Chapter 12

NDC Pension Schemes in Middle- and Low-Income Countries

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The notion of defined contribution (NDC)1 concept has been put forward as a paradigm shift to address fiscal, equity, and incentive problems with state pension regimes—mostly financed on a current disbursement or pay-as-you-go (PAYG) basis. Much of the policy discussion so far has been concerned with high-income countries such as Sweden and Italy. Little attention has been given to the question of whether NDC arrangements are desirable and viable in the case of middle- or even lower-income countries that are characterized by less stable macroeconomic environments, a narrow and volatile contributory base, and a more uneven income distribution; and often are in the midst of a demographic transition. This despite the fact that countries such as Brazil, China, the Kyrgyz Republic, Latvia, Mongolia, Poland, and Russia have introduced variants of the NDC concept.2

This chapter discusses the potential benefits of the NDC concept mostly in the context of middle- and low-income countries as well as the major constraints for implementation. Our scope, therefore, is what might loosely be called “non-OECD” countries. Clearly, the analysis of the costs and benefits of an NDC scheme should and will be very country specific. Here we focus on the general macroeconomic, demographic, and institutional variables that can affect the application and performance of the NDC concept.

The reminder of the chapter is organized in seven sections. The next section sets out a framework for subsequent discussions by introducing the NDC concept, outlining a typology of NDC variants and discussing differences and similarities with pure defined contributions (DC) and pure defined benefit (DB) schemes. In the following two sections, we discuss the potential primary benefits of the NDC concept in middle- and low-income countries in terms of reducing economic distortions (the third section) and improving financial sustainability of PAYG pension schemes (the fourth section). We identify key factors of design and initial conditions that are likely to influence the realization of these benefits. The rest of the chapter is concerned with implementation issues that need to receive particular attention in any country, including middle- and low-income countries: transi-

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tion mechanisms and the integration of heterogeneous pension plans (the fifth section); redistribution and poverty (the sixth section); and institutional capacity (the seventh section). The last section concludes by outlining the advantages of NDC schemes over traditional DB schemes in middle and low income countries, even when the latter are well designed.

**Description of the NDC Concept and Its Variations**

We take the NDC concept to be the application of the structures and vocabulary from funded DC schemes (plans) to largely PAYG regimes. NDC attempts to internalize within the expectations of DB-PAYG pension participants all or some of the risks that are automatically borne by members in funded DC schemes.

In funded DC schemes, the sponsor (employer) and worker make contributions according to commitments set out in the pension contract, typically regulated by tax and labor laws. A member’s retirement departure wealth is solely a function of past contributions plus interests on the investments of these contributions (at market prices). Absent illegal behavior, there is no future contingent liability on the “sponsor” (usually employers). Furthermore, at any moment the pension fund is “financially complete”—that is, liabilities by definition equal assets. Accordingly, members, not the sponsor, bear investment risk and the consequences of increasing longevity.

Generally in an NDC scheme the pension at retirement is equal to the sum of past contributions revalorized by an exogenously defined factor, divided by a measure of life expectancy at retirement. The resulting pension itself can be indexed over time in a variety of ways. Formally the dynamics of the NDC pension are given by:

\[ p_t = \frac{\sum_{k=a}^{R} \beta w_k J_k}{G_{A,R,r}} J_t, \quad t \geq R, \]

(12.1)

where \( p_t \) is the pension at time \( t \); \( \beta \) is the contribution rate; \( w_k \) is the imposable salary at time \( k \); \( a \) is the time when the individual joins the social security system; \( R \) is the time of retirement; \( G_{A,R,r} \) is the “g-factor” (annuity factor) at age \( A \), in time \( R \), given an interest rate \( r \); \( I_k \) is the revalorization factor that affects contributions at preretirement time \( k \); and \( J_t \) is the index that affects the pension at the time of retirement (\( R \)).

Choices regarding the parameters in equation 12.1 can define a large typology of NDC-type schemes. Among other possibilities, five examples are: (1) the “pure” wage-sum model, including annuities that move solely with wage-sum changes; (2) wage sum during accumulation, and annuities that are half price indexed and half tied to wage-sum changes (as in the Latvia variant); (3) a fiscally fully complete NDC model with smoothing for all contingencies along the lines of Swedish legislation; (4) average wage-indexed NDC accounts with participating annuities; and (5) government bonds that pay average wage growth (or other proxy of the sustainable implicit rate of return of the scheme), converted to participating annuities. These models differ in how they resolve the pervasive trade-off between solvency and predictability.

Whether Equation 12.1 can be formally considered a DC arrangement depends on whether \( I_k, J_t, \) and \( G_{A,R,r} \) are set in a way that guarantees that at all times expected assets are equal to expected liabilities. As discussed in the fourth section, this is not always a simple matter. Among other difficulties, one technical trouble relates to the transformation of the notional capital (the numerator in equation 12.1) into the proper annuity. Hence, in many
cases, NDC continues to be a DB arrangement in the sense that the “sponsor” (future generations) faces a contingent liability. A more adequate name for the scheme in this case would be “notional accounts.”

The fact is that the NDC mechanism used to compute the pension can internalize changes in life expectancies and some changes in the contributory base, thus reducing the risks faced by future payers (therefore reducing contingent liabilities) and increasing the risks faced by current workers (and even possibly retirees). Other benefits attributed to the NDC (or notional account) concept include improving incentives for work over retirement, overcoming adverse redistributive transfers within traditional DB schemes, improving transparency in the link between costs and benefits, facilitating issues of political economy related to parametric reforms, assisting in breaking PAYG reform deadlocks, and enabling the system to adjust automatically to changing circumstances.

Clearly, the same or similar outcomes can be achieved through a classic DB formula. Indeed, if lifetime salaries/wages are included in the calculation of the pension and these are adjusted (valorized) in the same way as contributions under the “incomplete” NDC formula, and if the index for pensions is also the same, then the DB formula gives:

$$p_r = \alpha \cdot \frac{\sum_{k=1}^{K} w_k I_k}{LOS_R} \cdot J_r$$

where $\alpha$ is the accrual rate and $LOS_R$ is the length of service at retirement. We notice that equations 12.1 and 12.2 are mathematically equivalent as long as $\alpha = \beta / G_{A,R,r}$.

 Basically, a DB formula where all wages are included in the calculation of the pension (indexed by an appropriate—that is, sustainable—rate), where the basic accrual rate is computed yearly on the basis of equation 12.2 and a reference minimum retirement age, and where there are actuarially neutral penalties (bonuses) for early (delayed) retirement (computed yearly) can generate the same outcomes, including the same individual behaviors, as the NDC formula.

Thus the key policy questions we address in this chapter are whether, in the case of low- and middle-income countries, it is feasible and desirable to move from a “flawed” DB formula toward a “good” DB or NDC formula (see box 12.1). What choices in terms of parameters (for example, which index for past wages or contributions) are preferable? Can the NDC concept be employed as a paradigm shift to facilitate the movement to a good DB formula, while simultaneously improving management, accounting, and reporting practices, which can also have a positive impact on individual behavior?

### Incentives

It has been argued that by creating a stronger and more transparent link between contributions and benefits, the pension formula used in NDC-type schemes has the potential to reduce distortions in labor supply and saving decisions associated with many traditional DB-PAYG formulas. This could be particularly relevant in the case of developing and transition economy countries where current DB-PAYG schemes often provide incentives for retirement over work, induce strategic manipulation of wages, and could be contributing to the informalization of the economy while reducing savings rates.

In this section, we analyze how individuals’ behaviors regarding retirement, labor supply, and saving are likely to change as countries move from the typical (“flawed”) DB-PAYG formula toward an NDC-type formula (see box 12.1).
Retirement Decisions

DB-PAYG pension formulas in developing countries often provide incentives for retirement over work. In most cases, the high prevalence of early retirement can be explained by low penalties and generous minimum pensions, which are awarded without an adequate minimum contributory period. Clearly, moving toward a "good" DB formula by setting penalties to actuarially neutral levels, reducing minimum pensions, and using adjusted lifetime wages (instead of final pay) can change the work/leisure choice considerably.

Leaving these factors aside, however, there is still the question of whether moving toward an NDC-type formula provides incentive for delaying retirement beyond the minimum retirement age (which is often low relative to life expectancy, and politically "sticky").

There will be incentives to delay retirement if, under the new formula, the marginal utility of waiting (resulting from a higher pension and higher consumption) is higher than the marginal disutility (resulting from lower leisure). In the case of "flawed" DB formulas, switching to a DB-4 formula (or even DB-3) or to an NDC cognate will encourage delayed retirement and more work. This is because the marginal accrual in the DB-1 or DB-2 is linear (one more year equals one more percentage increment in the lifetime benefit), whereas in DB-4 or NDC the extra year of work both adds to one’s lifetime benefit and it increases the benefit level based on the years of work before the minimum retirement ages (an upward slope in the price for delaying retirement).8

In simulations, we find that the NDC formula (or DB-4) can considerably delay retirement relative to the other DB formulas.9 The difference between a DB formula with no

Box 12.1. Gradations from “Flawed DB” to “Good DB” and NDC

1. Heterogeneous DB, characterized by various age/service qualification requirements by service, type of job, gender, usually use of final pay (or truncated wage histories, such as the best 20) in the calculation of the pension, accrual rates not linked to contribution rate and retirement age, no penalties for early retirement, and no automatic indexation of pensions.

