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Are Pay-as-you-go and Fully Funded pension schemes
on the same footing with respect to demographic shocks?
A Sraffian view

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Abstract - Many critics of Fully Funded (FF) pension schemes argue that these schemes would meet problems similar to those that, according to the dominant opinion, undermine Pay-as-you-go (PAYG) schemes as a result of the present demographic mutations, lower fertility and higher longevity. More specifically, they maintain that, whereas in a PAYG scheme a lower number of young workers would weaken the financial source of pension transfers, by the same token in a FF scheme a diminished number of young would render difficult the absorption of the capital assets accumulated by pension funds. This paper assesses this claim in the light of the neoclassical foundations of the conventional view of a FF scheme and of the criticism of it. It will emerge that the critics are partially right, but this conclusion should obtained through a more complex road that does not bypass the theoretical background of the mainstream assertion. The capital theory critique is shown to be very relevant in this respect. The final part of the paper extends the discussion on the presumed advantages of a FF scheme to an open economy.

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Introduction[1]

In the debate on pension reforms it is often argued by conventional economists and opinion makers that the adoption of a Fully Funded (FF) pension schemes would better prepare the economy with regard to forthcoming demographic shocks, lower fertility and higher longevity. Of an opposite opinion are some critics of the FF reform according to whom a FF scheme would meet problems similar to those that, according to the dominant opinion, undermines Pay-as-you-go (PAYG) schemes (this has for instance been held by conventional welfare economists, Barr, 2000, pp.7-8, but also by Postkeynesian economists, e.g. Eisner, 1988, p.88, Eatwell, 2003, p.23, Sawyer, 2003).[2] In particular, they argue, whereas in a PAYG scheme a lower number of young workers would weaken the financial source of pension transfers, by the same token in a FF scheme a diminished number of young would render difficult the absorption of the capital assets accumulated by pension funds (PFs). This argument, however, hastily bypasses the complex theoretical underpinnings of the mainstream position. This paper will try to assess the controversy in the light of the neoclassical background of the conventional view of a FF scheme and of its vulnerable theoretical foundations. It will emerge that the critics are partially right, but this outcome is the result of a more complex theoretical discussion. The capital theory critique is shown to be very relevant in this context.

Section 1 will describe the neoclassical view of the functioning of a fully operational FF scheme. Section 2 will discuss the alleged malleability of this scheme to demographic shocks in

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[1] I thank the participants of a seminar held in Siena in December 2002 for comments and, with the usual disclaimers, Prue Kerr for helping me to revise the text.

[2] With regard to the Italian debate cf. Pizzuti, 1995, p.176. A specific comment on Sawyer is in Cesaratto (2003b).

a closed economy. Section 3 will examine its flexibility in an open economy showing that, also in this case, some critics of a FF reform are right but with wrong reasons.

1.   *Description of a fully operational FF scheme*

A *FF* scheme is an old-age insurance scheme – generally but not necessarily privately managed - in which the reserves are invested in private assets representative of capital stock. Let us consider a stationary economy with two identical overlapping generations. By hypothesis, the old all have the same survival rate and the insurance side of a *FF* scheme can be neglected. The old generation lends the (gross) saving accumulated in youth to the PFs that, in turn, lend them to the corporations receiving financial assets in exchange. It might sometimes help the reader to imagine that the olds own directly the capital stock.

Let the ownership of these financial assets, representative of the capital stock K_t, be uniformly distributed among the olds 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 $a_t < w_t$.[3] At the beginning of each period the corporations, who have borrowed the capital stock, hire the young workers. At the end of the period the *net* per-capita product y_t is distributed as follows (in per capita terms): the replacement of the capital goods consumed in the production process, δk_t, where δ is the depreciation rate; the wage w_t to the workers; and the return $i_t k_t$ on the capital advanced, where i_t is the profit rate. In summation: $y_t = \delta k_t + w_t + i_t k_t$. The workers use their wage for two purposes: they consume c_t^w, and through the PFs they buy the assets a_t from the olds. In summation: $w_t = c_t^w + a_t$. Finally, the retirees consume all their financial resources and die. In summation: $c_t^r = i_t k_t + a_t$. In this economy the capital stock remains unchanged from one period to the next. Indeed there is no net saving since

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[3] Which is plausible if the 'periods' last 30 or 40 years (cf. e.g. 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.

the value of the assets bought by the young is precisely equal to that sold by the olds, in other words, the savings of the working generation are precisely matched by the dissavings of the retired generation. This description of a *FF* scheme can easily be extended to a steadily growing economy and to a multiplicity of generations. A capitalisation scheme might be defined as a buy-as-you-go system. As now described, an *existing* FF scheme is, so to speak, 'theoretically neutral', in the sense that we have not touched upon its creation process – how the capital stock owned by the olds is accumulated - that is instead 'theory dependent' (cf. Cesaratto 2002; 2003a).

A simple example presented by Auerbach & Kotlikoff (1995, pp.90-92) is useful to introduce the neoclassical view of a FF scheme and will be used again. These authors (A&K hereafter) adopt a Cobb-Douglas production function, in per capita terms: $y_t = A_t k_t^\beta$. 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. The olds own the capital stock, 5.987 units of account each (so the capital stock is 598.7 units) that, through the PFs, they have lent to the corporations. The corporations 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. At the end of their retirement period the olds obtain the interest payments and sell, through the PFs, the capital stock to the young generation (which is now at the end of the active period). In the final part of their life the olds consume all the proceeds and die. The per capita consumption of the olds, 11.119 units, is precisely the summation of the value of the capital stock, 5.987 units, *plus* the interest on it (net of replacement costs) calculated at the interest rate of 0.857. Table 1 shows the *secular* equilibrium.

