Global Demographic Trends and Social Security Reform

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1. Introduction

The issue of pension reform has recently received a considerable amount of attention, both in developed and in developing countries. In the former group the interest arises from the fact that current demographic trends –which project a dramatic increase in dependency ratios over the next 20 to 40 years– make the unfunded, pay-as-you-go pension systems currently in place in most of these countries, unsustainable. Some countries in Latin America, on the other hand, have pioneered the move towards funded private pension systems. Chile was the first country to move in that direction, followed in recent years by many others, including Mexico, Colombia and Argentina. The issue is also being discussed in Brazil.

The debate during the last decade has made clear the dramatic implications that current and future demographic trends can have on unfunded pay-as-you-go systems and has highlighted the need to look into the transition to a funded, and possibly private, one. It has become clear that the progressive aging of the population in many parts of the world, associated with decreasing fertility and increasing longevity, makes it very difficult to maintain PAYG systems with current levels of benefits and contributions. These trends will begin to be of relevance in less than 20 years in countries such as the US and those in Western Europe. In Latin America, on the other hand, as the aging process is much more delayed, they will not become an urgent issue for some time.

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Two important aspects of the problems associated with the aging of the population and its implication on the design and reform of pension systems have been only marginally discussed, if not entirely neglected. First, the same demographic trends that make the PAYG systems unsustainable are bound to have important implications for the welfare of a relatively 'large' generation followed by a relatively smaller one, even in situations in which the pension system is fully funded and possibly private. The reason behind this is the general equilibrium effects on factor prices. In a situation in which the capital labor-ratio is relatively high, the return on capital is bound to be low. As a consequence, the consumption that can be sustained by a relatively 'large' generation when it retires might be small.

Moreover, a 'baby-boom' generation faces a disadvantageous situation during its working years. Because such a generation is presumably larger than the previous one, it receives wages when labor is relatively abundant and when, therefore, wages are relatively low. The welfare consequence of this demographic situation might be exacerbated if, in addition, such a generation has to pay, at least in part, the cost of the transition from an un-funded to a funded scheme.

Second, very little has been said about the fact that demographic trends across the world are not synchronized. While in Latin America fertility rates have dropped quite dramatically in the last ten years or so, they are still well above those observed in developed countries. At the same time, longevity has increased in both regions, but it is still considerably lower in Latin America. The important consequence of this lack of synchronization is the fact that dependency ratios are projected to be much larger for the US and Europe than for Latin America. We argue that these differences in population structure among different regions of the world constitute an important opportunity.

As different regions of the world age at different speeds, this creates the potential for large production factor flows that could benefit both regions. If the capital-labor ratio is 'too high' in a given region, maybe because of the prevailing demographic structure of the population, there will be incentives for capital to move out and for labor to move in, in order to exploit return differentials. The capital invested in less developed region could yield returns that could not be obtained in other regions of the world and, in doing so, help finance the retirement of the US and European

baby boomers, while at the same time contributing to the development process in those regions.

In what follows we will focus mainly on the issue of capital mobility. Other papers have looked at the possibility that labor migration could alleviate some of the problems faced by the US social security system[1]. The main aims of this paper are two. First, we compare the welfare of a generation who is larger than both its predecessors and its offspring, of current demographic trends, in the absence of production factor flows, to that of the previous and following generations. The obvious example of such a generation is that of the US and European baby-boomers. Although some of the simulations will be calibrated to the data of the baby-boomers and their adjacent cohorts, it should be kept in mind that this type of problems will be faced by other regions in the future.

Second, we discuss the potential contribution of un-synchronized demographic trends and differences in existing capital stocks to the solution of the pension problem. As mentioned above, this problem is of immediate relevance in the US and Europe, but could become of extreme importance for other regions as well. Furthermore, if the solution to the welfare problems of the baby-boomers in retirement created by prevailing demographic trends is to be found in difference in these trends across different regions, such a 'solution' could be extremely relevant for other regions as well. In particular, such a process could foster development and growth in developing countries.

Current differences in levels of development between the US and Europe on one hand and Latin America on the other, increase the likelihood that the effects we discuss are important. In other words, if the returns to capital are negatively related to capital labor ratios, both differences –in (future) demographic trends and in existing capital stocks– will point to flows of capital (and possibly of labor) in the same direction.

To study these issues we use a general equilibrium approach. We begin by presenting a simple overlapping generations model which we use to

1 Storesletten (1998) computes the amount of immigrants that the US would require in order to keep the current system sustainable.

quantify the welfare effects of current demographic trends on the generation of individuals that will retire in the US and Europe in the next 40 years. We perform the computations under the assumption that these economies are closed and that the pension system is fully funded and private. We therefore ignore both transition issues and the opportunities created by different demographic trends. We then perform a similar computation for an economy with the age structure and demographic trends of Latin America.

Second, we allow for capital flows between these two model economies, in an attempt to find an answer to the following questions: (i) Does the lack of synchronization of projected demographic trends alleviate the problems faced by the two economies in isolation? (ii) How large should the capital flows be in order to achieve similar rates of return on both regions?

While these two exercises provide useful pieces of information, they miss at least two important factors. First, most developed economies will have to go through a transition from an unfunded to a funded system. The transition might be costly and might have an effect on the ability to exploit the opportunities afforded by the differences in demographic trends. Second, even in the presence of large differences in capital stocks, we currently observe relatively small capital flows.

Obviously, this paper cannot hope to explain why such flows are small. However, in evaluating the impact that the differences in demographic trends might have, we want to take into account the possibility that capital flows might take time to build up. In the second part of the paper we develop these two issues. The issue of impediments to capital flows is particularly important. If the potential from fully mobile capital is large –both in terms of guaranteeing large enough returns for US and European investors and to advance development in Latin American economies– there will be strong incentives to put in place the right type of institutions that can guarantee an orderly flow of capital.

