THE "DEMOGRAPHIC" EFFECTS OF GOVERNMENT-ENFORCED YOUNG-TO-OLD TRANSFERS: A HUMAN CAPITAL INVESTMENT ANALYSIS

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Abstract

Many governments, particularly in developed countries, mandate and enforce transfers of resources from young workers to old retirees. In this connection, a highly current issue, for laymen and economists alike, is the implications of a “greying” population structure for the future viability of government-enforced young-to-old transfers. The focus of my theoretical paper is on the opposite - namely, the demographic(broadly defined) effects of such transfers. My main theoretical finding is that government-enforced young-to-old transfers are self-defeating in the sense that they reduce the incentive of individuals to make “educational” investments, thereby impairing the future viability of such transfers. Intuitively, the rationale for this disincentive comes from two sources - first, government-enforced transfers of enable parents to free-ride on the educational investments of other parents and second, those transfers reduce the returns to such investments. Finally, my main finding obviously raises unflattering policy implications about government-enforced young-to-old transfers.

I. INTRODUCTION

An important, integral part of the modern welfare state is the government's transfer of resources to old retirees. Those transfers take many forms, including but by no means limited to income support and medical benefits. In many cases, governments finance such transfers, either explicitly or implicitly, by taxing young workers. Particularly in developed countries, many governments mandate and enforce young-to-old transfers, most likely for the purpose of providing a safety net, or a sustenance level of resources, to those old retirees who have been less prudent than they could have been when they were young. Government's role as a provider of last resort is particularly compelling for the old.

In this connection, a current, widely discussed policy issue is the implication of changing demographic structures, primarily in developed countries, for the viability of government-enforced young-to-old transfers. More specifically, in many developed countries, the population is rapidly "greying", due to a combination of declining birth rates and mortality rates. This raises uncomfortable thoughts about the future of those transfers since there will be too few young workers supporting too many old retirees - at best, discontent and disincentives against working and at worst, perhaps even the specter of outright intergenerational warfare.

A second policy issue is that of governments in developing countries introducing young-to-old transfers. A stylized fact is that as economies mature, the government tends to provide or at least try to provide a stronger safety net for the less fortunate members of the society, including destitute retirees. In other words, the government's role in the provision of safety nets, including nets for

old persons who are unable to provide for themselves, tends to expand. The governments of maturing developing economies, assuming at least a tolerable level of governmental competence, will undoubtedly measure the costs and benefits of introducing government-enforced young-to-old transfers. The governments of developed countries which already have those transfers will also weigh the costs and benefits of changing the level of such transfers. Therefore, it is worthwhile to examine, at a purely theoretical level, the effectiveness of government-enforced young-to-old transfers in achieving their objective, which is essentially to provide resources to the old.

The current and past focus in the debate on the relationship between demographics and government-enforced young-to-old transfers has been almost exclusively on the effect of the former on the latter. In this paper, I examine instead the effect of the latter on the former;the population structure becomes endogenous rather than exogenous. My main theoretical finding is as follows - government-enforced young-to-old transfers are self-defeating in the sense that the very act of introducing such transfers makes it more difficult to realize them. The driving intuition is that the government's imposition of taxes on young workers to finance young-to-old transfers creates disincentives against investments in children, which reduces the income of the children when they grow up to become workers;the lower income, in turn, will reduce the tax base from which the government can finance the transfers. Below, I construct a model from from which I first derive the above theoretical implications and then discuss the more general conclusions, particularly from a policy standpoint.

As will be discussed more fully later, I define "demographic" broadly and

somewhat unconventionally to actually mean human capital investments, also broadly defined. Therefore, the central theme of this paper is really the effects of government-enforced young-to-old transfers on human capital investments by parents in their children.

In this connection, Toshiaki(1994) provides a broad discussion of human capital investment and intergenerational transfers. Sala-i-Martin(1992) argues that intergenerational transfers are a way to induce early retirement by the elderly. Moffitt and Rangarajan(1989) discuss the U.S. evidence on the effects of transfer programs on work effort and human capital formation. Raut(1989) studies intertemporal relationships among population growth and other factors in an overlapping generations general equilibrium model which incorporates, among other variables, investments in human capital of children. Becker and Murphy(1987) analyze the relationship between bequests and investments in human capital of children. Becker and Barro(1985) point out that fertility may depend negatively on the growth rate of social security. In addition, Kotlikoff(1989) discusses social security, demographics and savings. Green(1988) studies social security, market failure and demographics.Seidman(1983) analyzes social security and demographics in a life cycle growth model.

The above literature survey reveals that so far, there has only been some, tangential research on the central topic of this paper. The (hopeful) goal of this paper, then, is to rectify such relative neglect of one potentially significant “other” effect of government-enforced young-to-old transfers.

