

Transitional fiscal costs and demographic factors in shifting from unfunded to funded pension in Latin America

Jorge Brevo and Andras Uthoff



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Jorge Bravo and Andras Uthoff



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Abstract

After the 1981 Chilean pension system reform, which shifted from a government run pay-as-you-go system to a private, fully funded one, many countries in Latin America have implemented or are considering reforms with an important funded component. We develop a simple model to assess the magnitude of the implicit government debt that needs to be made explicit by this policy, as well as the transitional fiscal costs that such a reform implies. We show that the liabilities and the associated fiscal costs are affected by the population age structure, old-age mortality, labour-market and pension system variables. By use of data from Latin American countries, we find that in several countries, especially those with more aged populations and high coverage systems, the pension debt is very high, and that a switch from unfunded to fully funded systems implies substantial fiscal costs, that may even turn out to be economically and politically unviable in some cases. The effect of some partial funding options are discussed in selected national contexts.

I. The switch from unfunded to funded pension regimes

Reforms to social security systems are being discussed or are underway in many countries around the world. The reasons for promoting the reforms vary from country to country, but in many cases they include the consideration of population aging and system maturation leading to high system dependency ratios, labor market restrictions that make it difficult to continue supporting generous welfare states, political and economic restructuring stressing a greater role of the private sector—even in the financing and management of traditional social programs—, inefficiencies and administrative problems with state run systems.

In the Latin American context, recent reforms include the rationalization of existing systems (e.g., standardizing and adjusting eligibility conditions and benefits, improving information systems and some administrative procedures) but also, and most importantly, the incorporation of at least one component of funding of contributions and benefits. Country cases include the early Chilean 1981 reform which, together with those of Mexico (1995) and Bolivia (1996), have dictated a complete switch from the state run pay-as-you-go (PAYG), benefit-defined systems to a privately managed, fully funded individual contribution-defined schemes. Other reforms maintain a PAYG component by establishing mixed (“multipillar”) or competing systems, such as those of Peru (1992), Argentina (1993), Colombia (1993) and Uruguay (1995).

The funding component is supposed to alleviate the financial burden that pay-as-you-go systems place on fiscal budgets in the

context of the mentioned demographic and labor market trends, to stimulate greater efficiency in the management of the system, to lead to higher national saving and investment and to promote the development of financial markets, where the pension funds are invested. Evidence is mixed regarding all of these presumed goods, in part because in many countries (where reforms started only a few years ago) it is too soon to tell. But even in the early Chilean case, where the growth and development of financial markets and of the corresponding regulatory framework is evident, it is not clear that funding has brought about a significant increase in national saving or productive investment (Uthoff, 1997), or whether it has helped to reduce administration costs, since they are quite high (about 25% of contributions), probably higher than those incurred by the inefficient state management before the reform took place. Although several models suggest or predict long term aggregate income and welfare benefits from U-F reforms (Schmidt-Hebbel, 1997, Valdés-Prieto, 1997, and references therein), it is still too early to assess this potentially important effect.

Of specific interest to this paper, it is not at all evident that the unfunded to funded (U-F) reforms alleviate the short to medium-term fiscal burden; to the contrary, a recent analysis by ECLAC (1998) and that presented in this paper suggest that the U-F transition generates large fiscal obligations, that have to be paid by the current and future generations of workers.

These costs arise because U-F transitions require to make explicit and to pay part or the whole of the implicit social security debt, without receiving the income from contributions made by those who switch to funded scheme. The implicit pension debt consists of all pensions due to those who retired from the unfunded regime, plus a compensation for contributions made by all those economically active at the time of the reform that switch to the funded regime. How much of this debt is made explicit depends on the specific U-F reform design.

As the paper shows, the size of the implicit debt in some cases can be so high as to make a complete U-F switch economically and politically unviable. In other cases, the size of the debt is such that it may plausibly be absorbed, but subject to important fiscal restrictions. In some other cases, the implicit debt turns out to be very small, and thus the U-F reform is feasible without imposing major fiscal constraints. Nonetheless, in this latter group of countries, the incentives for moving to a funded regime are less clear, given their demographic and structural economic conditions.

The following sections set out to measure the size of the implicit pension debt, derive the associated fiscal costs by use of a simple model and available demographic, labor market and pension system data, to analyze their factors and to discuss the results in the light of the reforms currently in place in the Latin American region.

II. Implicit pension debt: definition and measurement

The meaning and the size of the implicit pension debt that needs to be made explicit by a U-F reform depends on the specific reform scenario considered. Our base case is that of a (Chilean-type) complete substitution of a government-run pay-as-you-go system by a privately managed fully funded one. In this case, the government pension liabilities (or “debt”), calculated at actuarially fair values, correspond to the present value of the pensions due now and in future years, to all those currently retired under the rules of the (pre-existing) unfunded system, plus the present value of the contributions of those covered, currently active workers. Alternative definitions are possible in principle (Van der Noord and Herd, 1994; Franco, 1995; Holzmann, 1997b); section 4 of this paper discusses a few variants, taken from actual reforms in the region.

A direct and exact measurement of these obligations would require complete and detailed time series of age profiles of labor force participation, employment, coverage and compliance rates, and labor earnings over the last forty years or so. Since such an ideal database is not available in any Latin American country, we need to construct a model that, given some assumptions, can provide a reasonable estimate using more widely available demographic, labor-market and macroeconomic data. Some assumptions are needed in any case to estimate and project the expected future flows of pensions to be paid to those currently retired. As will be apparent next, the model has the added value of showing in a clear and simple way the effect of different demographic and economic factors on the pension debt.