Finally, in the concluding section we point to a number of important areas of future research. In particular, we would like to draw attention to the differences in the stock of human capital in the two regions under consideration and to the importance of the process of human capital accumulation. Furthermore, and related to the issue of the stock of human

capital, we would also like to consider the possibility of specialization in the production of commodities with different intensities of human capital and skilled labor in the two regions. Finally, while the focus of the paper are the US and Europe on one side and Latin America on the other, similar arguments could be applied to other developing regions, such as Africa and Asia.

The rest of the paper is organized as follows. In Section 2 we present the projected demographic trends in Europe, the US and Latin America. We also present some evidence on the differences in capital stocks and on the current size of capital flows. In Section 3 we present the overlapping generations model, whose basic structure we use in most simulations. In this section we also present some basic simulations for two closed economies, chosen to mimic, in their demographic behavior, Europe and the US (which we will call the 'North') and Latin America. In Section 4 we remove the assumption that the two economies are closed and introduce different assumptions regarding capital mobility. One is that capital is fully mobile. The other models introduce imperfections to capital markets in an ad-hoc fashion, trying to replicate the observed (small) capital flows. In section 5 we conclude.

2. Demographic Trends

In this section we want to illustrate the main demographic trends that motivate the exercise we propose below. For this purpose, rather than focusing on a few countries or detailing the trends in all countries in the regions of interest, we construct to wide aggregates. The first, which we label the 'North' is composed of the United States and Europe. The second is composed of most of the South and Central American countries (including Mexico). The data on demographic variables and projections come from the United Nations.

In Figure 2.1, we plot, from 1950 to 2050, actual and projected populations in the two regions. The vertical line in this and in the following figures indicates 1999. As can be seen, while the North is slowing down and even slightly decreasing, the population of Latin America is still increasing considerably. The relative size of the two regions in terms of population is projected to change around the year 2020. In Figure 2.2 we plot the relative

Figure 2.1 Population in US + Europe and Latin America

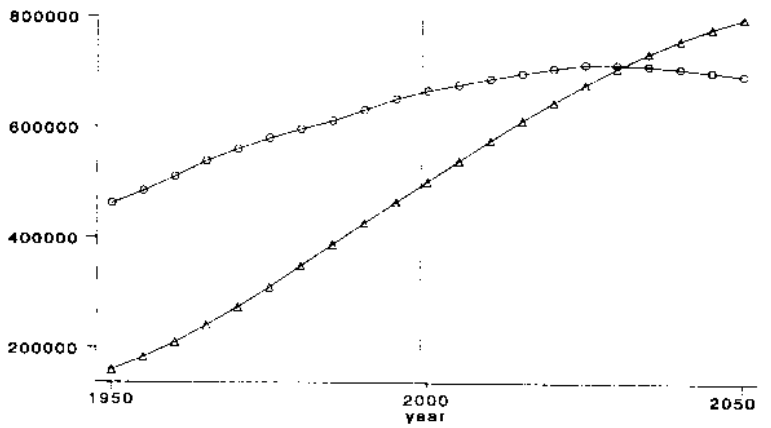
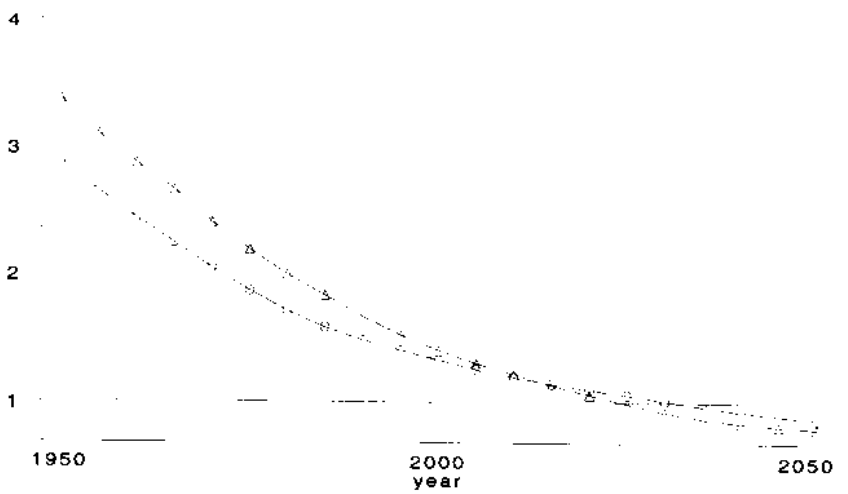


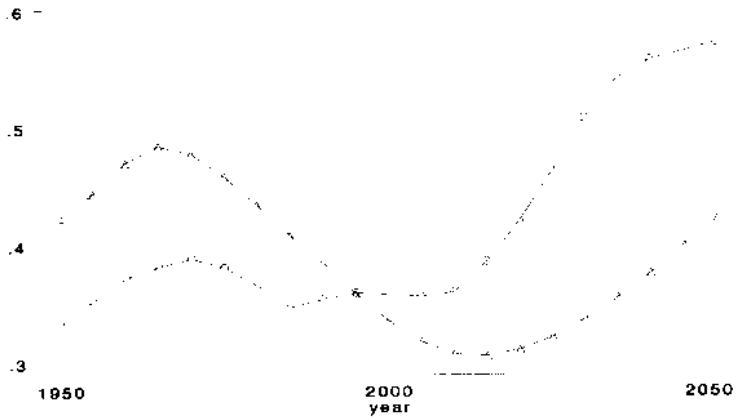
Figure 2.2 Ratios of total population and population aged 15-64 in US + Europe and Latin America



size of the two populations and the ratio of the number of individuals aged 15 to 64 in the two regions. Not only Latin America is becoming larger than the North, but this trend is even more pronounced for the part of the population that is of working age.

To stress the importance of these trends, we compute, for the two regions, several definitions of dependency ratios. The first is defined as the ratio of the number of individuals aged more than 64 plus half the number of individuals aged 0 to 14, to the number of individuals aged 15 to 64. This definition considers in the numerator all individuals that somehow have to be supported by those currently working, while trying to implement a crude adult equivalent scale. This definition of dependency is plotted in Figure 2.3. After decreasing during the 1970s and 1980s when the bulk of the baby boomers reached maturity, the dependency ratio in the North is now increasing slightly and is projected to increase dramatically over the next 50 years. This increase is caused by a dramatic drop in fertility and by a substantial increase in longevity. The increase is particularly pronounced in Europe, where the decrease in fertility was greater.

