Public Pension Expenditures in Latin America and Projections to 2075: Evidence from Chile, Peru, Colombia, and Mexico

Noelia Bernal*

Universidad del Pacífico, Lima

Abstract

This paper analyzes the main factors behind pension expenditures and projects their evolution to 2075 in four Latin American countries: Chile, Peru, Colombia, and Mexico. Pension expenditures are defined as those included in the national budget and allocated to specific benefit plans and to non-contributory pensions. Using a model developed by Clements *et al.* (2013), it was found that, currently, expenditures are between 1.8 and 6.4 percent of GDP. However, they will rise between 2 and 4 times by 2075, mainly due to population aging. Two simulations were conducted. The first boosted the aging process while the second assumed universal coverage of non-contributory pensions. Expenditures significantly increased in both scenarios and it is recommended that countries pay more attention to aging and its consequences in the long run, especially to the fiscal sustainability of pension systems, in order to permanently estimate pension liabilities, improve accounting, and to build up reserve funds.

Key words: Social security; public pension expenditure; aging; defined benefit; non-contributory pensions.

* Article received on December 11, 2015; final version approved on June 25, 2016.
Noelia Bernal holds a Ph.D. from Tilburg University and is currently a professor and researcher at Universidad del Pacífico. He has worked as a consultant at the Labor Markets and Social Security Unit of the Inter-American Development Bank, and at the Directorate of Foreign Affairs of the Ministry of Economy and Finance, Peru. he has also been a researcher at the Ministry of Labor and Social Affairs in the Netherlands. Foremost among his areas of interest are labor markets, health economics, intra-family decisions, and public policy.
Email: n.bernall@up.edu.pe

Vol. XLIII, N° 79, Second Semestre 2016: pages 79-128 / ISSN 0252-1865
DOI: http://dx.doi.org/10.21678/apuntes.79.867

Acronyms

Afore	Administradora de Fondos para el Retiro, México
AFORES	Retirement Fund Administrators, (Administradora de Fondos para el Retiro,), Mexico
AFP	Retirement Fund Administrators (Administradora de Fondos de Pensiones), Peru
APS	Aporte previsional solidario (Solidarity pension contribution), Chile
APV	Voluntary pension savings (Ahorro previsional voluntario)
CANAEMPU	Caja Nacional de Empleados Públicos y Periodistas (National Civil Servants and Journalists Fund), Chile
CAPREDENA	National Defense Pension Fund (Caja de Previsión de la Defensa Nacional), Chile
CEPAL	Economic Commission for Latin America and the Caribbean (Comisión Económica para América Latina y el Caribe)
CFE	Federal Electricity Commission (Comisión Federal de Electricidad), México
CONSAR	National Commission for the Retirement Savings System (Comisión Nacional del Sistema de Ahorro para el Retiro), México
DB	Defined benefit
DIPRECA	Carbineros Pension Directorate (Dirección de Previsión de Carabineros), Chile
DC	Defined contribution
DL	Decree-Law, Peru
EAP	Economically active population
EMPART	Private Employees Pension Fund (Caja de Previsión de Empleados Particulares), Chile
FGPM	Minimum Pension Guaranty Fund (Fondo de Garantía de Pensión Mínima), Colombia
FONPET	National Territorial Authorities Pension Fund (Fondo Nacional de Pensiones de Entidades Territoriales), Colombia
FSP	Pension Solidarity Fund (Fondo de Solidaridad Pensional), Colombia
GDP	Gross domestic product
GEPM	State minimum pension guarantees (Garantías estatales de pensión mínima), Chile
IBL	Base income for calculating pension payment (Ingreso base de liquidación), Colombia
IFA	Financial and Actuarial Institute (Instituto Financiero y Actuarial).
IMSS	Instituto Mexicano de Seguridad Social (Mexican Social Security Institute)
IMSS-RJP	Mexican Social Security Institute - Retirement and Pensions Scheme (Instituto Mexicano de Seguridad Social - Régimen de Jubilaciones y Pensiones)

