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An Introduction to the Debate

Pension Systems and Pension Reform in an Aging Society: an Introduction to the Debate

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Abstract

Traditionally, pension systems aim to fulfill a number of functions which include income security and consumption smoothing in old age, as well as income redistribution. The main rationale for pension reform lies in the interaction between current demographic trends (e.g. increasing old age dependency ratios) and the design of existing pension systems (particularly, the so called Pay-As-You-Go public systems). Under certain conditions, population aging can in fact undermine the ability of a pension system to fulfill those very aims for which it was created, putting pensioners at risks of higher poverty and inequality, besides creating large fiscal pressures on governments and threaten economic growth.

In the literature, we find two main approaches to this debate. On the one hand, economic theory helps us formalize the mechanisms through which aging affects a pension system, given its possible features (e.g. type of benefit offered, degree of actuarial fairness or type of financing); it also helps us quantify costs or returns associated to different pension designs and, consequently, to different pension reform options. On the other hand, the policy debate is centered on models of reform which take from concrete country experiences; overall, it focuses mostly on whether funding pensions (i.e. privatizing and individualizing retirement savings, away from Pay-As-You-Go systems) is the best option for reducing many of the negative economic impacts associated to population aging. After having illustrated both sides of the debate – the theoretical and the empirical - our paper makes two main claims. Firstly, the debate should be re-framed away from whether funding is the best option for pension reform in the face of population aging, towards a redefinition of the problem which rather focus on the type of benefit offered, its coverage, its eligibility conditions and actuarial design (as this controls important behavioral and efficiency implications). Secondly, and relatedly, the final impact of a given pension system or reform on future economic variables (i.e. growth, poverty, inequality, financial sustainability) cannot be inferred only by using the tools of economic theory, or the lessons of policy experience. Rather, it requires the ability to quantify the net effects of several interacting explanatory levels, such as country-specific demographic, economic and institutional trends. To this end, we propose the adoption of micro simulation modeling as a well-suited methodology for shedding more light on this important policy debate.

Sammanfattning

Traditionellt har pensionssystemet haft ett flertal funktioner, det har syftat till att fungera som en inkomstförsäkring och för att fördela konsumtionen över livscykeln samt att ha en fördelningseffekt. Den huvudsakliga orsaken till pensionsreformer har varit interaktionen mellan den demografiska utvecklingen (t ex den åldrande befolkningen) och hur pensionssystemet sett ut (framförallt det så kallade "Pay-As-You-Go" systemet). Under vissa omständigheter kan en åldrande befolkning undergräva pensionssystemets möjlighet att uppfylla själva syftet med systemet. Följden kan bli ökad ojämlikhet samt att pensionärer i högre utsträckning riskerar att hamna i fattigdom, såväl som en negativa påverkan på statens budget och den ekonomiska tillväxten.

I litteraturen förekommer två huvudsakliga angreppssätt till den här debatten. Ekonomisk teori hjälper oss att formalisera hur en åldrande befolkning påverkar pensionssystemet givet dess egenskaper (t ex typ av ersättning och finansiering). Teorin hjälper oss också att kvantifiera kostnader och intäkter i olika system och därmed olika alternativa reformmöjligheter. Policy debatten behandlar reformer som baseras på erfarenhet från andra länder. Fokus ligger framförallt på om pensionsfonder (privata och individualiserat pensionssparande) är det bästa alternativet för att minska problemen i samband med den åldrande befolkningen.

Efter att belyst de båda sidorna av debatten, den teoretiska och den empiriska, gör vi två påståenden. Debattens fokus bör vändas ifrån om pensionsfonder är det bästa alternativet i samband med den åldrande befolkningen och i stället omdefiniera problemet och framförallt fokusera på typ av ersättning, dess täckning, dess grund samt dess utformning. Vidare bör påverkan av ett givet pensionssystem eller reform på framtida ekonomiska variabler inte bara utvärderas med hjälp av ekonomisk teori eller tidigare policyexperiment. I stället krävs möjligheten att kvantifiera netto effekter av flertalet interagerande förklarande variabler, så som t ex landsspecifik demografi, ekonomiska och institutionella trender. Vi föreslår att mikrosimulerings modeller används för att bidra med viktig information i policy debatten.

Contents

PART I: The Problem of Aging

The theoretical rationale for pension reform is to be found in the interaction between recent demographic trends, such as population aging, and specific features of existing pension systems, especially whenever those systems were designed under different demographic scenarios. Pension reform is in essence the necessary response to pension systems becoming obsolete when the population itself is growing older.

Two key demographic trends, often referred to as population aging, are taking place in most countries globally: (i) consistent declines in fertility rates and in mortality rates. (ii) a steady increase in longevity. Among these, declines in fertility rates are the major culprit for aging. We are in other words witnessing a future world with fewer births and a growing number of elderly people who live longer and longer.

Why are these demographic trends important? In a nutshell, because they can cause serious efficiency and equity losses, particularly through the interaction with current social security policies, e.g. with pay-as-you-go (PAYG) public pension systems.

An increase in the proportion of elderly people leads to an increase in the aggregate claim on output by those who have lost the ability to produce (i.e. the pension bill), while at the same time a shrinking number of active workers will be required to produce a bigger amount of output to sustain those increasing claims. If productivity gains are not large enough, this will result in shrinking amount of resources available for redistribution, hence lower income replacement levels from working life to retirement, and higher poverty.

Pension systems are indeed set up to guarantee income security in old age, and fulfill a social insurance as well as a redistribution and a consumption smoothing function. Governments traditionally manage public pension systems. This is justified, among others, by individuals' inability to foresee the effects of demographic and other shocks on their future income, and to adjust their private savings accordingly, as well as by a number of other market failures e.g. informational asymmetries which grant a role for state intervention.

We will discuss later why many current pension systems are thought to be inadequate to address the challenges of demographic change, and consequently to fulfill their very aims, i.e. income smoothing, social insurance and poverty alleviation. In essence, the core theoretical argument in this debate is that, unless addressed by adequate pension reforms, population "aging" will (i) *slow down countries' growth prospects*, mainly by creating an unsustainable pressure on public finances, and by inducing inefficient behavioral responses (ii) *increase poverty and inequality*, particularly among the elderly who are by nature weaker, since aging implies a gradual loss in the ability to work and to earn enough to maintain previous living standards. The question to be explored then is what are the"adequate" policy changes that will contain these risks.

This paper is organized as follows. We begin by reviewing some of the key recent demographic "facts" and projections. We then illustrate the economic consequences of aging e.g. on growth, particularly by focusing on how aging can, for a given set of assumptions, disrupt pension systems and unleash a sequence of negative micro and macro economic consequences. We then review some of the basic principles of pensions economics, aimed at quantifying the economic

costs of aging. This step is necessary in terms of designing the most economically "sound" response in terms of pension reforms. This response might not always, however, fulfill the other important aim of pension reform, namely institutional or political feasibility. After presenting the way economic theory looks at pension reform, we therefore dedicate the following part of the paper to a review of pension reform from different "policy" perspectives. The main reference model in the pension policy environment is the so called Multi-pillar approach, which will be discussed. In conclusion, we hope to highlight the main differences, if any, between the focus of economic theory versus that of policy making in the area of pension reform, thus offering a platform for further discussion. In the attempt to bridge some of the unresolved differences emerging in the policy debate, we will finally advocate the creation and use of statistical simulation tools for measuring, on a case by case basis, the economic impacts of pension reform, thus contributing a scientific evaluation of different options.

1.1 *Key Demographic Facts*

Generally, populations begin to age when fertility declines and adult mortality rates improve. Successive birth cohorts may thus become smaller and smaller, unless sufficiently large immigration inflows counterbalance this trend.

OECD population projections from 2000 up to 2050 assume that over this period OECD countries will see almost no change in the already low average fertility rate (1.6), but will experience a considerable and permanent increase in longevity of around 1.2 years per decade. On average, by 2050 men in OECD countries will see their life expectancy increase by 6 years (from 74.4 to 80.5) and women by 5 years (from 80.4 to 85.7), thus also shifting upwards the median age (e.g. in Italy median age will move from 37 to 52 years) . In the developing world, aging will be mostly driven by rapidly decreasing fertility rates (below replacement rate), particularly in Asia and Latin America.

The World Bank estimates that globally, by 2030 the proportion of old people (above 60) to the rest of the population is expected to double, from 8 percent in 1990 to 16 percent on average. This increase will occur in every region of the world, and at a relatively faster pace in the developing world, particularly in Asia. Singapore for instance will see a 372 percent increase in its elderly population between 2000 and 2030. By 2030, OECD countries will still detain the highest proportion of old people, with an expected 30 percent (against 16-18 percent in 2000). In absolute terms however, 4 out of 5 old people will live in poor countries then. Almost two thirds of these old people are expected to be women.

Furthermore, an increasingly important feature of societal aging is the progressive aging of the elderly population itself, i.e. a growth in the numbers of very old people. This means that on average, larger proportions of people will survive to 80 years and beyond. The "oldest old" are indeed the fastest growing proportion of the total population, at 3.5 percent as a world average against the 2.3 percent of elderly as a whole (U.S. Census Bureau, 2001).

Data show that the proportion of elderly population rises linearly with per capita income, and so does the so called *dependency ratio* i.e. the proportion of people above pension age to working age people. The dependency ratio has crucial economic implications in that an increase in this ratio signifies a decrease in the size of the active work force relative to the (allegedly) unproductive or system -dependent population. Today OECD and transition countries indeed have the highest dependency ratios and the highest percentage of over 60s (relative to the whole

population), around 20 percent on average. This dependency ratio is expected to increase up to 50 percent again on average by 2030 (without indexing the dependency ratio to longevity gains). Given the positive relationship between dependency ratio and per capita income, those poor countries which are growing very fast, e.g. China, will also see a much faster growth in their dependency ratios, showing a pattern of convergence.

The logic for this trend in dependency ratios is that, as people grow richer, they enjoy the benefits of medical advances, better health care and nutrition, hence they live longer. Additionally, as people become better off, they tend to have fewer children. As the dependency ratio increases however, an ever smaller working age population has to support the consumption needs of a growing number of old people. Furthermore, the simultaneous fall in child dependency ratios is often not enough to counterbalance this effect; in OECD countries for instance, public spending on an old person is on average two to three times greater than public spending on a child, at any given point. Also, processes of urbanization, development and changes to family structures imply that informal support mechanisms for the elderly are weakening. This will put more pressure, particularly on poor countries, to adequately raise social expenditure to provide for the elderly.

1.2 The Impact of Aging on Growth

Population aging matters to economic growth. Indeed, the population age structure (more than its size) is strictly related to the level of per capita income. Demographically based GDP forecasting models for instance (Malmberg and Lindh, 2004) have shown that aging is negatively associated to per capita GDP growth. There are several economic explanations for this: for instance, a decrease in the worker per capita ratio, reducing the size of the labor force.