2. Defined benefit, but adoption of lifetime valorized wages and possible use of linear (not actuarially neutral) adjustments for early retirement.

3. Same as the DB-2 formula but with retirement-age accrual rates (calculated on the basis of equation 12.2) fixed at entry and calculated on the basis of expected survival probabilities retirement age. This is equivalent to having a reference accrual rate linked to a reference retirement age and actuarially neutral penalties (bonuses) for early (delayed) retirement.

4. Same as the DB-3 formula, but with retirement age-dependent accrual rates that are computed on the basis of equation 12.2 when the individual retires. This is also equivalent to having a reference accrual rate linked to a reference retirement age, but computed yearly, and actuarially neutral penalties (bonuses) for early (delayed) retirement.

5. Change in formal expression to NDC vocabulary, possibly with additional measures: (a) “participating annuities,” such that retirees share some of the risks associated with post-retirement longevity gains and periods of low real wage growth; and (b) a “balancing mechanism” to adjust promised (but not awarded) benefits to demographic or labor force trends.

As a practical matter, there are several options between DB-2 and DB-4 that reflect ad hoc legislative changes. For example, a country may decide to change the retirement age schedule but grandfather the previous schedule for work and credited service before the change was made.

Source: Authors.
adjustments for delayed retirement to the accrual rate and the NDC alternative is greater
the higher the preferences for leisure and, as noted earlier, the higher the accrual rate in the
DB formula (see the technical annex at the end of this chapter for a description of the
model and the simulations).

Clearly, our results apply to rational-utility-maximizer agents. *Homo economicus* in real
life might not display this type of behavior. Still, it is reasonable to assume that individu-
als will learn from their own and others experiences, as well as from the information pro-
vided by plan sponsors, that the ratio of the last pension to the last wage increases faster
under an NDC formula than even a near-equivalent DB formula (DB-2 and DB-3 in box
12.1). Other things being equal, this is a good incentive to delay retirement. Moreover,
even if retirement patterns do not change (that is, even if there are no gains in terms of
labor supply), NDC-type formulas will guarantee that, regardless of age, all individuals
are paid the same, presumably sustainable, rate of return.

*Labor Demand and Supply Decisions*

The informal sector in developing countries is often large, and a majority of these coun-
tries continue to struggle to reduce unemployment rates. It is argued that this is in part the
result of rigidities in labor markets (downward rigidity in wages) and high taxes on
labor.10 Lower contribution rates to social security could increase the demand for labor
and play a role in reducing the size of the informal sector. A DB formula that includes all
benefits in the calculation of the pension could also contribute. The type of pension for-
mula (good DB versus NDC) plays no clear role unless it affects workers’ perceptions
regarding the link between contributions (payroll tax) and the benefits. If the link is strong,
then it would be easier for employers to shift the costs of higher taxes to the workers (as
part of their compensation package). Gross wages in this case would be reduced and the
demand for labor would be less affected.

From the supply side, the benefit formula can influence the probability of evading the
public pension system (regardless of the level of the contribution rate),11 since it affects the
expectations about the rate of return that the system delivers. In many current (“flawed”) DB
schemes there are at least two factors that can contribute to evasion. First, rates of return
tend to be considerably higher for individuals who strategically game the system by evad-
ing most of their lives and joining close to retirement. Second, in the absence of automatic
stabilization mechanisms that adjust the parameters of the formula in response to changes
in macroeconomic and demographic conditions, the dynamics of the pension system are
vulnerable to political discretion and the vagaries of history. Individuals may thus harbor
pessimistic expectations, also fueled by international experiences, about the capacity of the
system to deliver on its promises. Hence, despite the fact that statutory rates of return in
DB-PAYG schemes are often generous and unsustainable, implicit rates of return may be
low and discourage enrollment. For the average employee, the nature of the benefit for-
mula may also complicate the calculation of the rate of return on his/her savings.

Among the two reasons for evasion, the first could be dealt within the context of a DB-
PAYG formula by introducing all wages in the calculation of the pension. The second rea-
son has more to do with individuals’ perceptions about the performance of the system and
therefore it is less clear what the impact of moving to an NDC-type formula would be.
There is some weak evidence from Latin America suggesting that, for a given level of the
contribution rate, the probability of enrollment in the mandatory pension system is higher
if part of the contribution is allocated to a DC scheme than if it is solely allocated to a DB
scheme.12 This could be because of better transparency (a clear link between contributions
and benefits), ownership of the assets accumulated, and more trust in the financial sus-
tainability of the system.
It is conceivable that the movement to an NDC system could generate similar signals, although individuals are not likely to feel the same degree of ownership about an “account” on a government register. Still, by better adapting to demographic and economic changes, the NDC scheme reduces the contingent liability of the government. As individuals are periodically informed of the status of their notional accounts and the financial position of the system, members may feel greater certainty that their contributions will produce a benefit.

**Saving Decisions**

The impact that the movement toward an NDC formula would have on individuals’ savings would depend on the size of the mandate, the induced change in the expected rate of return, and the induced change in the retirement age. There is no particular reason to expect individual savings to be higher or lower. Other things being equal, if expected rates of return are lower under the NDC formula, there would be incentives for developing other forms of savings. At the same time, however, if contributory periods are longer, savings rates should be expected to fall.

On balance, in our simulations we find that savings rates under the NDC formula appear to be lower than savings rates with DB-PAYG formulas without actuarial adjustments for delayed retirement. This is basically the result of longer careers. In line with theory, savings rates increase as the preference for leisure relative to consumption increases. Lower savings rates at the individual level, however, do not imply lower savings at the macro level, since higher government savings can compensate.

**Financial Sustainability and Benefit Predictability**

One of the features that make NDCs highly attractive for less-developed countries is their potential for constraining the growth of pension expenditure in often overly generous DB-PAYG schemes. Although in theory the parameters of these schemes (such as contribution rates, accrual rates, and retirement ages) could be periodically adjusted to adapt to changing macroeconomic and demographic conditions, in practice, usually as a result of social pressure and political discretion, this does not happen. Thus, the majority of DB-PAYG across Africa, the Middle East, and Asia are accumulating large unfunded liabilities. On the other hand, countries that introduced NDC, including Italy, Poland, and Sweden, show that such a reform, even if implemented over the long run, reduces future pension deficits. For instance, long-term projections show that a shift to NDC keeps the pension expenditure level relatively unchanged in the long run (see table 12.1).

<table>
<thead>
<tr>
<th>Country</th>
<th>Total old-age spending 2000</th>
<th>Total old-age spending 2050</th>
<th>Change 2000–2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>14.2</td>
<td>13.9</td>
<td>−0.3</td>
</tr>
<tr>
<td>Poland*</td>
<td>10.8</td>
<td>8.3</td>
<td>−2.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>9.2</td>
<td>10.8</td>
<td>1.6</td>
</tr>
<tr>
<td>OECD average</td>
<td>7.4</td>
<td>10.8</td>
<td>3.4</td>
</tr>
</tbody>
</table>

*Source: Chlon-Dominczak (2003).*

*a. Includes old-age spending and “early retirement” spending (including disability pensions for persons above 55 and preretirement benefits).*
As discussed at the outset, in theory an NDC system can be designed in a way that internalizes not only changes in life expectancy but also expected changes (known demographic waves, structural adjustment) and unexpected changes (fluctuations in wages, unemployment and coverage resulting from economic cycles) in the contributory base. In this sense, the NDC scheme could reduce or even eliminate contingent liabilities, effectively transforming the DB-PAYG into a DC-PAYG. Achieving this design, however, is not without complications and would necessarily imply less predictability in benefits, as these are adjusted to reflect changes in demographic and economic conditions. This may simply not be desirable or politically viable in most developing countries, particularly given less stable macroeconomic environments (for example, high variability in employment, coverage, and real wage growth rates) and usually in the midst of a demographic transition.

To assess the trade-offs between financial sustainability and predictability, we analyzed the impact that alternative NDC-type designs have on the dynamics of a representative middle- or low-income country’s PAYG system. We focus on two aspects of the design: (1) the mechanism used to adjust or valorize contributions, and (2) the mechanism used to index pensions. Our main objective was to understand how the various designs affect the dynamics of replacement rates as well as the balance of the system. For transparency, we focused only on a system that is “new” in the sense that there are no contributors prior to the start of the simulation. The implicit assumption is that the reform that introduces an NDC-style system “grandfathers” current plan members. We analyzed two cases: a case with stable conditions regarding the growth rate of the average wage and labor force coverage rates, and a case where these two variables are subject to random shocks.

Under stable conditions, we found that both the NDC scheme with contributions and pensions indexed by the growth rate of the wage bill and the NDC with contributions indexed by the growth rate of the average wage and pensions indexed by prices converged to equilibrium. Long-term replacement rates were similar. Its steady states were mostly independent of the shocks affecting mortality rates, as the system adapted pensions to changes in these rates. Over the medium term, however, the wage-bill indexed NDC generated a larger deficit. This is because the wage-sum NDC had higher replacement rates in the medium term than the average wage NDC, resulting from fast growth in the wage bill during the first years of the scheme.

