

(13) Ausschuss für Gesundheit

und Soziale Sicherung

Ausschussdrucksache

0453 B

vom 27.01.04

15. Wahlperiode

What are NDC Pension Systems? What Do They Bring to Reform Strategies?

Axel Börsch-Supan

**Mannheim Institute for the Economics of Aging (MEA), Mannheim University
National Bureau of Economic Research (NBER), Cambridge, Mass., USA**

ABSTRACT

This paper has two parts. Part 1 presents the basic ideas underlying notional defined contribution (NDC) systems and discusses their main advantages and disadvantages. We argue that a NDC system is mainly a political device. It makes parametric reform, badly needed to stabilize the pay-as-you-go (PAYG) pillars all over the World, easier because it exposes the trade-offs and clarifies concepts. It may also change the microeconomics of labor supply and savings. It does not, however, change the macroeconomics of PAYG systems and thus does not substitute for the introduction of pre-funded second and third pillars.

NDC systems can be installed as individual account systems, as done most prominently in Sweden. However, they can also be mimicked by a set of rules in a conventional defined benefits PAYG system, showing that NDC systems are more a political than economic devices. Part 2 describes how the German pension reform proposals made in late summer 2003 effectively introduce a NDC system without explicit NDC-type accounting.

Address:

Mannheim Research Institute for the Economics of Aging,
(MEA), Department of Economics, Mannheim University
L13,17

D-68131 Mannheim, Germany

e-mail: axel@boersch-supan.de

Acknowledgements: This paper has been written for the World Bank – RFV Conference on NDC Pensions in Sandhamn, Sweden, September 29-30. It takes as point of departure and owes much intellectual debt to Richard Disney's 1999 paper. This paper has profited from his as well as Anette Reil-Held's and Christina Wilke's comments, and from the lively discussion during and after the Sandhamn conference. My special thanks go to Nick Barr, Peter Diamond, Anna Hedborg, Robert Holzmann, Assar Lindbeck, Ed Palmer, Michal Rutkowski and Salvador Valdes Prieto. The German National Science Foundation (DFG) and the Gesamtverband der Deutschen Versicherungswirtschaft (GDV) provided additional financial support. The usual disclaimer applies.

What are NDC Pension Systems?

What Do They Bring to Reform Strategies?

By Axel Börsch-Supan

1. Introduction

The pressures exerted by population aging, amplified by negative incentive effects, make public pension systems unsustainable all over the world. The demographic pressures are strong in Europe because Europe has a already relatively old population. On the other hand, demographic change is particularly fast in Asia. Japan shares both the European level and the Asian speed, a particularly dangerous combination. Population aging does not spare the more youthful United States, but at a slower speed and level. Finally, aging also affects the developing countries and adds to their difficult economic and political problems. It comes to no surprise that pension reform is on the agenda in almost all countries of the globe.

Pension reforms seem to follow a wave like pattern. After a wave of reforms and reform attempts with a strong stress on pre-funding, not the least precipitated by the World Bank's "Averting" book (World Bank, 1994), the newest wave of reforms fashion "notional defined contribution" (NDC) systems. This paper's aim is to make a systematic assessment of such a reform strategy, both in economic and political terms.

This paper poses two questions: What are NDC systems, and what do NDC systems bring to pension reform. It may come as a surprise that the second question in the title has more quickly (and often with more confidence) been answered than the first question.

This paper goes back to square one. It begins with the first question. While there are large differences between a Beveridgian defined benefit (DB) pension scheme and a NDC system, and large differences between a NDC system and a pre-funded defined contribution (DC) system, the difference between Bismarckian DB pension schemes and NDC systems is less clear cut, both in terms of the underlying economic substance and the perception in the political arena.

We therefore provide a taxonomy of pension systems which enables us to structure our

answers to both questions. We show how blurred the distinction between conventional DB and NDC systems can become, and we try to condense the economic meaning of NDC.

Our answer to the second question follows the same line. Properly designed NDC systems can contain very powerful economic and political mechanisms that may alleviate pension reform, such as transparency and accountability. Cleverly designed DB systems, however, may often do the same job and in some circumstances maybe even better. Whether NDC systems bring new life into the pension debate is therefore a question of the historical path and the nature of the debate in each single country.

Section 2 sets the stage by stressing the most important challenges which NDC systems are supposed to master. Section 3 is conceptual and devoted to the paper's first question. It defines a NDC system on the mechanical level and then proceeds to extract its economic and political core. We contrast this to DB and FDC schemes. Section 4 answers the second question. It discusses the pros and cons of an NDC system in terms of economics, the perception of workers and pensioners, and the political process. Section 5 provides a real-life example of a well-known conventional DB system which almost perfectly mimics a NDC system. This is the German "point system" augmented by a so-called "sustainability factor" as proposed by the German government's reform commission for the "sustainability in financing the social insurance systems". Section 6 concludes and picks up the challenges described in Section 2: which of those challenges can be mastered by NDC systems, and which challenges must be addressed by other economic and political mechanisms, notably pre-funding.

2. The challenges

The first and foremost challenge to pension systems around the globe is *population aging*, heralded for a long time by often-cited publications such as OECD (1988) and World Bank (1994). The consequences of demographic change have now reached many countries in a perceptible way. Population aging is becoming one of the secular "mega trends" of the new century.

Demographic change has two distinct components: a decline in fertility and an increase in longevity. The fertility decline is most pronounced in Europe and occurred as a historically unparalleled and in many countries rather sudden succession of the baby boom in the late Fifties and early Sixties followed by the baby bust in the Seventies. In the developing countries, fertility decline is less sudden, but still steady and incisive. The secular increase in life expect-

tancy is largely owed to the progress in medical technology. With an unchanged or even declining retirement age, the longevity increase has led to a massive expansion of the pension systems.

Coping with these two demographic developments requires two strategies. To deal with the sudden decline in fertility due to the babyboom/babybust transition, a reduction of the pay-as-you-go (PAYG) replacement rate for the babyboomers and, simultaneously, an increase of privately financed pre-funded pensions substituting for part of the PAYG pensions seems unavoidable in those countries which already have very high payroll taxes. Increasing longevity, in turn, is most naturally addressed by an increase of the length of working life, i.e. a higher retirement age.

Demography is, however, not the only challenge to current pension systems. The European economies – and not only they – face two deeply rooted macroeconomic problems: *poor growth and high unemployment*. The most pressing goal of economic policy is therefore to increase employment (and thereby growth), not the least in order to provide the economic base which should support the social security systems in general, and the pension system in particular. If at least a part of pension contributions is perceived as distortionary taxes, the demographic and macroeconomic challenges interact with each other through the wedge which pension contributions drive between total labor costs paid by employers and net earnings received by employees. Germany is a striking example where population aging and macroeconomic weakness combine to create serious economic problems. Germany has the lowest economic growth rate among all EU countries. At the same time, Germany has by far the highest labor costs (total hourly labor compensation) within the EU (IW, 2003). Much of the thinking of current German pension reform is guided by the conviction that the goal of more growth demands more employment, and more employment demands at least a stabilization of, better a reduction of, payroll taxes and tax-like contributions.