We can conveniently identify two levels through which aging can impact growth: macro and micro. One major macro implication of aging is that countries need to spend more on health care as well as retirement pensions for the elderly, while available resources diminish as the productive force shrinks. On average, in the OECD, age-related public expenditures are expected to rise by 7 percent of GDP over the next five years even when taking into account the effects of implementing some much discussed pension reforms. Under the current public systems, aging is causing huge implicit debt across all OECD countries, which can vary from an estimated 50 percent of GDP in Ireland to 360 percent of GDP in Denmark. In a nutshell, this soaring of public expenditures and debt will crowd out national savings and other investments which are good for growth.

At the micro level, population aging can slow per capita GDP growth by inducing a number of behavioural responses which are bad for growth: these could range from altered fertility and fertility traps (Lutz, 2006) whereby people in reproductive ages have fewer children in response to the total set of pressures (financial and practical), including caring for the elderly; to human capital investment traps (Becker, Murphy, Tamura, 1990), where the same pressures lead to lowering the investment in education. Finally, population aging can slow per capita GDP growth if coupled with social security policies which discourage personal pension savings by workers and labor force participation of older workers. The OECD for instance predicts that, under the current pension systems, aging will tend to slow GDP per capita in France, Germany and Japan by -0.2 / -0.3 percentage points per annum during the next half century.

Reforms to pension systems across OECD (and other middle income) countries should mitigate the negative impact of aging on growth e.g. by affecting the implicit net return to education (as people will be able to capitalize more of that gain). Other more direct ways will include discouraging early retirement, increasing the minimum age of retirement, and supposedly promoting private pension savings through well regulated pension funds. In theory, increased savings should in fact promote investments and productivity gains. Under such combination of policies, which would promote capital deepening and more labor supply, the OECD estimates that GDP per capita in France, Germany and Japan could be boosted on average by around 0.4 - 0.6 percentage points per annum until 2050, relative to the non-reform scenario, thus offsetting the negative impact of aging.

More generally, one can argue that the age composition of society influences consumption and saving patterns, hence growth. Econometric estimates run by the OECD economics department for instance show that an increase in the share of over-60 in the population has a strong negative impact on the saving rate. This finding supports the so-called life cycle hypothesis, i.e. that elderly people have negative savings after retirement, since they use up all the savings accumulated during their working life to finance their consumption until they die (Modigliani and Brumberg, 1954). However, the same study shows that, when interacted with the characteristics of the public pension systems in place, an increase in the share of the over 60 leads to a positive effect on the saving rate, while the opposite is true when interacting these institutional characteristics with the younger population shares. This confirms similar findings across the literature (e.g. Feldstein 1974), namely that the more generous the public pension system (i.e. the higher the benefit rate relative to the contributions paid, particularly if it includes also health care insurance), the higher the disincentive for the young to save for retirement or to work up to retirement age, while in some cases the old, especially the better off ones, can afford to keep accumulating wealth and even leave bequests (e.g. if we assume that consumption costs other than health care might be lower for old people). In a situation where, in time, the younger age groups shrinks, this could lead to serious resource misallocations between age groups with harmful economic consequences.

Another study from the US (Gruber and Wise, 1997) stresses the same point about negative economic effects, e.g. high early retirement rates, stemming from the interaction of aging with natural incentives built in the old U.S. social security system and employer provided pensions. This system offered the possibility to retire at age 60 with a full retirement pension provided that the employee had 30 years of contributions, and to claim some Social Security benefit already from age 62, with substantial loss in pension value accrual after the early retirement age, and an even sharper loss after the normal retirement age of 65. According to Wise, this system resulted in higher exit rates from older workers and huge decreases in the U.S. labor force.

In conclusion, aging, coupled with institutional arrangements and social insurance mechanisms that do not adequately foresee and cushion its impact on the economy, can slow down growth. One obvious solution is for pension systems to revise downwards the levels of benefits paid to pensioners. Short of such unpopular measure, systems could remove those disincentives which produce inefficient behaviors by the working population, especially by older workers. Longevity for instance is often associated to an increase in the quality of life of the elderly, i.e. to more disability-free life expectancy, suggesting that a shift in the retirement frontier later on in life could be an efficient (although maybe not always equitable) policy response.

1.3   The impact of Aging on Pension Systems

The interaction between aging and the pension system is our key topic of interest, particularly since the impact of aging on growth often depends on the pension system in place.

In the following section of this paper the economic theory explaining the effects of aging on pension systems will be reviewed more thoroughly. Here we summarize the main arguments as follows.

First, aging, expressed as an increase in the old age dependency ratio, puts pressure on governments because it increases the expenditure on public pensions. Data show that public spending increases slightly faster than the proportion of the population over 60. Today, OECD countries spend between 6 and 12 percent of GDP on public pensions. This percentage is due to increase to an estimated average of 18 percent by 2040. Furthermore, an aging population puts greater strains on the health care system of a country thus increasing again the pressure on spending (e.g. Australia spends 6 times more in health care for someone aged 65 than for someone under the age of 15).

In the mid nineties, an estimated 40 percent of the world's labor force participated in formal programs of old age income support, most of them publicly mandated and publicly managed. Since their first appearance, by far the most prevailing form of mandatory publicly managed pension system has been the so called pay as you go plan (PAYG). PAYG plans usually offer a defined benefit pension i.e. a pension whose value is set by law (or by the employer, in case of defined benefit occupational pension plans), which may or may not be linked to past earnings, and which is often not actuarially tied (i.e. the amount of benefit received does not depend on the amount of contributions paid into the system). PAYG systems usually finance these defined benefits out of payroll tax. In other words, current workers pay taxes towards the pension benefits of current pensioners, hence redistributing income across generations. By contributing towards the pension of current retirees, current workers thus rely on an "intergenerational promise", underwritten by the government, namely that future generations of workers will in turn support their pension claim. PAYG systems are often called unfunded, to stress the future liability or implicit debt which is inherent to this particular design. It is important to note also that in a defined benefit PAYG system, the pension received by an individual from the time of retirement to her death may be more than what she contributed to the system over her working life, if she lives long enough, and if real incomes rise steadily over time (since social insurance contributions will also increase, for a given dependency ratio). This means that, as people live longer today than when PAYG systems were first in troduced (usually after World War II), a defined benefit PAYG scheme gives current pensioners the advantage of a long pension with little or no uncertainty (since the value is fixed), at a lower costs than that borne by future generations of pensioners, who instead will have to pay more and more in contributions while in work (due to increases in life expectancy, requiring pensions to be paid out for longer) relative to the benefit that the system will be able to afford when they retire (since there will be fewer and fewer workers paying for them).

So, we start seeing why aging is a particular problem for defined benefit PAYG system. Later on we will actually dwell more on the economic theory behind it. For now, we introduce this by means of a simple static equation (1) underlying the macroeconomics of pensions. In essence, under a PAYG system the government must try to balance this equation (see Barr 2001):

(1)   *t (WL) = PN*

It is easy to see that in a PAYG system, under a static output hypothesis (i.e. assuming that total output remains constant), if *L* decreases (i.e. if the labor force shrinks), the total contributions *t(WL)* paid into the social security system will also decrease; at the same time, an increase in both the number of pensioners *N* and their life expectancy means that the pension bill *PN* will increase (assuming no change in the level of pension *P*), creating a deficit or a future liability. To keep the system in balance the government has two straightforward options: either to reduce *P* (average pension), or to raise the contribution rate *t*. The government could also finance this deficit by selling its debt, shifting the costs on future generations, or by other government revenues, but for the moment we will focus on the former two options. There are of course several problems and trade-offs associated with both these reform policies. On the one hand, reducing the level of pensions could increase pensioners' poverty and income inequality (even more so if the new pension benefit is not indexed to earnings growth); on the other hand, increasing the contribution rate would effectively amount to increasing the tax burden of both workers and employers (as this would result in higher labor costs), with negative implications for efficiency and output growth, i.e. higher tax evasion, lower labor supply, and higher unemployment. With population aging, the PAYG system in other words can create disincentives to save, to work and to pay taxes, thus negatively affecting the future economy and the well being of future generations.

Barr (2001) however also points out that, under a growing output hypothesis, the macro-economic problem of aging changes form. If *L* decreases in a PAYG system, there is no need to reduce the pension benefit *P* or increase contribution level *t*, provided that wages *W* grow sufficiently (so that contributions will also increase). How much wages will be able to grow depends, among others, on labor market rigidities present in a specific country.

This leads us to another key point: namely, that output growth is in turn crucial to the problem of aging and its impact on pensions. In a dynamic setting, we start foreseeing a rather complex mutual relationship, whereby aging both affects and is affected by output growth (with time lags). Barr for instance argues that aging becomes an issue only if and when it is accompanied by structural impediments to growth and productivity which are unable to offset the effects of demographic shocks. Therefore, for Barr the question of pension design (i.e. PAYG versus so called funded systems) is crucial only to the extent that different financing systems might have different impacts on future productivity and growth. Policy focus should be not so much on how the system is financed, but on the incentives that it offers to raise workers' productivity (raising *W*) e.g. by sponsoring education and human capital investment, or to increase the size of the labor force *L* e.g. by raising retirement age, importing labor, and increase labor supply among key under-employed groups such as women.

The crucial questions in this debate therefore can be phrased as follows:

Is reforming pensions and their financing (e.g. away from PAYG) necessary to address the various challenges of aging? Or is it rather required under particular macro economic circumstances? And, if necessary in all cases, is it sufficient? Or, should the problem of aging be addressed by measures which lie outside the scope of social policy financing, e.g. by raising productivity and promoting growth-enhancing investments?

One of the crucial arguments characterizing the pension debate among policy makers, has in fact been that a switch from (usually publicly managed) defined benefit PAYG system to a privately

managed defined contribution funded system would deal with the demographic problems of aging, as well as other problems linked to the economic risks and uncertainties faced by modern pension systems, essentially by shifting risks from the State to the individual. This position, characterized by a strong support for policy reform in favor of privatization of pension assets, strong reliance on capital markets and little involvement by the State, can be identified as the Anglo-American policy model, due to its prevalence in countries such as the US, the UK, Canada, Chile (Minns, 2001), and has been advocated by authoritative financial institutions such as the World Bank. In these countries indeed, we find that the reliance on the stock market and private pension systems is maximized. For instance, between 1985-92 the UK was spending 9.5 percent of GDP on state pensions, while by 1996 funded pensions assets were totaling 74.7 percent of GDP.

Opponents to the Anglo-American position usually favor a more traditional reliance on the welfare state against widespread privatization of social insurance, and can be somewhat arbitrarily grouped into the Continental European model of pension provision, again based on the ideological predominance of this view in countries such as France, Germany, Italy, while the Scandinavian bloc might represent a third so-called Nordic model. In the continental European countries we find mostly very limited use of private funding / insurance, limited role of financial institutions and stock markets, with large public systems of universal coverage. For instance, between 1985-92 Italy was spending 14.4 percent of GDP on state pensions, while by 1996 funded pensions assets were totaling only 3 percent of GDP.

Other slightly different approaches can be identified in the so called Asian and Eurasian models, although we will not investigate them in this paper. Although this distinction is not always straight cut, it should be emphasized that in today's world we clearly see a link between the type of capitalism in place and the choice of welfare / social security system. This observed correlation suggests that finance and production relationships (identified by the structure, size and ownership of capital markets) on the one hand, and pensions and the financing of pensions on the other, are tightly interconnected (Minns 2001).