The investment decisions that in the past gave rise to the existing capital stock are explained by conventional economists in terms of marginalist principles, according to which gross investments are dependent on saving. 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 precisely in the amount of consumption goods whose enjoyment individuals decide to postpone to the future (Garegnani, 1983, p.33).

It is to this conception that the supporters of *FF* schemes refer: by selling the assets they possess to the fully employed young, the old (also previously fully employed) are able to recover the consumption goods 'crystallised' 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 olds is precisely matched by the saving of the workers so that the amount of consumption goods 'incorporated' in the capital stock remains constant. In this setting the pension funds just act as buffers between the overlapping generations.

This view of capital as a fund of consumption goods also fits very well into Modigliani's life cycle model, in which the provision of an income for the retirement years, the 'foresight motive' as Keynes defined it, is the main explanation of saving decisions made during the working years.

2. Demographic changes in the neoclassical approach

According to the dominant opinion, pending demographic changes - declining fertility and increased longevity - pose a challenge to *PAYG*. This is seen as an 'intergenerational conflict', in so far as a larger number of olds are supported by a contracting number of workers. We are interested here in the mainstream claim that tends to exclude any 'intergenerational conflict' due to demographic factors within a *FF* scheme. This is an important aspect of the debate on advantages of a FF reform. A criticism of the capitalisation reform which is often heard is indeed that a fully operating FF scheme, as described in section 1, at the end of the day, does work in a way not dissimilar from that of a PAYG scheme, that is through a transfer of mandatory contributions from the active to the retired generation (e.g. Barr 2000, Eisner 1988, Eatwell 2003, Sawyer 2003). If this were the case, then the conventional economists could not argue that a FF scheme protects the pension system from exogenous demographic shocks. It is, therefore, very relevant to discuss whether this criticism is well founded since. If it is not, the critique of FF reforms should point in other directions. As a matter of fact, mainstream economists have a somewhat sophisticated argument to support their claim that should not be injudiciously bypassed. Let us therefore see

why, according to the advocates of the *FF* scheme, this system is better equipped than *PAYG* to cope with the two above-mentioned demographic events.

Let us start from the first demographic change, that is a fall of fertility. The mainstream view of the advantages of a FF scheme are aptly summarised by Ceprini & Modigliani: 'should population begin to decline, determining an unfavourable ratio between olds and youngs, the system will not become insolvent because pensions would be paid by selling part of the financial reserves accumulated by the fund' (1998, p.282, my translation). The detailed economic mechanisms on which this argument is based are not, however, ever spelled out in detail by conventional economists.

In order to identify these mechanisms, let us consider again the numerical example of table 1 that describes an economy, which is in a secular stationary equilibrium characterised by two overlapping generations and zero net saving. Taking inspiration again from an example by A&K (1995, p.101) – that originally concerned 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. We shall supplement A&K's example with a comment that tries to convey what the conventional economists have in mind when they argue that a FF scheme is better able than PAYG to cope with a fertility shock. We consider here a baby bust in a stationary economy (but the example can be extended to more complicated cases, for instance, population decline in an initially growing economy).

For the sake of the argument, assume also that the economic life of the capital stock is equal to that of activity (and retirement) of workers, that is that at the end of each period the capital stock recovers its *liquid* form and the corporations are able to return the 'money value' of the

capital stock to the PFs.[4] In the example of table 1, at the end of each period the PFs, on the one hand, return the liquid capital to the retirees (who can thus finance their consumption) and, on the other hand, collect an equivalent amount from the new generation lending it again to the corporation, so that the capital stock does not change from period to period.

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. *At the beginning* of period 1 the corporations 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 becomes, given the labour and capital supply (respectively 90 workers and 598.7 units of capital), equal to 12.36 units. On the other, the new capital-labour ratio is higher (6.653 against the pre-epidemic value of 5.987) since the abundance of the capital supply 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, respectively, of the real wage, which is higher, and of the interest rate, which is lower.[5]

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[4] Therefore, we implicitly assume that the PFs only possess bonds, issued by the corporations, which have the same duration of physical capital.

[5] We adopt here the traditional distinction introduced by Marshall (1920, p.315) between secular and long-period positions. The former position is characterised by the secular, or very long run, change in factors' supply. A neoclassical example of secular position is the steady-state equilibrium of Solow's growth model. A stationary economy, such as that depicted in table 1, is a boundary case of a secular position in which factors' growth rate is set to zero. A long-period position is that determined for a given factors' supply. Standard neoclassical examples of long period positions are the long-period equilibria studied by Hicks (1932), particularly in the famous Chapter 6 on technical progress and distribution. In the example presented above in table 2, each period (each row) can be taken as a long-period equilibrium defined for given endowments of capital and labour. In the exercise we have a sequence of long period positions as a consequence of the change in the

At the end of period 1, on the one hand, 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 recovered its liquid form – and can return it to the olds 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 of the marginal productivity of capital. However, the possibility of reconverting all the real reserves into consumption goods has impeded an even greater fall.

At the end of the same period 1, on the other hand, the wage bill is 1112.3 (that is 12.36*90), and the young's 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 national product are lower. So, 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 1 will be 42.57 units, lower than in period 1. In other words, at the end of period 1 the dissaving of the olds (598.7) is *not* matched by an equal saving supply from workers, so that 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 is reconverted, so to speak, back into consumption goods. Observe indeed that in period 1 total consumption is 1631.17 (that is the olds' consumption, which is 10.75*100, plus the young consumption, which is 6.18*90), higher than the current *net* product, which is 1589.06. The difference, equal to 42.57, precisely corresponds to that part of the *gross* product that is diverted from the production of replacement capital goods to the production of consumption goods that become part of the olds' consumption. To visualise what is going on, it may be now helpful to think that the olds directly own the capital stock. It is then *as if* the olds are not able to realise the entire

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capital stock. The secular position is reached when the capital stock has attained its secular (here stationary) level. In the secular (here stationary) position the equilibrium capital-labour ratio does

value of the capital stock they possess (598.7), since the saving supply from the young generation is too low (556.17), so they recover the missing 42.57 units by eating up part of the capital stock.

