

# ***Are PAYG and FF Pension Schemes Equivalent Systems? Macroeconomic Considerations in the Light of Alternative Economic Theories***<sup>\*</sup>

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**ABSTRACT** *The dominant opinion is that Fully Funded (FF) pension schemes would better prepare the community to the occurring demographic mutations (solvency hypothesis). Many critics of FF schemes argue that they would meet problems similar to those that may create financial difficulties to Pay-as-you-go (PAYG) schemes (equivalence hypothesis). More specifically, they maintain that, whereas in a PAYG scheme a fall in the working population with respect to an increasing elder population would affect the financial source of pension transfers, by the same token in a FF scheme a diminished number of young savers would make difficult the absorption of the capital assets accumulated by the pension funds. This paper assesses the mainstream claim and its criticism in the light of the neoclassical foundations of the dominant view. It will emerge that the criticism is partially correct, but this conclusion is drawn through a more complex road that does not bypass the theoretical justifications of the mainstream claim. The capital theory critique is shown to be relevant in this respect.*

## **1. Introduction**

The demographic developments leading to ageing societies pose a significant challenge to both developed and less-developed countries. In this paper we discuss a thesis sometimes put forth by non-mainstream economists, namely that, when closely scrutinized, Pay-as-you-go and Fully

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Funded schemes (hereafter *PAYG* and *FF* schemes) would face the same troubles with respect to the demographic challenges. The intuitive argument is that since the support of the economically non-active old must come from the active young, whatever the institutional form of the pension system, the economic substance of the situation is essentially the same in the *PAYG* and the *FF* schemes. The two systems therefore face the same problems vis-à-vis the ageing process. This ‘equivalence hypothesis’, however, fails to discuss the mainstream claim that a *FF* scheme is—in theory, if not entirely in practice—immune from ageing shocks, that it is always solvent—the ‘solvency hypothesis’.

In approaching the comparison of the two hypothesis, it should be appreciated that it is not methodologically satisfactory to presume that a community could freely select one of the two pension schemes on the basis of a simple comparison of their respective advantages (with respect to demographic changes or, more typically, with regard to their respective rate of return on contributions). In particular, the *creation* of a new system raises microeconomic and macroeconomic questions about which economic theory is not unanimous. I have dealt elsewhere with these questions (Cesaratto 2005 Chapters 3 and 4; 2006a), and some of those arguments are recalled below. The comparison of the alleged advantages of the two competing schemes is, however, part of the game in controversy over pensions, so for the sake of the argument, in this paper I focus upon the neoclassical thesis that a *running FF* scheme is superior to *PAYG* in facing an ageing society.

Sections 2 and 3 describe the operation of a *FF* scheme. Sections 4, 5 and 6 expound and evaluate the mainstream solvency hypothesis. Section 7 inspects the equivalence hypothesis. Section 8 uses a questionable equation proposed by Eatwell (2003) to show how misleading the equivalence hypothesis can be, and to discuss a little further in Eatwell’s context the possible outcomes of different approaches to pension reform.

## 2. A Fully-operational FF Scheme

An *FF* scheme is an old-age insurance plan, generally but not necessarily privately managed, in which the reserves are invested in private assets representative of private capital stock. Such a plan has two aspects. The first is indistinguishable from a saving plan—the individual accumulation of resources for old age. The second belongs to the insurance domain; given that the duration of the retirement period is uncertain, this risk is pooled among the retirees. In this paper we are mainly concerned with the first aspect. For the sake of simplicity, we consider a stationary economy with two identical overlapping generations in which, by definition, the old all have the same survival rate, so that the insurance side can be neglected.

At the beginning of each period the old generation lends the (gross) saving accumulated in youth to the Pension Funds [hereafter *PFs*] that, in turn, lend them to the firms in exchange for financial assets. If this helps the reader, (s)he may imagine that the retirees own the capital stock directly; the *PFs*. play indeed a passive role in this paper, as mere buffers between generations. Let the ownership of these financial assets, representing the capital stock  $K_t$ , be uniformly distributed among the retirees so that each lends  $k_t$ . Call  $a_t$  the corresponding value of the per capita financial assets so that  $a_t = k_t$ , with  $a_t < w_t$ .<sup>1</sup> At the beginning of the period the firms that have borrowed the capital stock hire the young workers. At the end of the period the (gross)<sup>2</sup> per capita product  $y_t$  is distributed as follows (in per capita terms): the replacement of the capital goods consumed in the production process,  $\delta k_t$ , where  $\delta$  is the depreciation rate; the wage  $w_t$  paid to

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<sup>1</sup> This is plausible if the ‘periods’ last 30 or 40 years; see, for example, Auerbach & Kotlikoff (1995, p. 91). Alternatively, we may suppose a corn economy with only circulating capital, in which the periods coincide with the calendar year.

<sup>2</sup> Wrongly indicated as net in Cesaratto (2005, p.93).

the workers; and the return  $r_t k_t$  on the capital advanced, where  $r_t$  is the interest rate. In summation:  $y_t = \delta k_t + w_t + r_t k_t$ . Workers use their wage for two purposes: they consume  $c_t^w$ ; and through the *PFs* they buy the assets  $a_t$  from the old. In summation:  $w_t = c_t^w + a_t$ . Finally, the retirees consume all their financial resources and die. In summation:  $c_t^r = r_t k_t + a_t$ .

In this economy the capital stock remains unchanged from one period to the next. Indeed there is no net saving since the value of the assets bought by the workers is precisely equal to that sold by the retirees; in other words, the savings of the working generation are precisely matched by the dissaving of the retired generation. This description of an *FF* scheme can easily be extended to a steadily growing economy and to a multiplicity of generations. A capitalization scheme might be defined as a ‘buy-as-you-go’ system. As just described, an *existing FF* scheme is, so to speak, ‘theoretically neutral’, in the sense that we have not touched upon the process by which it is created, i.e. how the capital stock owned by the retirees is accumulated—an issue that *is* theory dependent, as we shall see.

An *FF* scheme thus works like a sort of relay race between generations in which real reserves are the baton. A proper *FF* programme, then, implies the existence of financial reserves held in assets that represent ownership shares in the capital stock. A scheme in which the *PFs* own government bonds is not, on this definition, a genuine *FF* scheme (Cesaratto 2005, pp.12-14, 151-153). The test of a pension reform aimed at the creation of an *FF* scheme is, therefore, whether it leads to the formation of new capital and corresponding financial reserves. According to neoclassical principles the capital stock increases if there is an increase in the supply of savings. But this proposition is erroneous from a classical–Keynesian point of view, which rejects the conventional causal relation between saving and investment. Quite the opposite, the attempt to increase savings may have the ultimate effect of decreasing the capital stock in use. Let us,

however, focus here on the mainstream claim about the solvency of a *FF* scheme examining the neoclassical description of this system.

### 3. The Neoclassical View of a *FF* scheme

A simple example presented by Auerbach & Kotlikoff (1995, pp. 90–92; A & K hereafter) and reproduced in Table 1 is useful to introduce the neoclassical view of *FF* schemes. A & K adopt a Cobb–Douglas production function, in per capita terms:  $y_t = A_t k_t^\beta$  ( $y_t$  represents here *net* output). They also assume a corn economy,<sup>3</sup> but let us consider the relevance of this assumption only later and proceed as if we were in a more realistic economy. In the calculations  $A_t = 10$  and  $\beta = 0.3$ . The economy has a stationary population with two overlapping generations of  $N = 100$  individuals each. Workers save half of their wage. In the stationary long run equilibrium the retirees own the capital stock, 5.987 units each (so the value of the capital stock is 598.7 units) that, through the *PFs*, they lend to the firms receiving financial assets.<sup>4</sup> The companies hire the young workers, to whom they pay at the end of the period a salary equal, in equilibrium, to the marginal product of labour. Net per-capital output is  $w_t + rk_t$  (that is  $17.106 = 11.98 + 0.857 \cdot 5.987$ ), while gross per-capita output is  $w_t + rk_t + k_t$  (that is  $17.106 + 5.987$ ). At the end of their retirement period the retirees receive interest payments equal, in equilibrium, to the marginal product of capital, and sell through the *PFs* their capital assets to the younger generation (which is now retiring). In the final part of their life the old use all the proceeds to buy consumption goods, eat them and then pass away. The per capita consumption of the retirees, 11.119 units, is precisely equal to the sum of the value of the capital stock, 5.987 units, plus the interest on it calculated at the interest rate of 0.857.