Despite this broad and general classification along a geographical axis, in reality pension systems' features tend to be extremely complicated, and often contain mixed elements which make any empirical classification quite hard. Before looking at the policy issues therefore, we will address their theoretical underpinnings. In the following chapter we start by briefly discussing the methodology required to measure the costs of aging. Measuring the cost of aging under different pension systems is the first objective to pursue when evaluating pension reforms from the point of view of economic theory.

1.4 Measuring the Pension Costs of Aging

The prospect of enjoying a longer life is certainly welcome news from the individual standpoint. As seen earlier however, from an economic point of view, population aging might entail some macro and micro costs, in the form e.g. of unsustainable financial burdens, lower aggregate savings and lower income growth, welfare loss, and an unequal redistribution of these costs between generations.

Economists are interested in quantifying the costs of aging, notably its impact both on public finances and on the adequacy of redistributive mechanisms to finance consumption in old age and

reduce the risks of poverty (notably the public pension system, but also private household transfers and personal savings).

It is important to stress once again that *the overall economic costs of aging depend on the interaction between aging on the one hand, and the design of a specific pension system on the other.* It is this interaction that we aim to focus on in this paper, including behavioral effects, rather than on the more explored question of financial sustainability. It follows that the economic costs of aging will likely vary depending on the system in place. Measuring such costs then leads to the next natural step of comparing them across different pension systems.

Population aging alters the "social contract" on which many PAYG pension systems rely: namely the intergenerational promise that young cohorts, paying for current pensioners, will be able to expect future young generations to do the same for them. However, under a scenario of negative population growth, smaller future cohorts will experience a progressively *lower return to their social security contributions* (as the contributions might have to increase relative to the future benefit that they in turn will receive), as well as the prospect of an *increased risk of poverty* in old age. This will clearly jeopardizes the promise on which PAYG pension systems are built. Future generations might in principle default on the promise and the system could break down.

Aging might also result in *efficiency losses*, both directly, e.g. through a smaller labor force to produce output, and indirectly, e.g. by inducing behavioral changes which result from the distortions caused by a lower return to social security contributions, since this amounts to a higher marginal tax rate on work, resulting e.g. in lower private savings, lower private household transfers, or even lower fertility rates. These efficiency losses will exacerbate the poverty risks for future generations.

More generally, when trying to quantify the economic costs of aging in relation to a given pension system, a distinction should be made between static and non-stationary measures, where the former refer to a steady state scenario (i.e. where any growth or change in any variable pertaining to the economic or demographic context is assumed to be constant); while the latter refer to out-of-steady state analysis, thus allowing to see how the costs of social security would change given changes in the underlying conditions (such as demographic or production shocks). We could say that measuring the cost of aging amounts to measuring the cost path of a pension system out of its initial steady-state, due to a demographic shock. This point is important since, as we will see later on, it often necessitates the use of simulation techniques rather than other traditional economic models such as overlapping generations or general equilibrium models.

Let's consider a common theoretical framework in pension economics, namely a single period overlapping generations model (OLG), made of two coexisting generations, where an intergenerational contract exists between young and old (i.e. where the old receive a benefit financed by taxation of the labor supplied by the young); as mentioned above, a balanced PAYG pension system in this framework would be represented by equation (1) where now the left hand side represents the (one period) total pension bill (PN) going to the old generation, and the right hand side the total tax $t(WL)$ required from the young generations (WL). It is important to notice that (1) does not include any funded element on the right hand side, i.e. the total pension cost PN is entirely financed by taxation rather than from returns on pensioners' assets, which we could

instead call rK (assuming r to be the one period rate of return on total savings K if invested on the capital markets).

Rearranging (1), the static measure of the PAYG pension cost in this case is simply:

(2) $\qquad t = (P/W) / (L/N)$

Where P/W is the income replacement ratio, and L/N the support ratio (i.e. the inverse of the dependency ratio). This static measure of the pension cost clearly relates this cost to demographic variables L and N, showing that the smaller is the size of workers L to the size of pensioners N, the higher the cost[1].

If, in a multi period framework, the support ratio L/N is subject to an aging trend, the ratio becomes smaller. From a simple comparative static exercise, it would be easy to show that this will make the tax burden increase, both directly of course, as well as indirectly i.e. through general equilibrium effects on wages, hence on the replacement rate P/W. An increase in the tax burden might in turn offset negative behavioral responses, for instance lowering the future saving rate, which also affect the "dynamic" measure of total system costs.

In a real world situation, a policy maker considering whether to reform this PAYG system therefore, might first want to influence the dynamic evolution of (2). Short of defaulting, or increasing government debt (i.e. borrowing and shifting the burden on to future generations), the most obvious intervention to keep the system in balance is by adjusting the replacement ratio P/W (i.e. the policy variable). However, intervening on the replacement ratio will be somewhat constrained by political feasibility, since the policy maker could be forced to break the social contract by changing P. This might explain why he or she might be more willing to consider pension reform away from PAYG altogether, if it represents a more politically feasible alternative. In any case, the point made here is that the unsustainability in the public PAYG pension burden often lamented in conjunction with aging is not inevitable from an economic point of view; rather, it intimately depends on the political context.

In the next section, we focus on the more general theory of pension reform, introducing some refinements to our basic OLG model to see whether, and under which conditions, reforming a PAYG system, e.g. by making it more actuarially fair, could decrease the various costs of aging.

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[1] In a non-static framework, if P was indexed to wages, productivity growth would not help either to keep the costs of the system down.

PART II: Understanding Pension Reform

The contemporary discussion on pension reform has been initiated mainly by concerns for the long term financial viability of existing PAYG pension systems, given the aging trends discussed above. There are also equity-driven concerns about current PAYG systems ending up disproportionately burdening future generations.

Overall, the policy debate on pension reform has often overlooked the importance of providing a rigorous analytical framework as a background. A useful contribution to the policy debate by pension economists has been to develop such an analytical framework. A complete evaluation of the various propositions suggested or already implemented by pension policy makers in some countries should benefit from the use of such a methodology.

2.1   Typologies of Pension Systems

Lindbeck and Persson (2001) offer one of the most enlightening discussions on how to classify pension systems. They identify three key dimensions delimiting an imaginary 3-D space within which we can place any given pension system. Such a three dimensional space helps to visualize the idea that pension system characteristics exist in a sort of continuum, where differences in practice are often just a matter of degree. While it is difficult to evaluate marginal differences along this continuum, we can orient ourselves by fixing what lies at the extremes of this space, as our main reference points for analysis. Given a pension system i.e. a particular point in space, we can think of pension reform as moving from the system's initial location towards any of the extremities.

The key three dimensions in the classification of pension systems are:

(i)   Type of Benefit: **Defined Benefit** versus **Defined Contribution**
(ii)   Type of Financing: **Funded** versus **Unfunded**
(iii)   Degree of Actuarial Fairness**: Non-Actuarial** versus **Acturial**

Type of Benefit: in a defined contribution system, the benefit amount received upon retirement is endogenous while the contribution rate to the system is exogenous. In other words, the individual knows how much they contribute each year while working but the final amount of pension is not known, and rather depends on the real return on the individual's contributions calculated at the time of retirement. In contrast, in a defined benefit system the contribution rate is endogenous and the benefit amount exogenous. This means that the definition of the final amount of pension is agreed and known to the individual, while the contribution rate required to meet the ensuing liability is adjusted accordingly.
Type of Financing: while in an unfunded (usually known as Pay-as-you-go) system aggregate benefits are financed by a tax on currently working generations, in a fully funded system benefits are financed directly from returns on previously accumulated individual (i.e. personal) pension funds; thus the individual contributes towards his or her own retirement rather than that of current pensioners.

*Degree of Actuarial Fairness***:** in a micro-economic sense, actuarial fairness refers to the existence of a link between contributions paid and benefits received, either within the lifetime of the same individual, or between different coexisting generations. Defined contribution type of benefits are usually seen as more actuarially fair than defined benefit. However, actuarial fairness in principle does not necessarily have to coincide with a specific type of benefit.

Below we report a graph from Lindbeck and Persson which shows two of the three above dimensions. System I represents a non-actuarial unfunded PAYG pension system; system II a quasi-actuarial unfunded system; system III a non actuarial funded system; and system IV a fully funded, fully actuarial system. Given a defined benefit or defined contribution benefit type (3rd dimension, here omitted), in principle we could place a system anywhere along the trapezoid in figure 1; although in practice it is virtually impossible to find defined benefit systems in position II (quasi actuarial unfunded pension system) or IV (fully funded actuarial system).
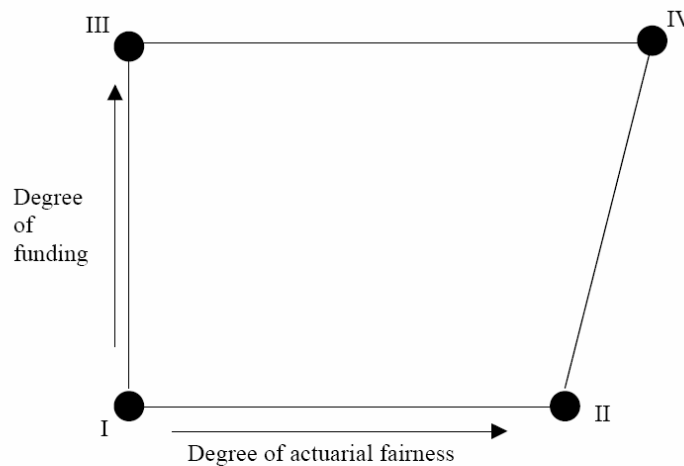

Figure 1: A taxonomy of social security systems

 Although in practice no real world pension system will be so clear cut, it is useful to keep these dimensions separate analytically since each dimension correspond to a different "cost", in terms of :
   (i)   *risk-sharing,* (defined benefit versus defined contribution)
   (ii)   *aggregate savings* (funded versus unfunded)
   (iii)   *labor market efficiency* (actuarial versus non actuarial)

i.e. the outcomes stemming from such characteristics are the variables of interest when assessing the costs of a pension system.

2.2   Pension Reform: the Economic Theory

Traditionally, most mandatory public pension systems were introduced as PAYG, and can be located around point I in the above figure (1). The main point behind arguments for pension reform essentially can be summarized as a shift from a system of type I to one of type II, III or IV.

From the point of view of economic theory, any shift along the trapezoid figure is justified provided that one can measure a related improvement either in risk sharing, total welfare or efficiency such as aggregate savings or employment. In particular, some *core principles* should be used to evaluate any proposal for pension reform:

(i)   **Efficiency:** impact of the system on aggregate savings / labour supply
(ii)   **Equity**: impact of the system on income (re)distribution, e.g. within or between generations
(iii)   **Financial Stability**: impact of the system on public finances
(iv)   **Political Sustainability**: is the system going to be supported by future generations?

A shift between pension types therefore is justified if it meets some if not all these criteria. An economic evaluation of a given pension reform requires consequently the ability to calculate and balance its effects on all four accounts by means, at least for (i)-(iii), of quantitative modelling.