The new relative scarcity of capital, due to the lower saving supply from the diminished number of youngs, induces in period 2, and in those immediately following, a rise of the interest rate and the adoption of less capital-intensive techniques. Nonetheless, also in period 3 and in the following periods, the saving supply is insufficient to preserve the capital stock, so that it continues to shrink. The secular stationary equilibrium is progressively restored to a new position of lower activity. Note that in this process of adaptation of the economy to the baby-bust, two mechanisms are at work:

(i) on the one hand, the variability of techniques according to the neoclassical principles allows most of the 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) on the other hand, in the example, the olds never suffer losses in 'capital account': they have, so to speak, the possibility to eat 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 production factors, albeit the real wage becomes initially higher, at the given marginal propensity to save, gross savings made by the workers out of their wages may well be insufficient to absorb the existing capital assets offered by the olds. However, according to the theory under examination, the olds may disinvest part of their savings 'crystallised' in the capital stock – savings that, so to speak, recover their original nature of consumption goods – so that the capital assets supply tends to adjust to the saving decisions of the young. In this way the olds realize their target consumption, partly by selling their

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not change from one period to the next.

capital assets to the youngs and partly by "consuming" the capital stock.[6] Over many long-period equilibriums 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 proper to the secular stationary equilibrium are eventually restored.

There are three important observations to be made:

(a) with regard to point (i), this side of the adjustment relies on the neoclassical mechanisms of factors' substitution whereby a change in the relative factors' scarcity, accompanied by a change in their relative price, induces a change in their relative use. After the capital theory controversy (Garegnani 1970), we may safely argue that the direction of factors' substitution is not necessarily in the direction predicted by the conventional theory. It may help to remember here that the quarrel had to do with the measurement of 'capital'. In short, considering the factors' supply side, 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 income distribution. 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 distribution. Note that what A&K do in the reported exercises is to assign an arbitrary value to K. This is only possible if we assume a one-commodity world, a corn economy. Moreover, it has been shown (Sraffa, 1960) that 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 (so that it is not correct to keep this value constant as A&K do from the pre baby-bust period to the next). In addition, on the factors' demand side, when distribution changes, the demand schedules do not have the shape

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[6] The rise of the capital-labour ratio determines a fall in the marginal productivity of capital below its secular level. For this reason, at the beginning of the transition, the olds may suffer a fall in their *per capita* consumption.

predicted by neoclassical theory. For instance, 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 entrepreneurs will ask an amount of capital goods – in value terms – which is lower and not higher, as predicted by mainstream theory.

(b) A second puzzling aspect of the adjustment process is the process (ii) whereby the economy contracts the capital stock and preserves the olds' consumption. To begin with, the transformation of part of the capital stock back into 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' (cf. Garegnani 1983, pp.43-4 and p.33). In the example, we assumed that 100% of the capital stock returns liquid at the end of each period. Even if the replacement rate in the first period were only 7.1% (the result of 42.57 *divided by* 598.7), a much lower value,[7] the irreversibility of investment in fixed capital would not have posed an obstacle, since the corporations could return enough liquidity to the PFs and write off 7.1% of the capital stock. The corporations will not order 42.57 of replacement capital goods, demand which is substituted by a corresponding olds' order of consumption goods. Note that, in the example, we have assumed that the PFs only own bonds of the same duration of the capital goods that they finance, and not equities. In case they held equities, the PFs could only realise their value by selling them in the stock market, where the gross saving supply has fallen. This is at the root of the sometimes-heard apprehension that the retirement of the baby boom generation will spawn a stock

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[7] A replacement rate of 7.1% is not particularly high, especially since we consider 'periods' of 30/40 years.

market slump.[8] 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 [33], p.9).[9] As shown below, mainstream economists find a way to anticipate this bleak perspective by encouraging foreign investment in southern countries.

(c) Note that also 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), implies that part of the capital stock that in each period becomes 'free' and can, therefore, assume the different technical shape relative to the new technique.

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[8] To figure out a smooth adjustment, we should imagine a process whereby at the end of period 1 the PFs, as usual, offer the 598.7 units of equities on the stock exchange in order to collect the new generation's gross saving and liquidate the olds. As seen, however, because of the epidemic the demand for equities has fallen, and so has their 'normal' price. The PFs therefore cut the amount of equities offered in order to sell them at the usual price, and recover the value of the remaining assets by asking the corporations not to replace part of the worn out capital stock (perhaps this is possible if the managers of the PFs sit in the executive board of the companies). However, the events in the stock exchange may, in practice, be much more dramatic.

[9] In the same vein *The Economist* wrote: 'Some Wall Street pundits predict that share prices will plunge as retiring baby-boomers pull their money out of the market, just as heavy investment by the boomers was responsible for the dizzy rises of recent years' (A Survey of Social Insurance, 24 October 1998, p.12).

(d) Finally, as observed by Garegnani (1983, p.44) on the basis of an observation by Wicksell (1934 [II], pp.192-193), 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 left free in the capital good sector to the production of additional consumption goods.