We also found that in the presence of uncertainty and volatility in the growth rate of wages and the coverage rate of the labor force, the NDC schemes with contributions linked to changes in the total wage sum displayed less stability than the other schemes. Although over the long run the wage-sum NDC converged to equilibrium (if we impose the existence of a steady state), in the medium term this policy variant generated both higher surpluses and higher deficits than the alternatives in our stochastic modeling. Indeed, it is well known that the standard Samuelson-Aaron conditions for the financial sustainability of a PAYG system do not apply outside the steady state (that is, during the transition periods). NDC schemes with contributions valorized by average wage growth displayed the best performance in terms of financial stability (though wage sum during accumulation and price indexing in the payment period was a second-best alternative).

In terms of the predictability of benefits, wage-sum NDCs were the least stable in replacement rates and other criteria. Similarly, indexation of pensions by the wage-sum changes generated fluctuations that are unlikely to be accepted by pensioners. The NDC that used average wage growth generated replacement rates that are as stable as those obtained with a traditional DB scheme—both because replacement rates are immune to the dynamics of the wage bill and because the growth rate of labor productivity was assumed to converge to a stationary process.
An important message from the analysis is that high volatility in wages and labor force coverage rates need not preclude low- and middle-income countries from adopting the NDC construct, provided that these countries carefully choose the indexes to valorize contributions and index benefits in payment. Pure wage sum is not advised. Instead, adjusting contributions by average wage growth rate seems always preferable, at least among the conditions for which we tested. First, the average wage alternative generated more stable replacement rates. Second, the wage-sum alternative did not outperform average wage, even when scenarios with persistent reductions in coverage rates are considered. This is largely because the average wage alternative never commits to high rates of return that lead to high pensions that become unaffordable once the dependency ratios increase. We did not, however, consider wage-sum alternatives for low- and middle-income countries that use a smoothed wage bill index and/or impose a band, similar to exchange rate bands, where the index would be allowed to fluctuate (say between –5 percent and 5 percent). We also did not analyze the performance stabilization mechanisms à la Sweden. In conclusion, revalorization of contributions by the growth rate of the average wage and price indexation for pensions appears as a good compromise.

The results of our analysis also illustrate how NDC-type formulas can contribute to improve financial sustainability relative to the typical DB-PAYG. This said, none of the proposed arrangements is bullet proof. Appropriate reserves or buffer funds are required to handle unexpected demographic and economic shocks. In all cases contingent liabilities will persist.

**Buffer Funds**

In the case of DB-PAYG systems, a reserve fund of six months’ to a year’s worth of payments has become accepted practice for managing unexpected fluctuations in the covered wage bill. To the extent that such reserves are kept solely in government bonds, the functional equivalent is authority to borrow from the central budget in an equivalent amount. Beyond this core agreement, opinions will differ on the size of reserves (buffer funds). Larger buffer funds, reaching the level of 20 to 30 percent of GDP, are invoked for several reasons. One reason is to smooth out known variations in demographics—for example, a baby boom, followed by a baby bust, followed by replacement fertility rates. The other reason is to manage unknown long-term demographic trends, such as a move from one birth rate pattern to another (for example, two plus to two minus children per woman). Such long-term trends can be mitigated by buffer funds. In addition, there is often the expectation, at least the hope, that the buffer fund, if well invested, will garner a rate of return that exceeds the PAYG return, thus softening the decline in the PAYG return.

**Integrating Heterogeneous Pension Plans**

Most developing countries with DB-PAYG have at least three separate regimes: civil servants, military personnel, and private sector workers. Countries such as Egypt and Tunisia have also public regimes for special categories of workers (for example, fisherman and agricultural workers). Occupational funds, usually linked to public companies, are also common (as, for example, in Iran and Morocco), not as complementary schemes to the public system, but as substitutes.

Integrating the various schemes is desirable to achieve economies of scale in management, improve financial sustainability, and facilitate labor mobility. The integration of the various regimes, however, has proven difficult. Beyond political resistance from managers and employees of the funds, the constraint to the merger is often technical, as contributions, benefits, and eligibility conditions vary considerably across funds. New rules can
apply to new workers, but the transfer of employees in current schemes requires agreeing on a mechanism to value past contributions.

The shift in paradigm imposed by the NDC concept can facilitate the integration of heterogeneous schemes in low- and middle-income countries. Below we discuss the main lessons from international experiences in terms of the speed of transition, the mechanism used to give credit for past years, and the alternatives in terms of financing.

**Speed of Transition**

The fastest transition can be observed in Sweden, when relatively old people are covered fully by the new system. Such a solution was possible for several reasons. One of them is related to a good database of individual records dating from 1960 that allows for calculating notional accounts for cohorts born in 1938 and older. Second, as retirement age is not changed with the reform, the only change relates to the benefit formula. In contrast, the longest transition can be observed in Italy, where cohorts born prior to 1960 can stay in the old system. This means that pensions according to old regime in Italy will be paid until around 2030 or even later.

Latvia and Poland have more or less the same regulations, but in Latvia all contributors were covered by notional accounts when reform was introduced; in Poland, those born before 1949 remain in the old system. This can be explained by differences in both countries. One difference is that early retirement that has been deleted from public pension system in Poland but still kept for some occupations and women in Latvia; the other difference is the availability of employment records. In Latvia, those records were nonexistent, as inflation caused serious deterioration of salary levels in late 1980s and early 1990s. As a result, transition arrangements were introduced in Latvia where pension did not depend on salary level but only on the number of years of contributions.

In the case of developing countries with usually more favorable demographics, the transition to a new scheme could take place at a slower pace. Simulations in the case of Jordan and Iran, for instance, show that even if only new cohorts are enrolled in the NDC scheme, the financing gap of the current system could be virtually eliminated. It also seems preferable to consider voluntary switching. Clearly, demographics is not the only factor to consider. Depending on the generosity of the system, the size of the financing gap, and the fiscal position of the government, more aggressive mechanisms could be considered.

**Giving Credit for Past Service**

In Sweden, because wage records existed and the pension reform did not violate any constitutional norm concerning acquired rights, the NDC could be projected backward, leading to a relatively quick truncation of the prior system. (It should also be noted that the old and new systems in Sweden have many similar design elements.) There are two other ways for transition to occur.

One way to make the transition is simply to keep the old pension regime in place with respect to years before the new scheme’s introduction. This truncation strategy may require some “cleaning up” of the old regime, but it has the advantage of being clear and probably administratively the easiest of the different approaches. The other major way to make the transition is to recognize rights under the prior system and to translate those rights into “initial capital” in the NDC scheme.

Initial capital in NDC is similar to, and probably owes its origins to, the concept of recognition bonds used in Chile and other countries in introducing a DC fully funded system to convert acquired rights into a security in a funded individual account scheme. At least two types of initial capital conversions have been developed. Poland is an example of the first: there, acquired rights under the old system were converted to “initial capital” (or
de facto recognition bond) based on salaries at the time of conversion. Poland generally uses a 10-best-years base to determine initial capital, but this is capped to minimize disparities and to keep aggregate cost in bounds.

So long as that initial capital is valorized (or indexed) by the growth rate (now the NDC “interest rate”) existing under the prior scheme, the expected present values under the prior system are generally maintained. This option, however, is no small administrative matter and communication challenge. One of the key advantages of this approach is that it makes the work/leisure choice after the minimum retirement age apply to a larger amount of retirement wealth much sooner than a truncation strategy.

The second type of initial capital was pioneered in Latvia, where credible individual wage records before 1996 did not exist. In that country, service before 1996 was credited with an NDC rate of 20 percent. The contributions were then valued based on individuals’ average wage histories for the four years 1996–9. This created substantial gains for those who had done well in the market economy and may have created a greater than intended legacy cost.

Clearly how initial capital is calculated can affect both rights and costs. In Russia, where individuals’ pensions had been compressed, calculating initial capital became very problematic. If acquired rights were calculated without the ad hoc ceiling that compressed the top end of the statutory pension schedule, and then those rights were allowed to grow at the normal valorization factor, aggregate costs would blow up. Even deciding how to project the ceiling became difficult. Estonia, in a technically DB scheme that borders on NDC, avoided these issues by using national average wage for years before 1999. After 1998, individual wage histories are used, but only for new accruals.

**Financing the Transition**

In theory, the transition from a DB to an NDC system does not require any additional financing. As both of the schemes function on the PAYG basis, current contributions are still used to finance current expenditures. The difference between both systems lays in the way pension rights are accrued.

We have shown earlier that the NDC scheme would usually require a buffer fund as a stabilizing mechanism. In countries where the required level of the buffer fund is below reserves, the difference would need to be built out of contributions in the new NDC scheme. The reduction in the level of expenditures needed to pay for current beneficiaries may require transfers from the central budget. These transfers can be considered payments of part of the implicit debt accumulated by the “old” system.

