Intergenerational Transfers and Growth

by

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Abstract

This paper shows that, when the supply side dynamics is modelled along the lines suggested by the endogenous growth literature, it is possible that properly designed unfunded schemes would promote growth. The reduction in savings when an intergenerational transfer programme is introduced has a negative impact on capital accumulation and output. However, in the long run the saving rate will be greater than in the absence of social security, and this could lead to increased well-being for future generations. Social security can thus positively contribute to long-run capital accumulation.

1. Introduction

The future of the welfare state is under threat. There is a growing consensus that current systems cannot survive, not only due to their heavy incidence on public finances but also for disincentive motives. In particular, the alleged adverse effects on private savings are thought seriously to undermine efficiency and growth. Special attention has been paid, in recent years, to reforming "unsustainable" social security schemes. The conventional view is that social security is harmful to growth, although it may have some merits in enhancing equity.

It is well known that, under the extreme hypotheses underlying Ricardian equivalence, intergenerational transfers would have neither allocative nor distributional consequences. Fully funded schemes would be neutral even when there is no fully operational bequest motive, since private egotistic agents are indifferent between funding their pensions or investing their savings in alternative assets yielding exactly the same rate of return. Unfunded schemes, by contrast, are thought to produce negative effects on growth; in spite of this, industrialised countries have adopted pay-as-you-go mandatory pension programmes after World War II.

The increase in life expectancy and the decline in birth rates, combined with the pronounced productivity slowdown, have cast serious doubts on the viability of such schemes. Intergenerational transfers have become excessively generous over the years in response to the occurrence of large adverse shocks (see Marchand and Pestieau, 1991, and OECD, 1995).

A central issue is to understand why compulsory transfers from the working labour force to the retired population are still so popular in the face of their presumed unsustainability. A possible answer one might expect is that the equity motive must outweigh the alleged efficiency loss brought about by unfunded intergenerational transfers. Gains may arise from several reasons. First of all, uncertainty could explain the need for social insurance, whereby generations hit by adverse shocks can find support from more fortunate ones (Gordon and Varian, 1988). Market forces alone could not provide intergenerational insurance nor could discretionary policies, when geared at achieving short-term results.

Even in the absence of uncertainty, there are several rationales for the existence of intergenerational social security transfers. The role of partial altruism and consumption externalities has been analysed by Veall (1986). In the presence of partial altruism, the solidarity chain implied by unfunded schemes may also justify why all generations might find

it optimal to maintain the previously introduced pay-as-you-go scheme (Hansson and Stuart, 1989).

The classic motive for social security is however based on paternalism (Samuelson, 1975). Private agents behave on the basis of a utility function which is not the true one; in particular, the needs for old-age consumption could be systematically underestimated. Mandatory pension schemes help to solve the typical Samaritan's dilemma (Buchanan, 1975) faced by society when the old had not set aside a sufficient amount of savings when young.

Short-sighted behaviour may also be due to unwillingness to accept the idea of growing old and grey or "deliberate" myopia (Diamond, 1977; Atkinson, 1987).

None of the above "imperfections" is however needed to explain the existence of social security. A different rationale can be based on time consistency and intergenerational equity (Marini and Scaramozzino, 1996a): a far-sighted planner may find it optimal to introduce and maintain over time an unfunded scheme. The benevolent government should maximise a social welfare function in such a way as to treat all generations alike. This requires discounting utilities of all generations to their birth date and not to the current date, in order to eliminate incentives to deviate from the optimal policy in the future.

Time consistency implies that future utilities be discounted at a rate above the population growth rate. The social discount rate, however, reflects not merely impatience but also care for the currently old at any point in time. In other words, the reverse discounting procedure implies that generations must be given a lower weight when young. Unfunded schemes may be optimal even when Aaron's rule (Aaron, 1966) is violated, that is when the economy is dynamically efficient, if the well-being of the elderly is sufficiently valued. Care for the old can thus justify both the introduction and the survival of intergenerational social security transfers.

Social security is, however, also bound to have allocative consequences. It is well known since the seminal work by Diamond (1965) that the introduction of unfunded social security does not result in a Pareto improvement, unless the economy is characterised by dynamic inefficiency. In other words, the transfers to the currently old need to be financed at the expenses of future generations, unless the sum of productivity and population growth rates exceeds the real rate of interest. Pay-as-you-go schemes affect the dynamic path of capital accumulation, and the usual effect is believed to be negative. In standard exogenous growth models this is certainly the case, since the production locus is shifted down by the introduction of social security. Private savings are crowded out and capital accumulation is reduced (Feldstein, 1985, 1995; Blanchard and Fischer, 1989, chapter 3).