For our initial calculations, we have made use of several, sometimes highly simplifying assumptions, the most important of which are: (i) the existence of an unfunded pension scheme since 1950; (ii) overall system coverage rates remain constant at the level observed around 1985 (a point in time intermediate between 1950 and 2020, the end of our projection period and reported in Mesa Lago, 1999); (iii) tax and replacement rates do not change with respect to those observed in the early 1980s (as reported in Mesa Lago, 1991); and (iv) contributions start, for all cohorts concerned, at the age of 20 years in our calculations, and continue without interruption until retirement, which occurs at age 60 in our estimations. The complete set of assumptions is given in appendix 1, along with a derivation of the following equations. The data used for the calculations are presented in Appendix 3.

Under these assumptions, the pension obligations to the economically active (Da) can be expressed, as a fraction of GDP, as follows:

$$Da = c \times s \times k \times Aa$$

where c = contribution rate (or pension tax rate); s = share of the wage mass in GDP; k = ratio of the number of workers ascribed to (i.e., covered by) the system to all wage-earners; Aa = discounted average number of contributing years of the active population.

Likewise, the debt to the currently retired (Dr):

$$Dr = r \times s \times k \times d \times Ar$$

where r = replacement rate (% of wages); d = dependency ratio of the unfunded system (retirees/active workers); Ar = discounted average expected number of retirement years per currently retired person, and the remaining variables are as previously defined. As indicated in appendix 1, both Aa and Ar are *weighted* discounted averages, with the weights given by the population in each one of the pertinent age groups.

Estimates based on this model are presented in table 1; they are valid for our “base” special case, where the discount rate is assumed to be equal to the rate of growth of wages¹. This table shows that the implicit pension debt is significant in most Latin American countries, even in some that have very young populations and low system coverage, such as the Dominican Republic, Ecuador, Honduras. The pension debt is substantial (over 20% of GDP) in most countries, and extremely large (over 200% of GDP) in those with more aged populations or high system coverage, such as Argentina, Uruguay and Brazil. It is interesting to note that, in most of the countries where data are available, the implicit pension debt is as large or, more often, several times greater than the official public debt: The ratio of the present estimates of pension debt to the official public debt, circa 1995, is 0.3 in Ecuador, 1.0 in Peru, 1.4 in Venezuela, 1.8 in Colombia, 4.4 in Brazil, 8.1 in Uruguay, 9.8 in Argentina and 11.4 in Chile. These data make us recall Auerbach et. al.’s (1991) observation that reported fiscal deficits (as well as the reported public debt) are strongly affected by the accounting conventions that may label some parts of government income and payments as tax-transfer or debt-amortization systems.

¹ The consequences of lifting this particular assumption are discussed in the next section.

Table 1
IMPLICIT PENSION DEBT IN LATIN AMERICAN COUNTRIES, CIRCA 1990
(Expressed as a percentage of GDP)

	Debt to economically active	Debt to retirees	Total Implicit Debt
Very high			
Argentina	230.6	74.8	305.4
Uruguay	193.3	96.1	289.4
Brazil	143.6	58.0	201.6
High			
Cuba	108.2	43.2	151.4
Panama	78.2	67.1	145.3
Chile	100.4	30.6	131.0
Costa Rica	51.7	42.3	93.9
Low			
Peru	29.9	14.6	44.5
Mexico	20.8	16.2	37.0
Venezuela	25.5	11.2	36.6
Paraguay	30.5	5.9	36.4
Colombia	19.9	14.8	34.8
Nicaragua	18.5	14.4	32.9
Bolivia	24.1	6.8	30.9
Guatemala	13.1	12.4	25.5
Dominican Republic	16.1	5.4	21.5
Very Low			
Ecuador	13.5	5.6	19.1
Honduras	7.5	7.9	15.4
El Salvador	3.7	5.0	8.7
Haiti	2.5	1.8	4.3

Notes: 1. Author's calculations, based on the equations for D_a and D_r given in the text above and aggregate data on tax and replacement rates, the number of covered workers and wage-earners as a proportion of the labor force, the share of wages in GDP, population and life tables, all of which are taken from official national sources. For more details on the data sources, see Uthoff and Bravo (1998); and Appendix 3. 2. These estimates assume that the discount rate (i) equals the rate of growth of wages (σ); table 3 reports on results where i may be equal or greater than σ .

Although several of the assumptions made in the model are crude and only good as a first approximation, it is worth noting that our estimates, when calculated with the same basic data and parameter values, come reasonably close to other estimates based on alternative, more elaborate and detailed procedures (see table 2). For example, Schmidt-Hebbel (1996), by use of a different method and different assumed parameters, reports estimates of the Colombian pension debt in a range between 59% and 88% of GDP, while our estimate is only 34.8%. However, when using the same parameters as the cited study, we get an estimate of 62.5%, which is within his estimated range. Our estimate of the pension debt of Chile, 131% of GDP, is not too far from the 126% figure given in Schmidt-Hebbel (1996, table 3.8). Our estimate for Brazil, 201.6% of GDP, is within the range of estimates provided by other studies, which go from 188% to 255% of GDP, depending on the assumptions made (Brazil, 1998). As a final example, we obtained the needed data to estimate the pension debt of France with our method, which gave a value of 225% close to that estimated by the OECD (216%).

