THE EFFECTS OF FULLY FUNDED SOCIAL SECURITY ON SAVINGS AND CAPITAL ACCUMULATION

OS EFEITOS DE UM SISTEMA DE SEGURIDADE SOCIAL DO TIPO FULLY FUNDED PARA A POUPANÇA E PARA A ACUMULAÇÃO DE CAPITAL

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Abstract

By using a three period overlapping generations model, in this paper the introduction of a fully funded social security is analyzed along with the study of its effect on savings, capital accumulation, and income.

Keywords: Fully funded social security; Capital accumulation; Overlapping generations model.

Resumo

Utilizando um modelo de gerações superpostas com três períodos, neste artigo analisa-se a adoção de um sistema de seguridade social do tipo *fully funded* e estuda-se o seu efeito sobre a poupança, a acumulação de capital e a renda.

Palavras-chave: Sistema de seguridade social do tipo *fully funded*; Acumulação de capital; Modelo de gerações sobrepostas.

1 INTRODUCTION

In the mid-1970s a sudden improvement in social security in the United States lead some economists, such as Feldstein (1980), to conclude that this change would explain the sharp reduction in private saving rates. The argument is simple: better state pensions represent a disincentive to accumulate savings for retirement. Galasso and Profeta (2002, p. 2) reported that "the size of these unfunded social security system has increased over the last few decades. [...] There has been a wide body of literature on the economics of social security".

One of the main focuses of this literature concerns the effects of social security programs on economic growth. Originally, social security programs were introduced only to provide for retirement income and they were not supposed to affect economic growth. However, as pointed out by Blanchard and Fisher (1989, p. 110), "any program that affects the path of income received by individuals is likely to have an effect on savings and thus on capital accumulation".

Zhang (2003, p. 65) has found that "funded program with earnings independent benefits and unfunded programs all reduce welfare through reducing labour supply, output levels and output growth". In this paper we study the effects of a fully funded program on savings and capital accumulation in a three period overlapping generations model[2]. In the next section, we argue how it gives rise to particular patterns of savings and capital accumulation, however, without producing effects on final income. Section 3 concludes the paper.

2 CAPITAL ACCUMULATION UNDER FULLY FUNDED SOCIAL SECURITY

Blanchard and Fisher (1989) present a model of overlapping generations initially developed by Diamond (1965), built on an earlier work by Samuel-

2 It is shown in the next section that a two period model does not allow us to properly capture the particular patterns of savings and capital accumulation due to the existence of a fully funded social security. Martins (1980) also considers a three period set up.

son (1958). In such a model individuals are assumed to live for two periods. They work only in the first period of life, supplying inelastically one unit of labor and earning a real wage of w_t. They consume part of their first-period income and save the rest to finance their second-period retirement consumption. The saving of the young in period t generates the capital stock that is used to produce output in period $t + 1$ in combination with the labor supplied by the young generation of period $t + 1$.

Firms act competitively and use the constant returns technology $Y_t = F(K_t, L_t)$, where Y_t is the product, K_t is the stock of capital, and L_t is the working force that is equal to N_t, which is the number of individuals born at time t and working in period t. The production function is assumed to satisfy the Inada conditions. Each firm maximizes profits, taking the wage rate, w_t, and the rental rate of capital, r_t, as given. Consider an individual born at time t. His maximization problem is:

$$\begin{aligned} \text{Max} \quad & u(c_{1t}) + (1+\theta)^{-1}u(c_{2t+1}) \\ \text{s.t.} \quad & c_{1t} = w_t - s_t \\ & c_{2t+1} = (1+r_{t+1})s_t \end{aligned} \qquad (1)$$

$$\theta \geq 0, u'(.) > 0, u''(.) < 0$$

Equilibrium in decentralized economy is characterized by:

$$u'(w_t - s_t) = (1+\theta)^{-1}(1+r_{t+1})u'[(1+r_{t+1})s_t] \qquad (2)$$

$$k_{t+1} = (1+n)^{-1}s_t \qquad (3)$$

$$w_t = (k_t) - k_t f'(k_t) \qquad (4)$$

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

Consider now this same individual facing a fully funded system where the pension funds or government raises d_t in contributions in period t from the young, invests the contribution d_t as capital, and pays $b_t = (1 + r_t)d_{t-1}$ to the old, whose contribution was invested in period t - 1. Individual's maximization problem in this case is:

$$\begin{aligned} \text{Max} \quad & u(\hat{c}_{1t}) + (1+\theta)^{-1}u(\hat{c}_{2t+1}) \\ \text{s.t.} \quad & \hat{c}_{1t} = w_t - \hat{s}_t - d_t \\ & \hat{c}_{2t+1} = (1+r_{t+1})(\hat{s}_t + d_t) \end{aligned} \tag{6}$$