Even countries such as Jordan, with reserves equivalent to 25 percent of GDP, out of which 60 percent are in liquid assets, the transition to the new scheme usually requires support from the general budget. In the Jordanian case, for instance, the military and civil servant pension funds (which do not have reserves) have been closed to new entrants. All the new employees in the public and private sector are joining the Social Security Corporation (initially designed for private sector workers). The unfunded liability of the closed civil servant and military pension funds, however, is being assumed by the central budget. Over the short run, as the flow of new contributions stops, cash expenditures will increase. Over the long run, however, important savings are being generated by this strategy.

In many, probably most, countries, the governance structure in public pension reserves or buffer funds has not been conducive to prudent investment policies. The shift to an NDC scheme could also be considered an opportunity to transfer the management of new cash surpluses to a different investment unit, which would operate under a different governance structure and adopt best practices in terms of accountability and financial risk management. Again in this case, new contributions would not be used to pay current pen-
sions. These would need to be financed out of existing reserves in the “old” system and/or general revenues.

**Poverty Prevention and NDC**

As with any earnings-related scheme, it is a challenge to reconcile poverty prevention goals with transparency, uniform rates of return, and incentives to work longer. Many countries have saddled themselves with unrealistic minimum pension guarantees. For example, in Iran, the minimum pension has been set equal to the minimum wage, which in turn is equal to 66 percent of the average wage. This is high relative, for instance, to the case of Chile, where the minimum pension is set at 25 percent of the average wage. In OECD countries, minimum pension typically represents 20–25 percent of the average wage. In addition, eligibility conditions are often lax in the sense that individuals with short careers are eligible for the minimum pension. In many existing pension regimes, middle-income workers with short careers benefit from the pension at the expense of low-income workers with long careers.22

Any reform has to address what is a sustainable and affordable mandate for the public pension system and what is a realistic minimum benefit relative to a country’s per capita income and absolute poverty measures. Countries where the marginal product of labor is so low as to generate wages that are close to the poverty line or below it, or equal to the minimum pension, in principle, should not be even consider contributory schemes. In fact, however, even countries such as Djibouti (US$800 per capita) or Yemen (US$400 per capita) have contributory schemes with an average covered wage above three times the poverty line. As discussed later, it is likely that when going down the ladder of countries classified by income per capita, the constraints of being able to implement an NDC (or a credible DB alternative) imposed by limited institutional capacities take hold and bind before constraints imposed by the level and distribution of income.

Once the mandate of the pension system has been defined, the objective is to achieve it efficiently and equitably. NDC or similar reforms can often improve current systems by homogenizing rates of return, reducing unfunded liabilities, and improving incentives. Indeed, adverse distributive transfers are pervasive in poorly designed DB schemes, which probably exist in greater number than well-designed DB regimes. First, it is common to observe high levels of heterogeneity in rates of return. Indeed, these rates of return depend on wage histories, life expectancies, and enrollment and retirement strategies. Usually, educated and healthy individuals generally have steeply growing wages and live longer, thus extracting higher rates of return. Other things being equal, individuals who game the system by evading most of their lives and joining close to retirement also obtain higher rates of return. Furthermore, heterogeneity is encouraged by multiple retirement rules and eligibility conditions (for example, lower retirement ages for high-risk professions, and various combinations of vesting periods and retirement ages). More importantly, the large unfunded liabilities that are being accumulated by the majority of funds imply a massive transfer of resources from future generations, including future low-income workers, to the current generations, including current high-income workers.

Critics of the NDC concept argue that improvements in efficiency and financial sustainability come at the expense of equity.23 The fact is, however, that a good DB system or an NDC can achieve redistribution transparently and without generating negative incentives. Probably the most effective mechanism to do this is a complementary noncontributory pension that is reduced as the contributory pension increases. Elsewhere it is shown that special cases of this formulation are the flat pension (when the reduction factor is set equal
to 0) and/or top-up minimum pension (when the reduction factor is set equal to 1). The former, however, can be unnecessarily costly, while the latter introduces incentive problems. Countries try to strike a balance between transfer costs and incentives by having reduction factors apply to top-up minimums that fall between 0 and 1 or to claw back flat benefits among the affluent (termed *affluence testing*). Operational costs also can be reduced by using the tax system to impose any reductions, especially claw-backs among the affluent. An attractive aspect of the flat benefit approach is its simplicity and the fact that parameters such as the minimum vesting period, which can also discourage enrollment and contributions, could become redundant. Moreover, because the complementary pension is financed outside the contributory scheme, it may help reduce labor market distortions. An illustration of the mechanism is presented in figure 12.1.

The NDC concept is useful for developing retirement benefits. As with funded accounts, it is difficult to translate NDC accounts into disability and survivor benefits, both of which are necessary to prevent poverty. Other mechanisms have to be developed for these other risks. In developing these mechanisms, care has to be taken not to make the total package too generous (for example, by allowing survivors to inherit NDC accounts without reference to collateral survivor benefits) or to make disability benefits more attractive than NDC annuities, especially for older workers. Integrating retirement and non-retirement benefits is a complex subject with many good and bad examples from existing practice, but this subject goes beyond the scope of this paper.

**Demands in Terms of Institutional Capacity**

NDC demands no less and—contrary to what is sometimes thought—no more than any thoroughgoing PAYG reform that depends ultimately on lifetime wage histories. In today’s world that attention has to be paid to the following.

First, a set of administrative processes has to be put in place. These are processes that interact with employers, covered workers, and the self-employed as customers or clients, not as agents of the government to do its bidding. Second, thanks to information technology (IT), implementing such processes is less labor and paper intensive than before. IT, however, is a handmaiden, and should not be allowed to become the engine that drives the way processes are designed. In addition, decisions have to be made about (1) a unique identifier associated with each person’s wage history and (2) how to interact with and use other government agencies, especially the tax authority, in collecting contributions.

The most central administrative question revolves around the collection of data. The information that drives the regime must be credible. In some countries, monthly reporting is considered optimal if employers do not have payroll systems that can remember transient workers for very long (this is the case in Zambia, for example). In other countries, payroll systems are advanced, and annual reporting on workers, whether or not they are employed in the firm on the reporting date, is viable and probably cost-effective. Yet other countries prefer intrayear period reporting—inevitably quarterly—to help with compliance.

Information must also flow back to the workers if the reformed pension system is to have any solid incentive effect in linking benefits to contributions. NDC accounts, however, have to be translated into examples of probable annuity amounts, which requires heroic assumptions and lots of cautionary comments in the benefit statement (this is equally true in the close DB analogues).

Adequate time must be allowed to create a new system or do any substantial system overhaul. That includes internal processes, business processes with clients, and IT changes. If adequate time is not allowed for a careful understanding of what is now in
place as well as what is intended and also for careful pretesting, the agency (and the government of the day) may find itself in a hole from which it is very hard to emerge. This institutional need is hard to reconcile with political imperatives and perceived moments of reform opportunity, but the pension reform landscape is replete with agencies climbing from such holes.

Systems that have large reserves or buffer funds—especially if they are invested in something other than government paper or very passively invested accordingly to a pre-determined index—require another set of governance mechanisms, a topic that goes beyond this chapter. Suffice it to note, however, that nothing can be more destructive to a social insurance agency than to mire its top- and medium-level management in managing a portfolio. Not only can that be, and has been, corrupting in both blatant and subtle ways,

![Figure 12.1. Implementing a Complementary Noncontributory Pension](image-url)

Source: Authors’ calculations.
it also distracts from the primary business at hand—collecting contributions (maybe via the tax authority); and collecting information, maintaining records, determining benefits, and dealing with customers.

If these relatively minimal conditions cannot be met, then two alternatives present themselves. One is to contract out to one or more private entities. The problem with this scenario is that a country that cannot run a contributory PAYG agency may not be able to credibly supervise nongovernment providers. In addition, this scenario probably makes sense only when there is both a mandatory funded tier as well as the NDC tier. Funded DC tiers in countries with low administrative capacity and/or probity are, if anything, more questionable than contributory PAYG schemes.

The second alternative is to put off having a standard contributory pension regime. After all, many now rich and cutting-edge countries started out with “basic benefits,” which were simple citizens’ pensions (for example, Sweden) or work-related flat benefits (for example, the United Kingdom). And when they had such minimal systems, they already were richer than today’s lower-income countries and may have had more equal incomes than many of today’s middle-income countries. In the case of low per capita countries, given the high current consumption needs of the population, the limited power of government to tax without serious compliance consequences probably is best directed to financing a very basic benefit. Limited fiscal capacity is generally correlated with limited administrative capacity.

**Why an NDC Scheme Would Be Preferred to a DB Scheme in Middle- and Low-Income Countries**

If “good” DB and standard NDC are very close substitutes, then why even bother with NDC? Why not just tinker with DB-PAYG to achieve best practice in terms of equity, incentives, and reasonable burden sharing across generations? A first answer is that if the DB formula is going to be modified to replicate the NDC formula (meaning that properly computed accrual rates are announced at the time of retirement), the DB formula loses its attraction of more predictability in benefits, and at that point the NDC formula is easier to implement and more transparent.