II. A MODEL OF THE "DEMOGRAPHIC" EFFECTS OF GOVERNMENT-ENFORCED YOUNG-TO-OLD TRANSFERS

1. The Setting of the Basic Model

There are three generations in each period - the old, the young and the children. For simplicity, we assume that there is no heterogeneity, in terms of tastes, income and or any other relevant aspect, among members of each generation. That is, we assume the Representative Individual. Furthermore, we assume that each individual bears and raises one offspring while he or she is young so that each individual will have one parent and one child when he or she is young. In each succeeding period, the old pass away, the young become the old and the children become the young. The notations for consumption by the old, the young and the children in period t are, respecectively, as follows:

$C_{o,t}$ = consumption of an old person in period t
$C_{y,t}$ = consumption of a young person in period t
$C_{k,t}$ = consumption of a child(kid) in period t

Labor is the only factor of production. Therefore, the only income is labor income, and it is earned only when an individual is young. Labor income of the young is a solely a function of private "educational" investments made by the preceding generation in the previous period. We define "education" broadly to include anything, including food, clothing and housing, which may influence the productivity of the young. Educational investments made by a parent determine the productivity and hence income of his/her child when the child grows up to be a young worker in the next period. For simplicity, and without loss of generality, we assume the returns to such investments to be positive and constant.

Thus, the (labor)income of a young person in period t is determined by the educational investments of his/her parent in period t-1 as follows:

$$I_{y,t} = I_{y,t}(e_{y,t-1}) = (1+r_e)e_{y,t-1},\ I_{y,t}' = (1+r_e) > 0 \text{ and } I_{y,t}'' = 0 \quad (1)$$

where $I_{y,t}$ = income of a young person in period t

$e_{y,t-1}$ = educational investments made by a young person(the period-t young person'sparent) in period t-1

r_e = rate of return on educational investments, in terms of effects on the productivity of a child

Notice that we assume r_e to be not only constant across investment levels but also over time. The period-t young, in turn, make investments in their children in period t and those investments determine the income of their children when they become young in period t+1.

$$I_{y,t+1} = I_{y,t+1}(e_{y,t}) = (1+r_e)e_{y,t} \quad (1)'$$

Although there are three generations in each period in our model, only the young optimize in each period. The young earn their labor income and choose to allocate their income among possible alternative uses so as to maximize their welfare over two periods, when they are young and when they are old. The alternative uses are consumption, saving, educational investment in their children(or, consumption by the children) and transfer to their parents(or, consumption of the old). The young, however, cannot choose their income, which is determined by their parents' educational investments in the preceding period.

The welfare of the children is entirely dependent upon the actions of their parents, the young. More specifically, the welfare of the children depends on the choices their parents make.

Like the children, the old are also powerless to choose their level of welfare.

The reason is that the choices they made in the preceding period, when they were young, have already effectively sealed their fate.

In the next two subsections, we discuss the optimization of the young under two polar assumptions about the benevolence of parents toward their children. The intent of the polarity is to underline the general validity of the theoretical implications to be derived later.

Notice that in our model, we use the term "demographics" somewhat loosely and broadly, to denote the level of human capital. Hence, changes in the quantity of human capital are equal to changes in narrowly defined demographics if and only if we hold the quality of human capital constant, which is the last thing we want to do in this model. The rationale for using our rather confusing terminology is as follows - although in terms of narrowly(correctly) defined demographics, the key variable would be the number of children, which is obviously a discrete variable and thus entails unnecessary complications, we still prefer to use the term "demographics" in its broader sense rather than "human capital" since we feel that the former better conveys the central insights set forth by this paper.

1.(a). The Selfish Parents Case

In this case, we make the following additional assumptions, for analytical convenience and without loss of generality. First, support from children is the only source of sustenance for the old. That is, for the young, investment in children is the only possible form of "saving" for old age.

Second, individuals care about the welfare of their parents but not their

children. They give resources to their parents but take resources away from their children. This young-to-old transfer of resources is possible because the children(the young of the next period) have identical preferences. The extent to which the young care about the welfare of their parents depends upon their level of altruism which, in turn, depends on, among other things on tradition, institutions, culture, social norms and other factors.

Third, the ability of the young to take care of the old depends on the level of their income. The higher their income, the better able they are to take care of the old. After all, destitute individuals are ususally in no position to take care of anybody, not even their own parents, while wealthy people can presumably afford the luxury of being generous to others, especially their own parents.

The three assumptions taken together imply an economy in which the sole purpose of investing in children is to provide for old-age consumption. The justification for this seemingly restrictive theoretical set-up is to focus more clearly upon the effects that the introduction of government-enforced young-to-old transfers, such as the pay-as-you-go public pension system in the U.S., has upon investments in children when parents make those investments out of "selfish" motivations. The returns to such investments depend upon the children's level of altruism and the effectiveness of those investments in terms of raising the productivity of the children.

This system of "social security" is possible because we assume that the young care for their parents but are selfish toward their children. Such asymmetry of benevolence is possible once we recognize the respective amounts of resources

held by the parents and the children(or more precisely, by the children when they become young). Put more bluntly, it follows from our assumptions that one's parent will starve to death if one does not transfer resources to him/her and, by the same token, one will also starve to death in the absence of transfers from one's child. Thus, a person is virtually forced into altruism toward his/her parent and selfishness toward his/her child.

A young person in period t earns labor income and, out of benevolence, gives away a fraction of his/her income to his/her parent.

$$pt_{y,t} = \lambda I_{y,t}(e_{y,t-1}) \tag{2}$$

where $pt_{y,t}$ = private transfer of resources from a young person to his/her parent in period t

$0 < \lambda < 1$

The natural interpretation of λ is that of an altruism parameter or, the parameter which captures the willingness of the young to take care of the old. In order for this "social security" system to be viable, λ must be at least greater than the level which enables the old to survive.