This finding has also been extended to the endogenous growth literature, which relies even more heavily on the crucial role of savings as the engine of growth. It is well known that endogenous growth models rule out the possibility of dynamic inefficiency (Saint-Paul, 1992). The logical corollary would appear to be that social security is always harmful to growth in endogenous growth models. Hence, efficiency considerations would seem unambiguously to call against social security.

A strong warning against such a conclusion has recently been made by Atkinson (1995), who argues that reductions in unfunded social security might be accompanied by an increase in the private market for pension funds with unclear effects on the saving rate and the growth rate of firms.

We take up this issue in a simple learning-by-doing endogenous growth model with overlapping generations *à la* Samuelson (1958) and demonstrate that social security may indeed positively contribute to growth. The reason is that the saving rate, while falling on impact, can increase in all subsequent periods (although at a declining rate), monotonically converging back to the rate prevailing before the introduction of social security. This result, which seems to have escaped the attention of the literature, casts serious doubt both on the conventional wisdom about the role of unfunded social security and on the appropriate policies to sustain production and growth. Properly designed unfunded intergenerational transfers, far from being harmful to growth, may indeed promote prosperity along the adjustment path.

The scheme of the paper is as follows. Section 2 briefly reviews the effects of social security on growth in the standard exogenous growth literature. Section 3 consider a prototypical endogenous growth model and shows the rather different implications of mandatory intergenerational transfers. The main results are summarised in the concluding section 4.

2. Social security transfers and exogenous growth

In the present section we briefly review the effects of unfunded social security in an overlapping generations (OLG) model with production and exogenous population growth. We follow Diamond (1965) in considering a simple OLG model formed of identical consumers, each of whom lives for two periods. Individual preferences are given by

(1) $$U(c_1^s, c_2^s) = u(c_1^s) + \frac{1}{1+r} u(c_2^s)$$

where the subscript denotes age, the superscript the date of birth, and where r is the private subjective rate of time preference. Consumers work when young and dissave when old. Population grows at the constant rate n. The individual lifetime budget constraint in the presence of a social security transfer programme is

(2) $$c_1^s + \frac{c_2^s}{1+r_s} = y_s - t + \frac{b}{1+r_s}$$

where y_s is income received by the young born at time s, t are their contributions, b are the benefits received when old, and r_s is the rate of interest at time s. Following Samuelson (1969), Feldstein (1985) and Veall (1986), we assume for simplicity that the utility index in (1) has a logarithmic form:

(3) $$u(c) = \ln c$$

Firms produce a homogeneous output by using capital and labour. Technology is described by a constant-returns-to-scale production function, satisfying Inada's conditions:

(4) $$Y_{it} = F(K_{it}, L_{it}) = L_{it} f(k_{it})$$

where $k_{it} \equiv K_{it} / L_{it}$ is the capital-labour ratio for firm i. Total capital and labour in the economy are defined as $K_t \equiv \Sigma_i K_{it}$ and $L_t \equiv \Sigma_i L_{it}$, where L_t is the number of young consumers.

Perfect competition in the capital and in the labour markets yields the usual first-order conditions:

(5) $$r_t = f'(k_t)$$

(6) $$w_t = f(k_t) - k_t f'(k_t)$$

where w_t is the wage rate.

The government enacts a balanced-budget, pay-as-you-go transfer scheme in which the benefits to the elderly are entirely paid through contributions by the young: hence, $(1+n)t=b$. We consider the effects of an unanticipated transfer to the elderly at time t, financed by the young. This represents the introduction of a social security scheme. The transfer programme is then expected to remain in place in all future periods. Consumption by the different generations is given by

(7a) $$c_2^{t-1} = \frac{1+r_{t-1}}{2+r} \cdot w_{t-1} + b$$

(7b) $$c_1^s = \frac{1+r}{2+r}\left[w_s + \frac{b(n-r_s)}{(1+r_s)(1+n)} \right] \qquad s \geq t$$

(7c) $$c_2^s = \frac{1}{2+r}\left[(1+r_s)w_s + \frac{b(n-r_s)}{(1+n)} \right] \qquad s \geq t$$

Consumption of the elderly always increases with the benefit b. The effect on consumption of future generations will either be positive or negative, depending on whether the lifetime income of future generations increases or decreases. One critical issue is whether the population growth rate is greater or smaller than the rate of interest: if $n>r_s$, consumption of future generations will increase. This would be the case under dynamic inefficiency. By contrast, if $r_s>n$ the economy is dynamically efficient and consumption of future generations will decline. The impact on future consumption will also depend on the effect of the transfer programme on capital accumulation and, hence, on the wage rate (equation (6)).