Figure 2.3 Dependency ratios in US + Europe and Latin America [0.5* pop 0-14 & pop 65+]/pop 15-64

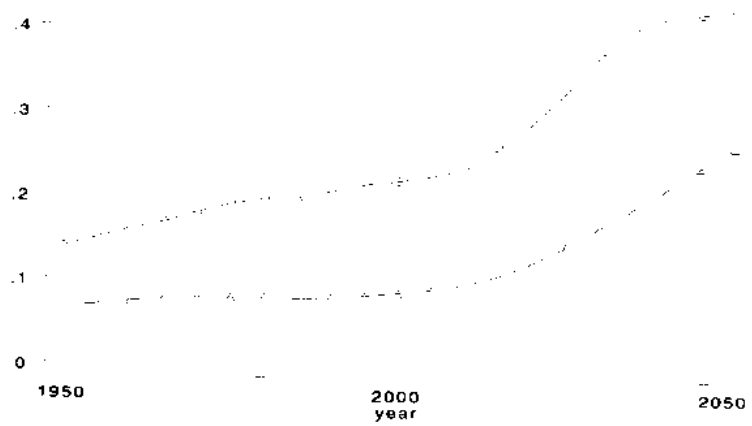


In Latin America, instead, dependency ratios are falling considerably and are not projected to start increasing until the year 2025. This picture shows that there is a large potential for capital accumulation in Latin America, as a large number of working age individuals will have to support a relatively small number of old and young individuals.

In what follows we will stress the potential created by differences in capital-labor ratios in different regions. If one would think that older individuals

are the holders of capital, which they have accumulated to finance consumption during retirement, then, in the aggregate, capital-labor ratios will be a function of the number of retired individuals to working age ones. Therefore, it might be interesting to consider an alternative definition of dependency ratio, one which excludes children completely. In Figure 2.4 we plot the ratio of individuals aged more than 64 to those aged 15 to 64. The picture does not show the dramatic differences in the dynamics of the series for the two regions, as it shows that this variable is increasing both in the North and in Latin America. However, what is relevant for our argument is that this dependency ratio is much higher in the North. Only towards the end of the period considered (2050) is there a slight tendency for the dependency ratio in Latin America to catch up with that of the North.

Figure 2.4 Dependency ratios in US + Europe and Latin America [pop 65+]/pop 15-64



In Figures 2.5 and 2.6 we plot two of the main determinants of the trends in Figure 2.3 and 2.4. In particular, in Figure 2.5 we plot average fertility rates (measured as the number of children per women aged 15 to 45) and in Figure 2.6 we plot life expectancy. Notice that even though fertility has decreased dramatically in Latin America, it is still way above the numbers observed in the North. Life expectancy, on the other hand, is still much higher in the North, even though there is some tendency for the two series to slowly converge.

Figure 2.5 Fertility rates - US & Europe and Latin America

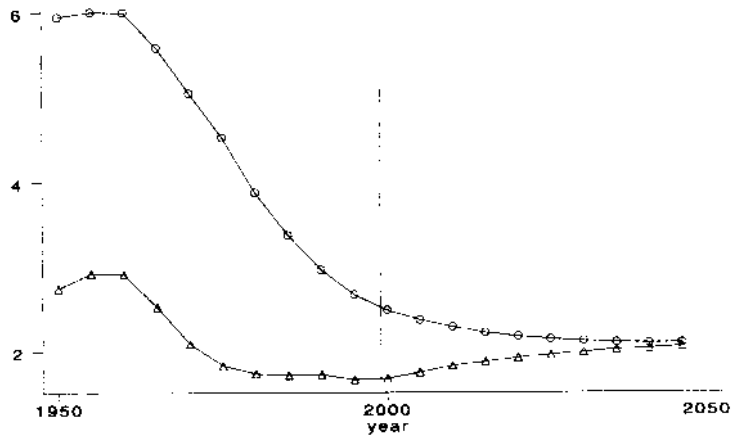
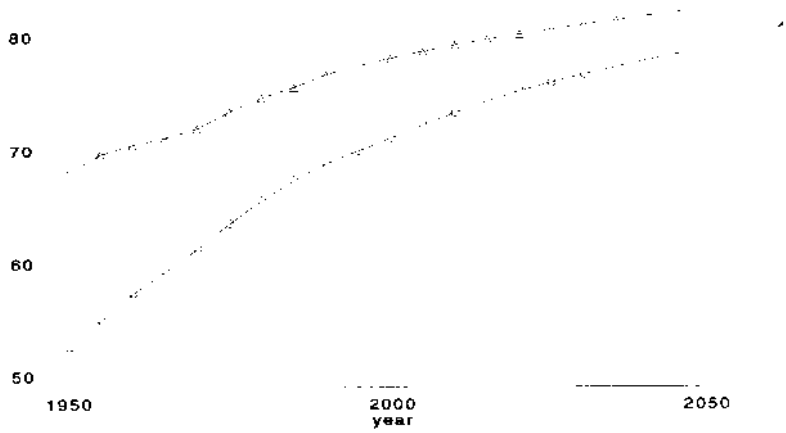


Figure 2.6 Life expectancy - US & Europe and Latin America



The simple demographic trends illustrated so far show the large potential for factor mobility that might exist between the two regions. However, these trends are only part of the story, as they neglect some other relevant factors. The three most important are: (i) labor force participation rates; (ii) human capital accumulation; and (iii) differences in the existing stock of capital.

Labor force participation rates have changed dramatically over the last 25 years, and they keep changing. In the North, men participation has decreased and women participation has increased. In many countries, the two are no longer very different. The large increase in female labor force participation means that the there is a limited scope for increases in the number of workers in the North that could come from this source.