It can thus be seen that the adjustment of the economy to the demographic shock actually takes place smoothly only under hypothetical and restrictive conditions. Both aspects of the adjustment process – its change in shape due to the change of techniques and its contraction for a given technique - meet the difficulties concerning the lack of malleability of the capital stock in the short run. Wicksell, however, did not regard these difficulties as fundamental with respect to the change of the physical shape 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). That is, these difficulties may not be enough to criticise the mainstream approach, since traditional theories of value and distribution (both Classical and Marginalist) are based on the concept of long-period positions and useful in so far as they underline the existence of dominant tendencies of the economy after some significant economic change, however imperfectly the tendencies take place in practice (Cesaratto 1995, 1996). More decisive is the capital theory critique, which shows that the neoclassical adjustment prediction concerning the first side of the adjustment process is flawed. With regard to the second side of the adjustment - the process whereby part of gross saving, within the limits in which the physical capital recovers its liquid form, is returned to the PFs and to the old generation - the assessment of its plausibility is an empirical question, therefore difficult to appraise in theoretical terms.[10]

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[10] In this regard, Garegnani (1979) shows the shortcomings of Joan Robinson's criticism of neoclassical capital theory as based on the absence of malleability of the capital stock

To sum up, on the one hand, the example examined above explains the position of the mainstream economists who argue that a FF scheme is quite adapted to deal with a fertility shock. On this basis Musgrave could, for instance, rebuke the criticism that, in the end, a FF and a PAYG program would suffer from the same problems: 'Various objections have been raised against the reserve [FF] approach, some more justified than others. The reserve approach, so 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 enjoined by the next generation' (Musgrave, 1981, p.98). On the other hand, we showed that part of the capacity of a FF scheme to adapt to a demographic shock is based on wrong theoretical predictions, and part on a number of assumptions whose empirical sustainability is difficult to assess. In practice, what will happen in those countries with significant FF schemes when the baby boom generation retires and starts to sell their financial assets is a source of great concern among mainstream economists.

To complete our discussion, let us consider also how a FF scheme might face the second demographic chance, higher longevity. In the short run enhanced life expectancy may be dealt with by a reduction in the annuities that the olds receive from the PFs. This would follow a policy by the funds of spreading the selling of the equities owned by the olds over longer time spans so as to distribute the proceeds over the entire life of the pensioners. As a result, initially, the olds' consumption will fall. This implies that there are net savings in the economy since the dissaving of the olds becomes lower than the saving supply of the workers. In practice at the beginning the young would find a lower amount of assets offered on the market, so that part of their saving supply would be translated, according to the neoclassical principles, into net capital accumulation. A simple simulation (see table 3) with two overlapping generations (the hypotheses are those of table

1), shows the long run effects on the welfare of both young and old. Suppose an expected life improvement of about 50% in period 1. If in this period the olds defer 1/4 of their consumption to the next period (so that their consumption falls from 11.12 units of account to 8.34 and net saving is 2.78), in the long run the capital stock, total income and real wages will, respectively, be 62%, 16% and 16% higher. With regard to the old generation, the possibility for the olds to transform in capital accumulation 2.79 units in the first period of retirement (in the new steady state position) enables them to consume in the second period 4.49 (a figure that includes the profit rate on investment). As a result, although their first-period consumption is permanently lower, in their second period of retirement the sacrifice is more than compensated. Notably, workers' current consumption has increased.[11] Note again that the capital theory criticism destroys these sort of predictions.

According to the conventional view, the reduction of the annuity due to higher longevity might induce an increased retirement age. This would lead to a one-off increase in the supply both of labour and of capital. This is because the workers retire later, thus increasing labour supply. In the meantime they do not sell their assets to sustain their retirement consumption, quite the opposite, they demand additional capital assets. In table 4, with the simple Cobb-Douglas production function used above, we see that if in the second (transition) period the duration of life increases from two epochs (work-retirement) to three (work-work-retirement), then both labour and the capital stock double. Given a constant returns to scale, also the output doubles, while wages and the rate of profit do not vary, but the per-capita consumption of the olds doubles, since they now

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[11] The real wage has risen, and the profit rate correspondingly fallen, because of the increase of the capital-labour ratio and the decreasing marginal productivity of capital. Recent neoclassical Endogenous Growth Theory (see below) removes the hypothesis of marginal decreasing returns to capital accumulation, so that the profit rate is constant. In this case, the results for the old people of postponing some consumption would have been even better.

possess twice as many capital assets as before. Once again, however, the capital controversy can be used to criticise these theoretical outcomes.

3. A world of investment opportunities: 'emerging markets' and endogenous growth

Another standard argument often heard is that *southern* countries will be the natural outlets for the abundant capital supply from the 'grey' developed countries.[12] According to Reisen (2000), for instance, current investment in southern countries will raise the rate of return on pension saving and help to meet the expected excess of supply of financial assets when the 'baby-boom generation' retires. Although demographic changes are expected also in southern countries, they will be much less dramatic and much slower there, so that a market for the capital assets supplied by the retiring *northern* baby-boom generation will not be missing in them.[13] This theoretical

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[12] Conventional economists define the southern countries, generically and without irony, as 'young developing countries' or 'emerging markets'.