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<sup>3</sup> This is explicitly assumed in their textbook (1995, p.47), but not in their 1987 essay.

<sup>4</sup> In this long run equilibrium these financial assets can be bonds or equities (A & K 1987, p.16).

Table 1 Simulation of the secular equilibrium of a neoclassical stationary economy with a *FF* scheme

Period	Workers	Retirees	Capital stock	Per capita capital	Per capita income	Wage rate	Interest rate	Per-cap. consumption		Net saving
								workers	retirees	
1	100	100	598.7	5.987	17.106	11.975	0.857	5.987	11.119	0
2	100	100	598.7	5.987	17.106	11.975	0.857	5.987	11.119	0
	...	...	...	...	...	...	...	...	...	...
Secular equilibrium	100	100	598.7	5.987	17.106	11.975	0.857	5.987	11.119	0

Source: Auerbach and Kotlikoff (1995)

Orthodox economists explain the past investment decisions that gave rise to the existing capital stock in terms of marginalist principles, according to which gross investment depends on saving. When dealing with an *FF* scheme, conventional economists have two models in mind. On the saving supply-side the reference model is Modigliani's life-cycle theory (Modigliani, 1986), which is an elaboration of Keynes's 'foresight' motive of saving decisions (Keynes, 1936, p. 107). On the saving demand-side, the reference point is the marginalist causal relationship between savings and investment found, for instance, by Solow (1956) in the conventional neoclassical growth model.

The capital stock, heterogeneous in nature, must of course be measured according to some homogeneous standard. According to the marginalist approach, all physical capital goods have the same economic origin, which lies precisely in the consumption goods whose enjoyment individuals decide to postpone to the future. As Garegnani effectively sums up:

Beneath the variety and, at times, the vagueness of the indications given in this respect by the marginalist theorists, there lies a common idea. The capital goods, and hence the quantity of capital they represent, result from investment; since investment is seen as the demand for

savings, ‘capital’ emerges as something which is homogeneous with saving. Its natural unit is therefore the same as we would use for saving, i.e. some composite unit of consumption goods capable of measuring the subjective satisfactions from which (according to these theorists) consumers abstain when they save. ‘Capital’ thus appears as past savings, which are, so to speak, ‘incorporated’ in the capital goods, existing at a given instant of time. As a result of the productive consumption of those goods, these past savings will periodically re-emerge in a ‘free’ form and can be re-incorporated in capital goods of the same or of different kinds; alternatively, they can be turned back into consumption. (Garegnani, 1983, p. 33)

This is the fundamental logic underlying *FF* schemes. By selling the assets they possess to the fully employed young, the old (also previously fully employed) are able to recover the consumption goods ‘crystallized’ in the capital stock, while the constancy of this ‘consumption fund’ is assured by the renewed abstention from consumption of the present workers. In a stationary economy, the dissaving of the retirees is precisely matched by the saving of the workers so that the amount of consumption goods ‘incorporated’ in the capital stock remains constant. Should the number of ‘young’ workers fall and the old generation’s dissaving not be matched by the young’s saving, then part of the past savings ‘can be turned back into consumption’ instead of being ‘re-incorporated in capital goods’. This reasoning provides the key to the neoclassical solvency thesis.

The reasoning suggests that a successful *FF* reform has three possible advantages:

- (a) By increasing the *number* of savers and the per capita level of saving, it helps to solve the old-age problem for a larger number of individuals.
- (b) By increasing the saving supply and the capital stock, it raises the present per capita capital endowment, preparing the economy to deal with the allegedly pending demographic shocks, as shown below. It is important to note that, *ceteris paribus*, the rise in the capital–

*labour coefficient takes place only in the take-off phase of the PFs, that is, when there are net saving decisions in the economy.* Once a new regime is established with a stationary population or there is a steadily growing economy, the saving decisions of workers are matched, on average, by the dissaving decisions of the old, in the relay race described in which the stock of capital assets held by the *PFs* is the baton.

(c) In case of a demographic shock, the real nature of the financial reserves assure the ‘solvency’ of the scheme. This makes clear why a scheme based on the accumulation of government bonds cannot be described as Fully Funded.

Let us now elaborate this last point.

#### **4. The Neoclassical Argument on the Robustness of an *FF* Scheme vis-à-vis a Demographic Shock**

According to the dominant view, pending demographic changes pose a challenge to *PAYG*. This is seen as an ‘intergenerational conflict’, in so far as the number of retirees is growing more quickly than the working-age population that will support them. A frequently heard criticism of capitalization reform is that, at the end of the day, a fully operating *FF* scheme, as described in Section 1, works in a way that is not dissimilar to that of a *PAYG* scheme, that is, through a transfer of mandatory contributions from the active to the retired generation. This is the position held by non-orthodox economists such as Eatwell (2003), Sawyer (2003), Baker & Kar (2003), Cadarso & Febrero (2006, section I.2.2.1).<sup>5</sup> Two leading Sraffian economists, for instance, have written:

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<sup>5</sup> Some Keynesian (e.g. Eisner, 1998) and welfare economists are of a similar opinion (e.g. Barr 2000, Pizzuti 1995).



In the political discussion on pension reforms ... the fact is often overlooked that, whatever pension system is in place, the substance of the question consists of the transfer of part of current real income from those who have produced it to the old.... Depending on the ruling scheme (private or public, fully-funded or *PAYG*, defined benefit or defined contribution) the financial mechanism will change according to which such transfer is operated. ... However, given aggregate pension obligations and output, the chosen transfer method is by no means relevant to the real sustainability and no change in this method ... is able to enhance it. (De Vivo & Pivetti, 2004, my translation)

Earlier we referred to this stance as the ‘equivalence hypothesis’. If this argument were valid, conventional economists could not argue that an *FF* scheme protects the pension system from exogenous demographic shocks, and an *FF* reform would prove useless, at least from this point of view. If it is not, the critique of *FF* reforms should point in other directions.

Let us proceed as follows. We shall first consider an example that shows how an economy, supposedly working on neoclassical principles and in which the old possess the capital stock through *PFs*, adjusts to a demographic shock.<sup>6</sup> We shall then examine two objections to the solvency hypothesis.

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<sup>6</sup> In this paper we shall focus on one demographic development, lower fertility, that for the sake of the argument, we assume without much discussion as leading to a higher economic dependency ratio, retirees/workers. The other demographic development is increasing longevity (for the full discussion see Cesaratto, 2005, pp.114-117, and Cadarso & Febrero, 2006, section I.2.3.b). In the short run enhanced life expectancy may be dealt with by a reduction in the annuities that retirees receive from the pension funds. This would follow a policy by the funds of spreading the selling of the retirees’ equities over longer time spans so as to distribute the proceeds over the entire life of the pensioners. As a result, initially, the retirees’ consumption will fall. This implies that there are net savings in the economy since the dissaving of the retirees falls below the saving supplied by the workers. In practice, at the beginning, the young would find a lower amount of ‘existing’ assets offered on the market, so that part of their saving supply would be translated, according to the neoclassical principles, into net capital accumulation. Alternatively, according to conventional theory, an increased retirement age can prevent the need for an initial reduction of the annuity. In this case, the supply of both labour and capital would increase. Since workers retire later, the labour

## 5. Demographic Shock

We assume that a demographic shock, a change in fertility, negatively affects employment. It must be emphasized that this is a conventional way of proceeding that is adopted here for the sake of the argument. In this hypothesis, the mainstream view of the advantages of an *FF* scheme are aptly summarized by Ceprini & Modigliani (1998, p. 282; my translation): ‘should population begin to decline, determining an unfavourable ratio between retirees and workers, the system will not become insolvent because pensions would be paid by selling part of the financial reserves accumulated by the fund’.<sup>7</sup>

Let us spell out the economic mechanisms on which this argument is based. In order to identify these mechanisms, consider again the numerical example of Table 1. In this economy the capital stock is possessed by the retirees through the *PFs*. Taking inspiration from another example presented by A & K (1995, p. 101), concerning the effects of an epidemic, suppose a baby bust in which the retirement of the baby-boom generation leaves the economy with a lower number of workers.