INP	Instituto de Normalización Previsional (Pension Standardization Institute), Chile
IPS	Instituto de Previsión Social (Social Welfare Institute), Chile
ISS	Instituto de Previsión Social (Social Welfare Institute), Colombia
ISSFAM	Social Security Institute for the Armed Forces (Instituto de Seguridad Social para las Fuerzas Armadas), Mexico
ISSSTE	Institute of Social Security and Services for State Workers (Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado), Mexico
MIDIS	Ministry of Development and Social Inclusion (Ministerio de Desarrollo e Inclusión Social), Peru
MW	Minimum wage
NCP	Non-contributory pensions
NPV	Net actuarial present value
ONP	Pension Normalization Office (Oficina de Normalización Previsional), Peru
PASIS	Welfare pension (Pensión asistencial), Chile
PBS	Pensión Básica Solidaria (Basic Solidarity Pension), Chile
PEMEX	Petróleos Mexicanos
PPSAM	Senior Citizen Social Protection Program (Programa de Protección Social al Adulto Mayor), Colombia
PV	Present Value
RAIS	Solidarity-Based Individual Saving Scheme (Régimen de Ahorro Individual con Solidaridad), Colombia
RB	Recognition bond
RCV	Retirement, redundancy and old-age (Retiro, cesantía y vejez), Mexico
RPM	Average Premium Scheme (Régimen de Prima Media), Colombia
SBC	Base income for contribution (Salario base de cotización), México
SEDESOL	Secretariat of Social Development (Secretaría de Desarrollo Social), Mexico
SGP	General Pension System (Sistema Nacional de Pensiones), Colombia
SISBEN	Beneficiary Selection System for Social Programs (Sistema de Selección de Beneficiarios para Programas Sociales), Colombia
SMLV	Current statutory minimum wage (Salario mínimo legal vigente), Colombia
SNP	National Pension System (Sistema Nacional de Pensiones), Peru
SP	Pension Superintendency (Superintendencia de Pensiones), Chile
SPP	Private Pension System, Chile and Peru
SPS	Solidarity Pension System (Sistema de Pensiones Solidarias), Chile
SSS	Social Security Service (Servicio de Seguro Social), Chile
TFR	Total fertility rate
UIT	Tax unit (Unidad impositiva tributaria), Peru

1. INTRODUCTION

After going through periods of macroeconomic instability, high rates of inflation, and high levels of poverty and inequality in the 1980s, the situation in Latin America and the Caribbean improved considerably in the subsequent decades. According to Levy and Schady (2013), the countries in the region have exercised better monetary policy management, with substantially lower fiscal deficits and improved public debt management compared with that observed in the 1980s. This improved administration of their economic policies left the countries better equipped to tackle the 2008-2009 financial crisis, unlike on other prior occasions.

In addition to these macroeconomic management achievements, there have also been advances on the microeconomic front. It can be seen, for example, that poverty - a measure of the percentage of individuals who live on less than 2.5 dollars per day - has fallen across virtually all countries and, taken as a whole, dropped in the region from 26.8% to 13.3% in the period 1996-2011. The reduction in levels of inequality is also notable. In 2000, the Gini coefficient was close to 0.55 for most countries, while by 2011 it had fallen by some six percentage points to 0.49 (Levy and Schady 2013).[1]

These achievements have been accompanied by an increase in public social spending. According to CEPAL (2013c), this is now a priority area, having increased from 50% of all expenditures in 1992-1993 to 65.9% in the period 2010-2011. As a percentage of gross domestic product (GDP), this spending has increased systematically in recent decades, having gone from 12.5% to 19.2% of GDP in the same period. Of this spending, one type of program has gained most in prominence is non-contributory pensions (NCPs). NCPs are financial transfers that the state disburses to population groups not covered by the contributory pension system. Recipients are generally poor, elderly, and subject to means testing.[2]

In this research, we focus on spending on such programs, which we analyze alongside traditional pension systems. These expenditures are relevant because they account for a

1. In the case of non-monetary measures of wellbeing, significant reductions in rates of maternal and infant mortality and in levels of chronic malnutrition have also been observed. Moreover, the region posted marked improvements in school attendance rates and in the number of years of education, as well as a reduction in the gender gap for child educational attainment and health conditions. Between 1990 and 2000, the infant mortality rate in Latin America went from 120 to 60 deaths per 1,000 children born, while maternal mortality fell from 50 to 25 deaths per 100,000 births. Finally, chronic malnutrition among children below the age of five decreased from 25% to 12% of the population.
2. A fuller description of NCPs is provided in Annex A.

significant proportion of public social spending (around 30.0%, on average). We analyze their determinants, their evolution over the period 2005-2014, and their long-term projections. Four countries in the region will be used in this analysis: Chile, Peru, Colombia, and Mexico, for which we adopt the projection model of Clements et al. (2013). We find that countries already spend between 1.8% and 6.4% of their GDP on pensions, and that this expenditure is expected to increase significantly - between two- and fourfold - by 2075.