We will first consider the theoretical analysis for shifting from I to II (i.e. from a non-actuarial to a quasi-actuarial PAYG system). Subsequently we will consider a shift from II to IV (since in practice, III is not common).

In the real world, we find many pensions systems of Type I and a few pension systems close to II (i.e. quasi actuarial) e.g. in Sweden. A quasi-actuarial PAYG system is still a tax-financed system, however individuals' contributions are earmarked into "notional" accounts on the basis of which their future public pension will be calculated (although still financed through taxation rather than fund accumulation). In practice, this analysis covers also the case of a shift from a defined benefit to a defined contribution system (as we saw that in practice actuarially fair systems are defined contribution).

We have already seen how in OLG models the non-actuarial DB PAYG pension system (Type I) is stylized as an intergenerational redistribution from the current working young to the current retirees, through taxation. In a single period, the system is in fiscal balance if equation (1) holds. We have already shown in the previous chapter how this might become a problem vis-à-vis population aging i.e. if L or N change, as this will rise the cost of the system.

In a multi period context, the question of fiscal balance is strictly tied to that of intergenerational equity i.e., fiscal balance might imply an unequitable outcome for some generations. Indeed, in order to keep this PAYG system balanced, while the first generation will receive a pure gift, following generations will have to pay contributions on their earnings, the effective size of which will depend on the rate of return of the PAYG system over the model period (i.e. on how much they will get back from future generations once they themselves retire). For the non-actuarial system to be in balance in other words, each generation's pension benefits must be equal to the capital value of the *effective* tax payment of the next generation (i.e. the real rate of return for the next generation). This will ensure pure redistribution across generations, i.e. no unequitable income gain over the total periods.

Assuming that this kind of contract is enforceable (the political sustainability of PAYG in the longrun being actually one of its criticisms), in a simple two periods model the rate of return for the pensioner generation (indexed with 1) in this system will essentially correspond to:

(3) $(1 + return)_1 = P_1/t_1 = t_2(W_2 L_2) /t_1(W_1 L_1) = t_2 / t_1 (1 + G)$

In other words, the return *P/t* (i.e. the ratio of pension received by the older generation against total contributions $t_1 (W_1 L_1)$ paid by this generation in the previous period) is equal to the growth rate in the tax base, G, at the time of retirement. This result was first shown by Samuelson (1958). Given a constant tax rate between two periods (i.e. $t_2 = t_1$), and constant wages *W*, we can therefore conclude that the rate of return of a pension system will be equal to the growth rate in the labor force *L* (although the case of population growth was actually not considered by Samuelson). Hence in case of decreasing *L*, the rate of return of PAYG would decrease between period 1 and 2.

The classic OLG model furthermore assumes that each generation will determine its own optimal consumption level in each period, C^1 and C^2, given its own budget constraint:

(4) $C^2 = (y (1 - t) - C^1)(1 + R) + P$

The budget constraint clearly shows that in a two period model, for a given generation, consumption in period 2 (i.e. when old and retired) will depend on saved disposable income from period 1 (i.e. *y (1-t)*), after consumption in period 1, on the real interest rate *R*, as well as on the pension benefit *P* (financed by taxes paid by the young working generation in period 2).

Immediately we can see the differences in period 2 consumption resulting from a non-actuarial Type I versus an actuarial Type II PAYG pension benefit *P*. In the non-actuarial case, the benefit is a fixed amount *P* which has nothing to do with previous contributions (if anything, in an earnings related defined benefit system, it might be linked to previous earnings). In this case, the return to the non-actuarial system will be given by *P/t*, as shown above. If however, the benefit is actuarial (as in a quasi actuarial pension system of Type II), *P* can be rewritten as a proportion of previous contributions, and of the growth rate in the tax base, e.g. *P = (1+G) ty*. Substituting, period 2 consumption can thus be rewritten as:

(5) $C^2 = (y (1 - t \ (R\text{-}G)/(1+R)) - C^1)(1 + R)$

From this we can see that under a quasi actuarial system type II, consumption in period 2 would be higher than under system I, by reducing the effective implicit tax rate on income earned in period 1 by an amount equal to *t(R-G)/(1+R)*, which is clearly less than *t*. In other words, this shows that making the system more actuarial can, in principle, reduce the distortions introduced by a PAYG system, by increasing the individual return to the system. In the special case where *R = G* (e.g. in a case where there is no capital markets involved), the system has even no cost at all to the individual (i.e. *t = 0*). For the moment, we ignore the effects that the pension system might actually have on *R* (i.e. by inducing people to work or save more, *R* might actually change).

So, aging notwithstanding, shifting from a PAYG non actuarial pension type I to a PAYG quasi actuarial pension type II increases the marginal return on contributions paid into the system, depending on the size of the difference *(R-G)*. Although not considered by the Samuelson's model, we might claim that this reform could also bring an efficiency gain since the lower

implicit tax might reduce the distortion to the labor supply of younger generation. The intergenerational distribution of income between generations will however depend on *R* and *G*. If *R = 0*, the pension gift will bear zero costs for the second generation. If *R > G*, the second generation will pay for the pension gift to the first, while for *R < G*, both generations will gain income, presumably shifting the cost on later generations. This shows that, while the system might not entail a welfare loss, there might still be a shift in who pays the costs (redistribution). The Golden Rule in this case is again achieved when R = G, i.e. a situation of equal distribution between generations.

If we then consider the possibility of aging in this theoretical model, this amounts to *G* possibly decreasing through a smaller labor force; then also under a quasi-actuarial system there will be an increase in the costs of the system (i.e. *t* will effectively rise), however this increase will be smaller than in the case of a completely non actuarial PAYG system, again if we exclude any effect on *R*.

To conclude, we stress that a shift from type I to type II might also result in an efficiency gain, once we allow behavioural responses to take place (i.e. people responding to a lower contribution rate or a higher return to the system by saving more, raising the capital available for future redistribution). The question of intergenerational equity on the other hand (another criterion by which the reform should be evaluated) will depend on the difference between *(R – G)*, and ultimately on the production function assumed.

In terms of financial stability, the properties of a specific pension system are hard to evaluate in a two generations OLG model. A multi-generation model seems more appropriate, as well as a quantitative simulation model. This question will be discussed later.

We can now turn to analyzing the next shift along the trapezoid space of pension systems, namely the shift from an unfunded actuarial system (type II) to a funded actuarial system (type IV). As Lindbeck and Persson point out, the most often quoted arguments in policy circles for such a move are that a funded system would provide a higher return on the individual's savings (i.e. no implicit tax rate), that as a result national aggregate savings would increase, and that better risk diversification could be achieved.

Using an OLG model approach, essentially a shift to a funded system brings two changes to the individual budget constraint: he or she will receive a market return on his mandatory savings *R* (rather than a return equal to *G, or R – G*), but he or she might additionally have to pay some tax to honor the claims of the old PAYG generation (the last generation to benefit from the system before switching to the new funded system, i.e. the transition generation, which we can refer here as *T*). This constitutes a transition cost which also needs to be quantified when assessing the gains of shifting to a fully funded pension system. This cost, whether fully or partially covered, will be spread between the future generations. In the case where the full cost of the transition is borne by the next generation, the tax is said to be front loaded, when instead the cost is shifted away to far away generations in the future, the tax is said to be backloaded. If the transition generation is not fully compensated, the size of the gain to future generations will exactly amount to a proportional decrease in the effective marginal tax rate paid under the previous system (i.e. the tax rate as above, minus the extra tax which should have been paid if the transition generation was to be fully compensated), and exactly equivalent to the income loss by the old generation, regardless of

the time profile of the tax vector, or of the size of *R-G*. This means that the income gain of one generation (stemming from the pension reform) is exactly equal to the income losses of other generations, resulting in no Pareto improvement (and again, assuming no general equilibrium effects or behavioral responses). This result is shown, among others, by Sinn (1999).

Some economists have finally used OLG models to look at the effects of a mixed PAYG and funded system, often invoked on the basis of risk diversification against systemic collapse. Von Weizsäcker (1999) links a standard OLG model to a production function with constant income factor shares, which is meant to model changes to the system´s returns due to population or technology shocks, in a closed economy. He shows that such shocks lead to variations in the rate of return of both the PAYG and funded system (*r* and *g)* that are perfectly correlated, leaving little room for risk diversification[2]. The case for a mixed system lies rather in its greater political sustainability in the event of a demographic shock, if the contribution rate of the PAYG system is indexed to the dependency ratio and is democratically set.

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[2] In an open economy however, there is scope for risk diversification by investing in funded or PAYG system countries, provided that uncertainties between countries is not completely correlated.

PART III   Pension Reform: The Policy Debate

This section will review the main arguments in the pension reform debate as they appear through a variety of policy experiences across the world. The major normative framework often referenced in international policy environments has been the one developed over the past 10 years by the World Bank, and known as the Multi-Pillar Approach.

Funding of pension systems appears as a crucial step in this approach[3]. Many countries, particularly in the developing world (e.g. Latin America) have indeed started to reform their pension systems according to this framework. Nevertheless, as it will be shown below, the policy debate has been far from homogeneous; much disagreement exists between what look like veritable geographical antagonistic "blocs" – delineating what R. Minns calls a veritable "Cold War" in welfare.

Within the policy debate we identify a so called Anglo American perspective, in which we include the Multi-pillar approach, and a more "old school" European welfarist perspective; in reality, we of course observe a continuum along which real systems can be placed.
Based on this policy framework, below we describe the main options for pension reform as shifts from e.g. a fully un-funded (PAYG) public pension system (Type I in the picture, e.g. Continental European system) to either a partially funded partially PAYG system (Type II, e.g. Nordic ?), or a fully funded (Type IV, e.g. Chile) public system. We have seen how Type II systems can in principle be funded or not. Given funding, the main difference between Type II and IV is rather the actual degree of funding and of private versus public involvement in funds management.

Each of these three Types of systems can also be grouped under a single "package" or a Multi-Pillar system (i.e. something which includes both a Type I, or a Type II, and a Type IV system). The move towards a Multi-Pillar System is part of a more general reform to a country´s pension system as a whole (i.e. involving a strategy to reform simultaneously its public, private and occupational systems). Such a move might therefore be more likely to take place in developing countries which are building a system from scratch.

While not excluding the importance of other system characteristics (i.e. benefit type and degree of actuarial fairness), the crucial topic in the policy debate appears to be the extent of *funding*, and whether funding should be the best financing mechanism for the public system. The Multi-Pillar approach, and more generally the issue of funding, can be described as a *structural* approach to pension reform.

Alternative strategies to structural reform do of course exist. One for instance is the so called *parametric* approach to reform, in which the question of funded is not viewed as the main "fix" but rather unfunded pension systems are "corrected" through policies changing some of their existing parameters, e.g. raising the retirement age, reducing the value of the benefit offered, or

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[3] In terms of our theoretical model, this would mean a shift to Type IV system

providing tax breaks for additional savings. A lot of these reforms aim to spark off behavioural responses which will correct the shortcomings of the system vis-à-vis aging. Other strategies put most emphasis on making the system more actuarially fair (e.g. in Sweden or Italy), in which often the system' s generosity is linked to demographics (e.g. longevity).