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supply increases; while in the additional working years they don’t have to sell their assets to sustain their retirement consumption. In the new secular equilibrium both labour and the capital stock rise. If workers save also in the additional period of work, the final capital stock would, of course, be even larger.

<sup>7</sup> See also these passages from a World Bank discussion paper: ‘An alternative approach to secure future pensions consists in covering the decline in labour, which lies at the root of the problem, through an increase in capital available for funding pension income. The higher stock of assets for pension funding, held domestically or abroad, would have two beneficial effects for the pension system: overall pension income would rise, generating scope to reduce pensions from pay-as-you-go systems. *In addition, the accumulated assets could be depleted to some extent when large cohorts retire.* The effectiveness of this approach to pension reform hinges on the increase in the stock of assets underlying the pension system. This increase generally requires higher domestic saving’. This report goes on to note that the same function cannot be absolved by a stock of government bonds: ‘Conversely, if the additional private savings serve merely to finance government deficit, aggregate saving will not rise and there will be no augmentation of the asset stock to finance future pension needs’ (Rother et al., 2003, pp. 8–9; emphasis added).

For the sake of the argument, assume that the economic life of the capital stock is equal to that of the activity (and retirement) of workers, that is that at the end of each period the capital stock recovers its *liquid* form. The assumption of a corn economy turns now didactically useful. As seen in the long run equilibrium of Table 1, at the end of each period the *PFs* sell the capital assets possessed by the retirees to the younger generation, so that the former can fully finance their consumption and the capital stock does not change from period to period. In our corn economy we may presume that the financial assets held by the retirees are constituted by bonds of the same one-period duration of the physical capital.

In the example shown in Table 2, it is supposed that a baby bust reduces by one-tenth the young population so that in period 1 the number of workers becomes 90.<sup>8</sup> At the beginning of period 1 the firms intend to hire the new generation of workers that, however, is now smaller. As a result, on the one hand, in the labour market the equilibrium real wage tends to increase and, given the supply of labour and capital (respectively, 90 workers and 598.7 units of capital), becomes equal to 12.36 units. On the other hand, the new capital–labour ratio is higher (6.653 against the pre-baby bust value of 5.987) since the abundance of the capital supply (that the *PFs* have received from workers at the end of period 0) at the initial  $k$  (5.987) induces a fall of the interest rate and the adoption of a more capital-intensive technique. To sum up, as a result of the new relative scarcity of factors (labour is now scarcer relative to capital), there are new long-period levels of the real wage, which is higher, and of the interest rate, which is lower.<sup>9</sup>

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<sup>8</sup> For the sake of simplicity, in this example, and in the subsequent, we shall assume that the propensity to save remains constant in spite of the changes occurring in the wage and interest rate. This is a limitation that further research should overcome. It can be reasonably assumed that this would not change the main conclusions reached in this preliminary exploration.

<sup>9</sup> We adopt here the traditional distinction between long-period and secular positions (Marshall, 1920, p. 315). In a neoclassical context, a long-period equilibrium is that determined for a given factor supply. A

*Table 2 - Simulation of the adjustment to a baby bust in a neoclassical stationary economy with a FF scheme*

Period	Workers.	K stock	Per-cap K	Total (net) income	Wage rate	Interest rate	Per-cap. consumption		Net saving
							Workers	retirees	
Pre-baby bust secular equilibrium	100	598.74	5.987	1710.69	11.97	0.857	5.99	11.12	0.00
Baby bust (-10%)									
0	90	598.74	6.653	1589.06	12.36	0.796	6.18	10.75	-42.57
1	90	556.17	6.180	1554.29	12.09	0.838	6.04	11.36	-12.17
2	90	544.00	6.044	1544.01	12.01	0.851	6.00	11.19	-3.60
3	90	540.40	6.004	1540.94	11.99	0.855	5.99	11.14	-1.08
4	90	539.33	5.993	1540.02	11.98	0.857	5.99	11.13	-0.32
5	90	539.01	5.989	1539.74	11.98	0.857	5.99	11.12	-0.10
6	90	538.91	5.988	1539.66	11.98	0.857	5.99	11.12	-0.03
7	90	538.88	5.988	1539.63	11.97	0.857	5.99	11.12	-0.01
8	90	538.87	5.987	1539.63	11.97	0.857	5.99	11.12	0
...	...	...	...	...	...	...	...	...	...
New secular equilibrium	90	538.87	5.987	1539.62	11.97	0.857	5.99	11.12	0

*Source:* Auerbach and Kotlikoff  
(1995)

secular equilibrium is characterized by the secular or very long-run change in factor supply. In the example presented in Table 2, each period (each row) can be taken as a long-period equilibrium defined for given or slowly changing endowments of capital and labour. In the example we have a sequence of long-period positions as a consequence of the change in the capital stock that, however, may be said to change slowly considering the generation-long length of our 'periods'. The secular position is reached when the capital stock has attained its secular (here stationary) level.

At the end of period 1, the *PFs* have recovered the capital (598.7 units) lent at the beginning of the period, on behalf of the retirees, to the corporations – capital which *ex hypothesis* has returned to liquid form – and can return it to the retirees who consume it and die. Eventually, the old generation's per capita consumption is 10.75 (equal to 5.987 units of capital plus the returns on the investment), which is less than in the pre-baby bust age (11.12) because of the fall in the marginal productivity of capital. However, the possibility of reconverting all the real reserves into consumption goods has impeded an even greater fall.

Also at the end of the period 1, the wage bill is 1112.3 (that is  $12.36 \times 90$ ), and the workers' saving supply, at the given marginal propensity to save  $\alpha = 0.5$  is equal to 556.17. Although the wage rate is now higher (since labour has become scarcer), the saving supply is now lower than in the pre-baby bust period because the number of workers and the gross national product are lower. The *PFs* are now able to collect only 556.17 units from the new generation, so that the capital stock at the beginning of period 2 is 42.57 units, lower than in period 1. In other words, at the end of period 1 the dissaving of the retirees (598.7) is *not* matched by an equal saving supply from workers, so that the amount of consumption goods embodied in the capital stock cannot stay constant (as in the stationary economy of Table 1). This part of the capital stock has been reconverted, so to speak, into consumption goods. With reference to our hypothesis according to which all the capital stock regains its 'liquid' form at the end of each period, part of it is not reproduced and consumption goods are produced instead of replacement capital goods. Observe indeed that in period 1 total consumption is 1631.63 (that is the retirees' consumption, which is  $10.75 \times 100$ , plus the workers' consumption, which is  $6.18 \times 90$ ), higher than the current *net* product, which is 1589.06. The difference, equal to 42.57, corresponds precisely to that part of the *gross* product that is diverted from the production of replacement capital goods to the production of consumption goods. The new relative scarcity of capital, due to the lower saving supply from

the diminished number of young workers, in period 2, and in those immediately following, induces a rise in the interest rate and the adoption of less capital-intensive techniques. In period 3 and in the following periods, the saving supply from the younger generations continues to be insufficient to preserve the capital stock, so that it continues to shrink. The secular stationary equilibrium is progressively restored— characterised by a lower activity level, but with the same value of  $w$ ,  $r$  and  $k$ .

Yet, in a more realistic setting in which the capital stock only partially recover its liquid form the retirees are not able to realize the entire value of the capital stock they possess (598.7), since the saving supplied by the young generation is too low (556.17). We may nonetheless conceive of that, in principle, they are still able to recover the missing 42.57 units by eating up part of the capital stock within the limits in which a corresponding part of the capital stock has regained its liquid form, seemingly by using the liquidity that would normally be put aside as depreciation.