On the contrary, in Latin America, while female labor force participation has increased, it is still considerably lower than that of men, or that of women in the North. Therefore, an additional increase in the relative size of the labor force might be a consequence of historical trends that increase female labor participation in Latin America. We will not investigate this aspect, as one would need to model the effects of economic incentives on the decision to participate. Our neglect of this issue probably causes us to underestimate the effects we stress below.

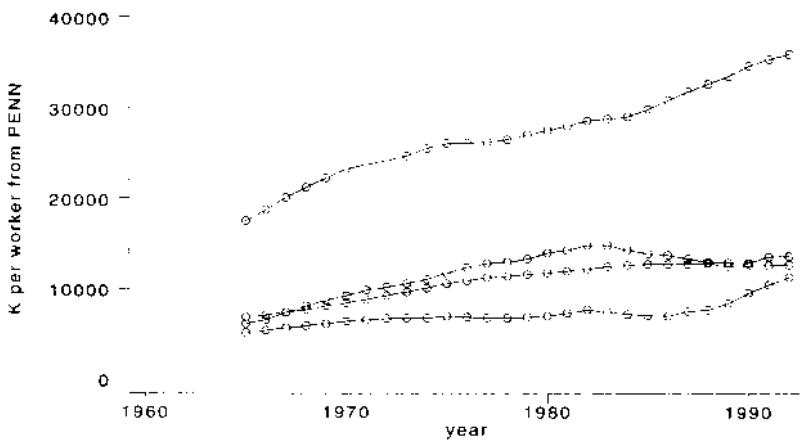
We will also neglect the issue of human capital accumulation. This is a very important topic of research, beyond the scope of this paper. It is not clear to us the direction of the bias introduced by neglecting this aspect.

In addition to the differences in number of workers, the initial capital stocks in the two regions are also very different. We can calibrate the two model economies in order to start them with the observed different levels of capital stocks and capital/labor ratios. To give an idea of the magnitude involved, in Figure 2.7 we plot the capital per worker extracted from the PENN tables, for the US, Mexico, Colombia and Chile. As can be seen, the graph for the US lies way above the others which, instead, are pretty much bunched together. Graphs for other Latin American countries look similar.

3. The Simulation Model

In this section we sketch the main components of the model, described in detail in Attanasio and Violante (1999). Obviously, the model has to abstract from a number of important issues and should not be taken too literally. We view it as a useful tool to quantify the importance of various trends. In the final section we discuss a number of extensions that we will pursue in the future.

Figure 2.7 Capital per worker US, Mexico, Colombia and Chile



First of all, we abstract from uncertainty in production. At the individual level, the only source of uncertainty is the date of death. At the aggregate level there is no uncertainty. The model is made up of three components: a demographic structure, consumption behavior and firms. The firm structure is extremely simple. We assume a Cobb-Douglas production function with a fixed index of technical progress that differs in the two regions. The production function employs efficiency labor units and capital to produce a homogeneous commodity. Firms are assumed to be competitive, so that factors of production are paid their marginal product.

Individuals maximize expected utility, derived from the homogeneous consumption good. Labor supply is exogenous. The utility function is assumed to be iso-elastic. Future utility is discounted by a factor that reflects a constant level of impatience and the age-related probability of dying. Individuals are endowed with efficiency units of labor that vary throughout the life cycle in a deterministic fashion. These efficiency units generate earning profiles that can be matched to evidence from micro data. In particular, we assume that earnings start at age 16 and increase in a concave fashion. By age 45, at which point they are about twice as large as those at the beginning of working life, they become substantially flat. At an exogenously given retirement age, efficiency units go to zero. This last effect generates a strong retirement motive for saving. Individuals can borrow, if they so wish, in the first part of the life cycle.

Individuals are assumed to be forward looking and to be aware of the existing demographic trends. However, they do experience 'surprises' in that abrupt changes in fertility or mortality rates are not fully anticipated. Once a demographic shock occurs, however, individuals are assumed to fully understand the dynamics of future demographic trends and their implications for factor returns.

Our periods are 5 years long. The demographic structure of the model is summarized by a simple transition matrix that describes the evolution of population shares. We consider 5-year birth cohorts and we match the relative size of the various groups to the population shares of Latin America and the US and Europe from 1950 to 2050 as projected by the UN. We also match fertility rates. We assume that individuals enter the economy 3 periods after they are born. During their childhood they are completely inactive.

As we are ignoring social security, we do not model the government. All retirement is financed through private saving. Therefore, our 'social security system' is fully funded and private.

Given the demographic trends, we compute the steady state of our model. In the absence of demographic shocks, the economy converges to such a steady state. When a demographic shocks hits the economy, individuals react and the economy converges slowly towards the new long run equilibrium. To make the transition smooth, we assume that the demographic shock itself is not abrupt; it happens smoothly. In particular, we assume that fertility rates move slowly from an initial level to a new equilibrium.

The overlapping generations model and the solution methods used to derive the behavior of the economy during the transition, are of the type developed by Auerbach and Kotlikoff (1987). We consider three versions of the economy. First, we consider two closed economies that are calibrated to mimic some features (demographic structure, capital-output ratio, labor share in GDP, etc.) of the US and Europe on one side and Latin America on the other. We then open the two economies in that we consider fully mobile capital flows that imply that rates of return on capital are equalized across the two economies.

In this experiment we make several restrictive assumptions. First we assume that labor is completely immobile. This is obviously an unrealistic

assumption, which is made only for the purpose of isolating the effects that capital mobility might have. Second, we assume that once open, capital can fully flow between the two economies so to equalize rates of return. In such a situation, the differences in capital labor ratios (and possibly in earning profiles) imply the presence of very large capital flows, that might be unrealistic. Because of this, we consider a third version of the model. We assume the presence of some sort of adjustment costs in the movement of capital across countries which prevents full equalization of rates of return. While such an assumption is necessarily arbitrary, it serves as a short-cut to model, among others, difference in institutional risks and limited development of capital markets, aspects beyond the scope of this paper.

