. Specifically, if some exogenous pressure slightly raises the marginal capital income tax, the resulting kids' savings will be too less from the parents' points of view. However, the kids will be better off since they can consume more in the previous period. On the other hand, an exogenously decreased capital income tax raises the parents' welfare by reducing kids' savings. Hence, the tax coordination has an effect of intergenerational redistribution of welfare gains, and it always decreases the welfare gain of the government.

The relation between our result and optimal taxation is also worth mentioning. Throughout the paper, we interpret the government's objective is formed as a consequence of political game; hence we are doing a positive analysis. Instead, it may be also possible to consider that we are investigating an optimal taxes of the economy. In that case, it is important to capture the source of heterogeneity and the types of social welfare. For instance, if the source of heterogeneity is the children's present-bias, then some may argue that the welfare should not include the kids' behavioral preferences. In that case, the optimal capital income tax is zero since parents perfectly correct the kids' present biases as Thaler and Sunstein (2003) discussed. On the other hand, if the government is a libertarian who respects the children's own preferences, the policy is set to reduce the interference to the kids by parents. In that case, the optimal tax will be negative to disincentive the too much saving motives. Kotlikoff and Razin (1988) suggest that there may be fewer (more) needs for the government if the inventive by parents are welfare improving (decreasing). Our theory, contrasting to the above normative discussions, shows that democratic government set positive capital income

[5]Notice that the value of b' may be greater than T_k' with some higher T_b', but it is positive with a realistic value of T_b'. Figure 2 (??) displays the cases where implements the efficient allocations of Problem 1 and 2 (illustrated in Figure 3). Sub-Section 4-2 discusses T_b' in details.

taxes since the parental transfers go too far from the government's perspectives. The parental transfers may improve the welfare comparing to the less fair economy, but it depends on the values of parameters.

4.3 Tax on Inter Vivos Transfers

We now consider the determination of the taxes on inter vivos that have not been explicitly considered yet. The resulting first order conditions for the parents' intra-household planning problem with respect to c_1^p, c_1^k, and b imply that:

$$\frac{u'(c_1^p)}{u'(c_1^k)} = \alpha(1 - T_b^{'}), \tag{27}$$

Intuitively, Eq.(27) reveals the efficient combination of $\{c_1^k, c_1^p\}$ from the parent's perspective. Knowing the parent's decision, the government set $T_b^{'}$ which achieve its efficient allocation. Notice that that the determination of $T_b^{'}$ concerns for $\{c_1^k, c_1^p\}$, not for $\{c_1^k, c_2^k\}$. Hence, in connection to the credit-rationed parents, $T_b^{'}$ cannot be used to adjust the different marginal income taxes that children face (Eq.(30)). In Problem 1, we could deliver such $T_b^{'}$ by equating the RHSs of Eqs.(13) and (27):

$$T_b^{'} = -\frac{1}{\alpha} \tag{28}$$

Here the negative $T_b^{'}$ enhances the transfers by parents and captures the government's motive to increase it. The basis of the mechanism is as follows. Since the government summarizes the utilities of both kids and parents, the welfare objective always put an extra weight, which is 1, on the children's welfares. Due to the extra weight, the government always considers the children's consumptions are too small comparing to those of parents. Thus the negative marginal taxes which increase the amount of inter vivos transfer are set. This is a common feature of the gift taxation problem with positive externalities from giving (Kaplow, 1995, 1998) and it is important to explicit about the consequence of it (Kopczuk, 2012).

As we have seen, the determination of $T_s^{'}$ is not relevant to the discussion. The marginal transfer b' depends on $T_b^{'}$, but it positivity holds unless $T_b^{'} < 1$ which might be considered to be natural to assume. Thus, our main result does not depend on the externality from giving for parents. Tax on Inter Vivos Transfers shows the marginal inter vivos transfer taxes, which is uniform in the first-best allocation while it is in-