Note that in this process of adaptation of the economy to the baby bust, two mechanisms are at work:

- (i) the variability of techniques according to neoclassical principles allows any capital supply to be absorbed by the economy. In the example, the capital stock first becomes abundant with respect to the diminished set of workers and is offered at a lower interest rate, so that the per capita capital endowment temporarily rises. Later it becomes relatively scarcer and the interest rate tends to rise.
- (ii) in the example the retirees never suffer losses in their ‘capital account’: should the saving supply from the new generations be insufficient to buy the capital assets accumulated when young, they have, so to speak, the opportunity of eating up the capital stock which is not bought by the new generation. As seen in Table 2, as a result of the change in the relative scarcity of productive factors, although the real wage is now higher,

gross savings made by the workers out of their wages at the given marginal propensity to save may well be insufficient to absorb the existing capital assets offered by the retirees. However, according to the theory under examination, the retirees may consume part of their savings ‘crystallized’ in the capital stock—savings that, so to speak, recover their original nature as consumption goods—so that the supply of capital assets tends to correspond to the saving decisions of the workers. In this way the retirees realize their target consumption, partly by selling their capital assets to the new generation, and partly by ‘consuming’ the capital stock (that is by consuming the depreciation funds).<sup>10</sup> In both cases the retirees are disinvesting their savings, but only in the second case is there a real disinvestment from the point of view of the community. In the first case there is only a change in the pattern of ownership of the capital assets; in the second, depreciation funds are used for consumption and not for replacement.<sup>11</sup>

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<sup>10</sup> The rise of the capital–labour ratio determines a fall in the marginal product of capital below its secular level. For this reason, at the beginning of the transition, retirees may suffer a fall in their per capita consumption.

<sup>11</sup> The relative importance of the two mechanisms depends on the factors’ elasticity of substitution ( $e_s$ ), which measures the variation in the relative quantity of factors used in production ( $K/N$ ) with respect to a change in their relative price ( $r/w$ ). With a Cobb–Douglas production function, as in the example,  $e_s = 1$ ; this implies that the shares of net output that go to labour and capital do not vary when factor supply and prices change. When  $e_s = 0$ , there is no scope for factor substitution; that is, the production function has fixed coefficients; in this case all the adjustments must rely on process (ii). When  $e_s < 1$ , there is a relatively low substitutability between  $N$  and  $K$  and the wage rate rises more than proportionally to the fall in the labour supply. In this case the output share that goes to labour would rise and, in A & K’s example, in period 1 the supply of saving out of wages, given the propensity to save, would fall less than in the Cobb–Douglas case, and the adjustment relies less heavily on mechanism (ii).

Over many long-period equilibria this sequence of events determines a progressive contraction of the capital stock and, given the labour supply, also of the per capita capital endowment, so that the initial magnitudes relative to secular stationary equilibrium are eventually restored. Neoclassical economists can thus conclude that an initial successful FF reform—one that is successful in raising the saving rate—would prepare the economy for a demographic shock.<sup>12</sup> On this basis Richard Musgrave (1981, p. 98) could refute the criticism that, in the end, an *FF* and a *PAYG* programme would suffer from the same problems:

Various objections have been raised against the reserve [FF] approach, some more justified than others. The reserve approach, it has been argued, is a fiction. Once the system is underway, the withdrawal by the older generation comes to be matched by contributions from the younger. This being the case, the system simply involves a transfer from the latter to the former, reducing it to a pay-as-you-go approach. This conclusion is incorrect because it overlooks the fact that the reserve accumulation of the first generation has added to the capital stock, so that its withdrawal will not reduce the level of income enjoyed by the next

Two groups of arguments can be envisaged against the neoclassical adjustment mechanism.

The first is related to the difficulties surrounding processes (i) and (ii) and concerns capital theory.

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<sup>12</sup> In this Section we examined the case of a one-off decline of a given working population. If we consider instead a decline in the rate of growth of the labour force, the standard neoclassical model of economic growth suggests that this leads, *ceteris paribus*, to a higher per capita capital endowment and income, which has been dubbed the ‘capital intensity effect’ (Elmendorf & Sheiner, 2000, p. 60). While in a stationary economy struck by a baby bust the capital–labour ratio rises only temporarily, to return later to its secular level, if we face a persistent fall in the rate of growth of the labour force—which may even become negative—then the rise will be persistent. Also in this case, the failure to replace part of the capital stock allows the old to reconvert the unreplaced capital goods into consumption goods, which makes up for the failure to sell part of the capital assets to the steadily declining number of young. As Samuelson (1975, p. 533) put it: ‘a declining population would yield higher per capita income as people can live off the “narrowing” of capital’. As Samuelson notes, the ‘fastest feasible decline’ is given by the rate of replacement, which constitutes ‘the maximum rate at which capital can be milked’ (ibid., p. 534).



The second is the idea that, were the economy of Table 2 endowed with a *PAYG* scheme, the final outcome would not have fundamentally changed. This second objection is an elaboration of the equivalence hypothesis.

## 6. Objections Related to Capital Theory

Beginning with the first objection, a puzzling aspect of the adjustment process concerns mechanism (ii) whereby the economy contracts the capital stock and preserves the retirees' consumption.

(a) To begin with, the transformation of the capital stock back to consumption goods may only take place by declining to replace part of the capital goods that have worn out in the course of time. Disinvestment is therefore only possible for that part of the capital stock that in each period, to use Wicksell's expression, becomes 'free' and, in this capacity, susceptible to be reinvested in the same or other capital goods, or 'turned back into consumption' (see Garegnani, 1983, pp. 33, 43–44) by using the corresponding depreciation funds. In the example of table 2, we assumed that 100 per cent of the capital stock reverts to liquid form at the end of each period. Even if the replacement rate in the first period were only 7.1 per cent (the result of 42.57 *divided by* 598.7),<sup>13</sup> the irreversibility of investment in fixed capital would not have posed an obstacle, since the corporations could return enough liquidity, taken from the depreciation funds, to the *PFs* and write off 7.1 per cent of the capital stock. They will not order 42.57 of replacement capital goods, demand which is replaced by a corresponding retirees' order of consumption good.

What works smoothly in theory, however, may not necessarily work in practice. This seems at the root of the sometimes-heard apprehension that the retirement of the baby-boom generation will

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<sup>13</sup> A replacement rate of 7.1 per cent is not particularly high, especially since we consider 'periods' of 30 or 40 years.

spawn a stock market slump. This scenario has become known as the peril of an ‘asset market meltdown’ (Poterba, 1997).<sup>14</sup>

Mainstream economists suggest that this bleak perspective might be mitigated by encouraging foreign investment in southern countries, rich in labour and poor in capital, and hence a natural outlet for pension savings. However, in the case of foreign investment, no less than in the domestic case, the idea that domestic saving may find an automatic *debouche* in investment in southern countries depends on the neoclassical saving–investment relationship, which the Keynesian and Sraffian critiques have shown as flawed (Dalziel & Harcourt, 1997; Cesaratto, pp.212-220, Chapter 6; 2006b).

(b) Note also that the possibility of changing the physical shape of the capital stock, that necessarily follows the changes in the capital–labour ratio according to the neoclassical mechanisms described in (i), also implies that part of the capital stock in each period becomes ‘free’ and can, therefore, assume the different technical shape relative to the new technique.

(c) Finally, as pointed out by Garegnani (1983, p. 44) on the basis of an observation by Wicksell (1934, II, pp. 192–3), the use of ‘free’ or ‘liquid’ capital to demand consumption goods instead of capital goods, contemplated by the cases (b) and (c), must be anticipated by the producers of both kinds of commodities who must convert the resources released from use in the capital goods sector to the production of additional consumption goods.