Two technical points are worth mentioning. The first is that the presence of uncertain mortality creates accidental bequests. In the model we assume that these bequests are divided among all the individuals alive at each point in time. These assets, therefore, do not enter immediately the production function as capital. The aggregate intertemporal budget constraint is therefore given by:

$$K(t+1) = (1-\mathrm{d})K(t) + Y(t) - C(t) + G(t)\,P(t) - G(t+1)P(t+1) + FL(t)$$

where d is the depreciation rate, K the capital stock, Y aggregate output, G the *per cápita* accidental bequest, P the size of the population and FL the flow of assets from the other country.

The second point is that when one considers two open economies, a meaningful long run equilibrium exists only if the populations of the two economies grow at the same rate. If that is not the case, one of the two economies would become exceedingly large and would come to dominate the model. The problem is obviously that in the very long run demographic trends are probably endogenous and adjust to economic incentives. We circumvent this problem by assuming that the two economies eventually converge (by the year 2100) to the same rate of population growth.

The parameters of the model are chosen in part following the conventions of the simulation literature, and in part to match some observed features of the economies we have in mind, such as capital labor ratios, capital output ratios, etc.

4. Results

In Figure 4.1 we plot the demographic trends of the two economies. These are kept constant across experiments and are calibrated to match data from the whole of Latin America and for the US. We have also worked with simulations that consider jointly the US and Europe. As discussed in Section 2, the demographic dynamics of Europe are not too dissimilar from those of the US. In the four panels we report fertility rates, total population, the dependency ratio (defined as the ratio of individuals aged 65 and older to working age individuals) and the average age of the population. Comparing these figures to those reported in Section 2, it is quite obvious that we do a pretty good job at mimicking the demographic trends projected by the UN.

These pictures are obtained as follows. In the US we assume that the economy starts from a steady state characterized by a fertility rate of 3. This value roughly corresponds to the pre-baby boom situation. We then assume that the economy is hit by a shock that increases fertility (and life expectancy). In particular, fertility is assumed to peak at about 3.6 in the mid sixties. While the transition is quite rapid, after only 3 periods, the economy is hit by another shock, this time reducing fertility considerably, to a long run value of 2.2. The decline, however, occurs slowly, as depicted in the first panel of Figure 4.1. In Latin America we start from a steady state with fertility of about 6 and we assume the occurrence of only one shock. Following the shock, fertility declines slowly towards the same long run value of the north (2.2). Convergence (both in fertility and life expectancy) is assumed to be reached in year 2150.

If we consider total population, we see that Latin America grows much faster than the US, mainly as a consequence of the much higher fertility rate. For the same reason, the dependency ratio and the average age of Latin America is much lower, albeit increasing. Notice the sharp increase in the dependency ratio in the US between year 2010 and 2030, when the bulk of the baby boomers have retired. The transition in Latin America is much smoother, as fertility does not present the spike observed in the US (and in Europe). Average age of the Latin American population is considerably lower than in the US, but catches up quietly quickly, as a consequence of the dramatic reduction in fertility and of improvements in life expectancy.