The post-transfer income of a young individual in period t is:

$$I_{y,t}' = I_{y,t}(e_{y,t-1}) - pt_{y,t} = (1-\lambda) I_{y,t}(e_{y,t-1}) \tag{3}$$

The welfare of a young individual in period t depends on the level of his/her consumption in period t as well as in period t+1, when he/she is old. As usual, we assume that both types of consumption are subject to diminishing marginal utility.

$$.U = U(C_{y,t}, C_{o,t+1}), U_1 > 0, U_{11} < 0, U_2 > 0, U_{22} < 0 \tag{4}$$

Given his/her post-transfer income, the period-t young person has to decide how

how much to consume in the current period and how much to save for the next period so as to maximize his/her welfare over the two periods. For simplicity, we assume no discounting. So the period-t young person's optimization involves:

$$\max_{C_{y,t}} U(C_{y,t}, C_{o,t+1})$$
$$s.t. C_{y,t} + C_{o,t+1} = I_{y,t}' \quad (5)$$

The consumption/saving decision boils down to a decision on allocating post-transfer income between consumption and educational investments, or

$$\max_{e_{y,t}} U[C_{y,t}, C_{o,t+1}(e_{y,t})]$$
$$s.t. C_{y,t} + e_{y,t} = I_{y,t}' \quad (5)'$$

What is critical for the young person is his/her rate of return on his/her educational investment in his/her child, which depends on the latter's period-t+1 income and level of altruism. More precisely,

$$pt_{y,t+1} = \lambda I_{y,t+1}(e_{y,t}) \quad (2)'$$

Therefore,

$$(1+r)e_{y,t} = \lambda I_{y,t+1}(e_{y,t}) = \lambda(1+r_e)e_{y,t}$$
$$r = \frac{\lambda I_{y,t+1}(e_{y,t}) - e_{y,t}}{e_{y,t}} = \lambda(1+r_e) - 1 \quad (6)$$

where r = rate of return on educational investments from the standpoint of a period-t young person

Parents, being selfish toward their children, consume up all the resources obtain from their children.

$$pt_{y,t+1} = \lambda(1+r_e)e_{y,t} = C_{o,t+1} \quad (7)$$

Combining (5)' and (7) and substituting in the budget constraint, we get

$$\max_{e_{y,t}} U[(I_{y,t}' - e_{y,t}), \lambda(1+r_e)e_{y,t}] \quad (5)''$$

Thus, the first-order condition for utility maximization is:

$$\frac{dU}{de_{y,t}} = \frac{\partial U}{\partial C_{y,t}} \frac{d(I_{y,t}' - e_{y,t})}{de_{y,t}} + \frac{\partial U}{\partial C_{o,t+1}} \frac{d[\lambda(1+r_e)e_{y,t}]}{de_{y,t}} = 0 \text{ or, equivalently,}$$

$$\frac{\partial U}{\partial C_{y,t}} = \frac{\partial U}{\partial C_{o,t+1}} \lambda(1+r_e) = \frac{\partial U}{\partial C_{o,t+1}} (1+r) \tag{8}$$

The interpretation of (8), which gives us the optimal levels of period-t consumption(=$C_{y,t}$ *) and period-t educational investments(=$e_{y,t}$ *) for a period-t young is straight-forward - the person will invest in his/her child up to where his/her marginal cost or foregone period-t consumption equals his/her marginal benefit or increase in period-t+1 consumption.

The second-order condition is satisfied:

$$\frac{d^2U}{de^2} = \frac{\partial^2 U}{\partial C_{y,t}^{\ 2}} + \frac{\partial^2 U}{\partial C_{o,t+1}^{\ 2}} (1+r) < 0 \tag{9}$$

1.(b) <u>The Altruistic-Parents Case</u>

In this case, we make the following assumptions - everybody takes care of themselves when they are old and parents care about the welfare of their children. The first assumption means that period t-young people will save in period t to provide for their consumption in period t+1. The second assumption means the same young people derive satisfaction from the consumption of their children in period t as well as the income of their children in period t+1. Our theoretical results do not change if young people were to care about the consumption rather than the income of their children in period t+1. Therefore, the utility function of a period-t young person is:

$$.U = U(C_{y,t}, C_{o,t+1}, C_{k,t}, I_{y,t+1}) \tag{10}$$

where $.U_1 > 0, U_{11} < 0, U_2 > 0, U_{22} < 0, U_3 > 0, U_{33} < 0, U_4 > 0, U_{44} < 0$

Unlike in the selfish-parents case, young people do not give away resources to their parents. So, for a period t-young person, the three alternative uses of his/her labor income are consumption, educational investments and savings for consumption in period t+1. Notice that for the same person, educational investments provide satisfaction in both period t and period t+1 since educational investments are at once his/her child's consumption in period t and the determinant of his/her income in period t+1. Hence, a period-t young person faces the following budget constraint in period t:

$$I_{y,t} = C_{y,t} + e_{y,t} + s_{y,t} \tag{11}$$

where $s_{y,t}$ = savings of a period-t young person

For analytical convenience, we assume that the only possible form of saving is a riskless asset which pays a constant return, both across levels and over time.

$$I_{o,t+1} = (1 + r_s) e_{y,t} \tag{12}$$

where r_s = the rate of return on the riskless asset

Although individuals are benevolent toward their children, they exercise all their benevolence when they are young, leaving no bequests. This means that the only possible use of their savings income is old-age consumption:

$$C_{o,t+1} = I_{o,t+1} = (1 + r_s) e_{y,t}. \tag{13}$$

The consumption of a period t-child is simply the amount of educational investments his/her (young) parent makes in period t.

$$C_{k,t} = e_{y,t} \tag{14}$$

As in the selfish-parents case, we assume the returns to educational invest-

ments to be positive and constant[refer to (1)], the only difference being that the child captures all of the returns.