where d_t is the contribution to social security and $\hat{s}_t$ is the private saving of a young person in period t. The equilibrium is characterized by:

$$u'[w_t - (\hat{s}_t + d_t)] = (1+\theta)^{-1}(1+r_{t+1})u'[(1+r_{t+1})(\hat{s}_t + d_t)] \tag{7}$$

$$k_{t+1} = (1+n)^{-1}(\hat{s}_t + d_t) \tag{8}$$

Comparison of (2) and (3) with (7) and (8) shows that if k_t is the solution to the first system, it is also the solution to the second. Hence:

$$s_t = \hat{s}_t + d_t \tag{9}$$

The amount that is saved due to the social security, d_t, crowds-out exactly the amount of the private saving without social security, s_t. According to Blanchard and Fisher (1989, p. 111),

> [...] the reason is clear: the social security system provides a rate of return equal to that on private saving so that it is as if the social security system were taking part of each individual's saving and investing that amount itself. The consumer is, however, indifferent to who does the saving, caring only about the rate of return; this means that consumers offset through private savings whatever savings the social security system does on their behalf.

Let us consider now two slightly different versions of the previous models. The main difference is that we assume that individuals live for three periods, working in the first and second and retiring in the third. Without social security, individual born in time t has to solve the following problem:

$$\begin{aligned} \text{Max} \quad & u(c_{1t}) + (1+\theta)^{-1}u(c_{2t+1}) + (1+\theta)^{-2}u(c_{3t+1}) \\ \text{s.t.} \quad & c_{1t} = w_t - s_{1t} \\ & c_{2t+1} = w_{t+1} + (1+r_{t+1})s_{1t} - s_{2t+1} \\ & c_{3t+1} = (1+r_{t+2})s_{2t+1} \end{aligned} \tag{10}$$

The first order conditions to this problem may be written as:

$$u'[w_t - s_t)] = (1+\theta)^{-1}(1+r_{t+1})u'[w_{t+1} + (1+r_{t+1})s_t - s_{2t+1})] \tag{11}$$

$$u'[w_{t+1} + (1+r_{t+1})s_{1t} - s_{2t+1}] = (1+\theta)^{-1}(1+r_{t+2})u'[(1+r_{t+1})s_{2t+1}] \tag{12}$$

In this new set up population at period $t+2$, P_{t+2} is composed of three generations as follows:

$$P_{t+2} = N_{t+2} + N_{t+1} + N_t \tag{13}$$

But the working force at period $t+2$, L_{t+2} is given by:

$$L_{t+2} = N_{t+2} + N_{t+1} \tag{14}$$

where N_t corresponds to that fraction of population which was born at period t and therefore is retired at period t + 2. Population grows at rate n so that:

$$N_{t+i} = (1+n)^i N_t \tag{15}$$

Then the stock of capital in period $t+2$ will be given by:

$$K_{t+2} = s_{1t+1}N_{t+1} + s_{2t+1}N_t \qquad (16)$$

Considering that $K_{t+2} = \dfrac{K_{t+2}}{L_{t+2}}$, expression (16) may be written as:

$$k_{t+2} = (2+n)^{-1}s_{1t+1} + [(1+n)(2+n)]^{-1}\, s_{2t+1} \qquad (17)$$

The equilibrium is characterized by equations (11), (12), (17) plus (4) and (5). Considering the fully funded social security individual born at time *t* one has to solve the following problem:

$$\begin{aligned} \text{Max} \quad & u(\hat{c}_{1t}) + (1+\theta)^{-1}u(\hat{c}_{2t+1}) + (1+\theta)^{-2}u(\hat{c}_{3t+1}) \\ \text{s.t.} \quad & \hat{c}_{1t} = w_t - \hat{s}_{1t} - d_{1t} \\ & \hat{c}_{2t+1} = w_{t+1} + (1+r_{t+1})\hat{s}_{1t} - \hat{s}_{2t+1} - d_{2t+1} \\ & \hat{c}_{3t+2} = (1+r_{t+2})[(1+r_{t+1})d_{1t} + \hat{s}_{2t+1} + d_{2t+1} \end{aligned} \qquad (18)$$