In the following chapters we focus on the Multi-pillar approach to reform since, although strongly influenced by the funding argument, in itself it does allow for combining structural and parametric reforms. The World Bank itself has suggested a rather flexible paradigm when it comes to the choice of specific system´s parameters, as these are country specific and are thus not part of the general model

Below we report a graph which tries to capture the key reform alternatives often discussed in the policy debate and makes them converge into the Multi-Pillar model.

Figure 2. Types of Pension Reforms in the Policy debate

Degree of Actuarial Fairness

Degree of Private Funding
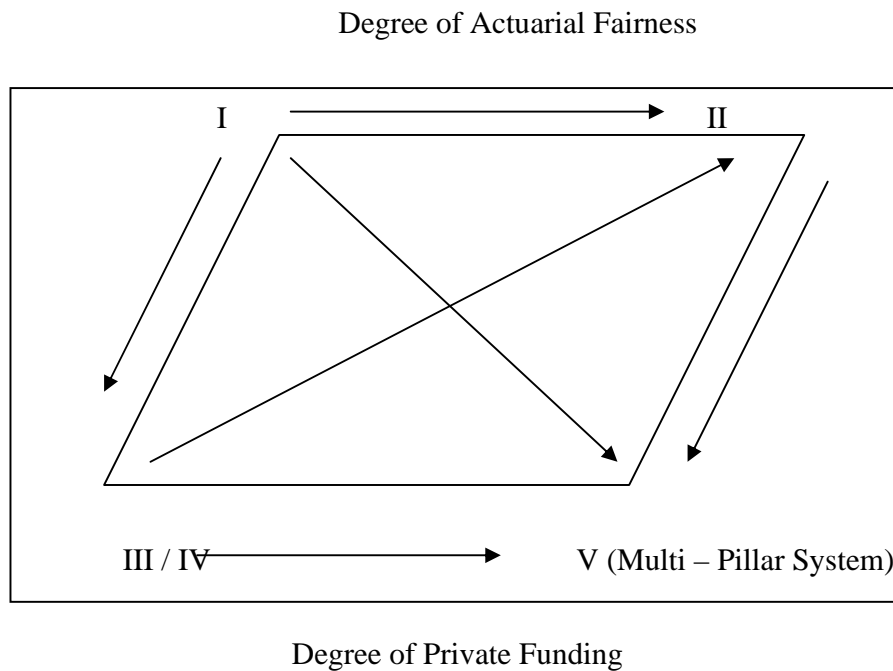
3. 1.   *The Multi-Pillar Model*

The Multi-pillar model of pension reform can be classified to lie within the broader Anglo-American appraoch of welfare, although in reality it tries to reconcile aspects from different welfare traditions (e.g. the more solidaristic European tradition with the more individualistic one coming from the Anglo-Saxon world). We begin here by describing the Anglo-American approach to welfare in general, before presenting the model itself.

By Anglo-American welfare tradition we refer to a normative approach where private funded supplementary pension arrangements should dominate over (if not substitute) public provision, through investments of private savings on the stock market, via financial institutions such as banks, insurance companies and pension funds managers. One of the main distinguishing features characterizing funded pension systems is that in practice they are almost exclusively "defined contributions". It follows that, under the Anglo-American model, most of the pension risk is shifted from the State, or the employer, onto the individual worker.

In relation to Fig. 2 above, the Anglo-American approach would therefore prescribe a shift from a system of Type I to one of Type III or IV, i.e where the public pension system itself becomes funded e.g. through individuals contributing into an individual pension saving plans managed by private authorized firms. An in-between reform would involve moving the system of Type I to a (partially funded) Type II (e.g. a notional defined contribution system, partly funded, partly PAYG), where the funded part might still be administered by the State. An example of a shift from Type I to Type IV is Chile's pension reform in 1980, while from Type I to II would be Sweden's reform of 1999.

The underlying rationale behind the Anglo-American approach is essentially a stark critique of PAYG systems. Minns (2001) conveniently summarizes the core shared claims of proponents of the Anglo-American model as follows:

1. PAYG are undermined by demographic changes, i.e. increasing dependency ratios.

2. The present value of state pension benefits to be paid between now and 2030 exceed the present value of expected contributions by 2 or 3 times the present value of GDP for most OECD countries, hence taxation will have to increase.

3. State expenditure on pensions is high, at 12-15 percent of GDP in most European countries.

4. The State is unreliable in keeping its promises, while crowding out private savings for retirement.

5. Allegedly, the private sector is better at creating and using savings for increasing investments hence the growth required for increasing pension claims.

The overarching philosophy behind the Anglo-American positions is essentially to move away from a redistributive emphasis in favor of more insurance and personal savings as a way to successfully address the aging challenge, mostly by reducing its adverse impact on growth. Redistributive policies in general should encourage savings and work rather than crowding them out, and be limited in coverage to the long term poor (i.e those who earned low wages when in work). The social insurance system of the future therefore needs to rebalance its redistributive and insurance roles in favor of the latter, mainly by shifting from defined benefits to defined contributions systems. One major implication of this shift is that, by re-introducing an actuarial link between contributions paid and benefits received, funded systems result in more savings, later retirement and lower evasion.

The saving argument is indeed crucial to the Anglo-American position, and is often used in conjunction with the need to privatize the management of such savings. The underlying logic is that (i) higher aggregate savings necessarily lead to higher investments (ii) privatization of social insurance is required in so long as it can increase the capital stock in the economy since, if individuals were to invest private contributions into a public trust fund, this would not necessarily be able to increase investments into new capital stock. A crucial assumption behind the Anglo-

American position therefore is that increased private savings must lead to the creation of new private capital stock; conversely, higher savings not accompanied by higher investment (as allegedly would happen under state management) would be just another form of taxation (Feldstein, 1997).

The Anglo-American welfare philosophy has been rather influential in shaping a number of pension reforms around the globe, e.g. in Latin America (Chile) or Eastern Europe*. In 1998, global pension funds assets amounted to 43 percent of world GDP. Such a huge figure should simply indicate that the influence and actions of pension funds cannot be ignored, particularly since it is estimated that about 12 percent of all pension funds assets are invested outside their country of origin, in the form of stocks and securities (Minn, 2001). Pension funds are huge global economic players, and any trade activity performed by them can have enormous knock-on effects on national economies, and potential for financial shocks.

These current global developments find an important policy response in a report that the World Bank published in 1994,"Averting the Old Age Crisis", which was to become an important reference in the pension policy world. Conceived as a "pension reform handbook" mostly for developing countries, the report contained strong linkages to the Anglo-American approach, while at the same time trying to still preserve a role for the public pension system in redistribution and poverty alleviation. The Multi-pillar model was in fact designed to fulfill all the 3 classic key aims of pensions: consumption smoothing, insurance (second tier and third tiers) and redistribution / poverty relief (zero and first tier), hence recognizing the existence of market failures justifying some state intervention.

The model highlights some general principles for countries thinking to create or reform their pension system, and offers access to a range of country experiences, but does not set specific targets, in recognition of the fact that varying initial conditions e.g. in terms of pension coverage, political and institutional capacity will need to inform the reform process on a country by country basis.

Looking at Fig. 2, the Multi-pillar model essentially would entail a shift from any pension system type to a system of type IV. For those countries with no pension system at all, type IV would become a blueprint for setting up the "optimal" system.

The Multi-pillar model is made of three parallel "pillars", namely a small mandatory, publicly managed (unfunded) defined benefit PAYG scheme (first tier), a substantial mandatory privately managed (funded) defined contribution scheme (second tier), and a voluntary private funded scheme (third tier). In 2005 a new World Bank report was released, in which a new "zero tier" was added, to function as a non-contributory minimum pension for the very poor and those with no working history. For the purpose of our discussion we will however treat this latest addition as an integral part of the public "first tier".

3.1.1 The 1st Pillar: Problems and Reforms of PAYG Systems

The starting point of the Multi-pillar argument, as discussed in the 1994 report, is again the inadequacy of design among many current public PAYG pension systems in fulfilling their very aims. The critique is based both on empirical and theoretical grounds. The empirical critique comes from observing particular systems and some of their failures namely:

(i) *Redistribute to the poor*: PAYG defined benefits are not always well targeted in this respect, particularly earnings-related benefits which end up being higher for higher earners or those whose earnings rapidly increase with seniority and have higher life expectancy. Thus defined benefit systems can be regressive (the shorter the years upon which the pension"base" is calculated) and less likely to reach the poor e.g. older women. Flat or means tested pension benefits are more progressive instruments than earnings related ones, and are usually less costly for the State or employers (especially universal flat benefits), however they still have the disadvantage of not being enough to lift people out of poverty (often they are set at a minimum level which is below the poverty line) or, being non contributory, they can lead to evasion by middle and high income workers, low savings when young or result in low take up (especially means tested benefit).

(ii) *Protect the old from uncertainty and risk*: often in PAYG systems benefit levels are changed for political or financial reasons, so someone working today cannot really count on a certain benefit level upon retirement. This is a failure of the system from an insurance point of view. Diamond (1994) for instance lists the possible sources of political risks to include (a) granting of excessive benefits to earlier generations (b) making promises to future retirees that cannot be met, maybe because pension contributions have been used to finance other expenses in the meantime, or government debt, thus yielding returns below market rates (c) excessive responsiveness of benefit levels to short run or long run conditions of the government budget. Lack of commitment devices in particular by government may result in PAYG being vulnerable to inefficiencies due to time inconsistency problems, and would call for adequate institutional reforms and regulation. Also, there is much evidence around the world of badly managed public pension schemes where for instance social security contributions of taxpayers would be invested in low-yielding or negative-yielding government bonds, i.e. used to finance the public debt, or in failing public enterprises.

(iii) *Protect the old from inflation* by keeping the real value of pensions constant: in many PAYG systems benefits are not always indexed, particularly in developing countries where inflation is very high (in Venezuela, real pensions fell by 80 percent between 1974 and 1992). Also, inequality can rise between old and younger generations unless benefits are indexed to average earnings growth. Failure to do this means that from the beginning of retirement the replacement rate would shrink over time (in terms of current earnings).

(iv)*Redistribute across generations*: evidence shows that in most PAYG systems, intergenerational transfers seem to be much larger to earlier cohorts in PAYG systems, since they could pay less contributions over their working life relative to the benefits received than later cohorts.

Beside these four points, the Multi-pillar approach shares the Anglo-American "ideological" bias against PAYG public pensions systems on the basis of their un-funded nature, which would negatively affect growth and the economy mainly through:

(i) *Negative impact on labor markets*: with no change to current PAYG benefit rules existing in most of the developed world, it is estimated that the tax rate required to finance such benefits would have to rise by about 50 percent in European countries (Feldstein, 2001). Employers' and workers' response to such tax rate hikes would be negative for growth. Employers might respond by lowering the demand for labor in the presence of wage rigidities (if they cannot respond by lowering wages). Alternatively, if they pass the tax onto workers by lowering wages, supply of

labor might be lower (although in industrial countries it is quite inelastic); consumers might also be affected by lower production and higher prices. Slower wage growth rate, inflation and unemployment might hamper growth (particularly in the presence of wage rigidities, if employers are to bear the payroll tax). Another effect on labor markets is possible shifts onto the informal sector, where workers would not face taxation, which would also result in efficiency losses. Or they might retire earlier, particularly if an earnings test is applied and there are no rewards for working longer.