The second answer is found in pragmatic political economy. First, it may be easier to achieve reform objectives in different settings by adopting and using the DC vocabulary from the world of funded schemes than to push conventional DB-PAYG palliatives. This is particularly true in the instance of bounding liabilities to reflect increasing life expectancies in the payment period (internalizing longevity). Because NDC changes the paradigm (à la Kuhn) in which trade-offs are examined, it is extremely useful when it comes to analyzing and changing some of the nonfiscal aspects of many state-managed DB-PAYG regimes.

Finally, an NDC system makes easier the tracking of its implicit liabilities (and the transfer of accrued rights between schemes). At the extreme, those liabilities can be made explicit if the contributions of the NDC system are invested in appropriately indexed government bonds or wage-indexed bonds issued by the pension fund. This improves transparency and provides incentives for a better management of fiscal policy. At the same time, this arrangement can allow, over the medium term, for a smooth transition to a fully funded scheme when those bonds can start to be traded.

As we have seen, most NDC regimes are unlikely to internalize all contingent liabilities. NDC benefits may be enhanced with imputations and minimum benefit top-ups financed from other revenue sources. And special unemployment benefits and age-related disabil-
ity can become major sources of early retirement. Accordingly, governments cannot rely solely on capping the NDC contribution rate as the sole means of keeping mandatory retirement savings in bounds. But capping the contributions can help and, in so doing, can help develop a consensus and commitment for changes that are fiscally imperative and/or simply desirable for incentive and equity reasons. (Since retirement wealth is not easily translated into income flows, it must be admitted that there are countervailing challenges in communication.)

Having praised the potential virtues of NDC as a paradigm shift, we would be less than candid if we did not admit that both theory and experience teaches that the NDC concept can be misapplied just as much as the traditional DB concept has been. As discussed above and below, with the exception of Sweden, there are unresolved contingent liabilities in the NDC schemes of most countries, making them less than “DC” as that term is used in the world of privately funded pensions. But, if the DC model is further relaxed by not being rigorous about the “G factor”—the factor used for annuity conversion—it is not obvious that the outcome is superior to a cognate DB reform. (We mean rigorous in both reflecting the age at which someone retires and increases in cohort longevity.) We say this because use of the term NDC may convince policy makers and the public into thinking more has been done than not. Indeed, some have argued that, without this G factor sine qua non, the NDC vocabulary has served only to harden benefit expectations that are not sustainable.
Annex 12A. Technical Notes

Characterizing Choices about Optimal Retirement Ages

We are interested in understanding how retirement decisions are affected by DB-PAYG formulas and NDC type formulas. The main difference between the two is that, while in the DB-PAYG case the accrual rate is constant when deciding to retire, it is effectively endogenous (depending on the retirement decision itself) in the case of the NDC formula.

We start by defining the expected utility derived from an individual retiring at time $R$, who will live at most until time $L$, and that it is assumed to depend on consumption and leisure:

$$E[U_t] = \sum_{t=R}^{L} \theta^t U(c_t, l_t) m_t,$$  \hspace{1cm} (12A.1)

where $U$ is the utility function (assumed to respect standard properties), $c$ and $l$ are respectively consumption and leisure, $m_t$ is the probability of survival to time $t$, and $p_R$ is the pension at retirement. An individual would be willing to delay retirement if the expected gains in utility from waiting, due to a higher pension and higher consumption, are higher than the expected losses in utility, due to lower leisure.

The present value of the marginal gain in expected utility at each future time $t$ resulting from a change in the pension is given by:

$$\frac{dE[U_t]}{dp_R} = \theta^t m_t U_t(p_R, l_R) \frac{dc_t}{dp} \Delta p_R.$$  \hspace{1cm} (12A.2)

The loss in utility for lower leisure today is given by:

$$\frac{dE[U_t]}{dl_R} = U_t(p_R, l_R) \Delta l_R.$$  \hspace{1cm} (12A.3)

The question is under which benefit formula is the sum of future gains in utility (equation 12A.2) more likely to be higher than the loss in utility from waiting (equation 12A.3).

Let’s first look at how the pension varies under each benefit formula. In the case of the NDC formula, the pension is given by:

$$p_R = w_R S \lambda \beta G_R^{-1},$$  \hspace{1cm} (12A.4)

where $\beta$ is the contribution rate, $w_t$ is the wage at time $t$, and $I \lambda$ is the index that applies to contributions at time $t$. For generality and simplicity we assume that contributions are indexed by the growth rate of the average wage and that the growth rate of different individuals is always proportional to this growth rate. Hence, if $\lambda$ is equal to 1, the individual has its wage growing exactly as the average wage. If $\lambda$ is below (above) 1, the individual has its wages growing above (below) the average wage. Under these assumptions, the NDC formula can rewritten as:

$$p_R = w_R S \lambda \beta G_R^{-1}.$$  \hspace{1cm} (12A.5)
where \( w_{R} \) is the wage at time \( R \) and \( S \) is the length of service at retirement. Then the change in pension resulting from contributing to the system an additional unit of time is simply given by:

\[
\Delta p_{r} = \lambda \beta G_{R}^{-1} S \Delta w_{r} + \lambda \beta G_{R}^{-1} w_{k} - \lambda \beta w_{k} G_{R}^{2} \Delta G_{R}^{-1} = \alpha' \left( \lambda S \Delta w_{r} + w_{k} \right) - \alpha' w_{k} G_{R}^{2} \Delta G_{R}^{-1},
\]  

(12A.6)

where \( \alpha' = \beta G_{R}^{-1} \).

Assuming that wages in the DB-PAYG formula are indexed in the same way as contributions in the NDC formula, the pension can be written as:

\[
p_{R} = w_{R} S \lambda \alpha,
\]  

(12A.7)

where \( \alpha \) is the accrual rate. Then the change in the pension resulting from an additional unit of time of contribution is simply given by:

\[
\Delta p_{R} = \alpha \left( \lambda S \Delta w_{r} + w_{k} \right),
\]  

(12A.8)

The first observation is that if \( \alpha \) and \( \alpha' \) are equal—that is, if the accrual rate in the DB-PAYG is age-dependent, then the increase in pension resulting from an additional period of contributions will be higher under the NDC type formula. This is because in the second term of equation 12.6 \( \Delta G_{R}^{-1} \) is negative (that is, the G factor decreases as the contribution period of the individual expands). Intuitively, the increase in the pension in the NDC scheme will be higher because the effective accrual rate will increase (as the G factor decreases). In fact, if \( \alpha \) and \( \alpha' \) are equal, it will be easier to meet the conditions for delaying retirement under the NDC formula than it would under the DC formula, because all the other terms in equations 12A.2 and 12A.3 would the same, except for \( \Delta p_{R} \).

What happens if \( \alpha \) and \( \alpha' \) are different? It turns out that as \( \alpha \) increases relative to \( \alpha' \), the incentives to delay retirement diminish under the DB-PAYG formula. This is because the marginal utility of higher consumption resulting from a higher pension at time \( R \) (equation 12A.2) diminishes as the accrual rate increases. Certainly, \( \Delta p_{R} \) will increase, but it will increase less rapidly. To see this, we differentiate equation 12A.2 with respect to \( \alpha \) (we assume that each extra unit of pension is translated into an extra unit of consumption).

\[
\frac{dE[U]}{dp_{R} \frac{d\alpha}{d\alpha}} = \theta' m_{I} U_{x} \left( p_{k}, l_{k} \right) \frac{dp_{R}}{\frac{d\alpha}{d\alpha}} + \theta' m_{I} U_{x} \left( p_{k}, l_{k} \right) \frac{d\Delta p_{R}}{d\alpha} = \theta' m_{I} U_{x} \left( p_{k}, l_{k} \right) w_{R} S \lambda \alpha \left( \lambda S \Delta w_{r} + w_{i} \right) + \theta' m_{I} U_{x} \left( p_{k}, l_{k} \right) \left( \lambda S \Delta w_{r} + w_{i} \right). \tag{12A.9}
\]

For this expression to be positive—that is, for the marginal utility of a higher pension to increase as \( \alpha \) increases—the following condition would need to hold:

\[
w_{R} S \lambda \alpha < \frac{U_{x} \left( p_{k}, l_{k} \right)}{U_{x} \left( p_{k}, l_{k} \right)}, \tag{12A.10}
\]

which implies that the pension at time \( R \) is lower than the inverse of the growth rate of the marginal utility of consumption. This is unlikely.