where d_{1t} is the contribution made in period, t, d_{2t+1} is the contribution made in period $t+1$, s_{1t} is the private saving in period t, and $\hat{s}_{2t+1}$ is the private saving in period $t+1$. Note the main difference between problems (18) and (10). In problem (10), savings in period t, s_{1t}, are transferred to period $t+1$ and they can be saved again through $\hat{s}_{2t+1}$ or consumed. In problem (18) the private saving $\hat{s}_{1t}$ in period t has this same feature but the contribution in this period, d_{1t} has to be saved until the third period $t+2$. This implies that it is capitalized twice. From the point of view of individuals, this means that the contribution d_{1t} is returned with interest of time $t+1$ and time $t+2$. From the point of view of capital accumulation, this means that the contribution d_{1t} remains as capital during two periods. The first order condition to this problem may be written as:

$$u'[w_t - (\hat{s}_{1t} + d_{1t})] = (1+\theta)^{-1}(1+r_{t+1})u'[w_{t+1} + (1+r_{t+1})\,\hat{s}_{1t} - d_{2t+1}\hat{s}_{2t+1}] \qquad (19)$$

$$\begin{aligned} & u'[w_{t+1} + (1+r_{t+1})\hat{s}_{1t} - d_{2t+1} - \hat{s}_{2t+1}] = \\ & (1+\theta)^{-1}(1+r_{t+2})u'\{[1+r_{t+2}][(1+r_{t+1})\hat{s}_{1t} + \hat{s}_{2t+1} + d_{2t+1}]\} \end{aligned} \qquad (20)$$

Comparing system (12)-(13) with (19)-(20) we conclude that the first order conditions to problems (10) and (18) are the same. This allows us to conclude that[3]:

$$s_{1t} = \hat{s}_{1t} + d_{1t} \tag{21}$$

$$s_{2t+1} = \hat{s}_{2t+1} + d_{2t+1} + (1 + r_{t+1})d_{1t+1} \tag{22}$$

The amount that is saved due to the social security crowds out exactly the amount of the private saving without social security only in period t. In period $t + 1$ the existence of a fully funded social security implies a different saving behavior. It was expected that expression (22) would run as:

$$s_{2t+1} = \hat{s}_{2t+1} + d_{2t+1} \tag{22a}$$

The individual's maximizing behavior implies that private savings with fully funded social security in period $t + 1$ is diminished not only due to the contribution in this period but also to the capitalized contribution in period t. This is a different dynamic behavior for savings from that obtained when there is no social security.

From the viewpoint of capital accumulation a different pattern is also generated due to the existence of a fully funded social security. Without social security, private savings of the first period s_{1t} can be either consumed or saved in period $t + 1$. With social security, private savings, $\hat{s}_{1t}$, mimic this behavior but the contribution to social security, d_{1t}, can be consumed only in the last period. Hence, this contribution will remain as capital also during two periods, which yields:

$$\hat{K}_{t+2} = (\hat{s}_{1t+1} + d_{1t+1})N_{t+1} + (\hat{s}_{2t+1} + d_{2t+1})N_t + (1 + r_{t+1})d_{1t}N_t \tag{23}$$

3 What is important to the maximizing individual is to keep the same pattern of consumption in both situations, since it is optimal. Hence expressions (21) and (22) are obtained considering that $s_{1t} = s_{1t}$, $s_{2t+1} = s_{2t+1}$ and $s_{3t+2} = s_{3t+2}$. Another way of generating expressions (21) and (22) is to consider utility functions such as Cobb-Douglas or constant relative risk aversion.

In terms of capital per worker this expression may be rewritten as:

$$\hat{k}_{t+2} = (2+n)^{-1}(\hat{s}_{1t+1} + d_{1t+1}) + [(1+n)(2+n)]^{-1}[(\hat{s}_{2t+1} + d_{2t+1}) + (1+r_{t+1})d_{1t}] \quad (24)$$

In order to compare expression (24) and (17) it is useful to rewrite the latter expression considering (21) and (22). This yields:

$$k_{t+2} = (2+n)^{-1}(\hat{s}_{1t} + d_{1t}) + [(1+n)(2+n)]^{-1}[(\hat{s}_{2t+1} + d_{2t+1}) + (1+r_{t+1})d_{1t}] \quad (25)$$

From (25) and (24), it is possible to conclude that fully funded social security has no impact on economic growth. Despite the fact the fully funded social security generates different patterns of private savings and capital accumulation, the effects on these variables cancel out.

3 CONCLUSION

In this paper we analyze if a fully funded social security has impact on savings and capital accumulation. The general view in the literature is that it has a negative impact. Here, by using a three period overlapping generations model, we show that fully funded social security displays particular patterns of savings and capital accumulation. However, there is no effect on final income, since the positive effect on capital accumulation is exactly canceled out by the negative effect on private savings.

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