Then, the optimization problem of a period-t young person becomes:

$$\max U(C_{y,t}, C_{o,t+1}, C_{k,t}, I_{y,t+1}) \text{ w.r.t. } C_{y,t}, e_{y,t}, s_{y,t}$$
$$s.t. C_{y,t} + e_{y,t} + s_{y,t} = I_{y,t} \quad (15)$$

Making use of the above assumptions and substituting in the budget constraint:

$$\max U[I_{y,t} - e_{y,t} - s_{y,t}, (1+r_s)s_{y,t}, e_{y,t}, (1+r_e)e_{y,t}] \text{ w.r.t. } s_{y,t}, e_{y,t}. \quad (15)'$$

The first-order conditions for utility maximization are:

$$\frac{\partial U}{\partial e_{y,t}} = -\frac{\partial U}{\partial C_{y,t}} + \frac{\partial U}{\partial e_{y,t}} + (1+r_e) = 0 \quad (16)$$

$$\frac{\partial U}{\partial s_{y,t}} = -\frac{\partial U}{\partial C_{y,t}} + \frac{\partial U}{\partial C_{o,t+1}}(1+r_s) = 0 \quad (17)$$

(16) and (17) together imply the following at the optimum:

$$\frac{\partial U}{\partial C_{y,t}} = \frac{\partial U}{\partial e_{y,t}} + (1+r_e) = \frac{\partial U}{\partial C_{o,t+1}}(1+r_s) \quad (18)$$

The interpretation of (18) is straight-forward - for a period-t young person, the marginal benefit of current consumption, the marginal benefit of educational investments and the marginal benefit of savings must all be the same at the optimum.

The second-order condition is satisfied since:

$$U_{ee} = U_{cc} + U_{ee} < 0, U_{ss} = U_{cc} + U_{cc}' < 0, U_{es} = U_{cc}$$
$$\text{and } .U_{ee}U_{ss} - U_{es}^{\ 2} > 0 \quad (19)$$

$$\text{where } .U_{cc} = \partial^2 U / \partial C_{y,t}^{\ 2} \text{ and } .U_{cc}' = \partial^2 U / \partial C_{o,t+1}^{\ 2}$$

2. Introduction of Government-Enforced Young-to-Old Transfers

Suppose now that the government mandates and enforces transfer of resources from the young to the old in period t. Then, by definition, the government finances the transfer in period t by imposing a tax on the young and distributing the revenues to the old. Then, the government-enforced transfer is:

$$GT_t = n_{y,t} t I_{y,t} = n_{o,t} gt_{o,t} \quad (20)$$

where GT_t = the total(aggregate) amount of government-enforced young-to-old transfer in period t
t = the rate of the tax the government imposes on the income of a period-t young person to finance the transfer
$n_{y,t}$ = the total number of young people in period t
$gt_{o,t}$ = the amount of government transfer(subsidy) each period-t old person receives in period t
$n_{o,t}$ = the total number of old people in period t

Due to out assumption that $n_{y,t} = n_{o,t}$ (20), we can simplify (20) into:

$$gt_{o,t} = tI_{y,t} \quad (20)'$$

(20) says that the amount of subsidy each old person receives is equal to the amount of tax each young person pays.

Let us make the additional assumptions that both the government-enforced transfers policy and the transfer tax rate are permanent, or at least perceived by the general public as such. Then, the old-age(period-t+1) government subsidy a period-t young person expects to receive is:

$$gt_{o,t+1} = tI_{y,t+1} \quad (20)''$$

For a young person in period t, assuming that there is no discounting of future income, as we have already done, there is no net change in expected income due to the introduction of government-enforced young-to-old transfer

policy since the amount of the transfer tax paid in period t is equal to the expected subsidy to be received in period t+1.

$$tI_{y,t} = gt_{o,t+1} = tI_{y,t+1} \tag{21}$$

(21) holds because in both the selfish-parents case and the altruistic-parents case, the optimal level of educational investments, which determine the child's level of income in the next period, remains constant over time, as does the number of people in each generation in each period.

$$e_{y,t-1}^* = e_{y,t}^* \quad \Rightarrow \quad I_{y,t}(e_{y,t-1}^*) = I_{y,t+1}(e_{y,t}^*) \tag{22}$$

2.(a) Selfish-Parents Case

As already noted, the total income of a period-t young person remains constant after the introduction of government-enforced young-to-old transfer of resources if t remains constant over time. Assuming a constant level of altruism toward one's parents, this means that for the young, the optimal level of transfers is the same with and without government-enforced transfers since

$$\lambda I_{y,t} = \lambda I_{y,t}' \tag{23}$$

where $I_{y,t}'$ = the income of a period-t young person after the introduction of government-enforced transfers

Whether the young continue to make voluntary transfers to their parents depends on the level of t or, more precisely, the relative sizes of t and λ. As will be discussed later, the young will no longer make any voluntary transfers if t is equal to or greater than λ. On the other hand, if t is less than λ, the young continue to make voluntary transfers. The reason is that when we say children care about their parents in our model, we mean that individuals care about

their parents' level of consumption. Hence, their voluntary transfer decision will hinge critically on the level of consumption their parents can achieve through the government subsidy alone.