[13] Reisen is worth quoting for his clear exposition of this standard argument: 'In the absence of foreign pension investment into younger economies, what should we expect to happen to capital returns on funded pensions once the OECD baby boomers have started to retire? As the labour force declines, the existing capital stock becomes oversized relative to the labour force. The change in relative factor proportion reduces the rental return on capital relative to wages; this effect is reinforced if fully-funded pensions indeed stimulate savings. Simultaneously, the prior phase of asset accumulation would give way to a long period of asset decumulation, as the baby boomers start to draw on their pension assets to finance their retirement. Clearly, therefore, a fully funded pension scheme is bound to get under stress by population ageing, very much like an unfunded scheme. But the funded pensions, unlike the unfunded schemes, can partly beat demography in an open economy. The asset decumulation during the retirement period will not be confined to home assets, but to emerging-market assets that still will be benefiting from net pension contributions of the underlying younger population. And capital returns, unlike in a closed economy, will not be lowered by a declining labour force, but by the world capital market and the demand for capital by the younger non-OECD area' (2000, pp.3-4).

prescription is warmly subscribed to by the international institutions. In an article on *The Economists* (August 2002) Kenneth Rogoff, director of research at the IMF, for instance, aptly translates it in policy indications: 'Isolationists in industrialised countries should stop and look at their populations' advancing age structure. As the dependency ratio explodes later this century, who is going to provide goods and services for all the retirees? … one desirable element has to be for the industrialised countries to save abroad by running large current-account surpluses vis-à-vis the developing world. These cumulated surpluses, while facilitating much-needed investment in poorer countries right now, could be later be drawn down as the baby-boomers stop working. …the resulting pattern of current-account balances could see industrialised countries accumulating overseas wealth amounting to 50% of their GDP by 2030. Then the process would reverse, with industrialised countries drawing down their wealth by running sustained current-account deficits of 3-4% of GDP'. Let us explore this argument.

First run back over some basic Balance of Payments relations. As we know from national accounting, using the standard textbook notation, the Gross National Product of an open economy is equal to:

$$GNP = C + I + G + (E - M) + X \qquad (1)$$

where X represents net income from abroad (that includes, for instance, emigrants' remittances and interest payments on capital lending) and $(E - M) + X$ is the current account. Let us assume, according to the neoclassical theory examined in this Chapter, that the GNP is at its full-employment or natural level. Subtracting private consumption and public outlay from both sides of the equation we obtain the following expression for national saving:

$$S^N = I + (E - M) + X \qquad (2)$$

$(E - M) + X$ can be defined also as *foreign saving* (or *foreign investment*), S^F, so that $S^N = I - S^F$. If $S^N < I$ the country is using foreign saving – actually is importing financial capital. If $S^N > I$, the country is lending abroad.[14]

We have seen above that a fall of population determines an excess of capital and leads, in the long run, to a contraction of the capital stock. According to the dominant opinion, southern countries are generally in an opposite situation: a younger and faster growing labour force accompanied by a scarce capital endowment. Hence, these countries offer a higher rate of return on capital investment than developed countries. As a result, if capital funds can move freely, the abundant saving supply from developed countries will tend to flow to more profitable southern countries, thus helping the latter to avoid the low saving trap (Nelson, 1960), and the northern countries to cope with demographic imbalances without incurring too low interest rates on the pension funds. [15]

The example of table 5, inspired again by A&K (1995, p.215), can be of help. There are two countries, Southland and Northland. Both have access to the same Cobb-Douglas technology. In the calculations $A_t = 10$ and $\beta = 0.3$, as in table 1 above. Northland has double the number of workers. All magnitudes are expressed in per capita terms. In period 0 the capital stock in Southland is *1.5* units and the propensity to save *0.19*; in Northland they are, respectively, *5.99* and *0.5*. The marginal productivity of capital is higher in the poorer country, and this attracts some capital flow from the richer country. So Northland lends *1.36* units to the poorer country. What happens is that

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[14] Clearly, in the short period in the former case the country can melt away its net financial wealth by financing the current account deficit through the foreign reserves, or hoard the current account surplus improving its foreign reserves.

[15] Immigration from southern countries is alternative or complementary to capital outflows from developed countries. This solution, although consistent with mainstream theory, is less frequently cited since it is politically less palatable and reveals the lack of solidity of the demographic alarmism.

each 'young' in Northland (there are two of them for each young in Southland) employs *0.68* of their savings in investments abroad. Gross per-capita investment in the richer country falls by 0.68 and this determines a corresponding trade account surplus. In the northern country the capital stock falls to 5.31. On the other hand, foreign investment allows Southland to overcome the poverty trap. At the same time in period 1 the propensity to consume of the poorer country jumps to 0.5. So the foreign investment (1.36 units) *plus* the greater endogenous saving effort (2.45 units) determine a jump in capital stock to 5.31 units in period 2, the same level as in the richer country. In this same period, the greater national income and propensity to save allow Southland to achieve a trade balance surplus such that it can cancel the foreign debt, principal and the interest on it. Then, the now growing Southland, endogenously converges towards the secular equilibrium. Northland also meets again its secular equilibrium. As seen, according to the marginalist principles, factors' mobility brings about a secular tendency towards the international equalisation of factors' marginal productivity.

In this example, savings flow to the developing country in order to obtain the higher interest rate at the cost, however, of a negative effect on domestic investment, at least temporarily. The example may be modified slightly to take into account a demographic shock that reduces the number of young in the Northern country in *t = 2* by 11% - a figure chosen *ad hoc* for the sake of example (table 6). In this case, the demand for capital also shrinks by 11%. The olds may now lend 0.68 units of their capital assets – equal to 11% of their per capita endowment of 5.99 units – to Southland, also attracted by the higher rate of interest paid there. In this case Northland does not suffer from any fall in domestic investment. We can see by means of this example that in the case of a drop in fertility, foreign investment is an alternative to the channel of recovering the consumption goods crystallised in the capital goods envisaged in section 2. There the olds took advantage of the neoclassical factors' substitution mechanisms and of the wear and tear of the capital stock. Here, the excess of capital stock above and beyond what is necessary to equip the remaining workers at the

secular per capita capital intensity is exported to the southern countries, receiving consumption goods in exchange.