Stabilizing or reducing contribution rates, however, requires cost cutting. This can be done by shifting the retirement age or by reducing pension benefits. Both reform strategies cut deeply into existing claims. It is an illusion to sell the necessary structural reform steps as a „win-win“ situation. Neither a reduction of the replacement rate, nor an increase of the retirement age, is popular. To minimize negative coalitions against reform, employees should therefore be able to choose as flexibly as possible between the two unpopular options.

Many people, in particular in Europe, view pension systems as social achievements that one must defend, no matter how much the demographic and macroeconomic environment has changed. Hence, a change of paradigm is necessary from thinking what one wishes to claim towards thinking what can be financed. This requires a change in the rhetoric of our pension systems; it also requires a transparent statement of the current systems' costs which supports this rhetoric.

There are further *political challenges*. Confidence in the PAYG pension systems is steadily declining during the past two decades (Börsch-Supan and Miegel, 2001). This poses a huge political challenge since every reform has to prove that things will eventually get better than without reform. Rhetoric alone will not bring confidence back, in particular because it has been discredited in the past. What is needed – not only for a change of paradigm, but also to restore confidence – is transparency and a credible reform process. Adjustment processes should be gradual. Any kind of emergency operations undermine credibility. The recent history of German reform provides bad examples, such as the 2000 unexpected discretionary indexation rule change and the 2002 contribution rate hikes, after much of the liquidity reserve had been given up during the last business cycle upturn, exposing the pension system to sudden changes and thereby further undermining confidence in the PAYG system.

Another challenge consists in the many *bad microeconomic design features* in existing PAYG systems that create negative incentive effects. Defined benefit (DB) systems that base benefits solely on last year's earnings, for example, do not reward additional years of work and yield incentives for strongly backloaded earnings. Other examples are systems that provide benefits which are not actuarially related to retirement age. There is strong evidence that the negative incentive effects exerted by such systems have shifted the effective retirement age to substantially earlier ages, and thus contributed to the financial pressures on PAYG systems (Gruber and Wise, 1999; Börsch-Supan and Schnabel, 1998, 1999; Börsch-Supan, 2000). In Germany, early retirement makes up for almost 25 percent of the old-age pension budget, corresponding to almost 5 percentage points of the contribution rate (Börsch-Supan et al., 2003a,b).

Negative labor supply incentives are an important reason to make contributions closely reflect pension benefits (“equivalence” or “insurance principle”). It minimizes the tax-character of contributions. Ideally, a fully equivalent pension system with an internal rate of return equal to a suitably risk-adjusted capital return has no tax-character at all. In turn, violating the equivalence principle, relatively low rates of return, and a lack of credibility all add to the tax-

character of contributions and thus to labor market distortions. In a similar vein, flexibility to choose the date for retirement entry and the abolition of earnings tests minimize distortions in the choice between labor and leisure and should therefore also minimize tax-like distortions.

In summary, the challenges are manifold. Population aging creates financial pressures on pension systems, requiring unpopular cuts in benefits and retirement duration; macroeconomic growth and employment problems are amplified by pension systems if and when pension contributions are perceived as distortionary taxes; reforms may lack political credibility in the same way as the underlying PAYG systems have lost their credibility; and a host of bad design elements on the microeconomic level requires fixing in order to minimize negative incentive effects.

3. Notional Defined Contribution Systems

Notional Defined Contribution (NDC) systems are supposed to address these economic and political challenges. Proponents argue that NDC systems make a large step to solve all these problems in one big stroke (Palmer, 2000; Chlon, Gora and Rutkowski, 1999). Skeptics argue that they add little new but may distract from deeper reform (Disney, 1999; Valdes-Prieto, 2000).

Notional defined contribution systems were legislated 1994 in Sweden and 1995 in Italy, among other countries. In Sweden, the new system was introduced for all employees with a 15-year transition period. It will be fully implemented within a few years from now. Palmer (2000) provides a good description of the Swedish NDC system and its introduction. In Italy, the NDC system was introduced as part of the so-called Dini-Reform with a very long transition period. It will be relevant only for workers who are younger than the baby boom generation. Franco and Sator (2003) provide a critical evaluation. While Sweden and Italy are the most often quoted examples of NDC systems, Latvia and Poland have actually served as trial grounds for these reforms (Rutkowski, 1998; Gora and Rutkowski, 1998; Fox and Palmer, 1999; Chlon-Domiszak and Gora, 2003).

What are notional defined contribution systems? What are their mechanics, and what is the economic essence of NDC systems?

3.1 The mechanics of a NDC system

NDC systems are accounting devices that treat a PAYG system like a defined contribution (DC) systems. Pension benefits are paid out of current contributions like in a conventional PAYG system, but the link between benefits and contributions is individualized and defined by the NDC accounting mechanism.

Like any other DC system, the system starts with the individual contributions to the pension system which are credited to, and accumulated on, individual accounts kept by the pension system. The balance is fictitious (or “notional”) since no capital is accumulated. The accumulated sum represents the fictitious (or “notional”) pension wealth.

The balance earns interest at some rate of return. The magnitude of this return is a central parameter of the NDC system. Since no capital is accumulated and the claims on the balance are not traded, there is no market-mechanism to determine the rate of return.¹ Viewed from a macroeconomic perspective, the “natural” rate of return for a NDC system is the implicit return of a PAYG system, i.e. the growth rate of the contribution bill. However, some NDC systems – such as the Swedish system – have chosen rates of return which are higher under current circumstances, such as the rate of wage growth.

When entering retirement, the notional pension wealth is converted into a lifelong pension („*annuitized*“) according to actuarial rules. The annual pension benefit depends on three variables:

- the notional pension wealth (proportionality guarantees equivalence)
- the interest rate used to compute the annuity (using the implicit rate of return from the PAYG system guarantees equivalence within each birth cohort), and
- the remaining life expectancy (using up-to-date cohort-specific life tables guarantees actuarial sustainability).

The two last elements are often combined and referred to as “annuitization divisors” or “G-values” in Sweden and Latvia.² In Italy, these values have been tabulated. Benefits B are then

¹ Valdes-Prieto (2003) suggests a potential trading mechanism.

² In Sweden, the G-value is the remaining unisex life expectancy at retirement age, reduced by the effect of compound interest during retirement. The assumed interest rate is 1.6%, modified, if the growth of contributions is unusually low, by the “automatic balancing mechanism”. For details see Settergren (2001).

$$B = PW/G,$$

where NPW denotes the notional pension wealth.

Including the implicit rate of return from a PAYG system and including the expected length of retirement in the benefit calculation links pension benefits to the demographic and employment parameters of the macroeconomic environment. This makes NDC systems more sustainable than conventional DB systems in the sense that changes in the demographic and macroeconomic environment automatically lower benefits.