The corollary is that if \( \alpha \) is set low enough relative to \( \alpha' \), incentives for delaying retirement under the DB-PAYG formula can be stronger than under the NDC formula.
Table 12A.1. Optimal Retirement, Savings, and Labor Supply Decisions under Alternative Benefit Formulas

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<tr>
<td>Loss in informal sector (percent)</td>
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<td></td>
<td></td>
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<tr>
<td>Preference for leisure</td>
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<td>0.3</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.1</td>
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<td>0.3</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
</tr>
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</table>

| Optimal retirement ages                        |      |      |      |      |      |      |      |      |      |      |      |      |
| DB-PAYG last-salary (1%)                       | 75   | 74   | 59   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   |
| DB-PAYG last-salary (1.5%)                     | 74   | 66   | 55   | 75   | 75   | 75   | 75   | 55   | 75   | 75   | 75   | 75   |
| DB-PAYG full-career (1.5%)                     | 75   | 74   | 56   | 75   | 75   | 75   | 75   | 59   | 75   | 75   | 75   | 75   |
| NDC                                            | 75   | 75   | 69   | 75   | 75   | 75   | 75   | 69   | 75   | 75   | 75   | 75   |
| DB-PAYG full-career                            |      |      |      |      |      |      |      |      |      |      |      |      |
| ADA55 (0.94%)                                  | 75   | 75   | 63   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   |
| ADA60 (1.04%)                                  | 75   | 75   | 61   | 75   | 75   | 75   | 75   | 59   | 75   | 75   | 75   | 75   |
| ADA75 (2.38%)                                  | 73   | 62   | 55   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   |

| Present value private savings (relative to initial wage) |      |      |      |      |      |      |      |      |      |      |      |      |
| DB-PAYG last salary (1%)                         | 7.1  | 7.1  | 56.0 | 37.3 | 37.3 | 37.3 | 35.3 | 31.8 | 37.2 | 37.2 | 37.2 | 37.2 |
| DB-PAYG last salary (1.5%)                       | 0.0  | 13.0 | 43.9 | 37.3 | 37.3 | 37.3 | 37.3 | 38.5 | 37.2 | 37.2 | 37.2 | 37.2 |
| DB-PAYG full-career (1.5%)                       | 10.7 | 10.6 | 61.5 | 37.3 | 37.3 | 37.3 | 31.8 | 31.8 | 59.3 | 37.2 | 37.2 | 37.2 |
| NDC                                            | 0.0  | 0.0  | 23.5 | 37.3 | 37.3 | 37.3 | 0.0  | 0.0  | 22.9 | 37.2 | 37.2 | 37.2 |
| DB-PAYG full-career                             |      |      |      |      |      |      |      |      |      |      |      |      |
| ADA55 (0.94%)                                   | 17.8 | 17.8 | 59.4 | 37.3 | 37.3 | 37.3 | 37.3 | 35.3 | 31.8 | 37.2 | 37.2 | 37.2 |
| ADA60 (1.04%)                                   | 17.8 | 14.2 | 60.8 | 37.3 | 37.3 | 37.3 | 31.8 | 31.8 | 59.3 | 37.2 | 37.2 | 37.2 |
| ADA75 (2.38%)                                   | 0.0  | 18.5 | 32.9 | 37.3 | 37.3 | 37.3 | 2.6  | 0.0  | 37.2 | 37.2 | 37.2 | 62.6 |

| Average savings rate (percent noninvestment income) |      |      |      |      |      |      |      |      |      |      |      |      |
| DB-PAYG last salary (1%)                         | 2.0  | 2.0  | 19.0 | 9.0  | 9.0  | 9.0  | 10.0 | 9.0  | 9.0  | 9.0  | 9.0  | 9.0  |
| DB-PAYG last salary (1.5%)                       | 0.0  | 4.0  | 16.0 | 9.0  | 9.0  | 9.0  | 10.0 | 9.0  | 15.0 | 9.0  | 9.0  | 9.0  |
| DB-PAYG full-career (1.5%)                       | 3.0  | 3.0  | 22.0 | 9.0  | 9.0  | 9.0  | 9.0  | 9.0  | 21.0 | 9.0  | 9.0  | 9.0  |
| NDC                                            | 0.0  | 0.0  | 7.0  | 9.0  | 9.0  | 9.0  | 0.0  | 0.0  | 7.0  | 9.0  | 9.0  | 9.0  |
| DB-PAYG full-career                             |      |      |      |      |      |      |      |      |      |      |      |      |
| ADA55 (0.94%)                                   | 5.0  | 5.0  | 19.0 | 9.0  | 9.0  | 9.0  | 10.0 | 9.0  | 9.0  | 9.0  | 9.0  | 9.0  |
| ADA60 (1.04%)                                   | 5.0  | 4.0  | 20.0 | 9.0  | 9.0  | 9.0  | 9.0  | 9.0  | 21.0 | 9.0  | 9.0  | 9.0  |
| ADA75 (2.38%)                                   | 0.0  | 6.0  | 12.0 | 9.0  | 9.0  | 9.0  | 0.0  | 1.0  | 0.0  | 9.0  | 9.0  | 20.0 |

| Share of time enrolled in public system (percent) |      |      |      |      |      |      |      |      |      |      |      |      |
| DB-PAYG last salary (1%)                         | 100  | 100  | 100  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| DB-PAYG last salary (1.5%)                       | 100  | 100  | 100  | 0    | 0    | 0    | 0    | 0    | 100  | 0    | 0    | 0    |
| DB-PAYG full-career (1.5%)                       | 100  | 100  | 100  | 0    | 0    | 0    | 0    | 0    | 67   | 0    | 0    | 0    |
| NDC                                            | 100  | 100  | 100  | 0    | 0    | 0    | 0    | 33   | 33   | 33   | 33   | 33   |
| DB-PAYG full-career                             |      |      |      |      |      |      |      |      |      |      |      |      |
| ADA55 (0.94%)                                   | 100  | 100  | 100  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ADA60 (1.04%)                                   | 100  | 100  | 100  | 0    | 0    | 0    | 0    | 0    | 67   | 0    | 0    | 0    |
| ADA75 (2.38%)                                   | 100  | 100  | 100  | 0    | 0    | 0    | 0    | 33   | 100  | 100  | 0    | 0    |

Source: Authors’ calculations.

Note: ADA55, ADA60, and ADA75 mean that the accrual rate is calculated on the basis of a retirement age of 55, 60, and 75 respectively. Accrual rates are in parenthesis. For the NDC system, and the DB system with all salaries included in the calculation of the pension, wages are revalorized by the growth rate of the average covered wage.
Dynamic Optimization Problem for Savings, Retirement, and Labor Supply Decisions

We assume that individuals solve the following optimization problem:

\[
\text{Max}_{c_i, f, r_t, k_t}: \mathbb{E}\left[U(c, l)\right] = \sum_{t=a}^{T} \rho \left(\frac{c_t^{1-\gamma}}{1-\tau}\right)^{\tau} m_t
\]

s.t.:

\[
c_t = \left(w_0(1+g)^t\right)(1-\tau)f_t\left(1-T_jf_t\right)+k_{t-1}r_t-s_t; \quad \text{if} \quad t \leq R_t
\]

\[
c_t = p_t+k_{t-1}r_t-s_t; \quad \text{if} \quad t > R_t
\]

\[
p_t = \sum_{t=b}^{R} w_0(1+g)^t(1+i)^{R-t} \alpha_j
\]

\[
k_t = k_{t-1} + s_t
\]

\[
k_1 = 0,
\]

(12A.11)

where the functions, variables, and parameters are as follows: \( E \) is the expectations operator, \( U(.) \) is a constant absolute risk aversion utility function that depends on consumption \( (c) \) and leisure \( (l) \). We assume that individuals, when working, work full time either in the formal sector \( (f = 1) \) or in the informal sector \( (f = 0) \). Hence, extra leisure can be achieved only while retired. In the value function \( \rho \) is a discount factor, and \( m \) is the conditional probability of surviving to time \( t+1 \) given that the individual is alive at time \( t \), \( R \) is the retirement age (endogenous), and \( a \) is the time when the individual starts working. In the consumption function, \( w_0 \) is the initial wage, \( g \) is the growth rate of this wage (assumed to be constant over time), \( o \) captures the costs of operating in the informal sector, \( T \) is the tax to the mandatory pension system, \( k \) is capital, \( r \) is the market interest rate, and \( s \) are savings. When the individual retires \( (t > R) \), he or she receives a pension that depends on the type of pension scheme, \( j \). This pension scheme is characterized by the parameters: \( b_j \) (the number of years included in the calculation of the pension), \( i_j \) (the factor used to index wages), and \( \alpha_j \) (the accrual rate). Clearly, there is no close form solution to this optimization problem. Hence, we use numerical methods to approximate optimal choices regarding savings, retirement age, and labor supply.

The results are presented in table 12A.1. The name and value of the parameters that are kept fixed between simulations are summarized in table 12A.2.

### Table 12A.2. Model Parameters

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<td>( r )</td>
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<td>( \rho )</td>
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</tr>
<tr>
<td>( \tau )</td>
<td>1.3</td>
</tr>
<tr>
<td>( a )</td>
<td>20</td>
</tr>
<tr>
<td>( L )</td>
<td>120</td>
</tr>
</tbody>
</table>

*Source: Authors.*
Simulating the Dynamics of Alternative Pay-As-You-Go Systems

In our model, we fix the future dynamics of the labor force by age $a$ and sex $s$ ${L_{a,s(t)}}^{200}_{t=1}$, the distribution of wages ${w_{a,s(t)}}^{200}_{t=1}$, and retirement patterns ${R_{a,s(t)}}^{200}_{t=1}$.