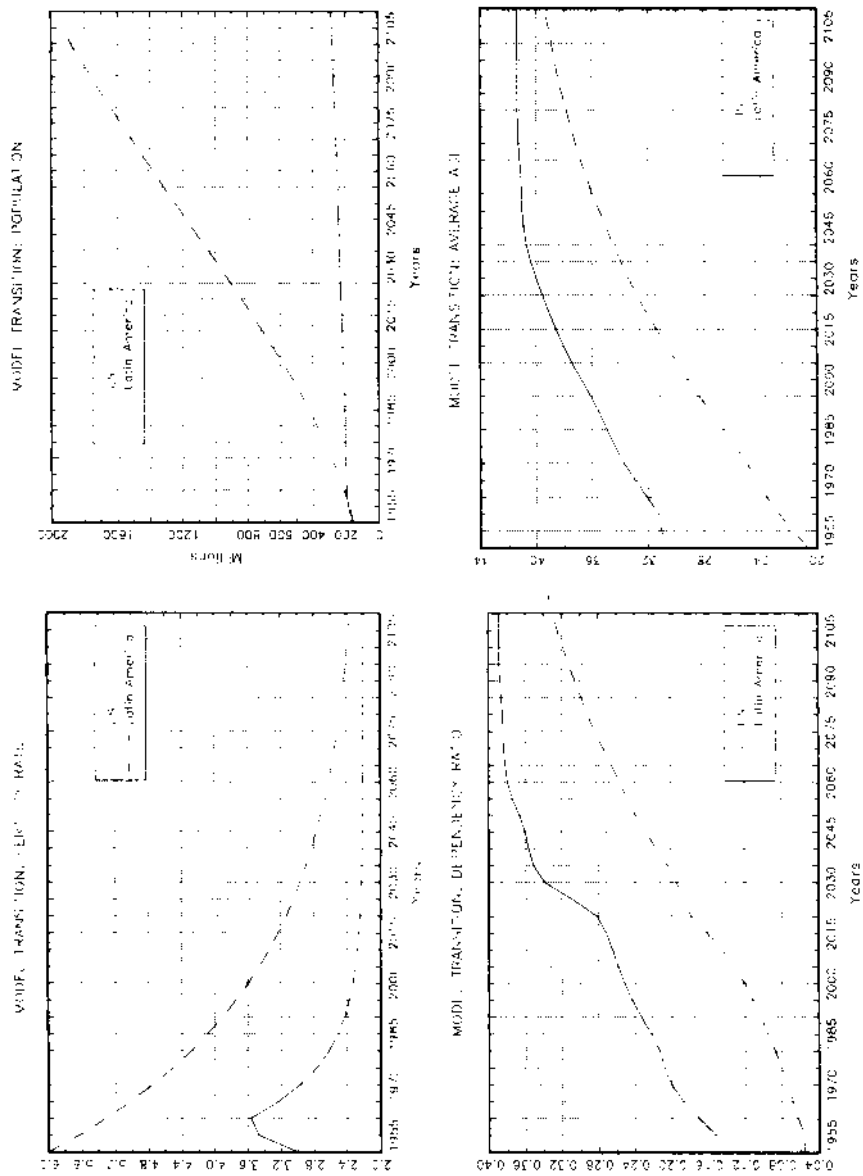


Figure 4.1

4.1. Closed Economies

The results for the closed economy are reported in Figures 4.2 to 4.4. In Figure 4.2 we plot some important aggregate variables. In the first panel we have the aggregate savings rate. This variable increases in both countries as a consequence of the first shock, which improves life expectancy and decreases fertility. The effect of these changes can be different in the aggregate. In particular, in our model, in which retirement is fixed and exogenous, improvements in life expectancy unambiguously increase aggregate savings. A reduction in fertility, however, lowers aggregate savings. At the beginning of the transition –as the improvement in life expectancy happens immediately, while the reduction in fertility is gradual– the first effect prevails strongly. In subsequent periods, as the economy slowly progresses in the transition, the savings rate declines towards the new steady state.

In the second panel, we plot the efficiency units of labor. Since labor supply and the life cycle profile are fixed, the pattern of efficiency units is essentially driven by the aging of the population. In the third panel we plot the aggregate wage rate. The difference between the two regions is determined by the efficiency parameters, chosen to replicate current differences in *per cápita* income and kept artificially constant during the simulations. In the new steady state, with a much lower fertility rate and a lower rate of growth of population, the equilibrium real wage is higher. However, the transition towards this new equilibrium is quite slow. Below we plot the overall labor market experience of different generations.

In the fourth panel we plot the aggregate interest rate. Given the assumptions about technology, the behavior of the interest rate is almost the mirror image of wages. In particular, notice that in the long run, as the steady state capital labor ratio (and therefore average welfare) is higher, the interest rate is lower. The effects of demographic trends on rates of return can be quite stunning. The interest rate in the US drops from a steady state value of around 5% to about 1%. While this is positive for future generations, it adds a further blow to the welfare of the baby boomers: they worked at a point in which labor was relative abundant and wages depressed, and they retire when the returns on their assets are low. In the model we assume that individuals are fully rational and behave taking into account these trends (except when they are a surprise). In a