Including the remaining life expectancy links benefits to the retirement age at the individual level. This makes NDC systems actuarially neutral (at the employed rate of interest).

Since the present discounted value (PDV) of pension benefits is independent from the actual retirement age, the financial burden of the younger generation is fixed for each cohort and determined by the G-value, i.e. the notional interest rate and the expected average duration of retirement.

The actual properties of a NDC system depend on many detailed design features. They are discussed in subsection 4.3. At this point, we just stress three features. First and foremost, the determination of the “notional” interest rate is central since it governs both the demographic and macroeconomic sustainability of the system and the microeconomic incentive effects. Second, it makes a big difference which life tables are used. Third, the extent to which retirees are protected from future shocks is an important parameter potentially conflicting with financial sustainability.

NDC accounting systems do not change the mechanics of PAYG systems, i.e. the necessity to adapt either the contributions or the replacement rate (or both) to changes in the demographic or macroeconomic environment. This is an important point. The current young generation pays the current old generation. The determination of the notional interest rate and the estimated remaining life expectancy amounts to the specification of the link between benefits (represented by some replacement rate) and contributions (represented by some payroll-tax rate). By changing this link, the system can shift the burden of population aging between the younger and the older generation. A NDC system, however, cannot mimic a pre-funded system in the sense that the financial burden of a cohorts’ worth of pension benefits will be carried by that same cohort.

3.2 The economic essence of a NDC system

Stripped down to its economic essence, three mechanisms are the crucial ingredients which make a PAYG system a NDC system:

- (1) An accounting mechanism that credits all life-time earnings
- (2) A mechanism linking the final balance with the demographic and macroeconomic environment
- (3) An actuarial rule converting the final balance into an annuity.

In order to stress the last point made in the preceding subsection, we add a fourth element which distinguishes notional from funded DC plans:

- (4) Claims on future benefits are not collateralized with real capital but promises by a (almost always) government-related entity.

The first mechanism is realized by crediting all life-time contributions to an individual account, just like funded DC plans. This parallels in many respects the German and French point systems, except that the unit of credit is currency (Euro), not earnings points (Legros, 2003). It substantially differs from the many pension systems in which only the x best years are credited (at the extreme only last year's earnings), and of course from Beveridgian systems that provide flat benefits.

The second mechanism is realized in NDC systems by the notional interest rate which reflects, if chosen to be the internal rate of return of a PAYG system, demographic changes, employment changes, and productivity changes, since the contribution bill grows with the rate at which the number of contributors and their labor productivity increases. This mechanism parallels the indexation rules of conventional DB systems: most pension systems index their benefits at retirement to the current wage level. Most conventional PAYG systems add discretionary adaptations of the replacement rate to demographic changes; one of the main features of NDC systems is the direct and automatic linkage to demography once the notional interest includes the growth rate of the contribution base. In funded DC plans, the demographic and macroeconomic environment enters benefits through exactly the same mechanism as in NDC systems, namely through the market rate of interest.

The third mechanism is the essence of the $B=NPW/G$ rule. Proportionality between B and NPW and an actuarially correct determination of the G -values makes a NDC system

actuarially neutral and, within each cohort, also actuarially fair (see Disney 2003 for this taxonomy). Some conventional PAYG systems have actuarial adjustments, notably the US Social Security system between age 62 and 65. Most funded DC plans are automatically actuarially neutral, since conversion to an annuity takes place at actual retirement. Many DB-type PAYG systems, however, have no or little linkage between annual benefits and retirement age (Gruber and Wise, 1999).

3.3 A taxonomy of pension systems

How close are NDC systems then to funded DC systems? And how close are they to conventional PAYG-financed DB systems? The taxonomy in table 1 serves to clarify matters. It distinguishes pension systems by four dimensions which are closely related to the four elements listed in the preceding subsection. The many possible design features in real life, however, add additional complexity to these four dimensions. We do not claim that all dimensions are covered (e.g., voluntary vs. mandatory).³

Table 1: Dimensions of pension systems

<u>(1) Credits for contributions</u>	
Base:	Life-long.....Best x years.....Final salary.....Flat
Weights:	Early vs. later contributions (-> interest).....Equal (point system)
<u>(2) Accrual of interest:</u>	
Rate:	$r.....g.....n+g$ (Aaron-Samuelson)
<u>(3) Conversion to benefits:</u>	
Conversion:	Linear (equivalence).....Concave (redistributive)
Indexation:	NDC: $B=NPW/G.....$ DB: $B=f(\text{credits, other; accrual rate})$
Actuarial:	Neutral (margin!) at retirement.....Flat
Risk:	Benefits frozen at retirement.....Indexation rules.....Fully adjustable
<u>(4) Funding:</u>	
Extent:	No fund at all.....Reserve buffer.....Fully funded
Collateral:	None.....Government bonds.....Commercial bonds/stocks

One of the main features of Table 1 is that all of the dimensions provide a continuum of allocations within each dimension. NDC systems often enforce an extreme position along a dimension, but conventional DB systems may come close in some of the dimensions of

³ See the textbooks by Homburg (1988) and Valdes-Prieto (1999).

Table 1.

In terms of *crediting contributions*, NDC systems do indeed take an extreme position: contributions are credited on a life-time basis and earlier contributions get a higher weight according to the rate of interest. While the German point system also credits all life-time contributions, the point system weights all contributions equally, independent of time. This corresponds to ignoring compound interest, see below. The French point system credits only the best 25 years; the US Social Security system permits taking out the 5 worst years, which creates less labor supply disincentives than the French system. Many systems in developing countries use only last year's earnings,⁴ and in strictly Beveridgian systems such as the Dutch or British base pensions, credits do not play a role in the determination of benefits at all since benefits are flat.⁵

NDC systems feature a "natural" *accrual of interest* through the crediting mechanism. However, the conversion factor between benefits at retirement and the sum of contributions over the working life can be interpreted as crediting all accrued interest at the time of retirement (Ruland, 2000). While the latter mechanism ignores compound interest because it does not matter when contributions are paid over the working life, there is no other genuine difference between NDC systems and a DB formula that (implicitly) credits the accrued interest at retirement. The determination of the rate of interest is another matter. In a funded system, the internal rate of return is r , the market rate of interest. In a PAYG system, it is $n+g$, where n is the rate of growth of the contribution base, and g the growth rate of labor productivity. In Sweden, the government choose g als the notional rate of interest, leaving out a direct link of accruing interest to demography.⁶ In an aging population, $n+g$ tends to be smaller than g since n is negative, and it is in most circumstances much smaller than r .⁷

The third dimension relates to the *conversion* of the accumulated notional wealth *into benefits* at and after retirement. There are four elements in that conversion. First, how are individual

⁴ Börsch-Supan, Palacios and Tumbarella (1999)

⁵ This is strictly true only in citizenship or residence-based flat benefit systems (e.g., Australia). In the UK, a minimum number of credits determines eligibility.