Nominal wages for each age are expressed as a fraction of a wage index $I$ (our proxy for labor productivity), which responds to the following stochastic process:

$$
\log I_t = \log I_{t-1} + \alpha_0 - \alpha_1 \exp(-\delta t) + \mu_t; \quad u_t \sim N(0, \alpha_2 \exp(-\delta t)),
$$

(12A.12)

where $\alpha_0$ is the steady state growth rate of the index; $\alpha_1 > 0$ is a short-term random distortion that holds the growth rate of labor productivity down, but that gradually fades away as development takes place; and $\mu$ is white noise with initial variance $\alpha_2$ also assumed to fade away.

Similarly, coverage rates by age ${c_{a,s(t)}}^{200}_{t=1}$ are assumed to evolve in proportion to the following index:

$$
\log C_t = \log C_{t-1} + \beta_0 + v_t; \quad v_t \sim N(0, \beta_1 \exp(-\delta t)),
$$

(12A.13)

Finally, mortality rates are given by:

$$
m_{a,s,t}^* = m_{a,s,t}^\ast \eta \text{ if } t > t^*; \quad \eta \sim U[\eta_1, \eta_2],
$$

(12A.14)

where $m^*$ are baseline mortality rate by age and sex and $\eta$ is a random shock uniformly distributed between $\eta_1$ and $\eta_2$. These mortality rates affect steady state dependency ratios as well as the life expectancies used to compute G factors in the case of the NDC scheme.

Equations 12A.12 to 12A.14 and the fix distributions determine the dynamics of the average wage, the wage bill, total contributors, total pensioners, and ultimately the financial balance of the system.

The distribution of wages, coverage rates, retirement patterns, and baseline mortality rates come from real data for Jordan. The parameters used in the simulations for equations 12A.12 to 12A.14 have been chosen to generate a large set of paths for the exogenous variables of the system. Our main interest has been to explore the dynamic properties of the various schemes in cases where these paths are subject to high levels of uncertainty. The values for the various parameters are summarized in table 12A.3. The types of PAYG schemes considered are described in table 12A.4. Figures 12A.1 to 12A.4 summarize the results.
Table 12A.3. Parameters Used in the Dynamics Simulations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_0$</td>
<td>0.02</td>
</tr>
<tr>
<td>$\alpha_1$</td>
<td>0.02</td>
</tr>
<tr>
<td>$\delta_1$</td>
<td>0.025</td>
</tr>
<tr>
<td>$\alpha_2$</td>
<td>0.03</td>
</tr>
<tr>
<td>$\delta_\mu$</td>
<td>0.025</td>
</tr>
<tr>
<td>$\beta_0$</td>
<td>0.0025</td>
</tr>
<tr>
<td>$\beta_1$</td>
<td>0.04</td>
</tr>
<tr>
<td>$\delta_\nu$</td>
<td>0.02</td>
</tr>
<tr>
<td>$t^*$</td>
<td>50</td>
</tr>
<tr>
<td>$\eta_1$</td>
<td>0.50</td>
</tr>
<tr>
<td>$\eta_2$</td>
<td>1</td>
</tr>
</tbody>
</table>

*Source: Authors.*

Table 12A.4. Pension Schemes under Consideration

<table>
<thead>
<tr>
<th>System</th>
<th>Indexation contributions</th>
<th>Indexation pensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB-PAYG with 1.5% accrual rate</td>
<td>n.a.</td>
<td>Inflation</td>
</tr>
<tr>
<td>Pension computed on the basis of last two years of salary.</td>
<td>Wage bill</td>
<td>Wage bill</td>
</tr>
<tr>
<td>NDC 1</td>
<td>Wage bill</td>
<td>Inflation</td>
</tr>
<tr>
<td>NDC 2</td>
<td>Wage bill</td>
<td>Inflation (if real wage growth is positive); real wage (if real wage negative)</td>
</tr>
<tr>
<td>NDC 3</td>
<td>Wage bill</td>
<td>Inflation (if real wage growth is positive); real wage (if real wage negative)</td>
</tr>
<tr>
<td>NDC 4</td>
<td>Average wage</td>
<td>Average wage</td>
</tr>
<tr>
<td>NDC 5</td>
<td>Average wage</td>
<td>Inflation</td>
</tr>
<tr>
<td>NDC 6</td>
<td>Average wage</td>
<td>Inflation (if real wage growth is positive); real wage (if real wage negative)</td>
</tr>
</tbody>
</table>

*Source: Authors.*

*Note: n.a. = not applicable. In the Swedish system, pensions are indexed with the growth rate of the average wage. Generally speaking we have: $p = \lambda w$ where $p$ is the pension, $w$ is the average wage, and a dot over the variable denotes its growth rate. The factor $\lambda$ is equal to one unless assets fall below liabilities and the stabilization mechanism is activated. In this case, $0 < \lambda < 1$. We observe that a system where pensions are indexed by prices when the average real wage grows and pensions are indexed with the average real wage when it falls, should in all cases generate lower pensions and therefore a more sustainable system without recurring to the complex calculation of $\lambda$. 
Figure 12A.1. Illustration of the Dynamics of the Average Wage, the Wage Bill, and Coverage Rates

Source: Authors’ calculations.
Figure 12A.2. Primary Balance and Last-Year Replacement Rates (Stable Environment)

Source: Authors’ calculations.
Figure 12A.3. Contributions Minus Expenditures (Volatility Environment)

Source: Authors’ calculations.
Figure 12A.4. Income Replacement at Age 60 (Volatile Environment)

Source: Authors’ calculations.
Notes

1. “Notional defined contribution” and “non-financial defined contribution” should be understood to have the same definition.

2. For some reviews, see Lindeman, Rutkowski, and Sluchynskyy (2001) and Chlon, Görą, and Rutkowski (1999).

3. In addition, most defined contribution (DC) arrangements do not redistribute across income classes. This, however, is not axiomatic. For example, Denmark has a small state-mandated funded DC tier that pays flat benefits financed by contributions proportional to earnings.

4. In funded pension schemes, similar hybrids exist. Cash-balance plans in the United States have the appearance of accumulation accounts, but investment returns are guaranteed, giving rise to a defined benefit promise. Australia has a similar scheme for national civil servants. In both instances, however, members bear “longevity risk” if and when converting the lump sum to an annuity or drawing it down overtime.


7. See Imrohoroglu, Imrohoroglu, and Joines (2000) for a review.

8. Under the DB-2 and DB-3 formulae, it is possible to conceive cases where the accrual rate is low enough relative to the contribution rate to provide more incentives to delay retirement than are provided by the NDC formula. Intuitively, this is because individuals in the small DB accrual world are less likely to have met their consumption target for retirement by the time they have reached the minimum retirement age. More technically, if the accrual rate is low enough, and therefore the marginal utility of additional consumption high enough, a DB formula with linear adjustments for delayed retirement to the replacement rate can generate more incentives to delay retirement than the NDC formula can generate. To put it differently, income effect may dominate the substitution effect if the overall wealth is low. Moreover, today there are DB schemes such as Morocco RCAR (Régime Collectif d’Assurance et de Retraite), where the accrual rate for individuals retiring after the minimum retirement age is adjusted by a factor that is above actuarially fair levels. Hence, the implicit rate of return paid by the system increases monotonically with the age of retirement.

9. The model used refers to rational agents with perfect information who make savings, labor supply, and retirement decisions in order to maximize intertemporal utility, which is assumed to depend on leisure and consumption.


11. Evasion can be induced when contribution rates are “high.” This is first because some individuals simply cannot afford the tax (for example, the long-term poor for whom joining the contributory system would be welfare decreasing). Second, this is because a mandate to save that is too large can also be welfare decreasing and encourage individuals to find alternative saving mechanisms. These problems, however, are not related to the type of benefit formula.


13. See the technical annex at the end of this chapter.


16. For reference, we also look at the dynamics of a traditional DB-PAYG.

17. See the technical annex at the end of this chapter for a formal description of the model.


20. Clearly, fiscal completeness in this case would require recurrence to a buffer fund, probably coupled with some type of stabilization mechanism.
22. There are also cases when the contributory system plays simultaneously a social assistance function (for example, Algeria), thus reducing the value of the average pension.
25. This difficulty applies not only to NDC but also to DB-PAYG schemes. One of the main criticisms of disability and survivorship pensions is that such benefits are not designed within an insurance framework. The systems are usually prone to abuse because of absent or lax certification criteria. Thus, disability benefits often substitute for unemployment insurance or more generous early retirement. Moreover, the way survivorship benefits are implemented tends to provide little incentive for survivor spouses to enter the labor market; in the case of death of the surviving spouse, surviving children can be left unprotected. Propositions that have been considered include outsourcing the provision of these benefits and having independent pension rights for both spouses with accumulated pension rights split after divorce or death. The move to an NDC scheme could allow for a more systemic reform of disability and survivorship pensions, whereby total costs for the “social insurance” package are not necessarily affected if leakages to people outside the normal ambit of social insurance protection are prevented. If the primary goal of NDC is forced savings solely for old age, then it is achieved by holding NDC accounts truncated by death or disability in abeyance until retirement and by imposing forfeiture on all accounts where the individual does not reach retirement.
26. This part of the chapter draws in part on Chłoń-Domińczak (2003).
27. See Rutkowski (2002).
29. See Valdés-Prieto (forthcoming).
30. Cases in point are NDC reforms in the Kyrgyz Republic and Russia that explicitly manipulate the G coefficient to reflect current fiscal realities.

