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Investment to Serve Future Consumption Needs
- Trade Theory Applied to Demographic Challenges

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Investment to Serve Future Consumption Needs

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Abstract

One-good-economy neoclassical models predict that the non-synchronized aging between developing and developed economies can cause interaction between them leading to a Pareto improvement, e.g. Holzmann (2000). Interaction can be released through pension reforms introducing foreign funding. As shown in this paper, these possible gains from pension reform might not occur when more than one sector of production is considered. The equilibrium may be characterized by no interaction between developed and developing regions. This paper takes into account the fact that some goods are non-tradables and suggests a reformulation of the so-called Lucas paradox (Lucas, 1990).

JEL-codes: F11, F21, H55, J11

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During the last four decades, the OECD countries have experienced a decline in fertility rates and an increase in life expectancy (UN, 2003). In the coming decades, the ratio of the number of workers to the number of elderly people will decline. It is therefore a challenge to meet future consumption needs. Many economists argue that a reform of the present pension systems is needed, and a transformation from the commonly used pay-as-you-go (Paygo) schemes to funding has been promoted, e.g. Modigliani et al (2000).

However, poor countries have undergone a different demographic development. Many of them have high population growth rates that will result in much higher ratios of potential workers to elderly than is the case for the OECD countries. In addition, there is less capital equipment in poor countries. Consequently, poor countries have lower capital / labor ratios than richer countries.

This paper discusses whether these demographic differences could cause interaction leading to a Pareto improvement, by means of a pension reform. The simplest neoclassical production function[2] in which only two factors of production, labor and capital, are included, predicts that the return on capital will be higher in relatively capital-scarce countries. One should then observe a higher return on capital in poor than in rich countries. If capital is mobile, it could result in capital movements from rich to poor countries, i.e. pension funds invested in developing countries. Yet, although many barriers on capital movements have been removed, these movements have not been observed. This is sometimes referred to as the Lucas paradox (Lucas 1990). Lucas (1990) himself discusses differences in human capital and capital market imperfections.

This paper discusses another possible explanation to the paradox, including neither human capital nor capital market imperfections. When taking into account the fact that some goods are non-tradables, the predicted capital movement might not occur because the repayment is

[2] In this paper the term 'neoclassical' will refer to the production functions with decreasing returns to scale with respect to each factor of production, in addition to a utility concept with the same properties; the utility is increasing, but the increase is decreasing as access to one good increases.

not possible. It is shown that a reformulation of the paradox is necessary when labor intensive goods are less tradable than capital intensive goods. Labor intensive goods are interpreted as services, the provision of which is seen as the main challenge for aging societies.