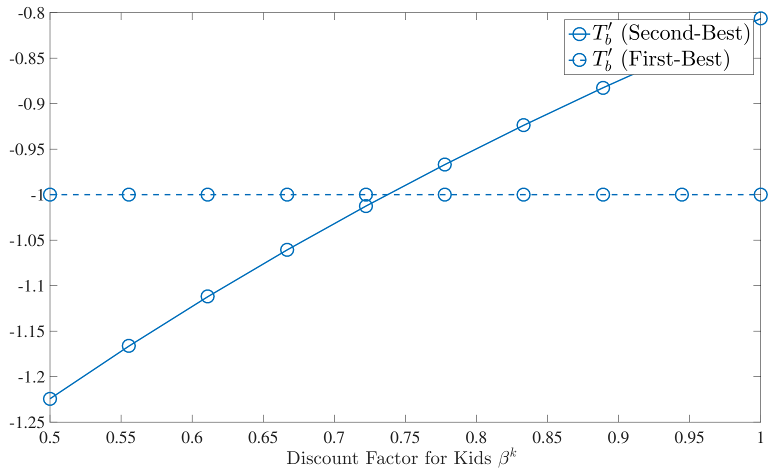


Figure 3: Marginal Inter Vivos Taxes

creasing in the second-best since the allocation has to compensate c_1^k for the children with a lower β^k in order to satisfy the incentive compatibility constraints.

4.4 Credit-Rationed Parents

In the previous sections, we supposed that parents are sufficiently rich to finance their inter vivos transfer rules. This may be not realistic for all households since b' is contingent on the kid's life-time saving. For instance, we show that parents set $b' = 25\%$ for a children with β^k in (See Figure 2) and it is apparent that not all parents could finance such offers. Instead we now suppose that parents are heterogeneous in income: $I^p \in \{I_L, I_H\}$ with $I_L < \underline{c} < I_H$ where where $\underline{c} \in \mathbb{R}_{++}$ is an exogenously determined lower bound of c_1^p. In the setting, the households who endowed I^H face the same problem as the previous case while the other ones do completely different actions. In the setting, the marginal transfer rules is now given by:

$$b' = \begin{cases} \left(\frac{\alpha}{1+\alpha}\right)\left(\frac{\hat{\beta}^p(\beta^k)-\beta^k}{\hat{\beta}^p(\beta^k)}\right) \geq 0 & if \quad I^p = I_H, \\ 0 & if \quad I^p = I_L. \end{cases} \tag{29}$$

Due to the liquidity constraint, the parents hold I_L cannot leave the inter vivos gifts to their offsprings suggesting that the credit rationed parents do not have power to affect their children. Knowing that the government set T_s' for $I^p = I_L$ to equate the RHSs of

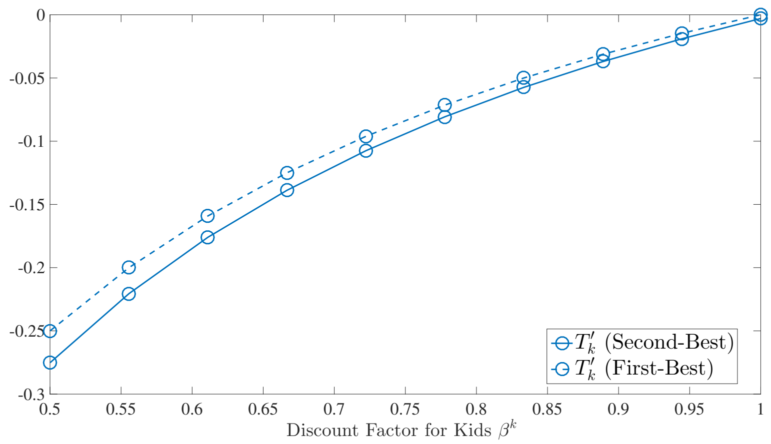


Figure 4: Marginal Capital Income Taxes for Kids of Credit-Rationed Parents

Eqs. (12) and (20) with $b' = 0$:

$$T_s' = \begin{cases} \frac{\beta^{p,k} - \beta^{g,k}}{\beta^{p,k}} \geq 0 \quad if \quad I^p = I_H, \\ \frac{\beta^{k} - \beta^{g,k}}{\beta^{k}} \leq 0 \quad if \quad I^p = I_L \end{cases} \tag{30}$$

Thus, the marginal capital income taxes are positive for the kids who receive money transfers while negative who do not. As in the previous result, if the parents are sufficiently rich, they will enhance the kids' savings too much from the government's perspective, and so the government sets positive marginal taxes to decrease the saving incentives for kids. Instead, if the parents could not finance the transfers, their children will consume as they want to. Then, since $\beta^k < \beta^{g,k}$ for children who conflicting with their parents, their current consumptions are too much from the government's viewpoint. Thus, the marginal saving taxes are negative for them to induce more savings.