While the introduction of government-enforced young-to-old transfers does not affect the total income of young people, what it does unambiguously affect is their returns to educational investments and hence their incentive to make such investments. There are two separate effects here - both working in the direction of reducing the attractiveness of educational investments.

In the first place, note that whereas the period-t+1 income of a period-t young individual who makes no educational investments is zero in the absence of government-enforced transfers, it becomes positive(the amount of government subsidy to be received in period t+1) after the introduction of such transfers. Since the marginal utility of period t+1 consumption falls with period t+1 consumption (as is the case with period t consumption), the marginal utility of period-t+1 consumption financed by educational investments falls relative to before the introduction of government-enforced transfers. In short, the introduction of government-enforced young-to-old transfers creates a new opportunity to free-ride on the investments of other parents, reducing the incentives to make such investments.

$$.\left(\frac{\partial U}{\partial C_{o,t+1}(e_{y,t})}\right)' = \left(\frac{\partial U}{\partial [gt_{o,t+1} + C_{o,t+1}(e_{y,t})]}\right) < \left(\frac{\partial U}{\partial C_{o,t+1}(e_{y,t})}\right) \qquad (24)$$

where $\left(\frac{\partial U}{\partial C_{o,t+1}(e_{y,t})}\right)'$ is the marginal utility of consumption educational investments after the introduction of government-enforced transfers

Secondly, for any given level of educational investments by a young person in period t, the ability of his/her child to support him/her in period t+1 falls in period t+1 after the introduction of government-enforced transfers. The reason is that part of the child's period-t+1 income is taxed away by the government and given away to all period-t+1 old people, and hence unavailable for voluntary transfers to the child's own parents. That is, the transfer tax is, in effect, a tax on educational investments, discouraging such investments and hence lowering future income.

$$I_{y,t+1}' = (1-t)I_{y,t+1} = (1-t)(1+r_e)e_{y,t} < I_{y,t+1} = (1+r_e)e_{y,t} \qquad (25)$$

where $I_{y,t+1}$' = the "transferable" income of a period-t young person's own child after the introduction of government-enforced transfers

Since for a period-t+1 young person the optimal level of transfer to his/her parent in period t+1 is a fraction λ of his/her transferable" period-t+1 income, his/her optimal level of transfer falls:

$$\lambda I_{y,t+1}' = \lambda(1-t)(1+r_e)e_{y,t} < \lambda I_{y,t+1} = \lambda(1+r_e)e_{y,t} \qquad (25)'$$

Hence, the returns to educational invesment, in terms of generating resources for old-age consumption at the optimal(for the children) level falls.

$$\frac{dC_{o,t+1}}{de_{y,t}} = \lambda(1-t)(1+r_e) < \lambda(1+r_e) \qquad (25)''$$

(24) and (25)'' together imply that the marginal benefit of educational investments has unambiguously declined. The reasons are two-fold - the marginal utility of old-age consumption financed by educational investments has fallen due to old-age government subsidies(and ultimately, the opportunity

to free-ride on others' investments) and, at the same time, the returns to educational investments in terms of generating "transferable" income and hence transfer-financed consumption also fallen due to the taxation of the those returns. Putting (24) and (25)'' together, we get

$$\frac{\partial U}{\partial C_{o,t+1}(e_{y,t})}\frac{dC_{o,t+1}}{de_{y,t}}=\left(\frac{\partial U}{\partial C_{o,t+1}}\right)\times\lambda(1-t)(1+r_e)<\left(\frac{\partial U}{\partial C_{o,t+1}}\right)\times\lambda(1+r_e) \qquad (26)$$

(i) $t=\lambda$

When the government introduces and enforces young-to-old transfers, it will have to set the transfer tax rate t. Suppose that the government sets the transfer tax rate equal to λ. In this case, for a young person period t, the amount of the transfer tax is identical to the amount he would have voluntarily given away to his/her parents in the absence of the tax.

$$tI_{y,t}=\lambda I_{y,t} \qquad (27)$$

This means that the income and hence consumption of his/her parent in period t is identical with and without government-enforced transfers even if he/she makes no voluntary transfers at all after the introduction of such transfers.

$$C_{o,t+1}'=tI_{y,t}=\lambda I_{y,t}=C_{o,t+1} \qquad (28)$$

where $C_{o,t+1}'$ = consumption of the old in period t+1 after the introduction of government-enforced transfers

Since what the young care about is the level of consumption of their parents and since after the introduction of government-enforced transfers their parents consume exactly the same amount as they did before such transfers without even receiving any voluntary transfers, the young will not make any voluntary transfers. The only change in young-to-old transfers after the introduction of

government-enforced transfers is in the nature of such transfers - from direct one-to-one(child-to-own parent) to indirect(whereby the government imposes an identical tax on all young people and distributes an identical subsidy to all old people) transfers. The total(aggregate) period-t government revenues from the transfer tax on the period-t young is:

$$R_t = n_{y,t} t I_{y,t} \tag{29}$$

The total period-t government subsidy to the period-t old is:

$$S_t = n_{o,t} g t_{o,t} \tag{30}$$

Since we made the simplifying assumption that $n_{y,t} = n_{o,t}$ and, by definition, we must have $R_t = S_t$, it must be true that

$$g t_{o,t} = t I_{y,t} = \lambda I_{y,t} = p t_{o,t} \tag{31}$$

When the government sets $t = \lambda$, in terms of transfer of resources to parents, the young simply substitute the tax for the voluntary transfer they would have made in the absence of the tax.