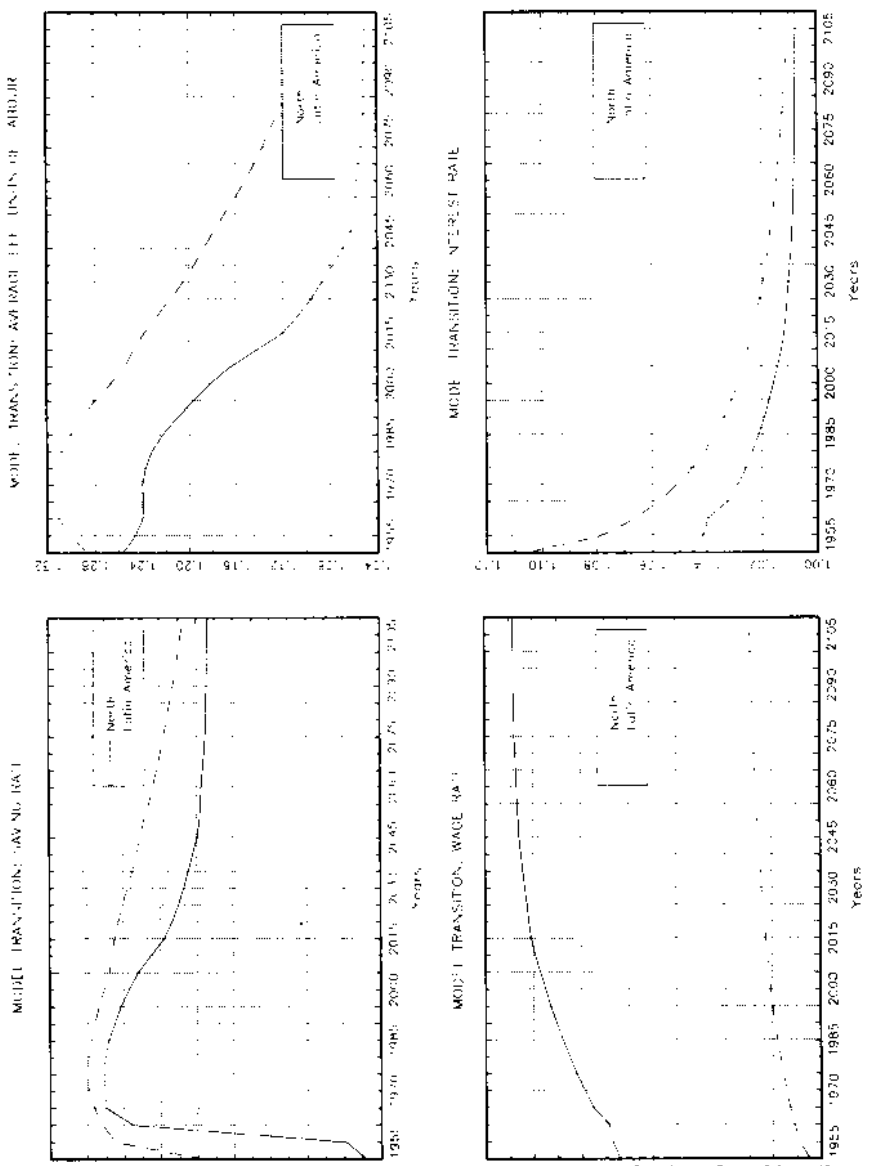

MODEL TRANSITION: SAVING RATE
MODEL TRANSITION: WAGE RATE
MODEL TRANSITION: INTEREST RATE
North Latin America
Years

Figure 4.2

Figure 4.3 Model transition: saving *per cápita*

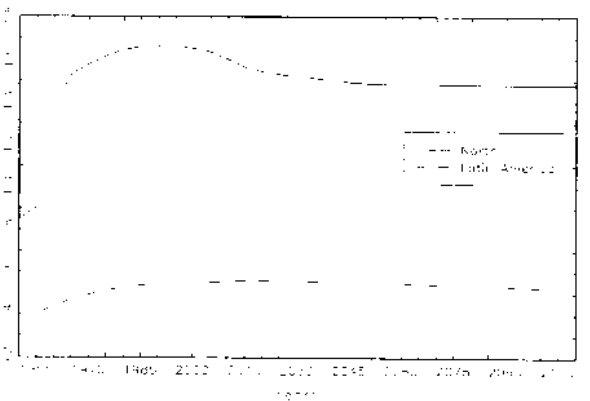
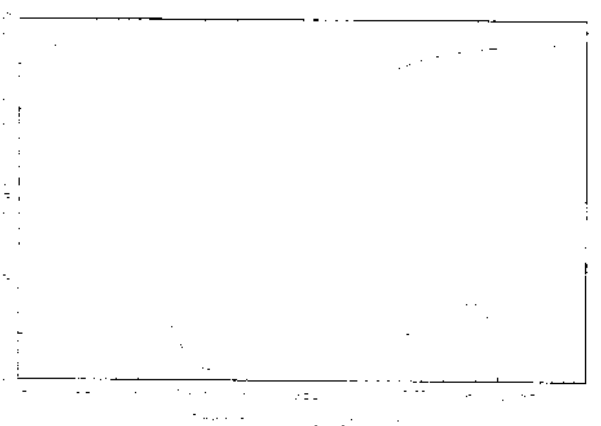


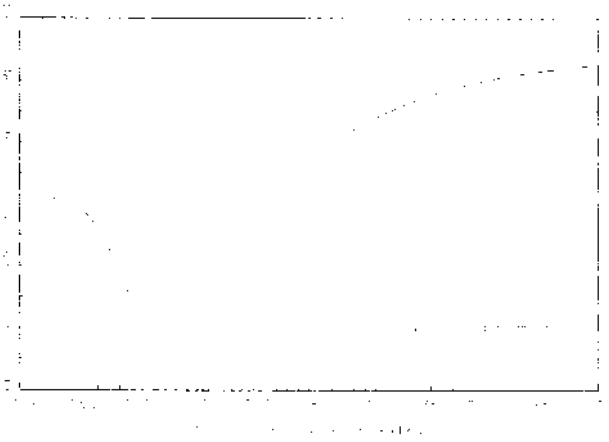
Figure 4.4 Welfare by generation



model where individuals gradually learn about demographic trends and their likely effects, or in which they fail to behave rationally in terms of intertemporal optimization, the effects on welfare can be even more dramatic.

To evaluate how large these effects are in the present context, in Figures 4.4 and 4.5 we plot the life cycle welfare of different generations. The first graph refers to the US, the second to Latin America. It is clear that in both regions the transition generations experience a welfare loss. If one

Figure 4.5 Welfare by generation



considers that the rate of growth of the economy starts declining immediately, so that the effect of higher average wages are felt immediately by all generations, one realizes that this graph underestimates the welfare loss caused by the transition period on some generations. While the amount of welfare and the magnitude of the loss depends on a variety of factors, ranging form the curvature of the utility function to the slope of earning profiles, it is pretty clear that potentially these losses can be quite large.

Finally, notice that while the demographic transition in Latin America happens later than in the US and in Europe, its effect will be important for Latin American baby-boomers. The timing of the two demographic transitions, however, might offer some important opportunities to reduce the negative effects of such demographic trends.

4.2 Open Economy

The next exercise consists in opening the two economies in order to see to what extent the differences in demographic trends offer an opportunity to improve the welfare of different generations in the two regions. The details of this exercise are reported in Attanasio and Violante (1999). There, we start the two economies over the same path plotted in Figures 4.1 to 4.5. We then assume that, starting in year 2000,

capital markets are suddenly and unexpectedly opened. We further assume that labor is kept immobile. In practice this implies that the rate of return in the two countries is equalized. Capital flows guarantee that the adjusted capital labor ratios are the same, so that rates of return are equalized. Wages, because of differences in productivity, are allowed to be different. In the very long run, as the basic demographic trends are the same (remember that we are assuming that there is convergence in fertility and life expectancy in about 150 years), capital flows will be zero in equilibrium, as the two closed economies would converge to the same interest rate. However, in the short run, there is scope for substantial capital flows.

The opening of the capital market has the effect of smoothing the transition in factor prices. This in turn, has important implications for the welfare of baby boomers and overall GDP growth in the US and in Latin America. These implications can be positive for both regions and, potentially, larger for Latin America than for the US. Opening capital markets would reduce the drop in the rate of return in the US, benefiting the US baby boomers. This would occur because of the shifting of savings from a relatively more mature society (the US and Europe) to Latin America, where labor is more abundant relative to capital. This would also have the effect of stimulating wages and in particular the rate of growth of output in Latin America. As Latin America ages (in about 30-40 years) and reaches levels of dependency ratios and fertility similar to those of the US and Europe in the next 15 years, the demographic trends would then turn against that regions' baby boomers. However, two important considerations are in order. First, while the rates of return on their saving will go down, they will not have experienced the same relative reduction in real wages experienced by the US baby boomers. This is an important benefit of the opening of capital markets for Latin America. Second, while in the model we only consider two regions, in the real world there are other parts of the world that are much 'younger' than Latin America In the future, that might provide a new destination for the capital that the generations of Latin Americans that are currently entering the labor market will accumulate to finance their retirement.

4.3 Extensions of the open economy model

While the simulation in which we open capital markets between the two regions is a useful one to quantify the potential effects of capital flows on equilibrium rates of returns, it is certainly unrealistic. Our simple exercise would imply massive capital flows that are unlikely to occur in the short run. Nonetheless, it is important to make the point that the fact that demographic trends are not completely synchronized in the two regions offers important opportunities that can be beneficial to both regions.