(ii) *Negative impact on savings and investments / capital markets*: again, the rationale for this negative behavioral effect is that, as the contributions needed to keep the system in balance have to rise, hence reducing disposable income, people would have less left to save, so at an aggregate level national private savings and capital accumulation would decline, thus hampering growth. Feldstein (1974) for instance claimed that the US PAYG reduced personal savings by 50 percent

(iii) *Negative impact on public finances*: this effect is tied to (ii) above. PAYG systems are financially unsustainable due to expected demographic changes, coupled with negative behavioral effects, and with political pressures to which PAYG are likely to fall victim (resulting in high and unsustainable replacement rates).

Despite all these shortcomings, the policy recommendation stemming from the Multi-Pillar model is not to scrape away PAYG systems altogether, but to reform them as part of a wider strategy which promotes strengthening the funded pillar alongside the reformed unfunded one. The recommendation is to introduce, at least as part of a transition period, a mixed system where a small public PAYG component is kept (the 0 and 1st pillars), mainly to attend to a basic poverty alleviation function for those people who are long term poor (e.g. unable to work and save for long periods of time). This would imply, in the eyes of the World Bank, a considerable downward sizing of the PAYG system compared to what we see today, thus addressing the problem of financial insustainability vis-à-vis population aging. As more people become older, fewer people will qualify for a public pension in this model. In this view, it becomes crucial therefore to re-design the PAYG pillar so as to increase its ability to provide sufficient coverage for the most needy, mostly by removing its income-replacement function and rather transforming it into a safety net.

A lean public first pillar possibly might be achieved through offering a progressive benefit formula such as a contributory flat or means tested benefit. Evidence shows that these formulas are less costly and better targeted. If instead an earnings related formula is used, the model suggests that its base should be compressed, so that the benefit calculation (usually a combination of number of years in work and earnings) not only includes the very last years of work, where usually earnings are higher, but on an average over a longer period. This should be less costly and also more equitable towards lower income groups. Essentially, the wage replacement rate should be based on lifetime earnings. Furthermore, there should be no ceiling on taxable earnings, so that also very high earnings would contribute to the social security fund.

3.1.2   *The 2nd and 3rd Pillars: Occupational and Personal Pensions*

The main difference between the so called second and third pillars is that, according to the Multi-pillar model, the former should be mandatory, and provided by the employer, while the latter should be a supplementary, voluntary system for those individuals who wish to save extra money during working life towards their retirement income. There are no substantial design differences between the two advocated pillars and so for the purpose of our analysis they will be treated as one and the same.

According to this view, both pillars should be funded, as opposed to PAYG[4], and defined contribution rather defined benefit. According to the World Bank model, both pillars should ideally also be privately managed although subject to government regulation. They would in other words take over the bulk of the pension liability away from the State into the hands of private employers, pension fund managers, and individuals themselves.

The basis for the second pillar is constituted by the so called occupational pensions schemes, which were started in the 18th century to cover military and public sector employees, i.e. traditionally high income groups. Today, occupational pensions, both funded and unfunded, are very commonly offered by employers, often to provide an incentive to increase workers' productivity or reduce turnover, since workers will earn pension rights proportionately to the length of their service and earnings. Yet, occupational plans have still very uneven coverage, since only large employers will be able to afford them. In the US for instance, only about half of the labor force today enjoys an occupational pension plan. As we will see later, this has major implications on the employees' decision of when to retire.

Generally, there are two main types of occupational pension today, again defined benefit (like under the most common public PAYG systems) and defined contribution. With a defined contribution scheme, the employee contribution rate is fixed, and matched by a fixed employer's contribution. The employee can be relatively free to choose where to invest the money (including in her firm's own equities). Upon retirement, the individual will convert the accumulated pension fund from such investments into an annuity (i.e. she will buy annuities with her final pot, minus administrative costs) whose size will depend on the size of the pension fund accumulated through the contributory period (including interests earned), the person's life expectancy and interest rates prevailing at the time of retirement. This implies that all risks and uncertainties e.g. about stock market performance fall on the individual. When contributing to the plan the individual cannot know the final value of her pension pot. It is estimated that pension annuities can vary from 20 to 65 percent of final salary, thus presenting quite a large variability and uncertainty.

With a defined benefit scheme, upon the employee's retirement the employer pays an annuity based on the employee's earnings, length of service etc. So in principle all risks and uncertainties fall on the firm, which in turn will redistribute them across workers, consumers, shareholders etc. This type of occupational pension is in fact more costly to the employer, who will often thus use the pension benefit as an employee retention policy; for instance, it can make the package accessible only after a certain number of years spent in the firm (e.g. in the US between 3 and 7

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[4] In practice, we find many occupational plans offering defined benefit pensions organized on a PAYG rather than a funded basis.

years), and increase the pension benefit for those employees who remain long term in the firm. However, older employees will become more costly than younger ones, so that employers have an incentive to"bail them out" by offering early retirement packages. Indeed defined benefit occupational plans have been shown to be a major cause of early retirement, e.g. in the US (Wise, 1997).

In principle, both types of systems, defined benefit or defined contribution, could be either funded or unfunded. In the former case, the employer sets up a pension fund which is then administered by a private third party; otherwise the employer can pay pensions out of its current revenues. In the latter case however, there are several moral hazard problems especially as the number of older workers increases, and the firm's pension liability increase; so workers will again bear the risk of default by the firm. This is why some countries following the Anglo-American model now make funding compulsory for occupational pensions. Such funding is subject to prudential regulation by the government and often accompanied by some form of government back up guarantee (in case of the fund going bust).

Whether funded or not, due to the higher costs associated to defined benefit occupational plans, these are becoming less and less commonly offered to young workers, especially in the Anglo-American welfare systems. Essentially, unfunded defined benefit plans suffer from problems similar to those of PAYG systems. The employer might in fact not be able to afford its pension liability over time, so often it reserves itself the right to terminate the plan, or to convert it into a contributory one. Defined benefit occupational plans therefore do not necessarily provide a better income guarantee for retirement than public pension systems. Beside, such plans have been criticized for blocking labor mobility. There are also problems of portability (the right to pass on the pension to one's heirs in case of death, often denied by occupation pensions) which, set restrictively, also allow the employer to reduce his pension costs at the expense of the worker.

In terms of their effect on the economy, fully funded defined contribution occupational plans are expected to:

(i) *Increase long term savings and capital accumulation*. Supporters of funded plans argue that, compared to PAYG, these plans offer higher levels of capital investments and higher returns. Returns to OECD pension funds have averaged 3-5 percent between 1970 and 1990, and even higher returns during the 1980s. Furthermore, pension funds have big stakes in industries and have an interest to keep good management and performance, monitoring the markets in lieu of other government regulation. Evidence on this however is not uncontroversial.

(ii) *Increase labor mobility*, as more and more companies are abandoning the old defined benefit type of plans in favor of individual based accounts which are more portable across jobs. However the negative effects on early retirement are also acknowledged.

(iii) *Improve public finances* by reducing spending on public pensions. Public pensions would be relieved from provided earnings related pensions and will be able to focus on those who need the most. However this effect needs to be balanced against losses in revenues from tax advantages often accorded to employers who offer to contribute to occupational plans, or to personal savings accounts. In fact, contributions to these private pensions are tax-deductible, while contributions to PAYG systems are not. Furthermore, a large proportion of low income workers today do not receive coverage by such occupational plans, particularly those workers employed in small businesses. In the US uncovered workers amount to approximately half of the working

population. This has major poverty implications which need to be added to the public pension bill.

The so called third pillar, consisting of private voluntary pension savings plan, might somewhat help in reducing the pressure on employers and the government to provide for old age security, although this pillar, being voluntary, is the least apt to cope with the aim of alleviating poverty in old age (i.e. for those low-wage individuals who cannot afford to save when working).

One way could be to introduce mandatory personal savings plans. Since 1951 for instance, Malaysia instituted the first mandatory private saving fund, centrally managed. These mandatory plans have rapidly spread particularly in East Asia and former British colonies, with mixed results, since to function well such funds need financial stability. The idea is that people are compelled to open private saving accounts, often facilitated by tax incentives, and withdraw retirement benefits depending on their contributions, longevity and investment returns. Like occupational plans, they have the advantage of stimulating capital accumulation; however the major risks (investment, inflation, longevity) are now borne entirely by the individual with no risk whatsoever for the employer. As an insurance mechanism, like all funded plans, private retirement accounts are also prone to investment performance of the funds, which might be a problem when workers have little familiarity with financial markets (while employers might have better information and ability to manage such funds). Furthermore, if personal pension savings were made compulsory, market efficiency might break down resulting in likely misallocation of investment.

The size of the personal fund accumulated over the saving life will depend on the contribution rate, the growth rate of real earnings, the interest rate, and the number of working and retirement years. The required contribution rises the higher the target replacement rate (set voluntarily by the individual), the longer the expected retirement period relative to the working period, and the smaller the rate of return on investments relative to earnings growth. Contributions also need to be increased by those who save in plans that make poor investments, incur high administrative costs, index pensions to inflation or wages, or allow to use accumulated balances for purposes other than pensions such as housing, education or health care. Workers assume the risk of longevity, investment and inflation in that most schemes will require to finally purchase annuities; the price of annuities however will increase for those with higher life expectancy, and for those who will want their annuity to be covered against inflation. In general, an individual reaching age 55 (minimum retirement age under most private pension plans) will need to compare the gains from working an extra year with the gains from retiring that year. If the interest rate is expected to be high at the time of retirement, the price of the annuity will be higher. So this will be a critical factor in influencing the retirement decision.

The most important consequence from expanding access to private savings accounts for retirement is that they are expected to increase aggregate savings even more than occupational plans, since the contributions paid into a personal account are likely to be perceived less as a tax, hence people should be more keen to save more during working life than under PAYG or other employer-provided plans, as well as less likely to evade. However other behavioral effects of these plans might not be as positive since, as mentioned earlier, they might also encourage early retirement (see Wise, 1997).

If we look at US data for instance, the last 20 years have seen a major behavioral shift, in that in 1980 92 percent of private retirement saving contributions were going to employer occupational

plans while in 2000, about 85 percent of private contributions were to personal plans (so called 401(k) and IRA plans), with an increase also in the average contribution rate to well over 5 percent of personal income, about twice as much as the average saving rate under a typical defined benefit plan. Rising retirement plan contributions as well as favorable rates of return on retirement plan assets in the 1990s explain such large increase in these saving assets relative to income (Poterba, Venti, Wise, 2001).