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<sup>14</sup> Two OECD economists have, for instance, argued that: The large cohort of ‘baby-boomers’ is currently in its high-earning-saving years, swelling total private savings. As this cohort moves into retirement in the early decades of the twenty-first century, it will start to run down savings and will be replaced by significantly smaller cohorts. It is generally, though not universally expected that private savings will tend to fall, possibly steeply. The effects of policies that would tend to increase private savings, *ceteris paribus*, need to be assessed against this backdrop of a possibly sustained decline when ageing gets under way. (Kohl & O’Brien, 1998, p. 9).

With regard to mechanism (i), it can be observed that this side of the adjustment relies on the neoclassical factor substitution mechanisms whereby a change in the relative scarcity of any pair of productive factors induces a change in their relative price and hence a change in their relative use. The capital controversy made clear that, outside the fanciful hypothesis of a corn economy, the direction of factor substitution is not necessarily that predicted by the conventional theory. In short, looking at the supply side of factor markets, the capital stock is a heterogeneous collection of capital goods that can be added up only in value terms. But to calculate the price of the capital goods we must know the distribution of income. Therefore, conventional economics is in a vicious circle: to determine income distribution it must know prices (to assign a value to the capital endowment), but it cannot calculate prices without knowing the distribution. It is true that in a stationary economy such that reported in table 1 the value of  $K_t$  (and of  $k_t$ ) can be determined without knowing distribution by just imposing the condition of a constant capital-labour ratio.<sup>15</sup> However, this *ad hoc* solution could hardly ‘be defended as a basis for the general theory of value and distribution’ (Garegnani, 1983, p.138). Moreover, it has been shown (Sraffa, 1960) that, in a multi-commodity world when distribution changes—as it does in the example of Table 2 when in period 1 the labour supply falls—the *value* of the capital stock in terms of the numeraire may change in either direction, even if its physical shape does not. Hence it is not legitimate to keep this value constant as A & K do from the pre- baby bust period to the next. In addition, looking at the demand side, when distribution changes, the factor demand schedules do not have the shape predicted by neoclassical theory. A fall in the interest rate might be followed by the adoption of less (and not more) capital-intensive techniques. This implies that, were the interest rate to fall, the

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<sup>15</sup> In each period the per-capita capital ratio  $k_{t+1}$  is equal to the worker’s saving supply of the preceding period, that is  $k_{t+1} = sw_t$ , where  $s$  is the marginal propensity to save. Substituting  $w_t$  with the marginal product of labour, we get  $k_{t+1} = s(1 - \beta)A_t k_t^\beta$ . By imposing  $\bar{k} = k_t = k_{t+1}$ , we obtain  $\bar{k} = [s(1 - \beta)A]^{1/(1-\beta)}$  (A & K 1995, pp.89 and 94).

entrepreneurs would demand an amount of capital goods – in value terms – which is lower and not higher, as predicted by mainstream theory (see Garegnani, 1970).

It can therefore be concluded that the adjustment of the economy to the demographic shock actually takes place smoothly only under hypothetical and restrictive conditions. The adaptation of the capital stock encounters difficulties concerning its lack of malleability in the short run. Wicksell did not regard these difficulties as fundamental with respect to the change of the physical composition of capital for a given change in income distribution: ‘this process presupposes an adaptability and a degree of foresight in the reorganisation of production which is far from existing in reality, though this is as a rule of secondary importance in comparison with the main phenomenon’ (1934, II, p. 193). With regard to the second side of the adjustment – the process whereby part of the gross saving, within the limits in which the physical capital recovers its liquid form, is returned to the *PFs* and to the old generation— we conclude that the assessment of its plausibility is an empirical question, and therefore difficult to appraise in theoretical terms. More decisive looks therefore the capital theory critique, which shows that the neoclassical prediction concerning the first side of the adjustment process is flawed.

## 7. The Equivalence Hypothesis

To appreciate the second objection mentioned at the end of Section 4, that *FF* need not generate better outcomes than *PAYG* in response to a demographic shock, we shall mimic a ‘battle of examples’ between a supporter of the equivalence hypothesis (EH) and one of the solvency hypothesis (SH). The EH strikes first by arguing that in an economy with *PAYG* a demographic shock creates, for a given  $k$ , an excess capital supply; this extra capital can then be used to fix *PAYG*’s finances. Consider Table 3, a modified version of Table 2, in which the capital stock belongs to the capitalist class and the retirees survive out of a *PAYG* scheme with a contribution

rate of 0.5. For the sake of simplicity we assume that capitalists consume all their interest revenues. In period 1 there is a demographic shock as shown in Table 2. Suppose that at the end of the preceding period the government, alerted by demographers to the forthcoming fertility drop and to the consequent fall in the *PAYG* contribution flow, taxes the capitalist in order to fill the gap and pay the same individual pension as before. Taxes would be equal to the pension benefit *multiplied by* the drop in the number of workers, that is,  $5.99 \times 10 = 59.9$ . Suppose that the capitalists use their depreciation funds (that is, their gross saving) to pay the new taxes. This action results in a crowding out of 59.9 units of the capital stock. Already in period 1 the economy is again in its secular equilibrium, with the same per capita capital endowment as the pre-shock equilibrium, also equal to that of Table 2. The conclusion could be drawn that, although in the two cases the pension schemes are different—and consequently also the pension benefits, since in Table 2 the retirees and not the ‘capitalists’ possess the capital stock and receive interest payments—the final outcome of the demographic shock on the macroeconomic magnitudes, on the capital–labour ratio in particular, is the same, irrespective of the different pension schemes. The equivalence hypothesis would thus be demonstrated even conceding, for the sake of the argument, a neoclassical context, the most favourable to show the advantages of a *FF* scheme. Accordingly, the standard argument that the adoption of an *FF* scheme would better prepare the economy for a demographic shock, avoiding the negative effects on the capital stock of having to support the retirees via *PAYG*, would not be correct. In both Tables 2 and 3 the capital stock falls by the same amount.

*Table 3 Simulation of the adjustment to a baby bust in a neoclassical stationary economy with a PAYG scheme  
Government intervention after the demographic shock*

Period	Wrkrs	Retirees	K stock	Per-cap K	Total (net) income	Wage rate	Interest rate	Payg's transfers	Aggr. consump*			Net saving
									caplists	wrks	retirees	
Pre-baby bust secular equilibrium	100	100	598.7	5.987	1710.7	11.97	0.857	598.7	513.2	598.7 5.99	598.7 5.99	0
Baby bust (-10%)												
1	90	100	538.9	5.987	1539.6	11.97	0.857	538.9	461.9	538.9 5.39	479.0 4.79	-59.87
2	90	90	538.9	5.987	1539.6	11.97	0.857	538.9	461.9	538.9 5.99	538.9 5.99	0
...	...	...	...	...	...	...	...	...	...	...	...	...
New secular equilibrium	90	90	538.9	5.987	1539.6	11.97	0.857	538.9	461.9	538.9 5.99	538.9 5.99	0

Notes: \*per-capita values in italics.

The SH would strike back arguing that had not it been for the necessity of wasting the ‘excess capital’ to fix *PAYG*’s budget, the economy would have been able to rise  $k$  (and  $y$ ). A neoclassical economist would thus offer the example of Table 4, in which the government does not intervene to sustain pensions in period 1 (they are allowed to drop in line with the contribution flow).<sup>16</sup> In this case the capital stock does not fall and the rise in the capital–labour ratio permits a rise in per capita output, wages and, from period 2 when the ratio between retirees and workers has again stabilized, even of pension benefits. So, the neoclassical economist concludes that had it not been not for the necessity to fill the *PAYG* gap in the presence of a fertility drop and the consequent crowding out of part of the capital stock, the capital–labour coefficient would have been higher. The EH’s counter-objection would then be that should the government fail to intervene, the likely effect would be a decline in living conditions for the old. The neoclassical

<sup>16</sup> The corresponding table 3.5 in Cesaratto (2005) reported three wrong values in the column ‘*PAYG* transfers’.

economist would in turn reply that this unfortunate event could easily been avoided had the economy carried out an *FF* reform well before the shock (Akerlof, 1990 advances a similar argument).<sup>17</sup>

*Table 4 Simulation of the adjustment to a baby bust in a neoclassical stationary economy with a PAYG scheme. No government intervention after the demographic shock*

Period	Wrkrs	Retirees	K stock	Per-cap K	Total (net) income	Wage rate	Interest rate	Payg's transfers	Aggr consumption*			Net saving
									capitalists	Wrkrs	retirees	
Pre-baby bust secular equilibrium	100	100	598.7	5.987	1710.7	11.97	0.857	598.7	513.2	598.7 <i>5.99</i>	598.7 <i>5.99</i>	0
Baby bust (-10%)												
1	90	100	598.7	6.653	1589.1	12.36	0.796	556.2	476.7	556.2 <i>6.18</i>	556.2 <i>5.56</i>	0
2	90	90	598.7	6.653	1589.1	12.36	0.796	556.2	476.7	556.2 <i>6.18</i>	556.2 <i>6.18</i>	0
...	...	...	...	...	...	...	...	...	...	...	...	...
New secular equilibrium	90	90	598.7	6.653	1589.1	12.36	0.796	556.2	476.7	556.2 <i>6.18</i>	556.2 <i>6.18</i>	0

Notes: \* per-capita values in italics.