In view of the above, let us now examine the fears sometimes expressed that investment in foreign countries by *PFs* may lead to the loss of 'national savings' that are useful for national investment.[16] Suppose that, following a fall in population, gross investment *I* falls. Looking at equation (2), conventional economists would say that now gross investment *absorbs* less *national saving*, increasing the share of the latter available for *foreign saving*. In practice, the fall of *I* induces an equal fall in imports, which for given *E* and *X*, generates a surplus (or a lower deficit) in the current account, as in the second example.[17] If, referring to another situation, the introduction of a capitalisation scheme leads to a rise in national saving, this might be partially offset by a rise of *I*, that is, of endogenous absorption, but also by a rise of foreign lending to *southern* countries, if this is convenient to do so, as in the former example. In both cases, mainstream economists may confidently argue that, on the one hand, a positive net foreign lending of pensions savings to 'emerging markets' increases the global welfare and, on the other hand, this is not associated, in the long run, with a loss of domestic investment (cf. Reisen, 2000, cap.2 and 3). Aptly, in their textbook Krugman & Obstfeld (1994, Chapter 7) deal with foreign lending by Northern to Southern countries as intertemporal trade, that is a channel by which the former nations can conveniently postpone their consumption exporting capital to those countries where this is relatively scarcer. It should be appreciated that 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 and it is therefore subject to the capital theory

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[16] Diamond (1996, p.78), for instance, observes in passing that while 'economists generally favor having part of the portfolio invested abroad, this would be controversial in the United States today'.

[17] Given the full employment *GDP*, that is $Y = C + I + G + (E - M)$, the decreases in *I* and *M* are opposite in sign, so that national output does not change.

critique mentioned above. In the non-orthodox context there is no automatic mechanism that would translate the larger (potential) saving supply into domestic or foreign investment since a fall in the rate of interest does not affect investment either in the domestic economy or in that of other countries. The result, therefore, is a fall in national income and employment.

In this light, it is surprising to hear also from less mainstream oriented economists that if a country opts for pension funds, the risk is that savings are 'exported' instead of being invested at home.[18] In the light of the theory of effective demand this assertion is wrong and a non-Keynesian argument can be detected behind it. As said, there is no automatic mechanism that guarantees that domestic or foreign investment will increase, so that the potential greater saving supply from northern countries does not actually materialise. The adjustment of saving to investment is brought about by a fall in national income. True, this fall will result in a reduction of imports and an improvement of the current account, so that the country improves its foreign lending capacity. However, this does not resemble what the above-mentioned economists seemed to have in mind. They are referring rather to a more direct causality from a capitalisation reform, through a rise in national saving, to a rise in foreign lending. They miss the Keynesian point that a country cannot achieve an increase in its saving supply for domestic or foreign uses at will, by the mere institutional design of a new mandatory pension scheme. [19]

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[18] In Italy, for instance, Pizzuti has advanced this thesis: 'a very real risk for the Italian economy has been noted. A recent survey in the daily financial newspaper of the Italian industrialists' association, analysing investment opportunities for Italian pension funds, found "high performance and low risk in foreign stock markets", while "the Italian market is outperformed even by those in emerging countries". The conclusion is that "in the long run, the highest-yielding asset is foreign shares". In short, the development of private pension funds could result in an additional outflow of Italian savings' (1998, p.58).

[19] The conventional theory approach to international financial capital flows (as distinct from foreign direct investment), according to which surplus countries – those which present an excess of domestic saving over domestic investment – lend this excess to borrowing countries – those who

As an alternative to lending to southern countries, conventional economists have regarded the outcomes of the recent debates on Endogenous Growth Theory as an inspiration for a solution to the excessive supply of capital and consequent decline in its marginal productivity that may result from demographic shocks. The results of Endogenous Growth Theory are not, however, firmly established. It is only by employing an impressive number of *ad hoc* devices, that Endogenous Growth Theory assumes away the traditional causes of a falling marginal product of capital. The main idea is that any rise in the full employment saving rate, for a given labour supply, is an opportunity for technological advancement – for instance externalities from capital accumulation or increasing resources for R&D activities – that ex hypothesis takes the form of 'labour-augmenting' technical change. This keeps the ratio between capital and labour - the latter measured in 'efficiency units' – constant, so that the marginal product of capital is unvaried. The

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invest more than the domestic saving supply - should be so re-expressed. In the absence of controls over capital inflows, the international private financial institutions are able to create credit facilities to Southern countries that use it to increase their imports – only in the most fortunate cases of investment goods, more often of consumption goods. It is this increasing demand for exports from the Northern countries that generates the 'double surpluses' in these countries, in which the increasing exports determines a rise of income and saving, and the corresponding 'double deficits' in the Southern countries. In this alternative account, 'credit precedes investment and both precede savings', as Kriesler & Halevi (1996, p.309) effectively put it, and the saving-investment gap is 'nothing but the *ex post* accounting result of the operation'. In other words, at the beginning the borrowing country uses foreign liquidity to increase domestic investment or consumption - from the point of view of the lending economy, it is irrelevant which of the two. What is relevant is that the larger investment or consumption is accompanied by a greater amount of imports from the lending country. If this happens, in the lending country, given the amount of domestic investment I_0^l and imports M_0^l, there is an upsurge in the saving supply S_1^l over I_0^l that is matched by the equivalent increase of export X_1^l over M_0^l, so that $S_1^l - I_0^l = X_1^l - M_0^l$ (the famous 'twin surpluses'). The origin of foreign saving is not, however, in a higher saving supply 'which is lent abroad', but is the result of the process described above. A non-conventional approach clearly deserves further research.

present author has not only demonstrated elsewhere that Endogenous Growth Theory is far from being a new approach, since it was already well known in the 1960's and discarded at the time for being too simplistic and *ad hoc*, but has also provided new analytical reasons to reject it (cf. Cesaratto, 1999a, 1999b where other criticism by distinguished neoclassical authors, e.g. by Solow, Stiglitz and Hahn, is quoted, and Serrano & Cesaratto, 2002).