Table 2

**COMPARASION OF ALTERNATIVE ESTIMATES OF IMPLICIT PENSION DEBT
IMPLICIT PENSION DEBT (% OF GDP), CIRCA 1990**

Country	ECLAC (1998)	Other studies	Sources
Brasil	202	188-255	Brasil, 1998
Chile	131	126 *	Arrau, 1991
Colombia	63	59-88 *	Schmidt-Hebbel, 1996
Francia	224	216	OECD, 1994

* Calculated by Schmidt-Hebbel (1996 and 1998) as the present value of the deficits derived from the region.

From our model, it is clear that demographic variables (basically, the population age structure and old-age mortality) affect the size of the debt, although as will be shown shortly, their impact is not as large as that of other (pension system, labor market) variables. The population age structure is represented directly in the system's "dependency ratio" (d =old-age over main working-age population) but it also enters in the calculation of the average number of contributing years of the active population (Aa) and of the expected number of retirement years per currently retired person (Ar). In the latter case, old-age mortality conditions determine the expected (life-table) number of years of life remaining to each of the cohorts presently in retirement ages.

By construction, the value of d is higher the more aged the population and the lower the mortality level. The value of Aa is higher the more aged the population, since there are relatively more people at ages where years of contributions are greater. Ar may be larger or *lower* in more aged, lower mortality settings: on the one hand, lower mortality implies higher life expectancy at most (or all) adult ages but, on the other hand, a more aged population structure means that the younger retirees (which have greater life expectancy) receive relatively lower population weights. Therefore, the resulting value of Ar , as well as the final "demographic" effect on the debt stock, depends on the particular combination of age structure and mortality at older ages in each country. As shown next, the positive aging effect (that operates through Aa and d) tends to dominate over the ambiguous interaction between mortality at older ages and population aging that operates through Ar .

One way to illustrate the magnitude of the demographic effects is to substitute extreme national aging and mortality values in place of the average values for the Latin American countries

considered. More specifically, we first construct a “benchmark” vector of indicators, defined as the mean value of each one of the intervening variables, and estimate a benchmark debt stock². Then, we recalculate the value of the debt using the highest and the lowest old-age mortality levels (those of Bolivia and Costa Rica, respectively) and the youngest and the oldest national age structures (those of Nicaragua and Uruguay, respectively). The basic population and mortality data used in the following calculations were taken from CELADE’s *Demographic Bulletin* (1994, 1997); the sources for the other indicators are given in Uthoff and Bravo (1998).

Figure 1 presents the results. They suggest that old-age mortality has a very small effect on the size of the debt: substituting Bolivia’s high mortality level instead of the Latin American “average” pattern, yields a pension debt a few percentage points lower. It hardly makes any difference if one uses Costa Rica’s low old-age mortality instead. This result is largely due to the fact that old-age mortality doesn’t vary as much in absolute values (which is what matters for the pension debt) as general mortality does within the region: life expectancy *at birth* was about 68.6 for Latin America in the early 90s, 76.3 in Costa Rica’s and 59.3 in Bolivia (a min to max difference of about 17 years), while life expectancy *at age 60* was about 18.9 for Latin America, 19.5 in Costa Rica and 15.2 in Bolivia, a min to max difference of only 4.3 years. In particular, note that Costa Rica’s old age mortality is only slightly lower than the Latin American average. Also, remember that old-age mortality only affects the part of the debt “owed” to the retirees, which is by far the smallest component of the total pension debt in almost all countries.

The population age structure plays a much more substantial role: using Nicaragua’s age distribution instead of that of Latin America as a whole, yields a pension debt more than 9 percentage points smaller, and using the more aged structure of Uruguay, the debt goes up more than 40 percentage points. A slightly more “realistic” comparison is that represented in the last two bars of figure 1, where the complete demographic configuration (age distribution and old-age mortality) of Nicaragua and Uruguay are contrasted, giving a result almost identical to the previous one: a difference in the debt stock (of about 40%) that may well be sufficient to turn a fiscally “manageable” pension debt into an unmanageable one.

It is important to note here that changes in the other pension system, and labor-market factors have an even larger potential of affecting the debt stock: if Nicaragua had Argentina’s age structure, its implicit debt would increase by more than half of its current value, but it would almost double if it had Argentina’s population coverage, and it would more than quadruple if it had Argentina’s social security tax rate (Uthoff and Bravo, 1998).