The SH's advocate would, in this regard, show table 5 that starts with a secular equilibrium similar to Table 3; that is, the capitalists have ownership of the capital goods and there is a *PAYG* scheme in place. In period 1, in anticipation of future demographic shocks, there is an *FF* reform that successfully leads workers to raise their marginal propensity to save from 0 to 0.05. Net saving in period 1 is 59.9 units of account. From period 2 the old integrate their retirement income with the revenues from the new *FF* scheme, and we assume that the government takes the opportunity to reduce *PAYG* contribution rate from  $\alpha = 0.5$  to  $\alpha = 0.464$ . In period 4 a new

<sup>17</sup> The tenacious EH's defender would argue that if the creation of a *FF* scheme was based on a cut in the private or social transfers to the old, then the decline in their living standard is just anticipated in to previous generations. We may however assume that the extra-saving needed to launch the *FF* scheme comes from a cut in consumption of wealthy-enough young.

secular state is reached in which the per capita capital endowment and per capita income are greater. In this new secular path, the wage rate is higher, although workers' per capita consumption is the same as before due to the higher marginal propensity to save partially compensated by the lower *PAYG* contribution rate. The per capita income/consumption ratio of the retirees has increased because of the new income deriving from the capital goods they possess.

*Table 5 Simulation of the adjustment to a baby bust in a stationary economy with an FF reform*

Period	Wrkrs	K stock	Per-cap K		Total (net) income	Wage rate	Interest rate	Payg's transfers	Aggr consumption <sup>a</sup>			Net saving
			total	owned by wrkrs					Capitalists	Wrkrs	Retirees	
Pre FF-reform secular equilibrium	100	598.74	5.99	0	1710.7	11.97	0.857	598.7 ( $\alpha = 0.5$ )	513.2	598.7 5.99	598.7 5.99	0
1 (FF reform <sup>b</sup> )	100	598.74	5.99	0	1710.7	11.97	0.857	598.7	513.2	538.9 5.39	598.7 5.99	59.9
2 <sup>c</sup>	100	658.61	6.59	0.60	1760.3	12.32	0.802	571.7 ( $\alpha = 0.464$ )	480.1	598.9 5.99	679.6 6.80	1.7
3	100	660.35	6.6	0.62	1761.7	12.33	0.8	572.2	479.2	599.3 5.99	683.1 6.83	0.05
4	100	660.4	6.6	0.62	1761.7	12.33	0.8	572.2	479.2	599.3 5.99	683.2 6.83	0
5	100	660.4	6.6	0.62	1761.7	12.33	0.8	572.2	479.2	599.3	683.2	0
6 (Baby-bust)	90	660.4	7.34	0.62	1636.5	12.73	0.743	531.5	445.1	556.7 6.19	639.0 6.39	-4.4
7	90	656.02	7.29	0.64	1633.2	12.70	0.747	530.5	447.2	555.6 6.17	630.5 7.01	-0.1
8	90	655.9	7.29	0.64	1633.1	12.70	0.747	530.4	447.2	555.6 6.17	630.3 7.00	0
9	90	655.9	7.29	0.64	1633.1	12.70	0.747	530.4	447.2	555.6 6.17	630.3 7.00	0
10	90	655.9	7.29	0.64	1633.1	12.70	0.747	530.4	447.2	555.6	630.3	0
...	...	...	...	...	...	...	...	...	...	...	...	...
New secular equilibrium	90	655.9	7.29	0.64	1633.1	12.70	0.747	530.4	447.2	555.6 6.17	630.3 7.00	0

*Notes:*

<sup>a</sup> per-capita values in italics.

<sup>b</sup> The marginal propensity to save of workers rises from 0 to 0.05.

<sup>c</sup> PAYG's contribution rate ( $\alpha$ ) falls from 0.5 to 0.464.



In period 6 the labour force falls by 10 per cent. The mechanics of the adjustment is similar to that of Table 2.<sup>18</sup> We note that in period 6 the per capita consumption of the old falls because both the *PAYG* contribution flow and the interest rate have dropped. Comparing this situation with that of Table 3 in which no reform anticipated the demographic shock, the government does not feel obliged to intervene since the per capita consumption of the old is still higher than its pre-reform level in spite of the shock. True, in periods 6 and 7 the retirees ‘eat up’ part of the capital stock they own, but this does not impede a rise in the per capita capital endowment, as happened in Table 4.

Summing up, suppose that we take a ‘neoclassical’ economy with given initial general equilibrium data, and compare two options, reform or no-reform. In the former case an *FF* scheme is successfully adopted that, say, complements an existing *PAYG*. This reformed economy will make the transition to a new secular path with a higher per capita capital endowment. After a demographic shock, the reformed economy is able both to preserve the level of pensions and to raise the per capita capital endowment again (as in Table 5), while the unreformed economy can do so only by allowing post-shock pensions to fall (as in Table 4) by avoiding a government intervention to support *PAYG* (as it did in Table 3). Therefore, the second objection that, given a neoclassical framework, whatever the scheme adopted the final outcome is the same, is disconfirmed.

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<sup>18</sup> Comparing Tables 2 and 5 a difference can be noted: in the former the post-shock secular value of  $k$  is equal to the pre-shock value, whereas in the latter the post-shock secular value of  $k$  is higher. This is so because in the former example the capital stock  $K$  is entirely owned by the retirees and contracts, in the long run, by the same amount of the gross saving rate expressed by the reduced labour force (that is by 10 per cent). In the second example only a portion of  $K$  is owned by the retirees and undergoes this contraction, while the remaining part is possessed by a capitalist class that, under our simplifying hypothesis, supply it in a fixed amount.

As mentioned above, these examples are merely indicative since the numerical results depend on the assumptions and simplifications made (in particular the adoption of a Cobb–Douglas production function, and the assumption that the propensity to save is constant irrespective of changes in the wage and interest rates), but they provide the flavour of the neoclassical argument in favour of *FF* reforms. We now see that the neoclassical claim of robustness for *FF* schemes is flawed because, once an *FF* scheme associated with a higher  $k$  has been created, the adjustment process depends: (a) on a degree of capital malleability and coordination that is probably lacking in the real economy and (b) on the direction of factors' substitution mechanism as predicted by neoclassical theory that has been proved false. In addition, it cannot be taken for granted that an *FF* reform leads to a higher saving supply: mandatory savings to an *FF* scheme may just displace existing savings (see e.g. Eschtruth & Triest, 2005). Moreover, in the light of Keynes's paradox of thrift reinforced by the capital critique, there are no analytical reasons why an *FF* reform, if accompanied by a higher saving supply, should lead to a higher  $k$ , that is to the creation of those individual *real* reserves that, according to Modigliani and Musgrave, should shelter workers from a demographic shock (Cesaratto, 2005, Chapter 4; 2006a). Note that the capital critique bites both in the *creation* phase of a *FF* scheme and in its *retrenchment* phase as it were, once faced by a demographic shock.