However, in terms of educational investments, the changes are much more significant since, as discussed above, the marginal benefit of such investments falls. The marginal costs of educational investments remain the same since young-age income remains constant and hence the marginal utility of foregone young-age consumption remains constant. That is,

$$(\frac{\partial U}{\partial C_{y,t}})' = \frac{\partial U}{\partial [(1-t) I_{y,t}]} = \frac{\partial U}{\partial [(1-\lambda) I_{y,t}]} = \frac{\partial U}{\partial C_{y,t}} \tag{32}$$

where $(\frac{\partial U}{\partial C_{y,t}})'$ = marginal utility of young-age consumption after the introduction of government-enforced transfers

With unchanged marginal costs and lower marginal benefits of educational investments, optimization by a young individual in period in accordance with (20) above results in a lower optimal level of investments. That is,

$$(e_{y,t}^*)' > e_{y,t}^* \tag{33}$$

where $(e_{y,t}^*)'$ = optimal level of educational investments for the period-t young after the introduction of government-enforced transfers

Every period-t young person faces the same disincentives against investing in children, leading to lower income for and lower transfer tax revenues from each child(period-t+1 young person) in period t+1.

Therefore, the government's total revenue from the transfer tax will fall, resulting in a smaller subsidy for each old person in period t+1.

$$gt_{o,t+1} = tI_{y,t+2}[(e_{y,t+1}^*)'] < gt_{o,t} = tI_{y,t+1}(e_{y,t}^*) = \lambda I_{y,t+1}(e_{y,t}^*) \tag{34}$$

Thus, since the government's goal in mandating and enforcing young-to-old transfers is presumably to help the old provide for themselves, such transfers are ultimately self-defeating because they reduce the incentives to invest in children. That is, the young will be less able to transfer resources to their parents, regardless of whether the transfer is voluntary or government-enforced, because their parents invest less in them after the introduction of government-enforced young-to-old transfers, lowering their incomes. Thus, the very act of initiating government-enforced young-to-old transfers makes achieving those transfers more difficult.

(ii) $t < \lambda$

If the government sets t at less than λ, the analysis will be virtually identical

to the $t = \lambda$ case. In particular, the first-order condition for optimizing the level of educational investment and hence the optimal level of such investments remain the same. The only difference is the following trivial one - a young person in period t will continue to make voluntary transfers to his/her parents since the latter's period-t consumption will short of what voluntary transfers from the former would have made possible in the absence of government-enforced transfers. Although the young's level of altruism toward their parents does not change, the level of their "private" altruism will fall so as to leave unaffected the total(private and government-enforced) level of transfers their parents receive.

$$pt_{y,t} = \lambda' I_{y,t} - tI_{y,t} = (\lambda - t) I_{y,t} \quad (35)$$

$$\lambda' = \lambda - t \quad (35)'$$

Thus, the post-transfer tax cum transfer income of the period-t young remains identical to the case of $t = \lambda$, as does the expected period t+1 total income.

iii) $t > \lambda$

First of all, notice that in this case, even if the period-t old finance their consumption entirely out of the government subsidy, they would enjoy a higher level of consumption than in the absence of government-enforced transfers.

$$C_{o,t}' = gt_{o,t} = tI_{y,t} = C_{o,t} = pt_{y,t} = \lambda I_{y,t} \quad (36)$$

Since neither the total(period-t plus period-t+1) income nor the altruism of the period-t young has changed, for a period-t young individual, the optimal level of consumption for his/her parent remains at $\lambda I_{y,t}$. Since the actual level of consumption, $tI_{y,t}$ already exceeds the optimal(for the period-t young) level even without any voluntary transfers, a period-t young individual will not make any

voluntary transfers at all. That is, the level of "private" altruism is zero.

$$\lambda' = 0 \Rightarrow pt_{y,t} = \lambda' I_{y,t} = 0 \tag{37}$$

In fact, a period-t young individual would want to somehow extract resources from his/her parent because he/she is forced to transfer, through the tax, more than his/her optimal amount. But this is not possible since our assumption of the selfish parent rules out any old-to-young transfers.

Notice that the post-transfer(both voluntary or government-enforced) period-t income of a period-t young individual has declined since

$$(1-t)I_{y,t} < (1-\lambda)I_{y,t} \tag{38}$$

Although total expected income remains constant since the lower period-t post-transfer is exactly offset by the period-t+1 subsidy, our assumptions that all individuals are identical and period-t children earn income only in period t+1 rules out the feasibility of borrowing to even out income between the periods. Therefore, for the period-t young person, for any given level of educational investments, period-t consumption is lower(since the post-transfer income is the sum of period-t consumption and educational investments) and hence the marginal utility of period-t consumption is higher.

$$C_{y,t}' = I_{y,t}' - e_{y,t} = (1-t)I_{y,t} - e_{y,t} < (1-\lambda)I_{y,t} - e_{y,t} = C_{y,t} \tag{39}$$

$$\frac{\partial U}{\partial C_{y,t}'} < \frac{\partial U}{\partial C_{y,t}} \tag{40}$$

This means that for $t > \lambda$, a period-t young individual's marginal cost of educational investments rises because, due to the lower post-transfer income, the marginal utility of foregone period-t consumption is higher. As was the case for $t = \lambda$ and $t < \lambda$, the marginal benefit of educational investments fall due to lower

returns and lower marginal utility of period-t+1 consumption. Therefore, once again, the optimal level of educational investments will be lower than under voluntary transfers.