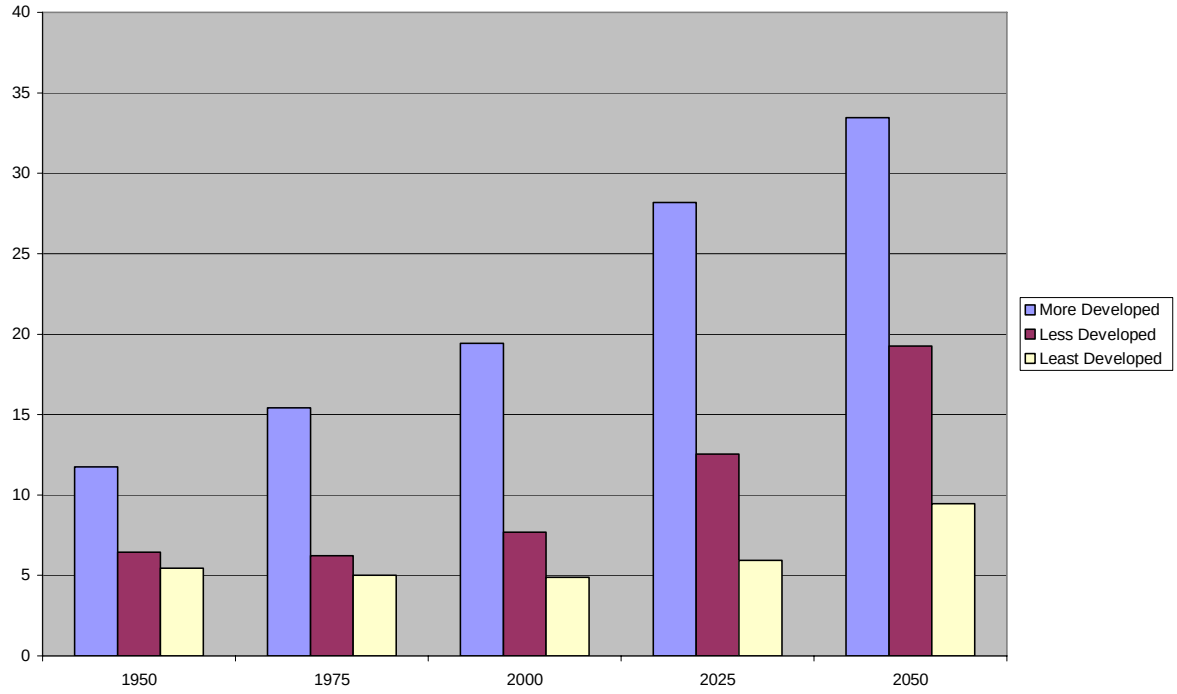
The first section of this paper describes various demographic developments, differences in capital / labor ratios and neoclassical predictions, while the next section provides a short introduction to the debate on funding versus Paygo pension systems. Finally, the last section discusses whether a pension reform could cause Pareto improvement by taking advantage of the different demographic trends in developed and developing countries.

The challenging future

The OECD countries have a demographic situation that challenges both current pension systems and the meeting of future consumption needs. The ratio of the number of workers to the number of elderly (i.e. the dependency ratio) is decreasing. The need for service provision for the aged is growing, leading to a higher demand for labor in the service sector. On the other hand, the total labor supply is decreasing in many of the OECD countries. Consequently, if the capital stock is fixed or grows at a positive rate, the capital/labor ratio in these countries will grow.

Poor countries also face a challenge in meeting future consumption needs. However, the demographic situation in these countries is different from that of the OECD; their population growth rate results in a much lower dependency ratio, as shown in diagram 1. If the savings rate and the rate of the inflow on capital are constant, the result will be a decreasing capital/labor ratio.

Diagram 1 Percentage of people over 60 years in the total population*



(*) Numbers from UN (2003)

Under the assumption that all other variables that can influence production are the same in developing and developed regions, the neoclassical models will predict:

- Capital movements from rich to poor countries where the rate of return is higher
- Labor movements from poor to rich countries where wages are higher
- Occurrence of trade; capital intensive goods flowing from the rich countries to the poorer ones and labor intensive goods flowing in the opposite direction
- Increased capital investment in one region, with all other variables constant, leading to a decrease in the return on capital in that same region

Lucas (1990) considered two countries producing the same good with the same constant returns to scale production function, relating output to homogenous capital and labor inputs. He then focused on the first prediction and asked why capital does not move from the richer to the poorer countries. This has later been called the Lucas paradox. The immediate answer to the question posed by Lucas is that the other variables that influence production are not the same for developing and developed regions. Lucas (1990) himself discusses differences in human capital and capital market imperfections. In this article however, a possible

explanation of the Lucas paradox will be given by introducing non-traded goods, keeping all other production variables equal between developing and developed regions.