The result implies that the capital income taxes should be contingent on whether the individual received strategic intergenerational transfer or not. From a broader perspective, it is translated to the implication that saving tax should be progressive, since the children of the richer households face the higher marginal taxes if they have a same preference. However, it is important to be aware that the conclusion depends on our assumptions that (i) all of the parents have strategic transfer motives, and (ii) the parents have an identical preference. By relaxing these assumptions, we'll understand the implication for the progressiveness of taxes more.

5 Conclusion

This paper has studied dynamic nonlinear capital income taxation in an economy where parents have exchange transfer motives(Bernheim et al., 1985; Chami, 1998; Cox, 1987; Cremere and Pestieau, 1996) due to the heterogeneities on time-preference. Our theory shows that the intergenerational transfers depend on the degree of heterogeneity between parents and kids. By taking account of the parents' incentives, the government designs positive marginal capital income taxes to implement the efficient allocation. Intuitively, the taxes are set to reduce the too much saving motives caused by the intergenerational transfers.

Regarding future research, one of our suggestions would be to include discipline or education by parents to the model. While we focused on the grown adult kids, parents could influence their children's preferences in their infancy. By adding such dimensions, the model can analyze the interaction between parenting styles, parental transfers, and public policies. The other promising future research question is to check our theoretical predictions empirically. For instance, is the marginal capital income tax higher in the country (or state) in which parents are paternalistic? Finally, it would also be beneficial to allow the heterogeneity in kids' labor skills and relatives' preferences. By incorporating such aspects, we could quantitively investigate the loss for each agent and optimal taxes in the economy.

References

S Rao Aiyagari. Optimal capital income taxation with incomplete markets, borrowing constraints, and constant discounting. *Journal of political Economy*, 103(6):1158–1175, 1995.

Anthony Barnes Atkinson and Joseph E Stiglitz. The design of tax structure: direct versus indirect taxation. *Journal of public Economics*, 6(1-2):55–75, 1976.

Gary S Becker. A theory of social interactions. *Journal of political economy*, 82(6): 1063–1093, 1974.

Gary S Becker. Altruism in the family and selfishness in the market place. *Economica*, 48(189):1–15, 1981.

Gary S Becker and Nigel Tomes. An equilibrium theory of the distribution of income and intergenerational mobility. *Journal of political Economy*, 87(6):1153–1189, 1979.

Roland Benabou. Tax and education policy in a heterogeneous-agent economy: What levels of redistribution maximize growth and efficiency? *Econometrica*, 70(2):481–517, 2002.

B Douglas Bernheim and Sergei Severinov. Bequests as signals: An explanation for the equal division puzzle. *Journal of Political Economy*, 111(4):733–764, 2003.

B Douglas Bernheim, Andrei Shleifer, and Lawrence H Summers. The strategic bequest motive. *Journal of Political Economy*, pages 1045–1076, 1985.

Vipul Bhatt. Adolescent alcohol use and intergenerational transfers: Evidence from micro data. *Journal of Family and Economic Issues*, 32(2):296–307, 2011.

Vipul Bhatt and Masao Ogaki. Tough love and intergenerational altruism. *International Economic Review*, 53(3):791–814, 2012.

Alberto Bisin and Thierry Verdier. The economics of cultural transmission and the dynamics of preferences. *Journal of Economic theory*, 97(2):298–319, 2001.

Ralph Chami. Private income transfers and market incentives. *Economica*, 65(260): 557–580, 1998.

Christophe Chamley. Optimal taxation of capital income in general equilibrium with infinite lives. *Econometrica*, pages 607–622, 1986.

Juan Carlos Conesa, Sagiri Kitao, and Dirk Krueger. Taxing capital? not a bad idea after all! *The American economic review*, 99(1):25–48, 2009.

Donald Cox. Motives for private income transfers. *Journal of political economy*, 95(3): 508–546, 1987.

Helmuth Cremere and Pierre Pestieau. Bequests as a heir "discipline device". *Journal of Population Economics*, 9(4):405–414, 1996.