We conclude that the critique of the mainstream view is much more complicated than suggested by the equivalence hypothesis. Cesaratto (2005, Appendix 3.2) develops the criticism of the equivalence hypothesis showing the artificial assumptions that have to be made to pretend that an economy can indifferently adopt a *FF* or a *PAYG* scheme. Next section will develop the argument by considering John Eatwell's contribution to the debate.

## 8. On a Misleading Equation proposed by Eatwell

In a recent contribution to the pension reform debate John Eatwell (2003) starts from the following equation (our symbols):

$$bR = (s + t)yN \quad (1)$$

where  $b$  is the average per capita pension,  $R$  is the number of pensioners,  $s$  and  $t$  are, respectively the average saving and tax rates, and  $y$  is net output per head. The left-hand side would show the pension bill corresponding to the amount of output consumed by the pensioners (supposing that they do not save), and the right-hand side the way they obtain their revenue: ‘savings and taxes are the means of extracting from the working population the goods and services which the pensioners require’ (2003, p. 4). Presumably, according to Eatwell, the saving flow represents the *FF* pensions and tax-based transfers *PAYG* pensions.

Equation (1) can be written as

$$\frac{R}{N} = (s + t) \frac{y}{b} \quad (2)$$

The pension problem, Eatwell notes, arises from a rising ratio on the left-hand side, that is from a ‘pensioner population’ which ‘is growing more rapidly than the workforce’ (ibid, p.5). This may of course be compensated by a falling pension cheque  $b$ , or by robust productivity growth that leads to higher  $y$ .<sup>19</sup> For given values of  $b$  and  $y$ , a higher  $R/N$  ratio must be compensated by greater ‘overall transfers’; that is, compensation requires that  $(s + t)$  be higher. In Eatwell’s view, it doesn’t matter whether the ‘overall transfers’ rise because of higher taxation, through a *PAYG* scheme, or because of higher savings, if a *FF* scheme is adopted, or from both causes:

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<sup>19</sup> Eatwell neglects to mention that productivity growth is a solution to ageing only in so far as it is not transmitted to pension benefits (to  $b$  in equation 2). He does note, correctly, that the increase in the retired population may be compensated by a growing labour force—so to keep at bay the rise of the term  $R/N$  in equation 2..

In a *PAYG* scheme current taxes are being used to pay current pensions. In a *FF* scheme it is current savings which are being used to pay current pensions. Savings today are funding the pensions of today. Accordingly, the ‘burden’ on the workforce, defined as the goods and services that are ‘extracted’ from income of workforce is exactly the same whether the nation’s pension scheme is *FF* or *PAYG*. (Eatwell, 2003, p.6)

This view, of course, reflects the ‘equivalence hypothesis’. It is not evident, however, how a rise in my young neighbours’ savings could finance one additional year of retirement of my sons’ resilient grandfather. Of course their savings could finance it if they purchased Treasury bonds that the government issues to finance my father in love in a pleasant retirement. But in this case aggregate savings have not increased, since the lower government savings precisely compensate the larger private savings. From a macroeconomic point of view, in first approximation, the mentioned purchase is equivalent to a rising payroll-tax by the government. In both cases the government is financing current pensions through current public debt or tax. If you want to finance current pensions, this is the only game in town.<sup>20</sup> What Eatwell overlooks—and we see here how much the ‘equivalence hypothesis makes all cats grey—is that an *FF* scheme necessitates a *take-off* period, as we have noticed in Section 3, in which additional savings are converted in additional capital goods and cannot be used to finance additional consumption. Then, when they retire, my neighbours will use their capital assets to buy their daily bread by selling their capital assets to the young workers

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<sup>20</sup> If current pensions are financed by public debt what we have is a ‘disguised *PAYG*’ in my parlance, or ‘narrow prefunded’ scheme, in Orszag & Stiglitz’s terminology (see Cesaratto 2005, pp.12-14, 151-153; Orszag & Stiglitz 2001, pp. 18–19; Geanakoplos et al., 1998, p. 3 and *passim*). Note that from a strict Keynesian point of view, the payment of pensions by the government come first, followed, through the income multiplier effect, by the generation of savings and taxes that, from the accountant’s viewpoint, ‘finance’ those payments.

(see Section 1). The feasibility of such a take-off by increasing savings is a source of difficulties on which we shall briefly return.

Let us first note that Eatwell also fails to see that the aggregate pension cheque (*PAYG* and *FF*) includes also the interest revenues on the capital assets owned by the old (as shown in Section 1 above). Including this revenue, equation 1 would read:

$$b_0 R_0 = t y_0 N_0 + k_0 R_0 (1 + r_0) \quad (3)$$

where  $k_0$  are the per capita capital assets owned by current retirees at time zero (subscripts are a time index), and bought by current workers, that is:

$$k_0 R_0 = s_0 y_0 N_0. \quad (4)$$

Supposing that investments are saving-led, if in the next period workers save more (for simplicity assume that  $N_0 = N_1$  and  $R_1 = N_0$  etc), in period 1 equations 3 and 4 would read:

$$b_0 R_1 = t y_0 N_1 + k_0 R_1 (1 + r_0)$$

$$k_0 R_1 + I_1 = s_1 y_0 N_1, \quad (4')$$

where  $I_1 = s_1 y_0 N_1 - s_0 y_0 N_0 = (s_1 - s_0) y_0 N_1$  and  $s_1 > s_0$ . Equation 4' now includes investment while, contrary to Eatwell's thesis, in spite of the rising saving rate, the revenues of the retirees in period 1 are the same as in period 0 (the larger saving supply is used to finance investment and not to increase current pensions).

According to neoclassical theory in period 2:

$$b_2 R_2 = t y_2 N_2 + k_2 R_2 (1 + r_2)$$

$$k_2 R_2 = s_1 y_2 N_2,$$

where  $N_2 = N_1$  (the ‘neoclassical’ economy was already in full employment),  $k_2 > k_0$ ,  $y_2 > y_0$  and  $r_2 < r_0$  (a higher capital endowment per worker associated with a higher output per head and a lower marginal product of capital). The criticism to this view has repeatedly reported in the preceding sections.

Were we to adopt the ‘classical’ saving-led growth model employed by Michl & Foley (2004) to support an *FF* reform, the result would be:

$$b_2 R_2 = t y_0 N_2 + (k_0 R_2 + I_t)(1 + r_0) \quad (5)$$

$$(k_0 R_2 + I_1) + I_2 = s_1 y_0 N_2 \quad (6)$$

Looking at equation 5, we note that  $N_2 > N_1$ , since capital accumulation has been, so to speak, of the ‘widening’ sort, enlarging employment (the ‘classical’ economy was supposed not to employ all the labour reserves), and not of the ‘deepening’ kind, as in the neoclassical framework (indeed  $k_2 = k_0$ ,  $y_2 = y_0$  and  $r_2 = r_0$ ). Benefits are higher ( $b_2 > b_0$ ), since the *PAYG* employment base has temporarily increased compared to retirees ( $N_2 > R_2$ ), and the amount of capital assets accumulated by retirees is higher. Looking at equation 6, given that  $k_0 R_1 + I_1 = s_1 y_0 N_1$ , recalling that  $R_2 = R_1$  and  $N_2 > N_1$ , then there is further scope for net investment (represented by the term  $I_2$ ). Michl & Foley’s *FF* reform actually spurs a Harrodian growth path with unlimited labour supply in which investment is saving-driven (for a criticism of Michl & Foley’s model see Cesaratto 2005, Chapter 6; 2006b).

Finally, a saving-paradox outcome of a rise in workers’ propensity to save in period 1 could be described as follow:

$$b_1 R_1 = t y_0 N_1 + k_0 R_1 (1 + r_1) \quad (7)$$

$$k_0 R_1 = s_1 y_0 N_1 \quad (8)$$

Looking at equation (7), pension benefits are now lower ( $b_1 < b_0$ ), given the resulting fall of output and employment ( $N_1 < N_0$ ). The degree of utilization and actual profitability of the capital stock would in all probability be negatively affected by the fall of output, so that from this side too benefits would be lower. Supposing, in the first approximation, that the value of the capital wealth is unaffected ( $k_1 R_1 = k_0 R_0$ ), equation 8 shows that this is bought by a lower number of savers (since  $N_1 < N_0$ ) who, however, are saving more ( $s_1 > s_0$ ).