The pension debate

It is widely accepted that the aforementioned demographic development constitutes a substantial challenge to the pension systems in all OECD countries. There is, however, no consensus as to whether the system should be changed from the most commonly used Paygo system to a system based on funding. Funded systems differ from Paygo in the sense that each generation accumulates assets to pay for own pensions when they retire. Modigliani, Ceprini, and Muralidhar (2000) argue that the current public Paygo system should be replaced by a fully funded scheme. The argument is that funding increases saving, and saving in financial assets gives a higher rate of return than the sum of population and productivity growth.[3] As a result, the need for future contributions will be reduced. The authors propose a shift from the Paygo system to a fully funded system in United States. They argue that the fully funded system is more cost effective in the sense that it requires smaller contributions for a given set of benefits. With a 5% rate of return on capital, they calculate that the required contribution to the system based on funding would be as low as 1/3 of that of the Paygo system. They propose that all participants' contributions be invested in one common, highly diversified portfolio consisting of a share of US' production, i.e. they argue in favor of domestic prefunding[4].

The promising calculations of Modigliani, Ceprini, and Muralidhar (2000) may be challenged by two main arguments.[5] First, the relatively high return on capital experienced in the last century in the US cannot be seen as constituting common rule for future predictions.[6] In a neoclassical framework, increased capital investment, i.e. pension funds that increase total national savings, decreases the return on capital. In addition, a decline in the labor force, i.e. the predicted future for many OECD countries, also tends to lower the capital returns. These predictions are supported by simulations (OLG models) indicating that

[3] In a Paygo scheme, the implicit return of the system is the sum of population growth and productivity growth.
[4] This discussion is interesting for the purpose of this paper, although the focus here is *domestic* funding. This paper focuses on non-traded goods, and some of the arguments for a closed economy will apply to a partly closed economy with one traded and one non-traded sector.
[5] The two arguments are related, and can be said to be only two ways to express the same point, in a closed economy.
[6] The US has experienced declining rates of return in recent years.

the return on savings for members of large birth cohorts (e.g. 1945-50) will be substantially lower than for other, smaller cohorts (e.g. Brooks (2000)).
Second, pensioners are not interested in money or accumulated assets per se, but in consumption. In a closed economy, pensioners can only consume goods and services by consuming some of the goods produced by the working population[7].

As a result, a transition to a system based on domestic funding can only meet the challenges of aging societies through an increase in output. If a pension fund is invested in foreign markets, however, future consumption of pensioners does not necessarily rely on *domestic* output.

In sum, when discussing whether or not the OECD countries should save in funds for future consumption, three aspects must be taken into consideration. First, saving in one region, all other things unchanged, could reduce the return on capital. Second, the predicted return on savings is higher in developing regions than in the OECD. Third, in a closed economy pensioners' consumption has to be produced by the current young, irrespective of pension system applied. In an open economy with foreign funding, however, only the non-traded goods must be produced by the current young in the country.

These aspects give a rationale to discuss Holzmann's (2000) argument that the non-synchronized aging between developed and developing countries could provide higher return for the one and higher capital formation for the other. The savings in the Norwegian Petroleum Fund (NPF) is an example of a country's savings for future consumption needs in foreign markets. However, it is invested in other OECD countries, i.e. countries with similar demographic developments as Norway. Thus, both the Lucas paradox and the predictions of decreasing return to savings apply to the NPF.

[7] Barr (2002) stresses this point by stating that if the production is fixed, there are two possible scenarios from funded schemes: Suppose that pensioners seek power over future production by building up piles of money, for example, government bonds. In that case, desired pensioner consumption exceeds desired saving by workers. Excess demand in the good market causes price inflations, reducing the purchasing power of pensioners' annuities.
Suppose, instead, that pensioners seek power over future production by accumulating non-money assets, for example, equities. In that case, pensioners' desired asset sales exceed desired asset purchases by workers. Excess supply in the assets market reduces asset prices, reducing pension accumulations and hence the resulting annuity.

Why do investments take place in capital abundant rather than in capital scarce countries?