Final remarks

This paper examined the alleged advantages of a *FF* scheme in view of the pending demographic shocks. To show the advantages that, according to the standard view, a FF scheme has in coping with a demographic shock, compared to PAYG, is quite relevant to assess the argument, often heard, that both systems are equivalent in this respect. We examined a neoclassical example, inspired by A&K, in which the economy adapted to a demographic shock partly by a change in the capital-intensity of techniques, and partly by failing to replace part of the capital stock. We argued, on the one hand, that the first side of the adjustment is theoretically wrong and, on the other, the second side is empirically doubtful. Not surprisingly mainstream economists are rather worried about what will happen in the financial markets when the retired baby boom generation start to sell a substantial amount of capital assets accumulated in some countries despite the absence of major FF reform. We may therefore conclude that, in spite of the rather hasty way in which the criticism is made, those economists that point out the difficulties of a FF scheme to adjust to a demographic shock are partially correct, although not supported by the robust arguments provided here.[20] In addition, these economists also tend to forget that a FF scheme must be created first, committing 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 (cf.

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[20] Our line of reasoning should be completed by showing that, symmetrically, PAYG schemes are not ineluctable victims of the pending demographic mutations, but can survive them given the right set of employment and distribution policies based on the non-orthodox theory.(cf. Cesaratto 2002).

Cesaratto 2002). Since this is not so, the criticism of a FF reform should point to the difficulties of raising the amount of 'foresight' saving, the problems of the transition from PAYG to FF schemes and the questionable assumption of a continuing full-employment economy, where investment matches the saving supply (on these objections to a FF reform, cf. Cesaratto, 2002, 2003a). Note here an interesting, albeit partial, symmetry in the roles that the capital critique does play in the discussion on pension reform. We have seen above that this critique is part of the criticism of the neoclassical view of the adjustment process of a FF scheme to a demographic shock, so to speak in a *retrenchment* phase of a FF scheme. In my other contributions (Cesaratto 2002, 2003a) I have shown the ultimate role of the same critique in reproaching the mainstream view of the process of *creation* of a FF scheme.

We have also illustrated the mainstream view of southern countries, rich in labour and poor in capital, as a natural outlet for pension savings. Alternatively, the results of Endogenous Growth Theory have offered an alternative source of rebuttal of decreasing returns to capital accumulation. Outside the realms of traditional marginal theory and the *ad hoceries* of its recent endogenous growth version, however, it is difficult to think of any automatic translation of savings into investment, innovations and economic growth, either domestic or abroad. In this regard, we criticised the idea that if a country opts for pension funds, the risk is that savings are 'exported' instead of being invested at home.

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

Periods	Number of workers	Number of olds	Capital stock	Per capita capital	Per capita income	Wage rate	profit rate	consumption youngs	olds	net saving	net investment
1	100	100	5,987	5,987	17,106	11,975	0,857	5,987	11,119	0,000	0,000
2	100	100	5,987	5,987	17,106	11,975	0,857	5,987	11,119	0,000	0,000
	…	…									
infinite	100	100	5,987	5,987	17,106	11,975	0,857	5,987	11,119	0,000	0,000

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

Periods	Number of workers	Capital stock	Per-capita capital	Total (net) income	Wage rate	profit rate	per-c. consumption youngs	olds	net saving
Pre baby-bust secular equilibrium	100,0	598,74	5,987	1710,69	11,97	0,857	5,99	11,12	0,00
Baby bust (-10%)									
1	90,0	598,74	6,653	1589,06	12,36	0,796	6,18	10,75	-42,57
2	90,0	556,17	6,180	1554,29	12,09	0,838	6,04	11,36	-12,17
3	90,0	544,00	6,044	1544,01	12,01	0,851	6,00	11,19	-3,60
4	90,0	540,40	6,004	1540,94	11,99	0,855	5,99	11,14	-1,08
5	90,0	539,33	5,993	1540,02	11,98	0,857	5,99	11,13	-0,32
6	90,0	539,01	5,989	1539,74	11,98	0,857	5,99	11,12	-0,10
7	90,0	538,91	5,988	1539,66	11,98	0,857	5,99	11,12	-0,03
8	90,0	538,88	5,988	1539,63	11,97	0,857	5,99	11,12	-0,01
9	90,0	538,87	5,987	1539,63	11,97	0,857	5,99	11,12	0,00
…									
New secular equilibrium	90,0	538,87	5,987	1539,62	11,97	0,857	5,99	11,12	0,00

Table 3 - Simulation of life improvement in a neoclassical FF scheme*

Period	Per-capital capital	Capital stock	Total income	Wage rate	Profit rate	Youngs' consumpt.	Old's income	Old's consumption		Old's gross saving	Old's net saving
								1st period	2nd period		
Old secular eq.	5,99	598,70	1710,60	11,98	0,86	5,99	11,12	11,12	-	-	-
1	5,99	598,70	1710,60	11,98	0,86	5,99	11,12	8,34	0,00	2,78	2,78
2	8,77	876,70	1918,03	13,43	0,66	6,71	14,52	7,44	4,60	2,48	0,43
3	9,19	919,24	1945,49	13,62	0,63	6,81	15,03	8,23	4,05	2,74	0,36
4	9,55	955,31	1968,08	13,78	0,62	6,89	15,46	8,26	4,44	2,75	0,09
5	9,64	964,27	1973,60	13,82	0,61	6,91	15,56	8,34	4,45	2,78	0,04
6	9,69	968,71	1976,32	13,83	0,61	6,92	15,62	8,35	4,48	2,78	0,01
7	9,70	970,10	1977,17	13,84	0,61	6,92	15,63	8,36	4,49	2,79	0,01
8	9,71	970,67	1977,52	13,84	0,61	6,92	15,64	8,36	4,49	2,79	0,00
9	9,71	970,87	1977,65	13,84	0,61	6,92	15,64	8,36	4,49	2,79	0,00
10	9,71	970,95	1977,69	13,84	0,61	6,92	15,64	8,36	4,49	2,79	0,00
11	9,71	970,98	1977,71	13,84	0,61	6,92	15,64	8,36	4,49	2,79	0,00
12	9,71	970,99	1977,72	13,84	0,61	6,92	15,64	8,36	4,49	2,79	0,00
…											
New secular eq.	9,71	970,99	1977,72	13,84	0,61	6,92	15,64	8,36	4,49	2,79	0,00