Peter Diamond and Johannes Spinnewijna. Capital income taxes with heterogeneous discount rates. *American Economic Journal: Economic Policy*, 3(4):52–76, 2011.

Matthias Doepke and Fabrizio Zilibotti. Parenting with style: Altruism and paternalism in intergenerational preference transmission. *Econometrica*, 85(5):1331–1371, 2017.

Thomas A Dunn and John W Phillips. The timing and division of parental transfers to children. *Economics Letters*, 54(2):135–137, 1997.

Emmanuel Farhi and Iván Werning. Capital taxation: Quantitative explorations of the inverse euler equation. *Journal of Political Economy*, 120(3):398–445, 2012.

Raquel Fernández, Alessandra Fogli, and Claudia Olivetti. Mothers and sons: Preference formation and female labor force dynamics. *The Quarterly Journal of Economics*, 119(4):1249–1299, 2004.

Mikhail Golosov, Narayana Kocherlakota, and Aleh Tsyvinski. Optimal indirect and capital taxation. *Review of Economic studies*, pages 569–587, 2003.

Mikhail Golosov, Aleh Tsyvinski, Ivan Werning, Peter Diamond, and Kenneth L Judd. New dynamic public finance: A user's guide [with comments and discussion]. *NBER macroeconomics annual*, 21:317–387, 2006.

Mikhail Golosov, Maxim Troshkin, Aleh Tsyvinski, and Matthew Weinzierl. Preference heterogeneity and optimal capital income taxation. *Journal of Public Economics*, 97: 160–175, 2013.

Lingxin Hao, V Joseph Hotz, and Ginger Z Jin. Games parents and adolescents play: Risky behaviour, parental reputation and strategic transfers. *The Economic Journal*, 118(528):515–555, 2008.

Kenneth L Judd. Redistributive taxation in a simple perfect foresight model. *Journal of public Economics*, 28(1):59–83, 1985.

Louis Kaplow. A note on subsidizing gifts. *Journal of Public Economics*, 58(3):469–477, 1995.

Louis Kaplow. Tax policy and gifts. *American Economic Review*, 88(2):283–288, 1998.

Narayana R Kocherlakota. *The new dynamic public finance*. Princeton University Press, 2010.

Wojciech Kopczuk. Taxation of intergenerational transfers and wealth. Technical report, National Bureau of Economic Research, 2012.

Laurence J Kotlikoff and Assaf Razin. Making bequests without spoiling children: Bequests as an implicit optimal tax structure and the possibility that altruistic bequests are not equaliz. NBER Working Paper 2735, 1988.

Assar Lindbeck and Jörgen W Weibull. Balanced-budget redistribution as the outcome of political competition. *Public choice*, 52(3):273–297, 1987.

N Gregory Mankiw, Matthew Weinzierl, and Danny Yagan. Optimal taxation in theory and practice. *Journal of Economic Perspectives*, 23(4):147–174, 2009.

James A Mirrlees. An exploration in the theory of optimum income taxation. *The review of economic studies*, 38(2):175–208, 1971.

Nicola Pavoni and Hakki Yazici. Optimal life-cycle capital taxation under self-control problems. *Economic Journal*, 127(602):1188–1216, 2017.

Frank Plumpton Ramsey. A mathematical theory of saving. *Economic Journal*, 38 (152):543–559, 1928.

Sanna Tenhunen and Matti Tuomala. On optimal lifetime redistribution policy. *Journal of Public Economic Theory*, 12(1):171–198, 2010.

Richard H Thaler and Cass R Sunstein. Libertarian paternalism. *American Economic Review: Papers and Proceedings*, 93(2):175–179, 2003.

Nigel Tomes. The family, inheritance, and the intergenerational transmission of inequality. *Journal of Political Economy*, 89(5):928–958, 1981.

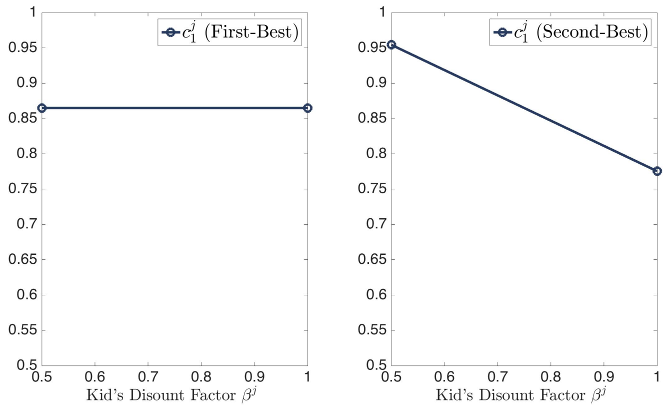
Bruce A Weinberg. An incentive model of the effect of parental income on children. *Journal of Political Economy*, 109(2):266–280, 2001.