> If the principles of international division of labor are to be applied, labor must either be transported towards capital (emigration), or capital must be transported towards labor (industrialization). From the point of view of maximizing the world income, the difference between these two ways is one of transport costs only, and may be assumed to be negligible. Emigration and resettlement would, however, present so many difficulties in immigration areas (and in emigration areas) that it cannot be considered feasible on a large scale. A very considerable part of the task will have to be solved by industrialization. (Rosenstein-Rodan, 1943)

Two sector model

Consider a two-country– two-sector (2x2) model. The neoclassical assumptions apply to the production functions, which are given by:

(2) $S = F_S(K, L)$

(3) $C = F_C(K, L)$

K and L denote capital and labor, respectively. The two sectors have different production technologies, and the C sector is assumed to be most capital intensive in production. The OECD countries are relatively better supplied with capital than developing regions.

In the following section, the situation in which both goods are tradables is described. Thereafter the non-traded sector is introduced.

Free trade in Commodity Markets (The Hecscher-Ohlin-Samuelson theory of international trade)

In this section I consider the situation in which both goods are freely traded, i.e. there are no trade costs and perfect competition. The two factors of production however, are totally immobile between countries. As long as perfect specialization does not occur in the post-trade equilibrium, the relative commodity prices after trade will be equal in both countries, and they will lie in the interval between the two pre-trade autarky prices. When the poor

country is relatively labor abundant, the relative post trade prices will be given by the relation:

$$(4) \qquad \left(\frac{P_S}{P_C}\right)^{Post-trade} \in \left(\left(\frac{P_S}{P_C}\right)_D^A, \left(\frac{P_S}{P_C}\right)_O^A\right)$$

Superscript A indicates the autarky prices and subscripts O and D represents OECD and developing countries, respectively.

Consumers are assumed to have homothetic and equal preference paths in the two countries. As a result, the relative price level in autarky for poor countries is lower than the relative price level for rich countries.

$$(5) \quad \left(\frac{P_S}{P_C}\right)_D^A < \left(\frac{P_S}{P_C}\right)_O^A$$

If both goods are tradables, the post-trade world market price will lie somewhere between the two autarky price levels.

The supply will equal the demand for each commodity in equilibrium:

$$(6) \quad C_P^D + C_P^O = C_C^D + C_C^O$$

$$(7) \quad S_P^D + S_P^O = S_C^D + S_C^O$$

If the trade is balanced between the two countries, the world market prices are decided so that the value of total consumption is equal to the value of total production in each country:

$$(8) \quad \begin{aligned} P_C * {C_P}^D + P_S * {S_P}^D &= P_C * {C_C}^D + P_S * {S_C}^D \\ P_C * {C_P}^O + P_S * {S_P}^O &= P_C * {C_C}^O + P_S * {S_C}^O \end{aligned}$$

where post trade world market prices have superscripts* and subscripts C and P denote consumption (C) and production (P), respectively.

The left side of the equation expresses country i's total income. $(C_P{}^i)*$ and $(S_P{}^i)*$ denote i's production of the two commodities in the post-trade equilibrium. The income, $\bar{I}$, will then be expressed as follows:

(9) $$P_C*(C_P{}^i)*+P_S*(S_P{}^i)*=\bar{I}^i$$

S and C with superscripts * are the production levels in the tangency point between the production possibility set (PPS) and the post-trade relative price line. $\bar{I}$ is the resulting income level for the country under consideration. The income level in each country depends on its endowment of production factors, consumer preferences and the other country's factor endowment.

When trade is balanced, the value of the consumption equals income:

(10) $$\bar{I}^i = P_S*S_C{}^i + P_C*C_C{}^i$$

Implicit derivation with respect to $C_C{}^i$ gives:

(11) $$0 = P_S*\frac{dS_C{}^i}{dC_C{}^i} + P_C*$$

This gives us the optimal consumption point:

(12) $$\frac{dS_C{}^i}{dC_C{}^i} = -\frac{P_C*}{P_S*}$$

The optimal consumption point will lie outside the country's production possibilities, and the utility is thus higher than in autarky.

The S sector produces non-traded goods

If one of the commodities is non-tradable, however, as assumed in Mundell (1957), the outcome may differ. Mundell (1957) claims that trade in factors and trade in goods are substitutes and he demonstrates this by introducing a non-traded sector. Yet, his conclusion needs not be true. It relies on his assumption that the non-traded goods use the mobile factor intensively in production.