Having said this, it is also important to think of several directions in which one can extend the model, in order to make it more realistic. In this section we consider 4 important extensions. First, we consider ways to limit, at least in the short run, capital mobility, even when capital markets are, to a certain extent, open. Second, we consider the likely effect of migration. Third, we introduce the government and un-funded pension schemes. Fourth, we consider the possibility of having different skills and types of human capital.

a. *Imperfect capital markets*. There may be many reasons why capital does not flow from one region to another even in the presence of large differences in rates of returns. Obviously, one possibility is the presence of risk, which we have not introduced in our model. We could introduce an exogenous risk premium for investment in a foreign country. We do not find such an alternative very attractive, both because such a mechanism is a bit of a deus-ex-machina and especially because it would not generate flows that would build up slowly. Alternatively, one could introduce some form of convex costs to capital mobility so that rates of return would be equalized, net of these costs. Such a scheme should be analytically tractable and at the same time would induce a gradual build up of foreign capital in the region where labor is relatively more abundant.

b. As we said above, migration is assumed to be zero. An important recent paper by Storesletten, on the other hand, explicitly looks at the effects on rates of return and on the welfare of different generations of letting labor flow among economies. It would be interesting to combine the two approaches.

c. An important feature we kept out of our discussion is the presence of social security. This was done because we wanted to isolate the effect of current and projected demographic trends on rates of returns and, more generally, on factor prices. It is important to introduce the government and unfunded pension schemes for at least two reasons. First, the transition from a PAYG to a funded system is an important problem for the US, many countries in Europe and some in Latin America. Second, the presence of a large unfunded system and of various ways of financing a transition to a funded one are bound to interact with the factors we have outlined in our exercise, as they affect the demand and supply of capital as well as the distribution of resources among generations.

d. The introduction of different types of human capital would not only make the model more realistic and allow the introduction of inequality among agents. It would also allow to focus on the fact, which has been swept under the carpet in our exercise, that regions have different stocks of human capital and this (and its evolution) could clearly be important for the results we have been discussing. A further interesting possibility would then be to consider different sectors with different intensity of human capital.

5. Policy Implications

The exercise we have performed has a number of important policy implications. Before listing them, it should be stressed that the model we constructed should not be interpreted literally. It should rather provide a useful tool to compute sophisticated 'back of an envelope' calculations to evaluate the likely quantitative importance of several factors.

1. *Demographic trends are important for equilibrium factor prices*. While this is quite an obvious point, it is one that has not played a large role in the recent debate, especially that on pension reform. What we show is that even in a world where social security is completely private and funded, the demographic trends that make the current system unsustainable have important welfare implications for generations that are relatively large in size. The recent debate that has looked at the privatization of the US system and suggested that the returns on private

savings are much larger than those implicit in a PAYG system (and especially in a PAYG system in equilibrium), has largely ignored these general equilibrium effects.

2. *The fact that demographic trends are not synchronized across the world offers important opportunities for factor mobility.* In section 2 we have documented the pretty well known fact that, while the US and much of the developed world is aging very rapidly as a consequence of reductions in fertility rates and increases in life expectancy, in other parts of the world these trends are much delayed and will lead to the current level of aging experienced by the industrialized world only in 30 or 40 years. Dependency ratios are currently decreasing in Latin America, while they are increasing in the North. Given the considerations in point 1 above, it is obvious that these differences create the opportunity for large flows of factors that would smooth the demographic transition and alleviate the movements in factor prices in both regions. These movements have the potential of being welfare improving for both regions.

3. *If labor mobility is deemed to be too costly or politically difficult to manage, capital mobility could be an important and useful alternative.* While factor mobility could involve movements in both capital and labor, in this paper we have focused on the implications of capital mobility. Other papers, such as Storesletten (1999), have looked at labor mobility. The steady state effects are obvious and not particularly interesting. An economy with lower rate of population growth will be able to produce more welfare for its members. In equilibrium, wage rates will be higher and interest rates lower. The most interesting issue is what happens during the demographic transition, which can last several decades. In our theoretical framework, large capital flows that equalize rates of return across the two regions have two effects during the transition. First, they tend to slow down the decline in interest rates in the region where capital is relatively more abundant. In addition, the more rapid increase in the capital labor ratio in the relatively younger region has the effect of increasing the wage of the large generations of workers that are now entering the labor market in Latin America. This last effect has important welfare consequences. Several commentators have refereed to the demographic trends faced by Latin America in the next 20-30 years as a window of opportunity.

The fact that these trends are happening when the industrialized world is already much 'older' constitutes an additional important opportunity that should be exploited.

4. *In addition to the factors we have explicitly considered, capital inflows into Latin America could play an important role in fostering development.* Obviously, our simple theoretical model does not explicitly include externalities generated by the process of capital accumulation and investment. However, it is likely that these effects will be at play and could be important factors in fostering development and economic growth in Latin America. Moreover, the presence of investment opportunities and larger capital labor ratios could also provide additional incentives to human capital accumulation, which is seen as crucial to the development of the region.

5. *One should seriously think about impediments to capital mobility.* While the difference in demographic trends and in existing capital in our simple model imply large capital flows, it is unlikely that these flows will occur quickly. It is therefore important to understand the reasons behind this lack of capital mobility. Institutional and political risk are likely to be important impediments to the flow of capital. The lack of well functioning, deep and transparent capital markets is also likely to be another important and related factor. The existence and development of well defined property rights, governance, etc., are also likely to play an important role in removing the impediments to capital mobility.

6. Thinking about the general equilibrium effects of demographic trends on factor prices also has important implications for the way in which one thinks about pension reform, both in the US and Europe and in Latin America. If one thinks about capital mobility as a possible solution to limit the decline in rates of returns in the North, it is also natural to think that a private and funded system should be better able to exploit these opportunities. In Latin America, on the other hand, the development of pension funds to channel the saving of the current (and future) generations of workers could help in developing deep and sound financial markets that could then more easily attract capital from the north. On the other hand, if one thinks that migration might be the answer to the problems created by demographic trends, a PAYG

system might be a more appealing way to finance retirement while at the same time providing insurance across generations.

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