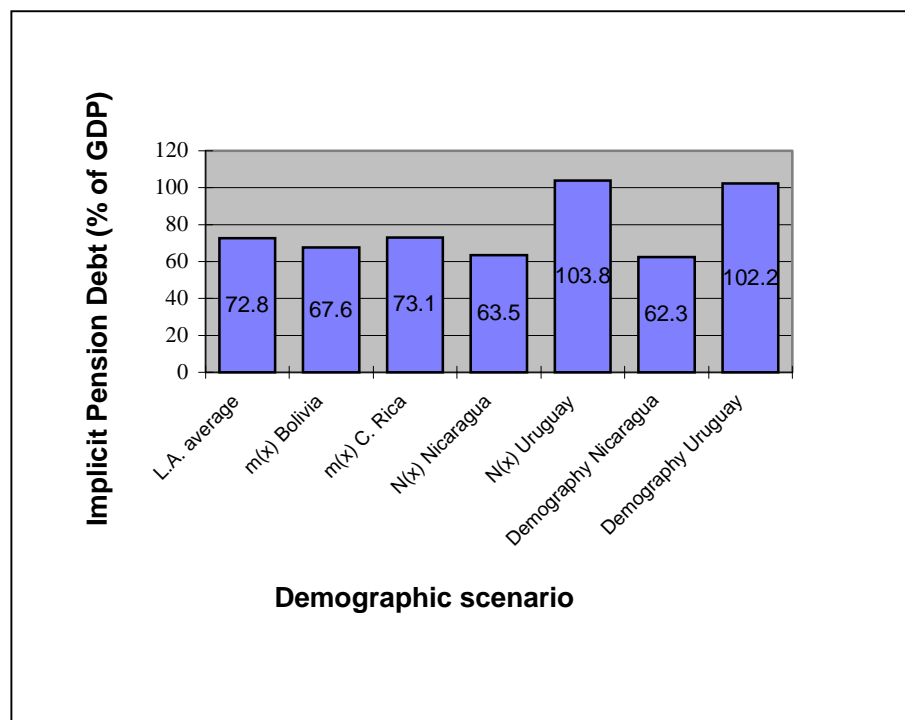
The potential demographic effect, on the other hand, weighs more heavily in the determination of the debt than some macroeconomic/policy variables. One such variable is the discount rate used by the government to express past contributions and future benefits in common present values. For this discount rate to have an effect comparable to that of the population age structure, it would have to be more than 2% higher than the rate of growth of wages, which is a relatively high value. Also, although subject to some uncertainty, medium term demographic changes are relatively more predictable: current projections show that population aging in Latin America will, in all probability, proceed at an accelerated pace from the 1990’s onwards.³

² For most variables in table 2 (in all cases except for *Aa*, *Ar* and *d*), unweighted means of the national observations were used to estimate the “Latin American average” benchmark pattern. In the case of the system dependency ratio and of the average number of years of contribution and retirement, the age structure of the Latin American population was used in the calculations. The “average” old-age life expectancy pattern (the e_x schedule, for $x=60$ and up) was computed as the mean life expectancies of Brazil and Mexico, which together comprise more than half of the Latin American population and closely represent the average level and pattern of regional mortality.

³ While it took 40 years, from 1950 to 1990, for the ratio of the older (60 and over) to the younger (15-59) adults in the region to increase merely 1.9 percentage points, from 10.7% to 12.6%; in the next 30 years, from 1990 to 2020, this ratio is projected to increase more than 7 percentage points, from 12.6% to 19.8% (see CELADE/IDB, 1996, table VI.4).

Figure 1

SENSITIVITY OF PENSION DEBT TO OLD-AGE MORTALITY AND AGE STRUCTURE



III. Transitional fiscal costs under different policy options

The extent to which the pension debt in any given country is “manageable” or not depends on many factors. A basic and central one is the sheer size of the debt, that in turn is affected, as we have just seen, by demographic and labor market factors. But the fiscal costs involved also depend crucially on some key macroeconomic and policy variables, like the growth rate of GDP, the rate of interest paid on the public debt, the financing mechanisms and other specific aspects of the reform.

As regards to the size of the debt, several strategies have been proposed and used to reduce that part of the implicit debt that is made explicit (Holzmann, 1997b)⁴: changes in benefits and eligibility conditions, introducing only partial funding, minimizing incentives to move to funded scheme, and introducing a contribution-defined scheme, maintaining the PAYG financing mechanism. We will come back to some of these strategies after examining our theoretical “base-case scenario” estimates of the transitional costs.

Table 3 illustrates the magnitudes of the fiscal costs that would be required, were the (full) implicit pension debt paid over a period of 40 years (which is roughly the time needed for the reformed pension system to end its transition), with an annual rate of GDP growth around 4% and different assumptions regarding Δ , the difference between the discount rate and the rate of growth of wages.

⁴ For a more detailed discussion of the different options, see also Uthoff and Bravo (1998).

Table 3

AMORTIZATION OF THE IMPLICIT PENSION DEBT, ACCORDING TO DIFFERENT VALUES OF THE RATE OF GROWTH OF GDP (g) AND OF THE DISCOUNT RATE-WAGE GROWTH RATE DIFFERENTIAL (Δ)
(Constant annual amount, as a percentage of GDP)

	g								
	3%			4%			5%		
	Δ								
	0%	1%	2%	0%	1%	2%	0%	1%	2%
Argentina	5.54	8.17	12.21	5.56	8.17	12.20	5.58	8.18	12.19
Uruguay	6.21	8.83	12.81	6.22	8.83	12.79	6.23	8.82	12.76
Brasil	3.52	5.02	7.30	3.53	5.03	7.30	3.55	5.04	7.29
Cuba	3.26	4.62	6.69	3.26	4.62	6.68	3.27	4.62	6.66
Panama	2.31	3.12	4.33	2.32	3.13	4.33	2.33	3.14	4.33
Chile	2.18	3.20	4.76	2.19	3.21	4.76	2.20	3.21	4.76
Costa Rica	1.38	1.87	2.60	1.38	1.88	2.61	1.39	1.88	2.61
Peru	0.67	0.97	1.41	0.68	0.97	1.41	0.68	0.97	1.41
Mexico	0.58	0.79	1.10	0.58	0.79	1.10	0.59	0.79	1.10
Venezuela	0.53	0.75	1.10	0.53	0.76	1.10	0.53	0.76	1.10
Paraguay	0.49	0.74	1.12	0.49	0.74	1.12	0.50	0.74	1.12
Colombia	0.57	0.78	1.08	0.57	0.78	1.08	0.57	0.78	1.08
Nicaragua	0.41	0.56	0.79	0.41	0.56	0.79	0.41	0.57	0.80
Bolivia	0.41	0.61	0.92	0.41	0.61	0.93	0.41	0.61	0.93
Guatemala	0.29	0.39	0.55	0.29	0.39	0.55	0.29	0.40	0.55
Rep. Dominicana	0.35	0.50	0.74	0.35	0.50	0.74	0.35	0.51	0.74
Ecuador	0.27	0.39	0.57	0.27	0.39	0.57	0.27	0.39	0.57
Honduras	0.18	0.25	0.34	0.19	0.25	0.34	0.19	0.25	0.34
El Salvador	0.11	0.15	0.20	0.11	0.15	0.20	0.11	0.15	0.20
Haiti	0.07	0.09	0.13	0.07	0.09	0.13	0.07	0.09	0.13