## 9. Conclusions

This paper has traced the foundations of the mainstream view of an *FF* scheme in marginalist capital theory. According to this theory, capital is a fund of consumption goods through which consumption can be postponed, say, from the active years to old age. According to this view, additional capital accumulation and a higher per capita capital ratio match a voluntary rise in the ‘foresight’ decisions to postpone consumption.

The paper examined the alleged advantages that, according to the standard view, an *FF* scheme presents in coping with the pending demographic shocks. This is relevant for assessing the argument, often heard, that both systems are equivalent in this respect. Taking inspiration from Auerbach & Kotlikoff (1995) we examined a simple neoclassical example in which the economy adapts to a demographic shock partly through a change in the capital intensity of techniques, and partly by failing to replace part of the capital stock. While the first side of the adjustment is theoretically unsound, the second side is empirically doubtful. Hence, despite the somewhat informal character of their criticisms, those economists that point out the difficulties of an *FF* scheme with respect to a demographic shock are partially correct. These critics tend also to forget

that an *FF* scheme must be created first—the same methodological mistake of those who pretend to discuss the relative advantages of the two systems by comparing their respective rates of return, as if they could be created at will. Since this is not so, the criticism of an *FF* reform should primarily point to the difficulties of raising the amount of ‘foresight’ and national saving underlined in this paper, the problems of the transition from *PAYG* to *FF* schemes, and ‘the questionable assumption of a continuing full-employment economy, where investment matches available saving’ (Musgrave, 1981, p. 98–99). We noted the symmetric role played by the capital critique in the discussion as part of the criticism of the neoclassical view of the adjustment process of an *FF* scheme to a demographic shock, in a *retrenchment* phase of an *FF*, and in discrediting the mainstream view of the process of *creation* of an *FF* scheme.

## References

Akerlof, G.A. (with J. Yellen) (1990) Comments on Cutler et al. ‘An aging society: opportunity or challenge’, *Brookings Papers on Economic Activity*, n. 1, 57–62.

Auerbach, A.J. & Kotlikoff, L.J. (1987) *Dynamic Fiscal Policy* (Cambridge: Cambridge University Press).

Auerbach, A.J. & Kotlikoff, L.J. (1995) *Macroeconomics: An Integrated Approach* (Cincinnati: South Western College Publishing).

Baker, D. & Kar, D. (2003) *World Bank involvement in the privatization of public pension systems in developing and transition countries*, report for the International Confederation of Free Trade Unions.

Barr, N. (2000) Reforming pensions: myths, truths, and policy choices’, *IMF Working Papers*, n. 139.



Cadarso, M.A. & Febrero, E. (2006) 'Pay-as-you-go versus Funded Systems. Some critical considerations', Universidad de Castilla-La Mancha, mimeo.

Ceprini, M. and Modigliani, F. (1998) Social security: una proposta per l'Italia, *Economia Italiana*, n. 2, 275–305.

Cesaratto, S. (2005.) *Pension Reform and Economic Theory: A Non-Orthodox Analysis* (Cheltenham, UK and Northampton, MA, USA: Edward Elgar).

Cesaratto, S. (2006a) Transition to Fully Funded Pension Schemes: A Non-Orthodox Criticism. *Cambridge Journal of Economics*, 30, pp.33-48

Cesaratto, S. (2006b) The saving-investment nexus in the debate on pension reforms, in: N.Salvadori (Ed), *Economic Growth and Distribution: On the Nature and Causes of the Wealth of Nations* (Cheltenham, UK and Northampton, MA, USA: Edward Elgar).

Dalziel, P.C. & G.C. Harcourt (1997), 'A note on "Mr Meade's Relation" and international capital movements', *Cambridge Journal of Economics*, 21, pp.621–631.

De Vivo, G. & Pivetti, M. (2004) Contro l'impovertimento degli anziani, *Il manifesto*, 17 february.

Eatwell, J. (2003) The Anatomy of the Pension "Crises" and Three Fallacies on Pensions, Cambridge Endowment for Research in Finance, Cambridge (UK), mimeo.

Eisner, R. (1998) Save social security from its saviours, *Journal of Post Keynesian Economics*, 21, pp.77–92.

Elmendorf, D.W. & Sheiner, L.M. (2000), Should America save for its old age? fiscal policy, population aging, and national saving, *Journal of Economic Perspectives*, 14, pp.57–74.

Eschtruth, A.D. & Triest, R.K. (2005) National saving and social security reform, *Just the Facts*, n.18, Center for Retirement Research at Boston College.

Feldstein, M. (1974) Social security, induced retirement, and aggregate capital accumulation, *Journal of Political Economy*, 82, pp.905–926.

Feldstein, M. (1976) On the theory of tax reform, *Journal of Public Economics*, 6, pp.77–104

Garegnani, P. (1970) Heterogeneous capital, the production function and the theory of distribution, *Review of Economic Studies*, 37, pp.407–436.

Garegnani, P. (1983) Notes on consumption, investment and effective demand, in: J.Eatwell & M. Milgate (Eds) *Keynes's Economics and the Theory of Value and Distribution* (London: Duckworth).

Geanakoplos, J., Mitchell, O.S. & Zeldes, S.P. (1998) Would a privatized social security system really pay a higher rate of return?, National Bureau of Economic Research Working Paper Series, no. 6713.

Keynes, J.M. (1936) *The General Theory of Employment, Interest, and Money* (London: Macmillan).

Kohl, R. & P. O'Brien (1998) The macroeconomics of ageing, pensions and savings: a survey, Ageing Working Papers AWP 1.1, OECD, Paris.

Marshall, A. (1920) *Principles of Economics*, 8th edn., reprinted 1949 (London: Macmillan).

Michl, T.R. & Foley, D.K. (2004) Social security in a classical growth model, *Cambridge Journal of Economics*, 28, pp.1–20.

Modigliani, F. (1986) Life-cycle, individual thrift, and the wealth of nations, *American Economic Review*, 76, pp.297–313.

Musgrave, R. A. (1981) A reappraisal of financing social security', in: Skidmore, F. (Ed), *Social Security Financing* (Cambridge, MA: The MIT Press).

Orszag, P.R. & Stiglitz, J.E. (2001) Rethinking pension reform: ten myths about social security systems', in: P.R. Orszag & J.E. Stiglitz, *New Ideas about Old Age Security* (Washington DC: World Bank).

Pizzuti, F.R. (1995) Economia e politica della previdenza sociale, in: O. Castellino (Ed), *Le pensioni difficili* (Bologna: Il Mulino).

Poterba, J.M. (2004) Population aging and financial markets, symposium global demographic change: economic impacts and policy challenges, Federal Reserve Bank of Kansas City.

Rother, P.C., M. Catenaro & G. Schwab (2003) Ageing and pensions in the Euro area. Survey and projection results, World Bank, Social Protection Discussion Papers, no. 307.

Samuelson, P.A. (1958) An exact consumption–loan model of interest with or without the social contrivance of money, *Journal of Political Economy*, 56, pp.467–482.

Samuelson, P.A. (1975) The optimum growth rate for population, *International Economic Review*, 16, pp.531–538.

Sawyer, M. (2003) An economic evaluation of alternative arrangements for retirement pensions', EPoC Conference on Privatisation of Public Pension Systems, Vienna.

Solow, R.M. (1956) A contribution to the theory of economic growth, *Quarterly Journal of Economics*, 70, 65–94.

Sraffa, P. (1960) *Production of Commodities by Means of Commodities. Prelude to a Critique of Economic Theory* (Cambridge: Cambridge University Press).

Wicksell, K. (1934) *Lectures on Political Economy*, two volumes (London: Routledge & Kegan Paul).