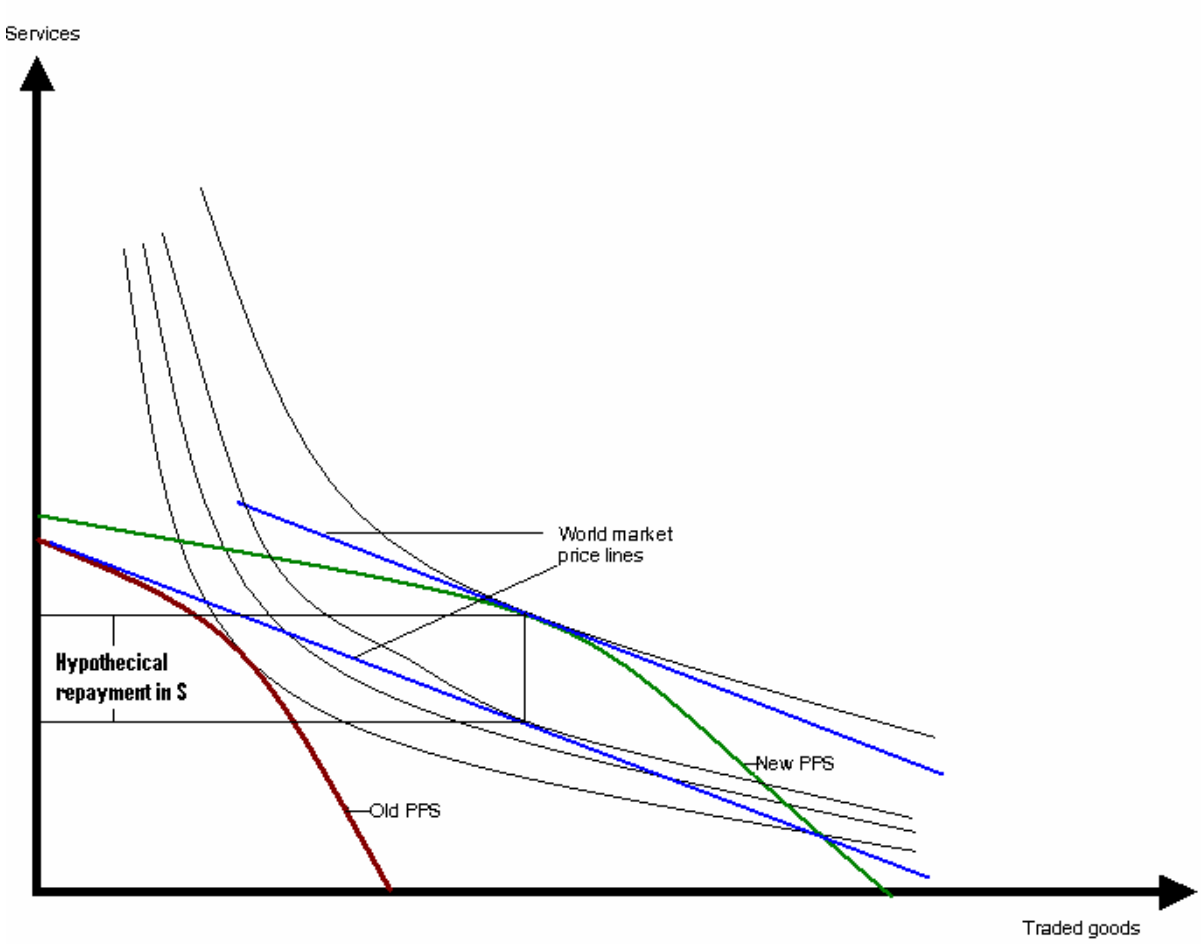
In the case of non-synchronized aging, however, non-traded goods are here assumed to be labor intensive, and goods trade and capital mobility are no longer substitutes. The assumption made here is that labor intensive *services* are non-traded and that labor is immobile between countries. The other sector can be interpreted as, for example, manufacturing. For simplicity, services are assumed to be totally immobile between countries, while manufacturing goods can be traded without costs. The rationale for this assumption is that services are often produced at the point of consumption. It is not possible, for example, to transfer health and care services from one country to another without either moving workers to the consumption point or consumers to the production point[8]. Manufactured goods, by contrast, can most often be produced in one country and bought by consumers in another country[9].