References


Discussion of “NDC Pension Schemes in Middle- and Low-Income Countries”

Monika Queisser*

In commenting on this very interesting and comprehensive paper, I would like to make three points about the applicability of notional defined contribution (NDC) schemes in low- and very-low-income countries.

First, the relevance and usefulness of comparing existing—as the authors point out, “bad”—defined benefit schemes and NDC schemes in the context of low- and very-low-income countries is questionable. The more relevant alternative to a defined benefit scheme seems to be a noncontributory scheme rather than a defined benefit scheme, given that many of these countries’ old people have spent most of their lives outside of the formal sector and often have to rely exclusively on family ties and informal support in old age. The chapter does mention the possibility of introducing basic pension or demogrant schemes, but it does so in passing. A more thorough discussion of the three options for this group of countries would have been beneficial and more relevant for practical policy purposes.

Second, if a decision has been made to have or maintain an earnings-related pension scheme in a low-income country, defined contribution schemes could indeed be a better solution than defined benefit schemes. Transferring more risk to the individual is preferable in a context where formal sectors are small and generous defined benefit systems are often subsidized by public transfers. Such transfers are financed predominantly out of indirect taxes. This means that many persons who do not benefit from the system in fact pay for coverage of a minority of formal sector workers. In this respect, a defined contribution system could reduce inequities and free government resources that could be used to finance social and health services for the excluded population.

The authors discuss the experience of provident funds, which exist in a number of low- and very-low-income countries in Africa and Asia. With the exception of some countries, such as Singapore and Malaysia, provident funds have been unable to provide retirement income security in most countries. Retirement savings have often been improperly invested and eroded by inflation. Administrative procedures, which are much easier in a provident fund than in a Swedish-style notional defined benefit scheme, were often inefficient and costly. Most observers would agree that the majority of pure funded defined contribution schemes in poor countries have failed. Now, are there good reasons to believe that defined contribution schemes would work better if there were no actual money to invest? I do not think so.

The experience with benefit management in these countries has not been encouraging. Annuiting account balances and converting future pension payments into lump sums has caused enormous administrative and political problems. Many poor countries do not have reliable life tables and finding an appropriate discount rate valid in the long term is even more challenging than this already daunting task in the OECD context. Even if such a rate were found, it is very difficult to adjust pension or lump-sum benefits. Again, it is not obvious why these problems would not occur in a notional defined contribution scheme.

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My third comment is about rules. Successfully running NDC systems requires a fairly sophisticated set of rules. Even if one disregards administrative difficulties and data deficiencies that may prove obstacles to implementation, the question remains: How likely is it that rules would be kept and followed?

This problem is not restricted to middle- and lower-income countries. Changes of rules and regulations in pension systems are very frequent in OECD member countries. Even simple, well-defined rules are broken all the time for economic, financial, social, or political reasons.

Take the United Kingdom as an example. The basic state pension scheme provides a benefit that is indexed to prices. This is a comparatively simple rule on which the projections of the future burden of aging are based. In reality, however, the evolution of benefits has been different. Between April 1997 and April 2003, pensions increased by 24 percent while retail prices increased by 16 percent and average earnings by 29 percent. This is not meant to be a criticism of the United Kingdom for breaking the rules—these increases were necessary to prevent more pensioners from falling into old-age poverty. But it shows that it is very difficult to design and auto-pilot a pension system that is “sustainable” in the long term in all of its dimensions.

The U.K. pension system also shows that pension problems cannot be contained within a pension system and isolated from the overall social policy environment. The United Kingdom has had to introduce a whole range of additional, mostly means-tested, social policy measures in order to pick up the social problems of a financially sustainable system. The result is an extraordinarily complex structure of supplementary benefits and different credits that functions with a high degree of discretion of gatekeepers.

There are many more examples of pension rules made and subsequently broken to be found across OECD countries. Just recently Spain announced that the decision taken by the Toledo pact to move to lifetime averaging of earnings in the pension benefit formula was being postponed due to upcoming elections. In Germany, the social democratic government annulled the previous government’s introduction of a demographic pension factor—only to realize that pension reforms toward a more sustainable system would not be possible without demographic adjustments. A modified factor will be reintroduced shortly.

The evidence seems to suggest that rules are there to be broken. Perhaps the Swiss approach is a more realistic one. Switzerland never believed in auto-piloting or even in the permanence of any pension arrangements. As a consequence, the system is being modified in a continuous series of revisions of the existing framework. The 11th revision of the social insurance scheme has just been completed, which means that the 12th revision is now being prepared—in a system that was started only in 1948. The population has gotten used to continuous reform and has come to accept that change is necessary, even if individual measures are hotly debated each time.

The introduction of notional defined contribution systems may or may not contradict the conviction that permanent change is necessary. Perhaps Sweden will show the rest of the world that auto-piloting is indeed possible. If it is not, or if it functions only in very specific country circumstances, the introduction of notional defined contribution schemes could actually be dangerous as it may convey a false sense of security and lead countries to sit back and rely on the auto-pilot without realizing that the system is about to crash.

Note

1. “Notional defined contribution” and “non-financial defined contribution” should be understood to have the same definition.
Discussion of “NDC Pension Schemes in Middle- and Low-Income Countries”

Elaine Fultz*

The chapter by Lindeman, Robalino, and Rutkowski examines the potential for notional defined contribution (NDC) pension reform\(^1\) to improve benefits and financing in low-income countries, but it contains limited analysis of the characteristics of these countries that might impinge on the success of such a reform. In particular, more needs to be said about issues of governance in low-income countries. In the transitional economies of Central and Eastern Europe, three typical features of governance not explored in the study might limit the success of this approach.

First, governments in transition may have less capacity to reach the kind of enduring consensus required to put an NDC system in place. Because defined contribution schemes operate on different principles than defined benefit schemes, the transition from one to the other will be a complex and time-consuming process. Governments in the transition countries of Central Europe tend to change rapidly, however, causing shifts in national policy. Between 1989 and 2000, for example, Latvia had five governments; Lithuania, Slovakia, and Slovenia had four; and the Czech Republic, Estonia, Hungary, and Poland had three. When the government changes, the new ruling coalition often tries to put its own distinctive mark on the pension system. If a major reform is not possible, the government may “tinker” with a newly passed reform, making mid-course adjustments. As has been explained in chapter 15 of this book (Palmer et al. 2006), Latvia has amended its NDC law nine times since its inception in the mid 1990s, introducing elements that change its form from pure NDC—for example, a minimum benefit that varies according to years of work and a system for converting pension rights under the previous social insurance system to NDC capital that gave disproportionate weight to a few years of work, thus creating major winners and losers.

Second, transitional governments may be less able to set and maintain the needed contribution rate for an NDC scheme than more stable governments. Since NDC benefits are based on each individual’s own pension contributions, the contribution rate must be set properly and maintained in order to ensure pension adequacy. However, many Central and Eastern European countries alter their contribution rates frequently, responding to forces that do not relate directly to pension adequacy—for example, public perceptions that the current rates are too high and impede international competitiveness. Two risks arise here: first, the risk that a government would adopt an NDC reform and then violate its key principle of a stable contribution rate, and second, the risk that the government would adhere to this principle but select a less than optimal rate initially and then be constrained from changing it.

A third possible mismatch relates to the heavy administrative and planning requirements of NDC versus the capacities of governments in transition. NDC poses extensive

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record-keeping requirements: each contribution made on behalf of each worker must be reported to, and recorded by, the pension agency. This is a major task even for high-income countries, few of which maintain this level of detail in pension contribution records. Governments in transition will find this a far greater challenge. As discussed previously, the Polish government experienced major problems in the recording of monthly contributions after the 1999 NDC reform, problems that initially paralyzed the pension system. Now, nearly five years later, it has a new record-keeping system up and running, but it still has not succeeded in recording a large backlog of contributions from the past. Nor, as we learned, has the Polish Social Insurance Institution (ZUS) yet been able to issue annual statements of contributions to scheme contributors.

In addition, because NDC operates on different principles than defined benefit (DB) schemes, there is a need for detailed planning of how the new pension scheme will interact with existing schemes for disability and survivorship. This makes an NDC reform more demanding in terms of planning than changes in the DB system with a similar thrust. In Poland, for example, problems of coordination exist between the NDC old-age scheme and disability pensions. Unless addressed, these will create horizontal inequities among workers with similar contribution records and put increasing financial pressures on the disability pension financing.

To sum up, a reform that works well under a steady, deliberative government with high levels of technical expertise cannot be expected to have the same effects in countries with less developed governmental capacities. Nor can a change of law alone be expected to circumvent weak governance. Rather, weaknesses in governance need to be dealt with as a prerequisite to major pension restructuring. A key challenge to those of us who offer policy advice to transitional governments is to gear our message to specific contexts and take governance into account. The risks of failing to do so are that a reform intended to impose new fiscal discipline may be too unwieldy and complex, ultimately producing greater difficulties for the pension system and those who count on it.

Note

1. “Notional defined contribution” and “non-financial defined contribution” should be understood to have the same definition.

Reference