⁶ Demography enters directly through longevity-dependent annuities and indirectly through feedbacks that change g , for instance via age-specific productivity. Sweden also has a re-balancing mechanism which will respond to demography once the current system fails, see Settergren (2001).

⁷ The theoretical relation between r and $n+g$ in and out of steady state and its relation to dynamic efficiency fills volumes and is not subject of this paper. See Valdes-Prieto (1998). For some enlightening empirical results, see Schnabel (1998).

credits related to individual benefits. NDC systems use simple proportionality by applying the $B=NPW/G$ rule. Some DB systems have the same proportionality, e.g. the point systems in France and Germany or systems with a simple accrual rate rule, while the US Social Security system credits additional contributions at a decreasing value – the system redistributes through a concave linkage function between contributions and benefits. In a strictly Beveridgian system, credits play no role at all, as mentioned before.

The second element is how benefits are related to the demographic and macroeconomic environment. In NDC systems, this is expressed in the G-values. Conventional DB systems usually have benefit indexation rules which link the benefits at retirement to the current wage or earnings level.⁸ They fail to include demographic factors directly, although there may be indirect linkages. Indexation to net wages, for instance, where net means net of taxes and contributions, entails an indirect linkage since rising contributions, precipitated by population aging, will also reduce benefits. There is nothing, however, to prevent DB formulae from including direct linkages to demography to increase the elasticity of benefits with respect to demographic changes, and we will show a concrete example in Section 5.

The third element is the relation between retirement age and benefits. NDC systems are automatically actuarially neutral in the sense that the PDV of benefits is not affected by the actual retirement age if the PDV is computed at the internal rate of return of the NDC system. However, workers may use a different rate of interest when they are computing the PDV in order to make retirement decisions. This difference then creates a wedge between actuarial neutrality and the absence of labor supply disincentives, the latter being defined as the case in which the PDV of benefits is independent of the retirement age, if the PDV is computed using the personal discount rate of workers. The crucial question is then, what is the personal discount rate of workers? If it is the market rate of interest, then it is usually larger than the internal rate of return of the NDC system, especially in times of aging populations.⁹

This is an important point: NDC systems may be actuarially neutral, but they may still create substantial labor supply disincentives. They may be more neutral than DB systems which apply very small adjustments of annual benefits to retirement age (such as the German

⁸ Note the difference between the initial indexation at retirement for the flow of new entrants and the indexation of benefits after retirement for the stock of existing retirees.

⁹ Empirically measured personal discount rates tend to be even larger than r , and this by a substantial margin, see the survey by Frederick, Loewenstein and O'Donoghue (2002).

adjustments of 3.6% p.a. phased in after 2001, see Section 5.2), and certainly than systems in which annual benefits are independent of retirement age (such as the German system before 2001), but NDC systems may be more distortive than DB systems that apply large adjustments (such as the UK with adjustments of 9% p.a.). NDC systems may provide a most “natural” way to compute retirement-age specific adjustments, but again: there is nothing intrinsic in this respect that distinguishes NDC from DB systems with actuarial neutral (or larger) adjustments such as the US Social Security system at age 62 to 65.

Finally, the fourth element is the indexation of benefits after retirement (different from the indexation, or anchoring, of benefits at retirement). Conventional DB systems index benefits after retirement to cost of living (US, Italian new system) or net wages (France, Germany) or some combination in between (Switzerland). In funded DC systems, this is represented by the type of annuity (real or nominal, or any other schedule). The Swedish NDC system freezes the benefits in real terms, corresponding to a cost-of-living indexation. Again, NDC systems provide no special features in this respect.

By now, it should be clear that NDC systems are accounting devices with properties which can (but maybe not politically easily) be introduced in conventional DB systems as well. They may serve to provide more transparency and credibility because some features come more “naturally” in a NDC system than through complex formulae in a DB system, but it is more rhetoric than economic substance which distinguishes NDC and DB. In fact, Lindeman, Robalino and Rutkowski (2003) show under which conditions NDC and DB schemes are mathematically equivalent, and we will present in Section 5 the example of the new German DB system which almost perfectly mimics a NDC system.

How is NDC different from a funded DC plan? This is addressed in the fourth dimension of Table 1. Most PAYG systems have some reserve fund, although the size of it varies greatly. The Swedish reserve fund amounts to some 5 years of expenditures, while the German system’s reserve fund is minimal with a few days worth of expenditures. The crucial question, however, is whether the accumulated balances are collateralized and which claims represent the collateral. NDC systems are “notional” in the sense that there is no collateral at all. Balances are claims against future tax payers, and they are not backed by a financial

instrument.¹⁰ Funded DC plans are usually understood as being collateralized against physical capital, mostly through financial instruments such as commercial bonds or stocks. We use the word “funded” only for these plans. Some authors also call those DC plans that are collateralized with government bonds “funded”. We think that this is a misuse of the word “funded”. While benefit claims of such plans are marketable and yield a well-defined rate of interest, they do not represent claims on physical capital. NDC systems may permit a “natural” way to make the implicit debt of a PAYG system explicit by linking the NDC balances to government bonds, and the resulting insights about future benefits and contributions may create saving incentives on the microeconomic level. However, NDC systems and conventional DB systems share the crucial macroeconomic features of PAYG systems: NDC systems do not accumulate savings in real assets with the potential beneficial side effects on the national saving rate, capital market development and growth (Holzmann, 1997; Schmidt-Hebbel, 1998; Börsch-Supan and Winter, 2001). NDC systems are therefore no substitute for pre-funding.

4. Pros and Cons of Notional Defined Contribution Systems

We now turn to the second question of the paper: What do notional contribution systems bring to pension reform? What are their advantages and disadvantages? Since we have seen in the preceding sections that NDC systems can almost perfectly be mimicked by conventional DB systems, we focus on the psychological and political aspects of a new rhetoric. This does not mean that we ignore the microeconomic implications of transparency and credibility. We will stress that they are important for pension reform. They are, however, sometimes quite subtle and indirect.

4.1 Advantages

A NDC system

- adapts itself automatically through an internal interest mechanism to the changed balance of contributors to pensioners (*baby boom/baby bust problem*) without the necessity to intervene discretionarily;

¹⁰ This could be changed by converting the implicit claims on the contributions of future workers in explicit claims on future taxes backed by government bonds, see Valdes-Prieto (2003).