The model is closed by the asset market clearing condition, which equates the demand for capital by firms to the supply of savings by the young:

(8) $$K_{s+1} = L_s[y_s - c_1^s]$$

The formal properties of this model have been studied by a number of authors, and are well known in the literature (see for instance Blanchard and Fischer, 1989, section 3.2, and Azariadis, 1993, chapter 18, for a formal solution of the model). The introduction of social security has the effect of unambiguously reducing both the steady-state capital stock

and the speed of convergence towards equilibrium, along the dynamic adjustment path. This result is driven by the decline in the equilibrium saving rate of the economy, which leads to reduced capital accumulation.

The desirability of balanced-budget, pay-as-you-go schemes appears to be limited to the circumstance in which the economy is over-accumulating before the introduction of the programme (Samuelson, 1975). Under dynamic efficiency, the scheme could still be justified by the requirements of symmetry across generations and of time consistency, if the social welfare function reflects sufficient concern for the elderly (Marini and Scaramozzino, 1996a). However, if the economy is not dynamically efficient there is a trade-off between the welfare of the elderly and that of future generations. The terms of this trade-off are substantially modified when the supply-side of the economy is modified to allow for endogenous growth, as we shall see in the next section.

3. Endogenous growth and intergenerational transfers

The endogenous growth model we analyse is based on learning-by-doing externalities in the accumulation of capital, consistent with Sheshinski (1967) (see also Buiter, 1993, and Barro and Sala-i-Martin, 1995, section 4.3). Each firm faces decreasing returns to scale with respect to its own input of capital: however, firm productivity is an increasing function of the average capital-labour ratio in the economy, which acts as a proxy for the level of technical knowledge in the economy and of the aggregate externalities from capital accumulation. Hence, the aggregate production function of the economy exhibits constant returns to an aggregate measure of capital.

The constant-returns-to-scale production function for firm i can thus be written as

$$Y_{it} = F(K_{it}, E_{it}) = E_{it} f(k_{it}) \tag{9}$$

where $k_{it} \equiv K_{it} / E_{it}$ is capital per efficiency unit of labour, and where the efficiency variable E_{it} is defined as

$$E_{it} = \frac{K_t}{L_t} \cdot L_{it} \tag{10}$$

where K_t and L_t are aggregate capital and labour respectively. The wage of a unit of raw labour is now

(11) $$\tilde{w}_t = \frac{K_t}{L_t} \cdot w_t$$

The measure of the set of firms is normalised to unity. In equilibrium, $k_t = 1$ by symmetry. The economy-wide production function therefore becomes

(12) $$Y_t = K_t f(1) \equiv a K_t$$

where $a \equiv f(1) > 0$ is the marginal social rate of return to capital. Using $k_t = 1$, factor prices (5) and (6) become

(13a) $$r = f'(1) \equiv a' \qquad 0 < a' < a$$

(13b) $$\tilde{w}_t = (a - r)\frac{K_t}{L_t}$$

The constant rate of interest *r* measures the marginal private product of capital, whereas the parameter α measure the social returns from capital accumulation. Following the introduction of the balanced-budget transfer scheme, consumption of the different generations is still described by equations similar to (7a)–(7c), where however the wage w_t is replaced by $\tilde{w}_t$ as given by (13b).

In order to assess the effects of the introduction of social security schemes, one must no longer exclusively concentrate on the implications for the long-run growth rate. Transfer programmes affect the profile of consumption and saving over time. Since such transfers modify the pattern of accumulation over time, and since such modifications have *permanent* effects under endogenous growth, it becomes necessary to consider the cumulative impact of social security on capital stock and on output.

The change in capital stock is given by

(14) $$\Delta K_t \equiv K_t - K_{t-1} = Y_t - C_t$$

If we define the growth rate of the capital stock in period t as $g_t \equiv \Delta K_t / K_{t-1}$, then g_t also denotes the rate of growth of the economy (from (12)). In the absence of social security, $b = 0$ and equation (14) gives (see Marini and Scaramozzino, 1996b):

$$g_t = g = \frac{r(2 + r + r - a)}{2 + r(1 - r) - a - r} \tag{15}$$

The growth rate g declines with the subjective rate of time preference ρ and increases with the rate of interest r and with the marginal social product of capital α. Interestingly, the rate of growth of output is independent of the rate of population growth: without a transfer scheme there are no externalities on the saving rate across generations. Population growth, therefore, exerts no influence on capital accumulation and thus on growth. Furthermore, $g>r$: the growth rate in the absence of social security is greater than the marginal private product of capital (see also Saint-Paul, 1992).