Capital mobility

Illustrating the capital flow in the same way as in Mundell (1957) would predict a flow on capital from the rich country to the poor, and a repayment in S goods. If the services could be traded, we would then have a situation similar to the one described in Holzmann (2000). The capital would then flow to developing regions, resulting in higher returns for developed regions and higher capital formation in developing regions. This is illustrated in diagram 2.

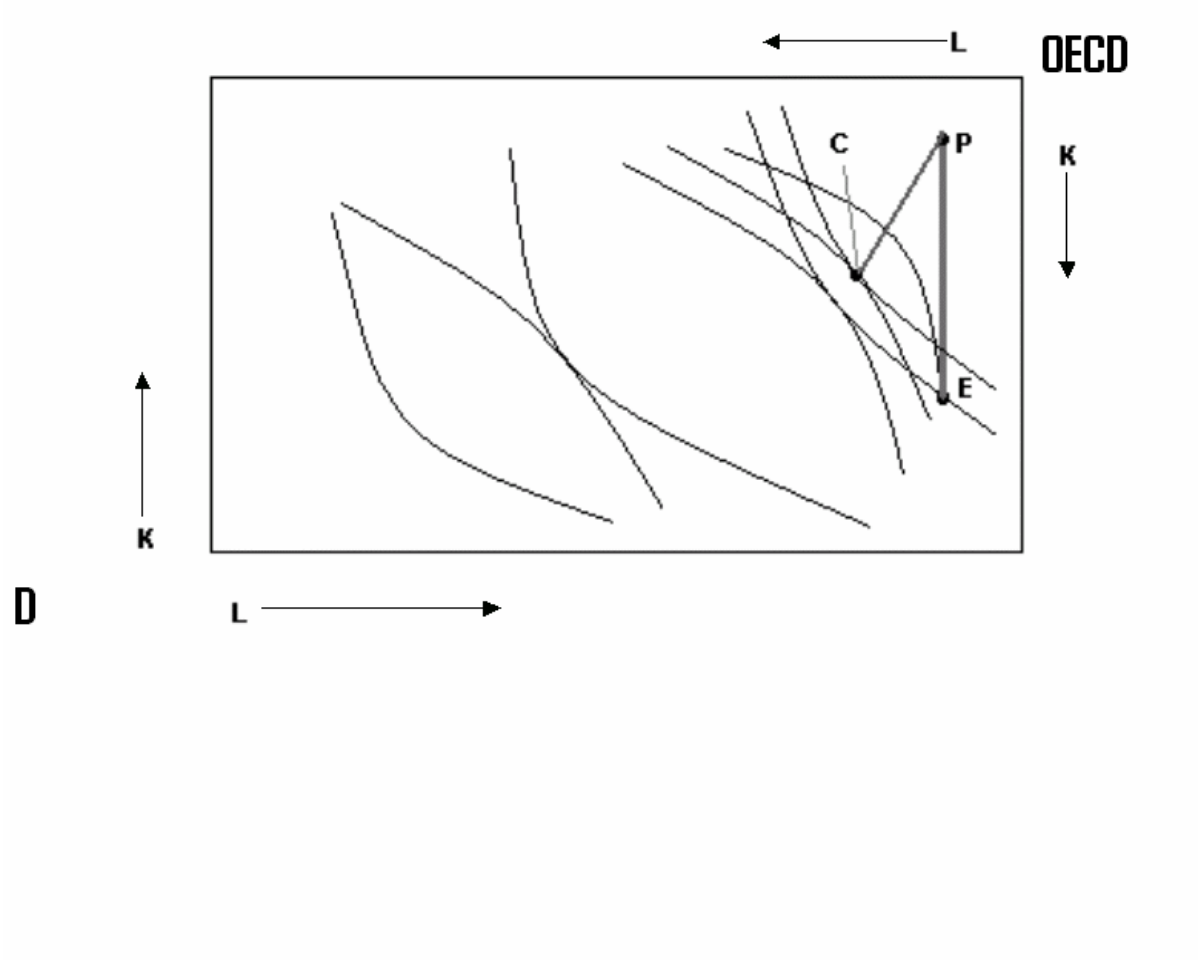
[8] In the pension debate, it has been suggested that pensioners can move to the production point. This will not be discussed further in this paper, where consumers are assumed to be immobile between the OECD and the developing countries.
[9] Obviously, times have changed in this respect with the remarkable improvements in information technology during the last decades. It is now possible to make use of the Internet to send information services from one country to another. In fact, it might be claimed that services are less costly to transfer from one country to another than manufactured products. The focus on aging societies, however, gives the rational for discussing health and care-services that are difficult to transport.