- through the actuarial conversion of the notional pension wealth into a life-long pension, the system adapts itself automatically to changed life expectancies (*longevity problem*); reductions for early retirement result automatically and are automatically adapted to the demographic situation (this adaptation is incomplete when benefits are frozen at retirement and pensioners are effectively insulated against subsequent changes of longevity);
- avoids *arbitrariness* of benefit indexation rules, adjustment factors, etc., the change of which have undermined the *credibility* of many unfunded DB systems;
- strengthens the *equivalence principle* and for this reason minimizes the wedge between gross and net income, which results from the distortionary impact of taxes and tax-like contributions;
- adds *transparency* to the PAYG pillar by clearly identifying individual contributions and the resulting benefit claims, helping to regain credibility;
- strengthens the principle that pensions are based on *life-long earnings*, and honors employees who enter the labor market early;
- *transfer mechanisms* can be easily identified as in-lieu contributions; notably tax-financed credits for higher and vocational education and similar credits for educating children;
- creates a framework, which can consistently be enlarged to a *general „accounting system“* of all PAYG subsystems; advantages and disadvantages of joining subsystems (e.g. civil servants and self employed) will become immediately obvious in such an accounting system;
- produces a suitable framework for *independent pensions of spouses*;
- creates a *homogeneous paradigm* for the first, second, and third pillar of a multiple-pillar system; hence, it may increase the acceptance of the second and third pillar which are regarded as “alien” system components in those countries which used to have a monolithic first-pillar dominated pension system; and
- permits a considerable amount of *flexibility* for employees in choosing their retirement age; makes the inflexible and politically problematic fixation of a „normal“ retirement age superfluous; and it exposes the trade-off between accumulated contributions and retirement age in an internally consistent fashion.

4.2 Disadvantages

One of the main strength of NDC systems, namely transparency, comes with some obvious disadvantages in the political realm:

- The financial situation of an unsustainable PAYG system becomes more obvious since workers “see” their declining benefits (while contribution rates are increasing) on their own accounts – thereby translating a general knowledge about the financial situation of the pension system into a personal concern. This is the flip side of the advantage of transparency; it may turn into a disadvantage, some think, because this may undermine confidence even more.
- If the contribution rate is fixed, the replacement rate becomes uncertain since it is dependent on the future development of earnings and demography. The replacement rate cannot serve any longer as a political instrument. This is of course the essence of a defined contribution system, including a notional one, but the uncertainty will become painfully visible in a NDC accounting system.
- The system does not change the tension between business cycle related earnings declines and long term spending commitments. Therefore, a genuine liquidity reserve is necessary. In countries where it has been depleted, it must be rebuild, even if this means sacrificing lower or installing higher contribution rates, especially during business cycle upswings.
- If the annuity is frozen at the beginning of retirement, a stabilizing feedback mechanism is missing if there is an unexpected rise in life expectancy. With a fixed contribution rate, the system will not automatically obey the annual budget restriction of a conventional PAYG system.¹¹
- Discretionary decisions are more hidden – they take place at the choice of life table, computation rules (such as the averaging) for the internal rate of return, the determination of a minimum retirement age, etc.
- The system does not change the fact that only pre-funding can change which generation pays for a given pension benefit. If one wants to have the workers of generation x at least partially pay for their own pension, rather than their children in generation $x+1$, some ex-

¹¹ For a clearly stated mathematical exposition of this point, see Valdes-Prieto (2000).

tent of pre-funding is necessary. A NDC system is no replacement for such partial funding. It is only an optimization of the PAYG pillar.

4.3 Design details

This is not the place to discuss the many design issues that must be resolved in order to establish a NDC system.¹² We mention only some especially important ones:

- Like any other PAYG system, a *minimum age* must be established when healthy workers may begin to receive a pension. Such a minimum retirement age is necessary unless one makes the participation in the PAYG system optional which is, especially in times of population aging, not a stable solution. None of the existing NDC systems have an automatic adjustment of the minimum retirement age to longevity, hence, the existing systems do only respond partially to demographic changes.
- Specification and update of life tables have immediate consequences for benefits. Most countries so far have adapted *unisex life tables* based on cross-sectional data. Actuarially correct are cohort tables, with some projection for changes in life expectancy. Many countries do not have a reliable mechanism to compute such tables. An independent board of actuaries should supervise the construction of such tables, and the life tables should be consistent with those used in the private pension sector.
- The *internal interest of the contributions* (growth rate of the contribution bill) must be smoothed over time. Several models are on hand. A moving average across a business cycle seems to be the natural choice. Peaks should be leveled off to flow into the liquidity reserve, used for the troughs of a cycle. Designing such smoothing mechanisms is not trivial since the amplitude and duration of a business cycle is not known in advance, and we do not have foolproof mechanisms to distinguish trends from cycles.
- Since the implicit rate of return of a PAYG system is often substantially lower than the workers' discount rates, *incentive effects to retire early* may still be large if later pension uptake is governed by actuarial neutrality. From a macroeconomic point of view, it is not obvious whether actuarial neutrality (using the internal rate of return of the PAYG system) or absence of incentive effects (using the workers' discount rate) is welfare maximizing.

¹² See Palmer (2003) for many of such details.

- There are many ways to design the *annuities*. They can be chosen to rise with inflation or with wages, or any other schedule; the initial level is adjusted accordingly, holding PDV over expected duration constant. The freedom to choose is probably more important than potential problems with adverse selection. However, we have little experience so far with such trade-offs.
- Benefits are determined at the beginning of retirement, but the demographic and economic environment may unexpectedly change after such determination. If the growth rate of contributions is very low, pensions may fall in real terms, which is politically unattractive. Some adaptation to the new environment is probably optimal, but pensioners seem to value protection quite highly. The overall welfare-maximizing policy is not known so far. As we have stressed before, if pensioners are fully protected from demographic and economic changes taking place after they entered retirement, NDC systems lose an important feedback mechanism which may undermine long-run financial sustainability. If pensions are protected by a floor (say, never fall in real or nominal terms), the system can become financially unbalanced because expenditures and contributions are treated asymmetrically: Expenditures cannot fall below a certain floor, while contributions can.
- The *rules for the transition period* should follow the Swedish, not the Italian model, since the extremely lengthy Italian transition time does not permit the NDC system to address the most urgent financial problem – the strain on the pension budget that will occur when the baby boom generation retires. A more difficult question is the extent to which existing pensions should be protected. “Natural” transition paths can be constructed when benefits are defined pro rata in proportion to the time spent under current and new law. The transition can be faster if important design elements of a NDC system are already in place. In Germany, for instance, a relatively short transition period (from 2005 through 2020) would be possible because the existing point system has an important feature of NDC systems already in place.

5. A Blend of DB and NDC: The German Point System and the Sustainability Indexation

In this final section, we use the proposed new German public pension system as an example of a DB system that quite closely mimics a NDC system. Three ingredients are the main

elements of the German public pension system: the point system of credits, the actuarial adjustments, and the benefit indexation formula. During the recent pension reform process,¹³ these elements have been changed consistently in the direction of NDC-type pensions.