Appendix A: Numerical Simulation

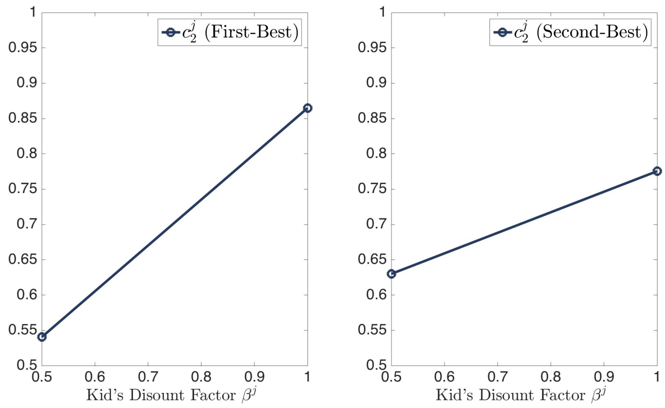
Parameters and Procedure

$u(c)$	$\ln c$	β^k	$[0.50, 1.00]$	β^p	1.00	α	1.00	γ	0.500
I^k	0.500	I^p	0.500	N	10				

Table 1: Specified Function and Parameter Values for Numerical Simulation



(a) c_1^k



(b) c_2^k

Figure 5: Economic Variables

We used Matlab solvers (fmincon and GlobalSearch), which solve the global optimum of a multivariable function with linear and nonlinear constraints for our numerical examples as Tenhunen and Tuomala (2010). We include all incentive compatibility constraints in the problem. The parameter values are displayed in Table 1. N denotes the types of kids' preferences. We suppose that β^p equals the maximum value of β^k implying that the parents are more or equally patient than kids. All parents identically have $\gamma = 0.5$ thus they gave both altruistic and paternalistic motives.

Interpretation of Second-Best Results

Figure 5 illustrates the resultant economic variables in both second-best and first-best allocations. In the first-best allocation, $c_2^k(\beta^k)$ is increasing in β^k, so the people have low β^k have an incentive to mimic their preferences in the economy with asymmetric information. Thus, in the second-best allocation, both of $c_1^k(\beta^k)$ and $c_2^k(\beta^k)$ for lower β^k are subsides to make them to declare their true preferences. The above mechanism influences the resultant taxes and inter vivos transfers. Notice that we obtain $T_s^{'} = 1 - \frac{u'(c_1^k)}{\beta^{p,k} u'(c_2^k)}$ from Eq.(24), it holds that

$$T_s^{'} = 1 - \frac{c_2^k}{\beta^{p,k} c_1^k}, \tag{31}$$

in our specification. The formula tells us that a higher $\left\{c_1^k, c_2^k\right\}$ leads a less $T_s^{'}$ for an individual with relatively low β^k, since $\beta^{p,k} < 1$ for them. From Eq.(27), we have $T_b^{'} = 1 - \frac{u'(c_1^p)}{\alpha u'(c_1^k)}$ which induces that:

$$T_b^{'} = 1 - \frac{c_1^k}{\alpha c_1^p} \tag{32}$$

in our numerical result. Since $c_1^p(\beta^k)$ is same in both the first- and second-best allocations, and $c_1^k(\beta^k)$ is increased for relatively low β^k individuals, Eq.(32) implies that the relatively impatient individuals face a smaller $T_b^{'}$ in the second-best allocation. Finally, Eq.(20) leads that

$$b' = 1 - \beta^k \left(\frac{1 - T_s^{'}}{1 - T_b^{'}} \right) \frac{c_1^k}{c_2^k} \tag{33}$$

In our numerical example, b' is heavily affected by $T_b^{'}$ which takes big different values in first- and second-best settings. Since $T_b^{'}$ is increasing in β^k in the second-best, b' takes the values displayed in Figure 2.