While personal mandatory or voluntary plans are expected to increase national savings, the efficiency of resulting capital allocation may depend on whether the fund is publicly or privately managed. The World Bank argues that most publicly managed funds get invested in government securities or failing state enterprises hence the record in most countries is negative (zero to negative returns). In these cases returns go to Government not to the fund, hence such investments are effectively subsidies to the budget, and can be seen as implicit taxes. Chile provides instead a showcase example of the efficiency gains by privately managed funds; here the government must compete against such funds and provide market price returns if it wants to attract private savings. Furthermore, pension providers become major owners in capital markets, thus influencing the stability and growth prospects of such markets, and the growth of parallel monitoring and regulatory institutions. The World Bank for instance argues that, as the claims of pension funds grow in the economy, and their rates of return boom, they also become corporate governance players, with positive implications for the economy as a whole.

From the redistributive point of view, it is acknowledged that personal saving plans have little effect, exactly like other funded pension systems based on actuarial fairness. Low income workers might also be at a disadvantage, especially those with interrupted careers (e.g. women) as they may never accumulate enough to buy sufficient annuities when they reach retirement; even so, the valuation of their expected pension benefit might be lower than their current contributions, e.g. due to lower life expectancy. Higher income workers instead can accumulate more funds and faster, thus being able to retire early, and to draw annuities for longer. Hence the critique that such plans are regressive. Many personal saving schemes go around the problem by offering to pay a lump sum at retirement (rather than buying annuities); but again, this option does not protect against the longevity risk.

3.3   Critiques to the Multi-Pillar Model

The Multi-pillar approach to a large extent promotes the move towards substantial privatization and funding of pension systems. This has spurred a flurry of responses both in the academic and policy circles. Essentially, some critiques come from defenders of the European welfare model, and uphold the unfunded public PAYG system as superior e.g. from a redistributive point of view; hence that it should not be reduced in scope. Others simply criticize some of the assumptions made by the Anglo-American model on the basis of conflicting evidence. In response to this evolution in the debate, in 1999 the World Bank presented another publication in which it revised some of its previous positions, particularly about the effects of private pensions on savings and growth (Orszag and Stiglitz, 1999). Even more recently, the previously quoted 2005 World Bank report re-stated its belief in the Multi-pillar approach but it claims this to be a "benchmark rather than a blueprint" (Holzman and Hinz, 2005).

For convenience, we will review some critiques pillar by pillar, so to say. Starting with the first pillar, it is noteworthy that according to the World Bank policy model this does not necessarily

need to be funded. Thus, the Multi-pillar model implicitly recognizes that the negative consequences of PAYG systems stem not so much from the fact that the system is unfunded but from its associated defined benefit (often earnings-related) design. By fixing the level of benefit to a pre-determined amount, the system commits itself to a future liability that it cannot control other than by raising taxation. Nevertheless, by re-introducing a small un-funded component in the pension system, the Multi-pillar model does not completely elude those critiques that have to do with negative efficiency or behavioural consequences. The model assumes that the other two pillars will compensate for this.

Moving on to the second and third pillars, the main critique is the same moved towards funding in general, or what Barr calls "one of the big myths on pension reforms"; namely, that unfunded PAYG are bad for savings and growth, while funded pension systems are sustainable in the long run because they bring about more savings hence necessarily more growth**.**

The majority of papers struggle to find econometric evidences which can either support or discard the theory[5]. Analysis has been carried out extensively at this regard on either cross-section, time series or cross country data. Generally, cross-section research suggests that social security tends to reduce private savings, although there is wide disagreement on the magnitude of this effect. Time-series and cross country analysis are inconsistent and are thought to offer little insight into this debate.

The most famous evidence in support of this view on pension and savings comes from Feldstein's famous article in 1973, where he claimed that US PAYG system reduced national savings by about 50 percent, whereby reducing the capital stock by 38 percent. Although his conclusions had to be later on revised due to a reported computational error, subsequent studies, mostly on U.S. data (e.g. Feldstein (1983), Diamond and Hausman (1984), Gale (1997)) have confirmed that median estimates of the effect of social security wealth on individual savings lie zero and -0.5; in other words, each dollar of social security wealth received reduces private savings by between zero and fifty cents.

Based on the assumption that higher savings must necessarily convert into higher growth through higher levels of investment, the implicit conclusion here is that PAYG must be bad for growth, if they reduce both savings and the capital stock. This conclusion however is not necessarily true, both from a theoretical and an empirical point of view.

From a theoretical macro economic point of view, it is not only the capital stock but also labor and the nature of the technology which together determine output. Increases in capital and labour productivity for instance may counterbalance such reduction in stocks. As for the relationship between savings and growth, Barr again points out that (i) increases in savings, if any, would actually only occur in the build up of the pension fund, while the system is not mature and the amounts of contributions exceed that of payments out of the fund. In steady state however, also under a funded system the amount of saving paid into the fund will be balanced out by an equal amount withdrawn from pensioners, which in principle (i.e. under the Life Cycle Hypothesis) is going to be entirely consumed. So savings would increase in steady state only if pensioners were to save back part of their annuity, i.e. if the Life Cycle Hypothesis did not hold. (ii) even assuming that savings do increase in a funded system, the question is to assess the extent to which mandatory contributions into a private pension plan (personal or occupational) would crowd out other voluntary savings. The net effect needs to be calculated before claiming that

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[5] For a review of the empirical evidence, see Page's paper, U.S. Congressional Budget Office (1998)

there is a positive increase in savings. (iii) when switching from a PAYG system to a funded pension, there remains the cost of paying for those elder workers who have not saved enough for their retirement (older generations). This will represent a pressure on governments to increase taxation or to withdraw from existing national savings to pay for the transition, thus eroding the positive macro economic effect involved in moving to funded pensions.

From the empirical point of view, many econometric studies have been conducted to research the effects of different pension systems on savings (Auerback and Kotlikoff, 1990), as well as the empirical validity of the Life Cycle Hypothesis. An IMF study (McKenzie, Gerson, Cuevas, 1997) argues that"some reasonable strong evidence exists that the introduction of private pension plans increases *private sector savings*, but the evidence derives mainly from the US, where the increase in personal and retirement plans in the 1990s has actually coincided with a negative household saving rate and substantial rise in personal borrowing, allegedly wiping out the supposed saving effect".

Overall, the evidence from all over the world is controversial and inconclusive, making it impossible to generalize across countries, as concluded by this very study and many others (Lesnoy and Leimer, 1982). In particular, the effect of funded systems on public savings will depend on the way the deficit arising from the costs of the reform is financed. Increased tax incentives to promote private saving plans may contribute to greatly deteriorate the state of public finances and public savings so as to outweigh the positive effects of any increase in private sector or personal savings. A PAYG system which on the other hand addresses its own actuarial imbalances by reducing the benefit rate or simply other public expenditures, or even set aside money from other public revenue sources (e.g. Norway with its oil revenues), might become sustainable without incurring into the same savings conundrums.

Even assuming that the evidence of increased private savings under funded systems holds, there needs to be a proven empirical link between funding and higher output growth in those same countries. The ability of the private sector to turn these higher savings into higher productive investments and growth through the equity market for instance is dubious. The highest volume of transactions in stock markets around the globe is actually of unproductive, speculative nature, meaning that it does not involve the creation of "new" capital but merely trading in existing shares, debt repayments, and dividends financing. During the period 1982-95 for instance only about 2 percent of all UK stock market turnover went towards the provision of new capital to companies, or "productive capital stock". In some cases evidence has been found of actually negative contributions of stock market to investment (Minns, 2001).

These facts point to a crucial question about the link between stock markets (where most pension funds are invested) and economic growth. During the end of the 1990s for instance, especially the UK and US saw great overvaluations of their stock markets to GDP, resulting in dangerous financial "bubbles" which suddenly burst due to the implicit imbalance with underlying fundamentals. Recent financial crisis across the world should lead us to ask to what point do financial markets drive economic growth, and to what point instead their performance depends on the underlying real economy. The relationship is complex. Certainly, under conditions of market overvaluation, such as those prevailing around 1998, the impact of bubbles bursting on growth can be disastrous. Furthermore, the financial transmission of such shocks onto the economy to a great extent passes exactly through the depreciation of pension assets and the ensuing losses in financial wealth incurred by households. This effect will be greater the higher the number of people choosing to invest in such retirement assets.

One theoretical problem with funded systems indeed is that, if the growth in demand for such assets rises too much relative to output growth, there will be excess demand for pension savings; increased demand will raise annuities prices, thus reducing the real pension value i.e. the amount of benefit that can be bought by a given pension fund. Excess claims will only be satisfied if the economy is able to match them up with sufficient growth in the supply of new investment options; or alternatively (and most realistically), by allowing portfolio diversification on international capital markets. However, once funding is accompanied by international pension capital flows, the effects of funding on domestic growth becomes even more difficult to establish. A further qualification needs to be made: funding might contribute to growth but only under the condition that it raises domestic investments. This might not be possible especially in transition countries were domestic investments would be low yield and high risk, hence a lot of pension funding would have to be directed abroad in order to fulfil their insurance purpose.

To summarize: the magnitude of the impact of funding on growth is controversial. In any case, the channel of this effect would be through an alleged increase in savings, which is one of many. Indeed growth requires, beside sustained high savings levels, also a number of other structural measures which reduce the cost of labor, increase labor mobility / labor supply, promote investments in research and development, and spur productivity growth. Furthermore, the saving argument would hold only in so far as there are non-decreasing returns to capital in the long run; otherwise, there will be an optimal level of savings that will depend on factor prices.

As for the argument that funded schemes have better labor supply incentives, in particular can delay the decision to retire early, critics stress that the labor supply incentives are not a function of the type of pension financing mechanism; rather they depend on the design of the plan. Under a privately funded scheme, workers near retirement will decide when to retire based on comparing their expected gains to work against their accumulated pension wealth. As mentioned earlier, evidence from the U.S. shows that many private occupational pensions for instance do provide early retirement incentives to their workers (e.g. at age 55) due to the high costs of keeping older workers employed.

Finally, the multi-pillar approach can be criticized for its rather small emphasis on implementation issues. What we see in reality is that many countries reforming their pension systems according to the Multi Pillar model have adopted a gradual reform process, often involving only parametric changes at first, and gradual shifts to funding involving only certain sub-groups of the population. This is because the Multi pillar model, as it was originally presented at least, said little about how to handle transition costs or about differentiating rules and eligibility conditions between socio-economic groups. In many cases, mandatory reforms have been applied only to the younger generations or new entrants, where older generations have been given the option to remain in the old unfunded first pillar program. In other cases, countries have chosen partial privatizations including only a voluntary, rather than mandatory choice of joining an occupational or private second pillar for all. Indeed, a key policy question ignored by the Multi pillar approach is about designing the transition to a funded scheme, and deciding on who should be allowed, offered or even forced to join a funded scheme (Disney, Palacios and Whitehouse, 1999).

PART IV

4   Using Micro Simulation to analyse Pension Reform

Up till now this paper has focused on two sides of the pension reform debate in light of population aging: a theoretical side, mathematically deriving the "costs" of negative population growth on different pension systems designs, and showing how different reforms can, *ceteris paribus,* affect these "costs" as well as the ability of pension systems to deliver on their ultimate goals; and a policy side, focusing rather on reforming current pension systems on the basis of empirically grounded beliefs, e.g. the belief that certain alternatives (e.g. system funding) would correct the shortcomings associated to certain types of pension arrangements, primarily by shifting risks onto individuals, and by contributing to higher economic growth.