2.(b). The Altruistic-Parents Case

As discussed before, in the altruistic-parents case, the old do not support themselves through a voluntary transfer from their children but rather by saving a part of their young-age income. If in period t the government introduces government-enforced young-to-old transfers and finances the transfer by imposing a tax rate t on the income of each period-t young person, the amount of subsidy each period-t old person expects to receive is, as before, equal to the amount of the tax on each period-t young person.[refer to (20)]

Therefore, a period-t old person's income will increase:

$$I_{o,t}' = I_{o,t} + gt_{o,t} = s_{y,t-1}(1+r_s) + gt_{o,t} > s_{y,t-1}(1+r_s) = I_{o,t} \quad (41)$$

where $I_{o,t}'$ = post-subsidy income of period-t old person

Recall that for an altruistic period-t old individual, the optimal level of old-age consumption, which has already been determined in period t-1, is equal to old-age income or, equivalently, the returns to young-age(period-t-1) savings.

$$C_{o,t}^* = I_{o,t} = (1+r_s)s_{y,t-1} \quad (42)$$

Therefore, if the period-t old person were to consume his/her entire post-subsidy income, he/she would be consuming more than his/her period-t optimal level.

$$C_{o,t}' = I_{o,t}' > C_{o,t}^* = I_{o,t} = (1+r_s)s_{y,t-1} \quad (43)$$

At the same time, the period-t young, who do not make any voluntary transfer to their parents in the altruistic-parents case, suffer an income loss due to the

involuntary, government-enforced tax. That is,

$$I_{y,t}' = (t-1)I_{y,t} = I_{y,t} - tI_{y,t} < I_{y,t} \quad (44)$$

where $I_{y,t}'$ = post-transfer tax income of period-t young

But recall that altruistic parents both care about and determine the income of their children through educational investments. Taking into account the welfare of their children, parents optimize on their level of educational investments which, in turn, sets the income of their children in the next period. [refer to (1) and (10)] Hence, the income of the young earn in period t is, if you will, an optimal level of income, from the viewpoint of their parents. Therefore, in the absence of any additional income, the period-t young will be earning less than their "optimal" income.

The above discussion implies that the introduction of government-enforced transfers, from the viewpoint of the period-t old, forces them to overconsume and their children to underconsume. This means that it will be optimal for the period-t old to simply give away to their children what the government(in the final analysis, their children) gave them in the first place. That is, voluntary old-to-young transfers exactly offset the involuntary young-to-old transfers.

$$I_{o,t}'' = I_{o,t}' - pt_{o,t} = I_{o,t} \quad (45)$$
$$I_{y,t}'' = I_{y,t}' + pt_{o,t} = I_{y,t} \quad (45)'$$

where $I_{o,t}''$ = post-subsidy, post-transfer income of the period-t old
and $I_{y,t}''$ = post-tax, post-transfer income of the period-t young

Consequently, the introduction of government-enforced transfers in period t does not affect the income of either the old nor the young in period t.

However, one thing which does change for the period-t young individual is

that regardless of his/her level of savings, he will receive a subsidy from the government in period t+1. Unlike the period-t old, the period-t young do not simply hand back their subsidies to their children in period t+1;rather, they take into account those subsidies in their period-t optimization. Therefore, the period t+1 income and hence consumption of the period-t young rises regardless of their level of savings.

$$I_{o,t+1}' = C_{o,t+1}' = gt_{o,t+1} + (1+r_s)s_{y,t} > (1+r_s)s_{y,t} = I_{o,t+1} = C_{o,t+1} \quad (46)$$

where $I_{o,t+1}$' = post-subsidy period-t+1 income of the period-t young
and $C_{o,t+1}$' = post-subsidy period-t+1 consumption of the period-t young

Another change due to the government-enforced transfers is that a child can no longer all the returns to educational investments. More precisely, the period t+1 returns to educational investments fall because a portion of those returns are taxed by the government to finance the government-enforced transfers. That the children capture, in the absence of such transfers, all of the period-t+1 returns to the investments does not alter the fact that the parents will still face period-t+1 lower returns and thus a disincentive against investment since, in the altruistic-parents case, the returns to the child are, in effect, the returns to the parent.

$$I_{y,t+1}' = (1-t)(1+r_e)e_{y,t} < (1+r_e)e_{y,t} = I_{y,t+1} \quad (47)$$

Putting together (46) and (47), we can derive the first-order conditions for the optimal level of educational investments and savings for a young altruistic person in period t:

$$\frac{\partial U}{\partial e_{y,t}} = -\frac{\partial U}{\partial C_{y,t}} + \frac{\partial U}{\partial e_{y,t}} + (1+r_e)(1-t) = 0 \quad (48)$$

$$\frac{\partial U}{\partial s_{y,t}} = -\frac{\partial U}{\partial C_{y,t}} + \frac{\partial U}{\partial [\, gt_{o,t+1} + (1+r_s)s_{y,t}\,]}(1+r_s) = 0 \qquad (49)$$

(48) and (49) together imply the following at the optimum:

$$\frac{\partial U}{\partial C_{y,t}} = \frac{\partial U}{\partial e_{y,t}} + (1+r_e)(1-t) = \frac{\partial U}{\partial [\, gt_{o,t} + (1+r_s)s_{y,t}\,]}(1+r_s) \qquad (50)$$

The interpretation of (50) is identical to that of (18) - at the optimum, the marginal benefit of period-t consumption, educational investments and savings must all be the same for the period-t young individual.