The *point system*, described in detail further below in Subsection 5.1, is a feature of the German pension system since its conversion to a PAYG system in 1957. *Actuarial adjustments* have been legislated by the 1992 reform; they are phased in since 1997, with the bulk of adjustments in force by 2007. As a result, effective retirement ages are expected to increase by about two years within the next ten years.¹⁴ In 2001, the so-called “Riester reform” made a first step from a purely pay-ay-you-go to a capital funded pension system: it established upper limits to the contribution rate, discontinued the benefits indexation formula, and substantially lowered pension levels. At the same time, the Riester reform introduced state-subsidized supplementary private pensions (“Riester pensions”) in order to fill the upcoming pension gap. However, these reforms did not suffice to stabilize public pension finances. In late Fall of 2002, the government established a reform commission to achieve “sustainability in financing the social insurance systems”. A broad majority of this commission took the view that the upper limit of the contribution rate legally anchored by the Riester reform must be adhered to, and consequently changed the *benefit indexation formula* to follow an income-oriented policy. This change has been approved by the government and passed the Bundestag in first reading in Fall 2003. Details of this new indexation mechanism are described below in Subsection 5.3. This was the last step which in effect turned the German DB system into a NDC-type pension system.

5.1 The German point system

The German public pension system computes benefits according to the following formula:

¹³ Börsch-Supan and Wilke (2003) present a detailed description of the pension reform process.

¹⁴ Econometric estimates are provided in Berkel and Börsch-Supan (2003).

$$B_{t,i} = PV_t * EP_i * AA_i$$

where

$B_{t,i}$ = Benefits of pensioner i in year t ,

PV_t = Current pension value in year t ,

EP_i = Number of individual earnings points collected by pensioner i until his retirement

AA_i = Actuarial adjustment, dependent on the retirement age of pensioner i .

Benefits therefore have a simple structure: an individual component $EP_i * AA_i$ determined by each person's earnings history and retirement age which stays fixed for the entire retirement period, and an aggregate component PV_t which adjusts benefits over time equally for all pensioners.

EP_i represents the "point system" and AA_i is determined by actuarial accounting rules, see below. A typical worker who works for 40 years and earns the average labor income in each of these 40 years receives 40 earnings points. If this worker retires at age 65, no actuarial adjustments take place ($AA=1$). In the second half of 2002, the current pension value PV_t was 25.86 Euro.¹⁵ Hence this typical worker receives a pension of 1034.40 Euro per month. A worker who has worked for 20 years at average earnings, or a worker, who has worked for 40 years at 50% of average earnings, will receive half of these pension benefits, while workers who earn twice the average labor income for 40 years will receive twice as much as the 40 year average earner.

5.2 The actuarial adjustments

Before 1992, adjustment of benefits to retirement age was only implicit via additional earnings points. For a worker with 40 years of service at the average earnings level, an additional year of service would therefore increase the annual pension benefit by 2.5%. There were no further actuarial adjustments. The 1992 reform changed this, and the changes are currently being phased in.¹⁶ Age 65 will then act as the "pivotal age" for benefit computations. Benefits will be reduced by 3.6% (maximum 10.8%) for each year of earlier retirement. The 1992 reform also introduced rewards for later retirement: for each year of postponement, benefits increase by 6%. There is some debate whether these percentage

¹⁵ This value was determined by the goal to provide a 70% ratio between the average pension and the average earnings level, see Section 5.3 below.

¹⁶ See Berkel and Börsch-Supan (2003) for details of the transition process.

adjustments are actuarial neutral.¹⁷ The German Reform Commission took a cautious position by stating that “the adjustments are low, but probably sufficiently close to actuarial neutral”.¹⁸ At conventional discount rates, they still exert negative incentives to retire early of considerable magnitude.¹⁹

5.3 The benefit indexation formula

Each year, currently on July 1, the current pension value PV_t is recalculated with the aid of the benefit indexation formula. Until recently, this benefit indexation formula was essentially a simple indexation rule, increasing pensions by the growth rate of net earnings:

$$PV_t = PV_{t-1} * \frac{ANW_{t-1}}{ANW_{t-2}}$$

where

PV_t : Current pension value in year t

ANW : Average earnings of all employees subject to compulsory insurance, net of taxes and social insurance contributions

Since the current pension value PV_t has a direct influence on every individual pension, the benefit indexation formula is a critical determinant for the well-being of pensioners and the amount of money spent by the public pension scheme.²⁰ However, the benefit indexation formula gives no direct reference to the demographics of the system, nor to the number of employed persons, although there is a feedback through net earnings: higher contributions dampen net earnings, thus also pension benefits, incorporation a kind of burden sharing between generations. The limitations of this feedback mechanism are one reason for the unsustainability of the German pay-as-you-go system.

Starting in 2005, the benefit indexation formula will be augmented by a “sustainability factor” which incorporates demography and employment into the German benefit indexation formula. Specifically, it indexes benefits also to the numbers of contributors and pensioners. The relative number of contributors to pensioners, the so-called system dependency ratio (PQ), is

¹⁷ There is a controversial discussion about the correct actuarial adjustment rate in the German public pension system, see Ohsmann, Stolz and Thiede (2003) vs. Börsch-Supan (2000).

¹⁸ Kommission für die Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme (2003).

¹⁹ Börsch-Supan (2000), Börsch-Supan und Schnabel (1998, 1999), Börsch-Supan et al. (2003a,b).

²⁰ Ruland (2000) has succinctly expressed the relationship between earnings points and current pension value by regarding earnings points as “shares” in the “financial assets” held by the pension fund. The current pension value corresponds to the current “share price”. See Section 3.2 for a discussion of this view.

the most important long-term determinant of pension financing:

$$PV_t = PV_{t-1} * \frac{ANW_{t-1}}{ANW_{t-2}} * \left[\left(1 - \frac{PQ_{t-1}}{PQ_{t-2}} \right) * \alpha + 1 \right]$$

where

PV_t : Current pension value in year t

ANW : Average earnings net of public and private pension contributions²¹

PQ : System dependency ratio [pensioners / (contributors + unemployed)]

Incorporating the sustainability factor in the benefit indexation formula links annual increases in pensions to productivity growth and the growth of the contribution base. The weighting factor α gives weight to each of these two determinants; it effectively spreads the financial burden among contributors and pensioners. If α equals zero, the current benefit indexation formula would remain unchanged and the financial burden generated by a higher proportion of pensioners in the population would mainly be shouldered by the labor force. α equals one implies a purely receipts-oriented pension expenditure policy. The German Reform Commission has set α to $\frac{1}{4}$ in order to target the contribution rates anchored in the Riester reform (contribution rate below 20 percent until 2020, under 22 percent until 2030).

5.4 The NDC characteristics of the German pension system

While there is no perfect equivalence, the three main elements of the German public pension system (the point system of credits, the actuarial adjustments, and the indexation to both earnings and system dependency) mimic the essential features of an NDC system.

The *point system* includes all earnings over the life-time; almost all redistributive features of the German old-age pension system take the form of earnings points credited without actual earnings (e.g., years of unemployment, years of higher education, years of educating a child, etc., in each case valued at an imputed earnings level). The equivalence between the point system and an NDC system is not perfect since all earnings points count equally, while in a NDC system earlier earnings are valued more than later earnings due to compound interest.

²¹ The careful reader may note the difference in the ANW definitions which we choose to ignore here since we want to focus on the NDC characteristics. The current formula does *not* net out taxes and social insurance contributions other than taxes, but *does* net out contributions to second and third pillar pensions at an imputed rate. It also computes the system dependency ratio using full-time equivalents for workers and pensioners. For these computational details, see Börsch-Supan and Wilke (2003).