Notes: 1. Author's calculations, using formula given in appendix 2; 2. All of the figures in this table assume a payment period of 40 years. It is assumed, additionally, that the share of wages in GDP stays constant over the relevant time period. Consistency with the debt stock equations implies that, for a given rate of growth of the labor force (n_L) and a discount rate-wage growth rate differential (Δ), the discount rate (i) must satisfy $i = g - n_L + \Delta$. For the calculations in this table, g and Δ are let to vary over the shown range, while the data for n_L were taken from CELADE (1996) national projections for the period 1990-2025.

The reading of this table is similar to that of table 1: the annual fiscal costs appear to be small to “manageable” (under 1.5% of GDP per year) in the countries in the “Low” and “Very Low” debt groups; they are quite substantial—from 1.4% to 6.7% of GDP—in the “High” debt group (Cuba, Panama, Chile, Costa Rica), and seem to be overly high for Argentina and Uruguay: these countries would need to make a financial effort equivalent to 6% to 13% of GDP (depending on assumptions) over a period of 40 years to pay off the full U-F transition costs. Note that the fiscal costs (as a fraction of GDP) do not vary significantly with the *level* of GDP growth; what matters the most is its *difference* with respect to the discount (or interest) rate: a discount rate 2% greater than GDP growth more than doubles the fiscal costs in many cases, with respect to the case where $i=g$.

These numbers refer to the *average*, over a 40 year period; in actual transitions, the fiscal costs vary over time, depending on the stipulations regarding the payment of the pension debt and the financing mechanisms.⁵

We next discuss briefly the observed and projected trajectories of the transitional deficit of Chile, Argentina and Bolivia according to our estimates (table 2) and those from other sources. These countries were chosen for discussion because they have different demographic characteristics and represent two types of reforms. The age structure of the population of Bolivia is quite young, it is intermediate to aging in Chile, and is more aged in Argentina. The U-F switch is complete in Chile and Bolivia, and partial in Argentina.

By Latin American standards, *Chile* has a moderately aged population, and a relatively large pension debt that implies very substantial transitional fiscal costs: the government needs to confront an implicit debt of the order of 130% of GDP, which in turn requires, according to our estimates, payments of about 2% to 5% of GDP for 40 years. The effective fiscal outlays have fluctuated from 3.8% to 7.8% during the first 18 years since the reform, although the government projections suggest that they should converge towards zero over the next 30 years or so (AIOSFP, figure II.4). The Chilean transition has required a very important effort of fiscal discipline, including sacrifices in other items of government spending, in health, education and housing (Uthoff and Bravo, 1998, table 3), and has been facilitated by the very favorable macroeconomic performance from the mid-eighties to the present. Since not all countries in the region are in a similarly positive footing to confront these costs, it is important that governments carefully weigh the fiscal obligations that this type of reform implies.

Argentina, although it has a more aged population distribution and one of the most mature and high-cost social security systems in the region, is expected to experience smaller transition costs: according to one government estimate (AIOSFP, figure II.4), the annual transitional deficits would be no larger than 2% of GDP, and are even projected to yield a *surplus* after the year 2003. This is due in part to the fact that the Argentinean reform only partially switches to funding, retaining an important PAYG component. Also, the Argentinean reform specified the payment of *Da*, the debt owed to those economically active at the time of the reform, to be spread out gradually over the cohort’s retirement life span, as a complement to their pension benefits (in the form of a “*prestación compensatoria*”), and not as a one-time payment at the moment of retirement, as in Chile and Peru (AIOSFP, 1996, chapter II; Arenas and Bertranou, 1997)⁶, Bolivia and Colombia. Given the new eligibility conditions of the Argentinean reform, it is very difficult to accurately project the level and time trajectory of the transitional costs, although it is clear that they will be

⁵ Two main financing mechanisms are (current) taxes and the issuance of new official public debt (i.e., future taxes). The financing mix affects both the amortization program and the distribution of the transitional costs over the present and future generations of taxpayers. These intergenerational distribution effects are important, but will not be discussed here in any detail; the reader is referred to Arrau, 1991; Schmidt-Hebbel, 1996; Cifuentes, 1995; Rofman, 1997.