Notes
* Corn economy; the young save 50% of their wage; the olds 25% of their 1st period earnings.

Table 4 - Simulation of a postponement of retirement age in neoclassical FF scheme

Period	Per-capital capital	Capital stock	Total income	Wage rate	Profit rate	Youngs' consumpt.	Old's income	Gross saving	Net saving
Old secular eq.	5,99	598,70	1710,66	11,97	0,86	5,99	11,12	0,00	0,00
Transition period*	5,99	1197,40	3421,31	11,97	0,86	5,99	0,00	598,70	0,00
New secular eq.	5,99	1197,46	3421,36	11,97	0,86	5,99	22,24	0,00	0,00

Notes
* The periods of work double, i.e. 200 workers, 100 retirees.

Table 5 - Simulation of pension saving flows to southern countries in a neoclassical FF scheme*

Southland**

Periods	capital	domestic income	wage	profit rate (%)	consumption youngs	consumption olds	propens. to save	net saving	net dom ivestmer	net foreign savings	net foreign income	trade balance
0	1,50	11,29	7,91	2,26	6,41	4,89	0,19	0,00	0,00	0,00	0,00	0,00
1	1,50	11,29	7,91	2,26	3,95	4,89	0,50	2,45	3,81	-1,36	0,00	-1,36
2	5,31	16,50	11,55	0,93	5,78	7,63	0,50	1,82	0,47	1,36	1,27	2,63
3	5,78	16,93	11,85	0,88	5,92	10,86	0,50	0,15	0,15	0,00	0,00	0,00
4	5,92	17,05	11,93	0,86	5,97	11,04	0,50	0,05	0,05	0,00	0,00	0,00
…	…	…	…	…	…	…	…	…	…	…	…	…
infinite	5,99	0,72	11,98	0,86	5,99	11,12	0,50	0,00	0,00	0,00	0,00	0,00

Northland**

Periods	capital	domestic income	wage	profit rate (%)	consumption youngs	consumption olds	propens. to save	net saving	net dom ivestmer	net foreign savings	net foreign income	trade balance
0	5,99	0,72	11,98	0,86	5,99	11,12	0,50	0,00	0,00	0,00	0,00	0,00
1	5,99	0,72	11,98	0,86	5,99	11,12	0,50	0,00	-0,68	0,68	0,00	0,68
2	5,31	16,50	11,55	0,93	5,78	11,57	0,50	-0,21	0,47	-0,68	-0,63	-1,31
3	5,78	16,93	11,85	0,88	5,92	10,86	0,50	0,15	0,15	0,00	0,00	0,00
4	5,92	17,05	11,93	0,86	5,97	11,04	0,50	0,05	0,05	0,00	0,00	0,00
…	…	…	…	…	…	…	…	…	…	…	…	…
infinite	5,99	0,72	11,98	0,86	5,99	11,12	0,50	0,00	0,00	0,00	0,00	0,00

Notes
* All per capita magnitudes
** Northland has a dimension double than Southland.

Table 6 - Pension saving flows to southern countries with demographic shock in the northern countries*

Southland

Periods	n.workers	capital	domestic income	wage	profit rate (%)	consumption youngs	olds	propens. to save	net saving	net dom. investment	net foreign savings	net foreign income	trade balance
0	100	1,50	11,29	7,91	2,26	6,41	4,89	0,19	0,00	0,00	0,00	0,00	0,00
1	100	1,50	11,29	7,91	2,26	3,95	4,89	0,50	2,45	3,81	-1,36	0,00	-1,36
2	100	5,31	16,50	11,55	0,93	5,78	7,63	0,50	1,82	0,47	1,36	1,27	2,63
3	100	5,78	16,93	11,85	0,88	5,92	10,86	0,50	0,15	0,15	0,00	0,00	0,00
4	100	5,92	17,05	11,93	0,86	5,97	11,04	0,50	0,05	0,05	0,00	0,00	0,00
…	…	…	…	…	…	…	…	…	…	…	…	…	…
infinite	100	5,99	17,11	11,98	0,86	5,99	11,12	0,50	0,00	0,00	0,00	0,00	0,00

Northland

Periods		capital	domestic income	wage	profit rate (%)	consumption youngs	olds	propens. to save	net saving	net dom. investment	net foreign savings	net foreign income	trade balance
0	200	5,99	17,11	11,98	0,86	5,99	11,12	0,50	0,00	0,00	0,00	0,00	0,00
1	177	5,99	17,11	11,98	0,86	5,99	11,12	0,50	0,00	-0,68	0,68	0,00	0,68
2	177	5,99	17,11	11,98	0,86	5,99	12,44	0,50	-0,68	0,00	-0,68	-0,58	-1,26
…	…	…	…	…	…	…	…	…	…	…	…	…	…
infinite	177	5,99	17,11	11,98	0,86	5,99	11,12	0,50	0,00	0,00	0,00	0,00	0,00

* All per capita magnitudes, unless different indications.