One deviation from equivalence is the fact that the *actuarial adjustments* in the German system are not directly linked to life expectancy. The actual adjustment rates are somewhat arbitrary, probably too small and certainly controversial.²² One of the advantages of a NDC system is to automatically generate the adjustment rates by the annuitization mechanism.

The *benefit indexation formula* of the German DB system with its indexation to earnings growth and changes in the system dependency ratio approximates the effect of the accumulated interest in a NDC system, in which the internal rate of interest is the growth rate of the contribution bill $(1+n)*(1+g)$. This is easy to see in the most stylized case when all contributions (normalized to one unit) are credited upfront. In this stylized NDC case the notional pension wealth after T years is $T*(1+n)^T*(1+g)^T$; the pension benefit is therefore $P=T*(1+n)^T*(1+g)^T/G$ where G denotes the annuity factor (or “G-value”). In the German DB system, this average worker earns T earnings points, and during these T years, the average pension value PV will increase with the rate of wage growth (g) and the growth rate of the dependency ratio (n , if the number of pensioners remains constant): $PV_T = PV_0 * (1+n)^T*(1+g)^T$. Hence, the pension benefit is $P= T*PV_0*(1+n)^T*(1+g)^T$, proportional to the NDC value. This stylized comparison may ignore many differences in detail: non-constant contributions will have a differential impact on the two formulae; net wages are likely to grow at a different rate than gross earnings; the system dependency ratio is likely to shrink faster than the labor force. The principles, however, are the same. What a country prefers as a pension policy – an almost textbook-like NDC system as in Sweden or a demography-indexed DB system as in Germany – is probably more dependent on the historical path of a country and the specific circumstances of the political debate than on abstract economics.

6. Conclusions: Can NDC Systems Master the Challenges?

Our summary starts with three claims about NDC systems that are not true. NDC systems are *not automatically balancing*: they do not automatically fulfill the PAYG budget constraint when economic parameters change. In particular, automatic balancing will not hold if annuities are frozen at retirement and the contribution rate is fixed since there is no feedback mechanism if longevity of current pensioners increases unexpectedly. Second, a NDC system is also *not automatically sustainable* unless the contribution rate is fixed and the rate of return

²² See footnote 14.

equals the contribution bill (or the system follows an equivalent trajectory). Third, a NDC system is *no substitute for pre-funding*. A NDC system does not change the basic PAYG mechanism in which the children pay for the pensions of their parents, and it does not create savings unless it generates a benefit cut which in turn precipitates savings.

However, if correctly designed, a NDC system will *automatically respond to changes in the demographic and macroeconomic environment* because benefits are indexed to longevity (due to the annuitization mechanism), fertility and employment (through the notional rate of interest, if indexed to the contribution bill).

Moreover, a NDC system has potentially important microeconomic effects. It will create a sense for *actuarial fairness* (because annual benefits in line with life-time contributions) and *actuarial neutrality* (because the system creates automatic adjustments to retirement age). It exposes redistribution because any non-contributory credits appear clearly marked on the account statements.

A NDC system changes the *rhetoric of pension systems*. It makes people *think in accounts*, and thus may make the transition to partial funding psychologically easier. Moreover, by *exposing the dwindling balance of first pillar pensions*, it may create incentives to actually save in the second and third pillar. A NDC system makes workers and administrators *think in "pension wealth"* which may ease portability both within a country and between countries; it enables interpersonal transfers (e.g., between husband and spouse) and eases replacement of survivor pensions by independent pension claims.

NDC systems also *takes certain issues out of the political agenda*, potentially easing reform. It minimizes the role of the "normal retirement age" and permits a more flexible choice between consumption (work longer) and leisure (get lower replacement rate). This flexibility finds its limitations in the conflict between actuarial neutrality and absence of labor supply disincentives and the necessity to establish an early retirement age. NDC systems also *create a new set of „parameters“*, another aspect of the new rhetoric, which may make reform more palatable. It permits redefinitions and readjustments and changes the focus of debate from parametric reform to the introduction of "a new system" (while this is not the case with respect to economic substance), thus enabling parameter change. This point is not without some irony, and even more so, because we claimed that NDC systems strengthen credibility through transparency, while we now use it as a device to deflect emotional opposition by using a new rhetoric.

The usage as a rhetorical and psychological device, however, should not be belittled, and insights among workers and pensioners precipitated by a new rhetoric may have real economic effects. By exposing the economics of a pay-as-you-go system, by visualizing the budget constraint of a pension system, and by making the trade off between retirement age and replacement rate concrete, NDC systems may induce economic reactions, such as later retirement or higher saving rates.

In addition, the new rhetoric may help to get a pension reform process going because it provides a framework to introduce actuarial adjustments (since they come „automatically“), a framework to diffuse the explosiveness of changes in the retirement age (since a flexible choice of retirement age minimizes opposition), and a framework to change intergenerational redistribution in a genuine sense if, and only if, NDC systems make workers save more.

Coming back to the challenges posed in Section 2, NDC systems are well positioned to manage the *challenge of longevity*. They are also well set up to react to slow *changes in fertility*, if the internal rate of interest is properly defined as the growth rate of the contribution bill. Sudden changes of fertility, however, such as the sudden babyboom/babybust transition, are not well manageable in NDC systems; countries, in which the younger generation is simply overwhelmed by the financial burden of pensions, need pre-funding, enabling the members of the older generation to carry part of the pension burden themselves.

Design flaws of current DB systems (such as labor supply disincentives) are relatively well manageable in NDC systems; changing the rhetoric may be instrumental here. We have, however, already stressed the important distinction between absence of labor supply effects and actuarial neutrality.

NDC systems are only indirectly devices to foster *growth, savings, and capital market performance* improvements. Since NDC systems are still PAYG devices, they do not alter the macroeconomic mechanisms at all; by changing the microeconomic incentives at least by psychological means, they precipitate substantial real effects after all – through later retirement and higher savings. In order to alter the growth path of an economy, NDC systems therefore must be coupled with a strengthening of second and third pillar pensions – this combination of NDC with pre-funding looks like one of the most fruitful paths of future pension reform.