⁶ Contrary to Peru, however, in Chile the “recognition bond” that is given in compensation for the worker’s past contributions earns an interest of 4% per year. In Peru, the value of the bond is adjusted by inflation until it is transferred to the worker’s private account, but earns no real interest.

spread over a much longer period of time than in most of the other reform countries. In order to attempt a more realistic estimate of the transition costs, we made a slight adaptation to our model to take into account the proportion of the economically active population that has chosen the funded subsystem as well as the percentage of the contributions that finance the funded pillar. Incorporating these extra parameters in the model, we obtain (uniform) annual transitional costs in the range of 2% to 4% of GDP. These estimates lie just above the AIOSFP projected trajectory; the difference could be due to the many different elements of the two estimation procedures.

Finally, transitional costs in *Bolivia* (UDAPE, 1997) are expected to show a time trajectory similar to that of Chile, since the Bolivian reform followed the Chilean stipulations of a complete U-F substitution and a maturation of the bonds issued for the compensation for past contributions (*bonos de reconocimiento*) at the time of retirement. The overall level of the deficits, however, is much lower (of the order of 0.4% to 0.9% of GDP, according to our estimates), given Bolivia's lower contribution rate and system coverage (only about 23% of the labor force is covered by the social security system), its lower life expectancy at older ages and its younger population structure.

When the fiscal obligations that the U-F reform requires are added onto insufficiently solvent or stable government budgets there is a substantial risk of governmental default on parts of the pension rights owed to workers and retirees. For example, in Argentina the automatic inflation adjustment of the "prestación compensatoria" (the benefit given in compensation for past contributions) was eliminated; this happened only 2 years after the reform, in a country with an aged population and where retiree groups are well organized and active. Later, in 1996, a new decree even vanished the *AMPO*, the reference average wage that the reform law established as the basis for the calculation of the (compensatory) benefit. In Bolivia, just 2 years after the reform and in spite of its relatively low debt and transition costs, the new government drastically modified the level and the form of payment of the old-age benefit Bonosol. An annual benefit of about 240 U.S. dollars for all those aged 65 and older established in the 1996 reform, was redefined by a new law passed in June, 1998, into a 90 dollar benefit payable to all those 50 years and older, and this only starting in the year 2000 (the new law also stipulates an additional benefit, payable in the form of stock options). In Chile, the annual inflation-based adjustment to pensions still payable under the "old" (unfunded) regime, face the negotiation and approval in the Senate, where the decision on the level of the adjustment falls within the realm of fiscal policy considerations.

IV. Discussion and conclusions

In concluding, we briefly review the main ideas that we want to emphasize in this paper.

Social security reforms that introduce a funded component to the system must make explicit part or the whole of the implicit social security debt, owed to the workers and retirees ascribed to the system. A *complete* substitution to the funded scheme (as dictated by the reforms in Chile, Mexico and Bolivia) implies that the government must take upon itself to pay very substantial government liabilities, that could be unbearably high in some countries; for example, they would be almost certainly unsustainable in Argentina, Uruguay and Brazil. This is an aspect often downplayed in reform discussions, which in their most optimistic presentations even advance the presumption that the U-F reform will alleviate the fiscal social security burden, which we argue is not warranted.

The implicit pension debt is, not surprisingly, larger in countries with lower old-age mortality and more aged populations, although pension system and labor-market variables tend to have larger effects on the size of the debt stock and the associated fiscal costs in the countries studied. The small old-age mortality effects estimated for the Latin American countries is a reflection of the relatively small differences in adult mortality across countries within the region. Future progress in mortality levels would make these effects more substantial, and old-age mortality would evidently be much greater a factor in more developed countries that could embark on U-F reforms. Population aging plays, and will continue to play, an important role in the determination of the size of the implicit debt and the associated fiscal costs in all countries.

Although we have estimated the implicit pension debt with a uniform methodology and data base, it is important to note that neither the size of the debt that is made explicit nor the amortization program are absolutely given, since they can and in fact have been shaped by policy. The fiscal costs are also determined by the strategies that governments follow regarding the relative importance of the funding component and the way they make explicit the implicit pension debt. Reform countries have followed different variants that tend to make the payment of the transitional costs viable and more bearable.

Along these lines, many countries in Latin America have made only a *partial* switch to funding (all the recent reforms, except those of Chile, Mexico and Bolivia), which is specially important in countries with mature, broad-coverage pension systems and aged populations, such as Argentina and Uruguay. The implementation of the Chilean reform has been made possible by a very favorable macroeconomic performance thus far, and by actively introducing needed adaptations in the financial market regulatory framework (Arrau, 1996), and has required a substantial effort of fiscal discipline. Thus other countries are well advised to carefully weigh the fiscal costs that this policy requires.

In most cases within the region, *changes in benefits and eligibility conditions* have been introduced concurrently with the funding mechanism, in the direction of reducing fiscal obligations. This is, in fact, equivalent to a cancellation of a portion of the implicit debt, even before it is made explicit and begins to be disbursed by the State. In some cases, the payment of the compensation for past contributions of the economically has been spread out over the entire retirement life span, has also contributed to dampen fiscal costs over time. Unfortunately, in some cases, the alleviation of public budgets has been obtained after enacting the reforms, at the cost of an outright default on workers and retirees pension rights.

Finally, it is worth mentioning other possible reform options, such as those recently implemented in Italy, Sweden and Latvia, which introduce contribution-defined mechanisms into the existing unfunded (tax-transfer) system. This scheme allows for the (“notional”) capitalization of contributions at a rate equivalent to the rate of growth of the wage mass, providing actuarially fair benefits across cohorts (Holzmann, 1997a; Bravo, 1996; De Santis, 1997), without the need of introducing funding. Like in the funded system, in this scheme benefits adjust, to a large extent, endogenously to changes in old-age survivorship and population aging.