Diagram 2 Capital movement from OECD to D, PPS for developing countries



Capital would move to the poor countries, and service provision would be returned to the OECD countries. The S goods, however, are immobile between countries and repayment is impossible. Thus this situation will not occur. The prediction drawn from this model, however, in which there are no barriers to capital movements, is that capital will flow into the poor country to the extent that it becomes capital abundant compared to the rich country, and the poor country will send capital intensive goods back as repayment for the capital loan. This argument can be found in Venables and Norman (1995) and can be illustrated in an Edgeworth box, as done in diagram 3.

Diagram 3 Edgeworth box with capital mobility and non-traded goods



Rosenstein-Rodan (1943) expressed capital movements to one region as industrialization of that region. Using this terminology, the above technical situation would lead to industrialization of the poor countries and deindustrialization of the OECD countries. These large movements on capital have not been observed. Thus, the paradox regarding capital movement might not only be that poor countries are not industrialized, but also that the industrial countries are not deindustrialized.

Thus a reformulation of the Lucas paradox is necessary:

If the labor intensive goods are less tradable than the capital intensive goods, capital is mobile and labor is immobile between countries, capital moves to the developing countries to the extent that the poor countries have relatively more capital than the rich countries. These flows on capital have not been observed.

If deindustrialization of the industrialized countries does not happen, because of political, technical or other constraints, the fact that labor intensive goods tend to be less tradable than capital intensive goods could be an explanation of the Lucas paradox.

Future will evince whether pension reform will cause interactions between regions with different demographics by means of pension funds invested in developing countries (or emerging markets). One-good-economy-models (i.e. Lucas 1990) predict that such investments are Pareto improving. However, in reality, some goods are non-tradables. The discussion above indicates that when the non-tradables are incorporated in the models, these predictions do not hold.

Concluding remarks

The statement by Holzmann (2000) that non-synchronized aging between developing and developed countries could result in higher capital formation for poor countries and higher return on investments for developed countries, is worth noting at a time when funding has been suggested as the solution to the challenges of aging societies. An increase in funding within the OECD area, together with a fall in the labor force in some of the OECD countries, could result in decreasing rates of return on capital investments in this area. The necessity of production by the future working generation will remain even if the pension system is changed towards domestic funding. If the pension funds are invested in foreign markets, however, future consumption could differ from future production. Further, if the funds are invested in economies with different demographic developments, the predictions from One-good-economy-models are that one should experience higher rates of return.

However, a focus on service provision is needed in the OECD countries. If services are of a non-traded character and labor is immobile between the OECD countries and developing countries, the optimistic view of Holzmann (2000) is not realistic. The Lucas paradox will then apply to the investment for future consumption needs through pension funds invested in OECD countries (i.e. the Norwegian Petroleum Fund).

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