References

- Berkel, B., and A. Börsch-Supan (2003): Pension Reform in Germany: The Impact on Retirement Decisions, MEA Discussion Paper 31-03, Mannheim Research Institute for the Economics of Aging, Mannheim University.
- Börsch-Supan, A., 2000. 'Incentive Effects of Social Security on Labour Force Participation: Evidence in Germany and Across Europe.' *Journal of Public Economics* 78, 25-49.
- Börsch-Supan, A., and R. Schnabel, 1998, Social Security and Declining Labor Force Participation in Germany, *American Economic Review* 88.2, 173-178.
- Börsch-Supan, A., and R. Schnabel, 1999, Social Security and Retirement in Germany, in: J. Gruber and D.A. Wise (eds), *International Social Security Comparisons*, University of Chicago Press: Chicago.
- Börsch-Supan, A. und M. Miegel (Hrsg.), 2001, *Pension Reform in Six Countries*, Springer. Heidelberg, New York, Tokyo.
- Börsch-Supan, A., and C. Wilke, 2003, The German Social Security System: How it Was and How it Will Be, MEA-Discussion Paper Prepared for the MRRC-Conference on Social Security, Washington, D.C.
- Börsch-Supan, A. und J. Winter, 2001, Population Aging, Savings Behavior, and Capital Markets. Working Paper No. 8561, National Bureau of Economic Research (NBER), Cambridge, Mass.
- Börsch-Supan, A., R. Palacios, and P. Tumberello. 1999. *Pension Systems in the Middle East and North Africa: A Window of Opportunity*. Pension Reform Primer. Washington, D.C.: World Bank.
- Börsch-Supan, A., R. Schnabel, S. Kohnz and G. Mastrobuoni. 2003. Budget Effects of Pension Reform in Germany, In: J. Gruber und D. Wise (eds.), *Budget Effects of Reforming Public Pension Systems*, University of Chicago Press, in press.
- Börsch-Supan, A., S. Kohnz and R. Schnabel. 2003. Micro Modelling of Retirement Choices in Germany, In: J. Gruber und D. Wise (eds.), *Incentive Effects of Public Pension Systems*, University of Chicago Press: Chicago, in press.
- Chlon, Agnieszka, Marek Góra, and Michal Rutkowski. 1999. *Shaping Pension Reform in Poland: Security through Diversity*. Social Protection Discussion Paper 9923. Washington, D.C.: World Bank, Social Protection, August.
- Chłoń-Domińczak, Agnieszka, and Marek Góra. (2003). The NDC system in Poland – assessment after 5 years. Paper prepared for the World Bank and RFV Conference on NDC Pensions, Sandhamn, Sweden.
- Disney, Richard. 1999. Notional Accounts as a Pension Reform Strategy: An Evaluation, Social Protection Discussion Paper 9928. World Bank, Washington, D.C.
- Disney, Richard. 2003. Are Contributions to Public Pension Programmes a Tax? Paper prepared for the Fourth Annual CeRP Conference, Turin, 16 September 2003.
- Fox, L., and E. Palmer. 1999. Latvian Pension Reform. Social Protection Discussion Paper Series No. 9922. The World Bank, Washington, D.C.

- Franco, Daniele, and Nicola Sartor, Notional Defined Contribution in Italy: Unsatisfactory Present, Uncertain Future. Paper prepared for the Conference on NDC Pensions - Stockholm 28-30 September 2003.
- Frederick, S., G. Loewenstein and T. O'Donoghue. 2002. Time Discounting and Time Preference: A Critical Review. *Journal of Economic Literature* 40, 351-401.
- Góra, Marek, and Michal Rutkowski. 1998. *The Quest for Pension Reform: Poland's Security through Diversity*. Social Protection Discussion Paper 9815. Washington, D.C.: World Bank, Social Protection, October.
- Gruber, J., and D.A. Wise (eds.), 1999, *Social Security and Retirement Around the World*. University of Chicago Press: Chicago.
- Holzmann, Robert. 1997. "Pension Reform, Financial Market Development, and Economic Growth: Preliminary Evidence from Chile." *IMF Staff Papers* 44(2, June): 149-78.
- Holzmann, Robert, M. Orenstein, and Michal Rutkowski. 2003. *Pension Reform in Europe: Progress and Process*. Washington, D.C.: World Bank.
- Homburg, S. (1988), *Theorie der Alterssicherung*, Berlin, Heidelberg, New York: Springer.
- Institut der deutschen Wirtschaft (IW, 2003), *Deutschland in Zahlen*, Köln: Deutscher Instituts Verlag.
- Kommission für die Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme (2003): Abschlußbericht. Bundesministerium für Gesundheit und Soziale Sicherheit, Berlin. (<http://www.bmgs.bund.de/deu/gra/themen/sicherheit/kommission/index.cfm>).
- Legros, Florence. 2003. "Notional Defined Contributions: A Comparison of the French and the German Point systems", Paper prepared for the World Bank and RFV Conference on NDC Pensions, Sandhamn, Sweden. (<http://www.rfv.se/konferens/index.htm>).
- Lindeman, David, David Robalino and Michal Rutkowski. (2003). NDC Pension Schemes in Middle and Low Income Countries: Promises and Constraints. Paper prepared for the World Bank and RFV Conference on NDC Pensions, Sandhamn, Sweden. (<http://www.rfv.se/konferens/index.htm>).
- OECD (1988). *Ageing Populations: Social Policy Implications*, Paris: OECD.
- Ohsmann, S. and U. Stolz and R. Thiede, 2003. Rentenabschläge bei vorgezogenem Rentenbeginn: Welche Abschlagssätze sind "richtig"? *Die Angestelltenversicherung*, Heft 4.
- Palmer, E. 2000. The Swedish Pension Reform Model: Framework and Issues, Social Protection, Discussion Paper Series No. 0012, The World Bank, Washington, D.C.
- Palmer, E. 2003. Conversion to NDC – Issues and Models, Paper Presented at the World Bank and Swedish Social Insurance Board Conference on NDC Pensions, Sandhamn, 28-30 September 2003 (<http://www.rfv.se/konferens/index.htm>).
- Ruland, F. (2000): Neugestaltung der Rentenformel im bestehenden Umlageverfahren. Vortrag bei Speyerer Sozialrechtsgesprächen, www.vdr.de.
- Rutkowski, Michal. 1998. "A New Generation of Pension Reforms Conquers the East: A Taxonomy in Transition Economies." *Transition* 9 (4, August).
- Schmidt-Hebbel, Klaus. 1998. "Does Pension Reform Really Spur Productivity, Saving, and Growth." Working Paper 33. Central Bank of Chile, Santiago, April.

- Schnabel, Reinhold, 1998, Rates of Return of the German Pay-As-You-Go Pension System, *Finanzarchiv*, 55(3), 374-399.
- Settergren, O., 2001. The Automatic Balance Mechanism of the Swedish Pension System, *Wirtschaftspolitische Blätter* 2001/4.
- Valdés-Prieto, Salvador, ed. 1998. *The Economics of Pensions: Principals, Policies, and International Experience*. Cambridge, U.K.: Cambridge University Press.
- Valdés-Prieto, Salvador. 2000. "The Financial Stability of Notional Account Pensions." *Scandinavian Journal of Economics*.
- Valdés-Prieto, Salvador. 2003. Instantaneous funding of NDC plans. Paper prepared for the World Bank and RFV Conference on NDC Pensions, Sandhamn, Sweden. (<http://www.rfv.se/konferens/index.htm>).
- World Bank. 1994. *Averting the Old-Age Crisis: Policies to Protect the Old and Promote Growth*. New York: Oxford University Press.