Since the funded “pillars” are almost always contribution-defined, they can be more easily integrated into this kind of design. This option could be attractive for many Latin American countries that are not able to absorb the transitional costs that a full U-F reform implies, or that have political, financial market, demographic or other constraints. For example, and for different reasons, this could be an interesting option for countries like Brazil, Costa Rica or Paraguay.

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Appendix

Appendix 1

Derivation of the Equations of the Implicit Pension Debt

According to the definition of section 2 of the paper, the implicit pension debt at a given time t , $D(t)$, is equivalent to the present value of the contributions made by the economically active, $D_a(t)$, plus the present value of the expected benefits of the retirees, $D_r(t)$:

$$D(t) = D_a(t) + D_r(t) \quad (1)$$

We express D_a , D_r and D as a fraction of the Gross Domestic Product (GDP).

1. Debt to the presently active

We assume that the contributions start at age 20 and take place continuously until retirement, at age 60. The contribution (or tax) rate c is the same for all workers and it is assumed to stay constant over time. Wages w grow at an annual rate σ , but the age (x) profile is flat, that is to say, $w(x,t)=w(t)=w(0)\exp(\sigma t)$, for all x, t .

The present value (PV) of the contributions made by workers currently age 20 to 24 (${}_5C_{20}$) at time t is, to a good approximation⁷:

$$PV({}_5C_{20}, t) = 2.5cw(t - 1.25) {}_5q_{20}(t - 1.25) {}_5N_{20}(t) \exp(1.25i) \quad (2)$$

where ${}_5q_{20}(t)$ is the number of covered workers aged 20 to 24, ${}_5Q_{20}(t)$, divided by the population aged 20 to 24, ${}_5N_{20}(t)$ at t , and i is the discount (or interest) rate. From here on, it will be assumed that the quotients q are the same for all ages and do not vary over time; i.e., ${}_5q_{20}(t) = {}_5q_{25}(t) = \dots = {}_5q_{55}(t) = Q(t)/N_a(t) = q$ for all t , where Q is the total number of contributors and N_a is the working age population. We will also let the interest differ with respect to σ in an amount equal to Δ ; i.e, $i=\sigma+\Delta$.

Eliminating the time subscripts, the assumptions made imply that:

$$PV({}_5C_{20}) = 2.5cw \exp(-1.25\sigma) q {}_5N_{20} \exp(1.25i) = 2.5cwq {}_5N_{20} \exp(1.25\Delta) \quad (3)$$

Following the same reasoning,

$$PV({}_5C_{25}) = 7.5cwq {}_5N_{25} \exp(3.75\Delta) \quad (4)$$

And, in general,

$$PV({}_5C_x) = (x - 17.5) cwq {}_5N_x \exp((x - 17.5) / 2) \Delta \quad (5)$$

for any age $x \in (20, 55)$. Now we aggregate the present value of contributions made by all those currently of working age:

$$\sum_{x=20}^{55} PV({}_5C_x) = \sum_{x=20}^{55} (x - 17.5) cwq {}_5N_x \exp((x - 17.5) / 2) \Delta = cwq \sum_{x=20}^{55} (x - 17.5) {}_5N_x \exp((x - 17.5) / 2) \Delta \quad (6)$$

⁷ The exponential adjustment factors from this equation onwards, are used for computational convenience only; geometric-discrete factors are in fact more consistent with the discrete-time specification. Nonetheless, the alternative specifications do not affect the final results in any significant way.

Since $q=Q/N_a$ and the debt to the active D_a is expressed as a fraction of GDP (Y), then

$$D_a = \frac{c w Q \sum_{x=20}^{55} \frac{(x-17.5)^5 N_x \exp([x-17.5]/2)\Delta}{N_a}}{Y} \quad (7)$$

Denoting $A_a = \sum_{x=20}^{55} \frac{(x-17.5)^5 N_x \exp([x-17.5]/2)\Delta}{N_a}$ the (discounted) average number of years of contributions of the currently economically active, and multiplying the right-hand side of (7) by S/S (where S =number of wage-earners), we find that

$$D_a = c \frac{wS}{Y} \frac{Q}{S} A_a \quad (8)$$

Further calling $s = wS/Y$ the share of wages in GDP and $k = Q/S$ the quotient of covered workers over wage-earners, we finally obtain

$$D_a = c \times s \times k \times A_a \quad (9)$$

2. Debt to the retirees

Pensions are calculated as the product of the replacement rate r by the base salary. Assuming that pensions are adjusted according to the contemporary level of wages, by operating as in **I**, it can be verified that the present value of the expected benefits of retirees currently aged x to $x+5$, ${}_sB_x$, is, approximately

$$PV({}_sB_x) = r w \exp(({}_sE_x/2)\sigma) q {}_sN_x \times {}_sE_x \exp(-({}_sE_x/2)i) = r w q {}_sN_x \times {}_sE_x \exp(-({}_sE_x/2)\Delta) \quad (10)$$

where ${}_sE_x$ is the mean life expectancy of persons aged x to $x+5$. Equation (10) is valid for any age $x \in (60, \omega-5)$, where ω is the maximum life span.