When a social security programme is introduced, $b > 0$ and the level of capital stock is given by

$$K_{t+s} = (1 + g)^s [K_{t-1} + (x_s - z)L_{t-1}] \qquad i=0,1,2,... \tag{16}$$

where

$$z = b \cdot \frac{2 + r + r + n + nr}{[(2 + r) - (1 + r)(a - r)](1 + r)}$$

$$x_s = b(r - n) \cdot \frac{(2 + r + n + r + nr)[2 + r(1 - r) - a - r]}{[2 + r - (1 + r)(a - r)]^{s+1}(1 + r)} \cdot$$

$$\cdot [4 + 2r - 2a - r(a + r - r) + n(2 + r - rr - a - r)]^{s-1} \qquad i=0,1,2,...$$

From (16), one can see that capital stock in the presence of positive social security transfers is greater than in their absence if and only if $x_s>z$. The dynamics of output over time can be analysed by considering its growth rate:

$$g_t = \frac{1}{2 + r(1 - r) - a - r} \left\{ r(2 + r + r - a) - b \left[\frac{2 + r + r + n(1 + r)}{1 + r} \right] \frac{L_{t-1}}{K_{t-1}} \right\} \tag{17a}$$

(17b) $$g_{t+i} = \frac{1}{2 + r(1-r) - a - r}\left\{ r(2 + r + r - a) + b(r - n)\frac{(1+r) + (1+n)(1+r)}{(1+r)(1+n)}\frac{L_{t+i-1}}{K_{t+i-1}} \right\}$$

i=1,2,...

From inspection of the growth rates (17a) and (17b) one can see that the growth rate of the economy will fall, on impact, when the social security programme is introduced. The transfer will result in greater consumption by the old and a fall in the rate of capital accumulation and output. However, the long-run effects of social security on capital accumulation depend on its cumulative effects on the capital stock and output. If $r>n$, the growth rate of the economy from period $t+1$ onwards will overshoot its long-run equilibrium value, which is given by equation (15). Since $g>r>n$, the growth rate will thereafter monotonically converge towards the value g. The cumulative effect of social security could well be positive, if the higher growth rate along the transitional dynamic path outweighs the impact fall in growth.

A greater social return to capital accumulation, as measured by the parameter α, makes it more likely that the introduction of the social transfer programme increases long-run capital and output. The intuition for this result is as follows. When introduced, the social security programme reduces savings. Under endogenous growth, this leads to slower capital accumulation. However, as the scheme is implemented in future periods, savings increase, provided $r>n$. This will result in accelerated accumulation and growth. The cumulative effect could well be positive, so that social security can indeed lead to greater output in the long run.

4. Conclusions

Social security unfunded transfers are not necessarily in conflict with growth. The conventional argument against the welfare state is based on presumptions which may not be valid. When the saving behaviour of agents is allowed to affect the rate of growth of the economy, the effects of a transfer programme can be qualitatively different from the case in which only the composition of output is affected.

As pointed out by Atkinson (1995), the verdict on the undesirability of social security has perhaps been reached too precipitously. This paper provides additional reasons as to why "the jury should still stay out". In particular, when the supply side dynamics is modelled

along the lines suggested by the endogenous growth literature, it is possible that properly designed unfunded schemes would promote growth. The reduction in savings when an intergenerational transfer programme is introduced has a negative impact on capital accumulation and output. However, in the long run the saving rate will be greater than in the absence of social security, and this could lead to increased well-being for future generations.

The main policy implication to be derived from our theoretical analysis is that social security may indeed positively contribute to long-run capital accumulation. The terms of the trade-off between present and future generation are thus very different than is usually assumed. The current generation always benefits from the introduction of a transfer programme. In the conventional analysis, all future generations will suffer (unless the economy is dynamically inefficient). By contrast, according to the analysis in the paper a number of intermediate generations might still suffer in terms of lower capital and output, but in the long run future generations might be better off. Clearly, this result has important implications for the debate on equity *versus* efficiency of the social security system.

Rather than dismantling the welfare state altogether, the relevant policy issue might be to find an optimally designed benefit ratio, which is conducive to a positive effect on growth in the long run.

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