A third approach, known as microsimulation modeling, might help both sides of this debate as it offers a methodology for assessing the flaws and virtues of different reform proposals, with quantitative answers grounded in statistical analysis and complex computational and computing power.
In general, a microsomilation model can be used:
1. to simulate income distribution under a given pension system (so called static microsimulation)
2. to simulate future public and / or private pension accumulation and de-cumulation over the life cycle, under the given pension system, given demographic changes (so called dynamic MSM)
3. to simulate effects of reforms to this given system on (life-cycle) income distribution and costs.

By way of introduction here, suffice to say that dynamic micro simulation provides a tool for analyzing non linear pension systems by simulating individual trajectories of heterogeneous economic agents over their life course. Usually, these models require micro panel data information on socio-economic characteristics as inputs (e.g. household surveys), and then uses it to forecast individual life trajectories in a number of dimensions (demographic choices, such as marrying or having children; educational choices, labor market choices, etc). In any given simulation period, individual life *transitions* are modeled as stochastic processes, conditional on exogenous characteristics and information (e.g. historical data). At the aggregate level, these models therefore (re)produce the demographic and economic composition of society, from the bottom-up. Given some assumptions and external parameters, these models essentially output entire distributions of key individual variables such as a disposable income for a number of years in the future. These distributions will of course be affected by changes in the underlying conditions, such as demographic trends, or institutional rules which affect people´s transitions and behaviours.

Dynamic microsimulation models have often been applied to pension analysis (e.g. Dupont, Hagnere', Touze', 2003; Flood, 2003, Curry, 1996), In a nutshell, because this method improves our understanding of the long term impacts of pension reform not only on aggregate costs and financial sustainability, but also on individual pensioners´ welfare, future income and intra as well as inter-personal redistribution. It helps therefore to answer important redistributive

questions such as who gains and who looses from a given system. It also allows to separate, through the running of multiple simulations, which effects are due to demographic change, and which ones to institutional changes, everything else remaining the same. It allows furthermore comparisons across systems and populations; for instance, the same population structure can be used to simulate the effects of an alternative pension system, or viceversa, a given pension system can be simulated on different population structures so as to infer the best possible combinations for reform (rather than promoting a one-size-fits-all solution).

Our future research is indeed going to develop and apply microsimulation modelling to specific country contexts and reforms.

5   Conclusions

The main rationale for the debate on pension reform across the world today is given by a consistent trend of population aging. This trend characterises, to different extents, both developed and developing countries. The major risk associated with population aging is lower growth due to a shrinking labor force which must support consumption needs of an increasing number of system dependents and unproductive retirees. Another related consequence is higher poverty among the old as the public financial system cannot sustain such demographic pressure, given the existing pension systems. Furthermore, the design of the pension systems themselves might interfere with prospects for future growth. Thus the fear that aging might ultimately throw some countries in a spiral of bad economic performance and higher inequality, especially between old and young.

Economic theory shows how, given population aging, under static output assumptions (i.e. not considering the effects of aging on growth, wages etc.), the returns to a Pay As You Go (PAYG) pension system - the most common form of public pension system traditionally to be found across the globe - would become negative, and the system itself financially unsustainable. Reform of public PAYG systems is the main starting point for all debate on pension reform.

This paper has hopefully shown that one key argument in the debate needs re-assessing: namely the alleged inescapable failure of unfunded PAYG vis-a-vis aging, and the superiority of funded (possibly occupational or private) systems in terms of providing the adequate response.

As we saw in the theoretical section of this paper, the sustainability problem of PAYG systems arises when the benefit is defined. This is not a question of how the system is financed per se; rather it is a question of the type of benefit offered. The question of system financing might indeed be related to that system's impact on future growth; assuming that funding increases savings while PAYG decreases them, many supporters of the Anglo-American view have argued for the superiority of funding. This link between funding, savings and growth is however not empirically robust. Furthermore, whether a pension system should address directly the question of growth is debatable. Traditionally, the aims of a pension systems are consumption smoothing, insurance and redistribution. Growth has not appeared as an explicit aim of pension systems until recently; rather it appears as one of the crucial conditions for the system's ability to perform as expected.

Barr (2000) suggests that stable output growth is indeed crucial to the financial sustainability of both funded and unfunded pension plans, and that this should be an important focus of any policy

change, but that funding of the pension system is not necessarily the answer for sustaining growth; the answer should rather lie in a set of other structural economic reforms e.g. of the labor markets. Indeed, he claims that under a static or falling output assumption, a demographic shock can undermine output growth equally in an unfunded PAYG as well as in a funded system, with the only difference that in the latter case the mechanism is less obvious. In fact, when the worker base shrinks from one generation to another due to aging, the pension bill simultaneously increases. If workers have contributed to a funded system (e.g. private savings account) rather than PAYG, as more people come to retire at a given time, under a static output assumption there will still be a resulting imbalance in the assets and goods market. The larger generation retiring will have accumulated a lot of savings which they will all want to sell in the asset market in order to finance their relatively larger consumption needs. Aging will thus potentially result in (i) excess demand in the goods market by a growing number of pensioners, which will need to be met by the productive workforce. So unless productivity grows, this demand will go unmet, and will push up inflation (ii) excess supply in the assets market by pensioners who will have accumulated more savings (e.g. in the form of equities) than current workers want to buy. This will push the price of equities down, hence lowering pension accumulations and the resulting annuity or pension benefit, in the same way as it would happen under a PAYG system.

Whether one agrees or not with the above series of arguments on funded pensions, these critiques should lead one to conclude that *the superiority of funded over unfunded systems in the context of population aging cannot be established a priori.* Rather, the optimal pension policy reform will need to be assessed on a case by case basis, since this will to a great extent depend on e.g. (i) the present age composition of society, labor market structure and speed of growth, determining the timeframe for action (ii) the degree of system maturity i.e. how close is the system to become financially un-sustainable (iii) the type of social insurance mechanism already in place, if any (iv) the transition costs involved in the reform (v) the degree of fiscal and macro economic stability (vi) the degree of institutional development, determining the ability to regulate the private financial sector and reduce both political and investment risks (vii) the depth and extent of capital markets.

Depending on its specific circumstances, the World Bank (1994 Report) gives some sound policy recommendations, namely that a government considering to reform its pension system should aim to fulfil a minimum set of conditions across all the relevant pillars (not just the public one):

(i)Public Sector requirements:
- Fiscal Sustainability of the state scheme
- Political sustainability of pension reform package
- Administrative capacity to enforce taxes / contributions
- Capacity to maintain macro stability
- Effective regulatory capacity

(ii)Private Sector requirements:
- Sufficiently well informed population
- Public trust in private financial instruments
- Presence of financial assets and financial markets
- Sufficient technical capacity in the private insurance markets

In terms of pension system design, there are many possible solutions beyond the question of whether to keep a public unfunded PAYG component at all; other relevant questions include whether public PAYG pensions should be earnings related, in order to preserve income levels after retirement (thus reducing poverty in old age, at the cost of higher inequality and financial burdens). This is the case in those countries currently facing the biggest sustainability problems where nevertheless reform is encountering severe political resistances (e.g. Italy). Or whether the benefit should be flat (e.g. Ireland), or cover only a minimum guarantee (e.g. the U.K), in order to guarantee an equal basic level for all pensioners at the cost of increased poverty among some. Alternatively, one other option might be to pre-fund only part of the public pension, like for instance in Sweden since 1999.

Furthermore, despite critiques coming from the so called Anglo-American welfare model, PAYG systems also have some virtues. For instance, as we face a world of increasing globalization in labour flows, changes in employment conditions, and in family structures (e.g. higher female employment), short of mandatory private individual pension accounts which people can transfer across borders, defined contribution PAYG systems might be better than occupational pensions to guarantee labour mobility (since the state pension depends on one´s contribution record, while occupational pensions often depend on seniority within the same firm), or to deliver pension rights which are transferable internationally (e.g. public pension contributions can be cumulated across the EU and claimed in a different country upon retirement). Most importantly, PAYG have been shown to be more effective to fight old age poverty than other systems, provided that the benefit is universal and not means tested (since this is often associate to low take up problems, e.g. in the UK). However, as argued by the Multi-pillar approach, undoubtedly most PAYG systems today require reform e.g. in the way benefits are calculated, by indexation, by raising the retirement age, or by enlarging the earnings base, so as to avoid inequities and fiscal strains on later generations.

In conclusion, it is hard (and maybe fruitless) to evaluate pension systems and pension reforms a priori since eventually their actual outcomes will depend on country specific initial conditions, the institutional environment, and on a number of variables which might not be easy to catch in traditional economics or policy models. For this reason, different reform proposals should be evaluated on a case by case basis, possibly with the help of analytical tools which allow to reproduce the largest possible number of conditions, including demographics, specific to that country. Simulating these conditions against all the various pension policy options would help to measure and compare the trade offs (e.g. between equity and sustainability) which they each entail. To this end, the use of appropriate statistical forecasting or simulation models will prove to be a useful complement to the policy debate, short of which there is a risk for it to remain mostly ideological and of a speculative nature. The development of such statistical techniques for the evaluation of the economic consequences of pension reforms is indeed at the center of our further research, to which this paper offers an introduction.

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Table 1 Main Structural Reforms from PAYG to Funded or DC system (source: Schwartz, 1996)

Country	Funded Pillar, Privately Managed	Safety Net	Status of Old System	Transition Mechanism
Argentina	Optional second pillar	First pillar flat pension	Reformed, but open to new workers	Compensatory pension for previous years of service
Australia	Mandatory second pillar	Means-tested first pillar	Fully functional	Not needed; second pillar added to first
Bolivia	Primary system	Annual pension benefit for those at least 21 years of age in 1995 out of shares in state-owned firms	Closed to new workers and those below age 35	Compensatory pension
Chile	Primary System	Minimum Pension Guarantee	Closed to new workers	Recognition Bonds payable at time of retirement
Colombia	Optional primary system	Minimum pension guarantee	Slightly reformed, but open to new workers	Recognition bonds
El Salvador	Primary system	Minimum pension guarantee	Closed to new workers and those under the age of 35	Recognition bonds
Hungary	Optional second pillar	Earnings-related first pillar	Closed to new entrants	Compensatory pension
Kazakhstan	Primary system	Minimum pension guarantee	Closed completely	Compensatory pension
Mexico	Primary system	Minimum pension guarantee	Closed completely	Current workers retain rights to state pension if higher
Peru	Optional primary system	None	Open to new workers	Recognition bonds at time of retirement
Poland	Mandatory second pillar	Notional accounts first pillar	Closed to new entrants and workers under the age of 30	Notional initial capital
Sweden	Mandatory second pillar	Notional accounts first pillar	Conventional DB closed	Compensatory pension in transition to notional accounts
United Kingdom	Optional second pillar	Flat first pillar	Open to all	Compensatory pension calculated based on last contribution
Uruguay	Optional second pillar	Earnings-related first pillar, but with ceiling	Reformed, but open to new workers	Years of service recognized for those under 40, but under new formula; older cohorts get reformed benefits, phased in

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