The debt to the currently retired, therefore, is:

$$D_r = \frac{\sum_{x=60}^{\omega-5} r w q {}_sN_x \times {}_sE_x \exp(-({}_sE_x/2)\Delta)}{Y} \quad (11)$$

Recalling that $q=Q/N_a$ and multiplying the right hand side of (11) by S/S and by N_r/N_r (where N_r =number of persons in retirement ages),

$$D_r = \frac{r w Q \sum_{x=60}^{\omega-5} \frac{{}_sN_x \times {}_sE_x \exp(-({}_sE_x/2)\Delta)}{N_r} \frac{N_r}{N_a}}{Y} = r \frac{wS}{Y} \frac{Q}{S} \frac{N_r}{N_a} A_r \quad (12)$$

where A_r is the (discounted) average number of years that those aged 60 and over are expected to live in retirement. Letting $d=N_r/N_a$ be the demographic dependency ratio of the unfunded system and recalling the previously given definitions, we finally have:

$$D_r = r \times s \times k \times d \times A_r \quad (13)$$

Appendix 2

Amortization of the implicit pension debt

As explained in the text, we assume a uniform amortization schedule, that is to say, annual payments that are a constant fraction p of GDP. GDP (also denoted by Y) is assumed to grow at an annual rate g , i.e., $Y_t = Y_0(1+g)^t$. In order to find the value of p , we write down the present value of the debt (D) as a function of p , g , i and the number of periods of payment n :

$$D = \frac{1}{Y_0} [pY_1(1+i)^{-1} + pY_2(1+i)^{-2} + \dots + pY_n(1+i)^{-n}] = p \left[\left(\frac{1+g}{1+i} \right) + \left(\frac{1+g}{1+i} \right)^2 + \dots + \left(\frac{1+g}{1+i} \right)^n \right] \Rightarrow$$

$$D = p[a + a^2 + \dots + a^n] \tag{1}$$

where $a = (1+g)/(1+i)$. Dividing both sides of (1) by a results in

$$\frac{D}{a} = p[1 + a + a^2 + \dots + a^{n-1}]. \tag{2}$$

Subtracting (2) - (1) yields

$$D \left[\frac{1}{a} - 1 \right] = p[1 - a^n] \tag{3}$$

and therefore

$$p = D \left[\frac{1-a}{a(1-a^n)} \right] \tag{4}$$

for all $a \neq 1$. For $a = 1$ (i.e., $i=g$), straightforward substitution in (1) gives $p = D/n$.

Appendix 3

Basic Statistical Data

	Contribution Rate (%)	Wage Share (% of GDP)	Labour Force Coverage (%)	Salaried Labour Force	Replacement Rate (%)	Demographic Dependency Ratio
Argentina	35.0	33.3*	79.0	71.2	70.0	0.27
Uruguay	25.0	39.8	73.0	69.4	65.0	0.33
Brasil	20.0	34.7	87.0	65.3	70.0	0.14
Cuba	20.2*	33.3*	93.0	94.1	50.0	0.21
Panama	9.0	52.1	69.0	63.3	60.0	0.16
Chile	20.2	33.3	62.0	66.7	50.0	0.17
Costa Rica	7.5	50.6	68.0	75.2	55.0	0.13
Perú	10.0	26.7	39.0	53.5	50.0	0.14
Mexico	6.0	29.5	42.0	53.5	40.0	0.14
Venezuela	6.5	30.7	54.0	64.1	30.0	0.12
Paraguay	22.5	24.3	14.0	36.7	42.0	0.13
Colombia	6.5	37.4	30.0	53.5	45.0	0.13
Nicaragua	5.5	33.3*	32.0	45.4	45.0	0.11
Bolivia	9.5	33.3*	18.0	38.2	30.0	0.14
Guatemala	4.5	33.3*	27.0	46.9	40.0	0.13
Rep. Dominicana	12.0	33.3*	14.0	51.3	40.0	0.12
Ecuador	12.0	13.6	26.0	47.6	44.0	0.14
Honduras	4.0	45.0	13.0	45.4	40.0	0.12
El salvador	3.5	34.1	12.0	59.2	40.0	0.15
Haiti	4.0	33.3*	2.0	16.6	33.0	0.14

Note: Where data was missing, the value of the chilean variables were used.

Appendix 4

discount rate	Present value of contribution years (Aa)		Present value of retirement years (Ar)	
	0%	2%	0%	2%
Argentina	17.8	29.9	10.7	8.4
Uruguay	18.5	31.4	10.7	8.4
Brasil	15.5	25.0	12.8	9.7
Cuba	16.3	26.8	12.5	9.4
Panamá	15.3	24.6	12.3	9.4
Chile	16.1	26.1	11.6	9.0
Costa rica	15.1	24.1	12.9	9.7
Peru	15.4	24.9	10.7	8.4
México	14.9	24.0	12.5	9.4
Venezuela	15.1	24.2	12.0	9.2
Paraguay	14.6	23.2	11.7	9.0
Colombia	14.6	23.2	12.1	9.3
Nicaragua	14.3	22.8	12.4	9.5
Bolivia	16.2	26.3	10.4	9.3
Guatemala	15.1	24.5	12.5	9.5
R. Dominicana	14.8	23.6	12.4	9.4
Ecuador	15.1	24.2	12.2	9.3
Honduras	14.5	23.2	12.8	9.6
El salvador	15.1	25.0	12.2	9.3
Haití	15.4	25.0	9.9	8.0

Source: author's estimations based on the equations given in Appendix1 and CELADE's demographic data, 1998.



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