From (50), we can readily see that the introduction of government-enforced transfers will raise the optimal level of period-t consumption and lower the optimal levels of both educational savings and savings. The reason is that while the transfers do not affect the marginal utility of period-t consumption, they lower the marginal benefit of both educational investments and savings.

III. CONCLUSION AND POLICY IMPLICATIONS

Regardless of whether parents invest in their children, as selfish parents do, or invest for their children, as altruistic parents do, we find that for the individual parent, the introduction of government-enforced young-to-old transfers creates disincentives against investing in children and thus leads to a lower level of investments in children and hence a lower aggregate level of investments and aggregate future income of the children, thereby reducing the future tax base from which the government can finance its transfer. The reason is that, in the final analysis, such transfers transform the children from private "goods" into public "goods" from the viewpoint of the individual parent since the transfers enable all the other parents to capture a part of the returns to the

parent's investments in his/her child, regardless of whether the parent is selfish or altruistic toward his/her child and, by the same logic, the same parent captures a part of the returns to "educational" investments of all the other parents in their own children.

This disincentive against educational investments originates from two sources. First, the returns to "educational" investments, whether partially appropriated by the parent for his/her own old-age support(as in the selfish-parents case) or entirely appropriated by the parent's child(as in the altruistic-parents case), fall since they are taxed by the government to finance the intergenerational transfer. That is, government-enforced young-to-old transfers impose, in effect, a tax on educational investments. Second, regardless of one's own level of educational investments and regardless of whether one is selfish or altruistic toward one's own child, the intergenerational transfers enables one to obtain resources from the children of other parents when those children grow up to be young workers. Therefore, government-enforced young-to-old transfers, by transforming children into public goods, encourage parents to free-ride on the "educational" investments of other parents.

Since the above disincentive against educational investments exists for every parent, the aggregate level of educational investments will decline, leading to a lower aggregate income when the children grow up into young workers. The fall in aggregate income will, in turn, reduce the tax base from which the government finances its intergenerational transfer. Therefore, insofar as the government's goal in mandating and enforcing young-to-old transfers is to provide

resources to the old, the transfer policy is self-defeating in the sense that the very act of enforcing it will reduce the its fiscal feasibility.

Digressing somewhat from our main issue of concern, the theoretical finding that government enforced transfers will reduce the level of educational investments also raises unpleasant implications about the effects of those transfers on economic growth. In particular, in developing countries where economic growth is likely to be a top priority, such effects warrant a careful scrutiny if and when the transfers are enforced.

Finally, the theoretical conclusions derived in this paper appear to have a significant degree of relevance for economic policymakers. First, in the case of the mounting concern about the demographic inverse pyramid in developed countries, it is perhaps worthwhile, in light of the above discussion, to examine what, if any, effect the government-enforced young-to-old transfers themselves have on inverse "pyramidization.". Second, in the case of discussions about introducing intergenerational transfers in developing countries, it is probably worthwhile to examine beforehand, along with all the other relevant considerations, the potential demographic consequences of such transfers which, in turn, will have implications about the future viability of the transfers. Finally, and this is the more general policy-relevant suggestion, in planning the introduction and/or level of government-enforced young-to-old transfers, policymakers should not stop at analyzing the the impact of demographics on such transfers;they are well-advised to examine the flipside of the coin as well.

References

Becker, Gary S. and Robert J. Barro(1985). “A Reformulation of the Economic Theory of Fertility.” University of Rochester Center for Economic Research Working Paper 26 (October).

Becker, Gary S. and Kevin J. Murphy(1987). “The Family and the State.” Economics Research Center/NORC Discussion Paper 87-15 (November).

Green, Jerry R.(1988). “Demographics, Market Failure, and Social Security.” in Susan M. Wachter(ed.), *Social Security and private pensions:Providing for Retirement in the twenty-first century*. Lexington, Mass. and Toronto:Heath, Lexington Books

Kotlikoff, Laurence J.(1989). *What determines savings?* Cambridge, Mass. and London:MIT Press.

Moffitt, Robert and Anuradha Rangarajan(1989). “The Effect of Transfer Programs on Work Effort and Human Capital Formation:Evidence from the U.S..” in Dilnot, Andrew and Ian Walker(ed.), *The economics of social security.* Oxford and New York:Oxford University Press.

Raut, Lakshmi Kanta(1989). “Capital Accumulation, Income Distribution and Endogenous Fertility in an Overlapping Generations General Equilibrium Model.” University of California at San Diego Department of Economics Discussion Paper 89-2 (January).

Sala-i-Martin, Xavier(1992). “Pensions.” Yale Economic Growth Center Discussion Paper 657 (April).

Seidman, Laurence S.(1983). “Social Security and Demographics in a Life Cycle Growth Model.” *National Tax Journal* 36, 2 (June), 213-224.

Toshiaki, Tachbanaki(1994). *Savings and Bequests*. Ann Arbor:University of Michigan Press.