Moreover, this study finds that the rise in costs depends not only on external factors such as population, but also on internal factors determined by the policies of the countries themselves, such as the role of defined-benefit (DB) systems and their maturation, the generosity of pension rules, how these are related to defined-contribution (DC) systems, and policies related to NCPs.

Our analysis places special emphasis on population aging and its long-term consequences. At present, the region has a relatively young population, but projections suggest that the population over the age of 65 will more than triple in the long term, which will necessarily increase spending on pensions (Bosch et al. 2013).

Another key factor in explaining the spending trend in the countries analyzed lies in the continued importance of DB systems and their maturation. For example, decisions by governments on whether to keep these systems open or closed, or to extend or reduce their scope as part of coverage-expansion policies, has a direct impact on spending. Similarly, another internal factor that determines spending levels is the generosity of DB-system parameters (e.g., retirement age, years of contributions, and replacement rates, among others). Overall, it is observed that the more generous these parameters are, the higher the spending on the systems will be (see for example the cases of Colombia and Mexico).

Moreover, spending also increases because of NCP programs. As at 2015, all the countries analyzed had implemented programs of this kind. Chile and Mexico have the most extensive coverage, and therefore spend the most. Peru and Colombia, for their part, are still expanding their coverage, so their expenditure is relatively limited. By 2075, our projections show that - as with DB systems - aging will exert upward pressure on spending on these programs, prompting a fivefold increase in the case of Chile, Colombia, and Mexico, and a nine fold rise in the case of Peru.

In this study, we also perform two simulations. The first assumes a more pronounced aging scenario (external shock), and the second, the universalization of NCPs (internal shock). Both scenarios are important because they enable analysis of what would happen

to public spending given the occurrence of a demographic shock, which is exogenous to the countries, or an internal shock, which arises out of the decisions of a given country through a public policy that extends NCPs. We find that pension spending is sensitive to these shocks. Lower fertility rates within the population and consequent faster aging means that countries should allocate even more funding to their pensions, especially to DB systems. Moreover, public policies that extend NCPs to the entire adult population imply escalating commitments in the long run, which in many cases are not projected or budgeted properly.

In the light of this analysis, it is recommended that countries in the region afford more attention to the aging process and its long-term consequences, especially the fiscal sustainability of pension systems. Moreover, it is desirable that they conduct ongoing estimates of future pension payments, that they budget for them properly, and they establish, insofar as is possible, sources of financing such as pension reserve funds.

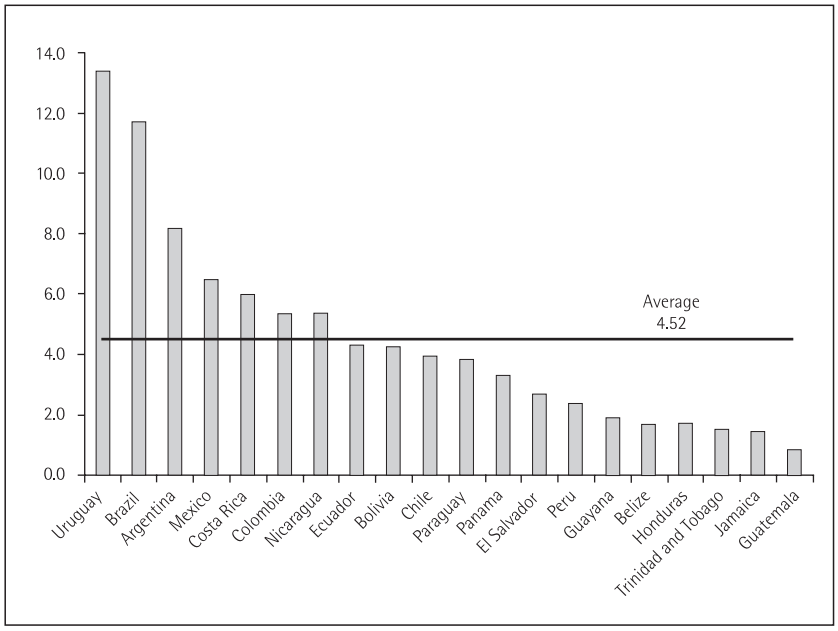
This study is organized as follows: following this introduction, Section 2 analyzes pension spending in Latin America and the Caribbean, exploring the different factors that determine this spending. Section 3 studies the spending of each of the countries in more detail for the period 2005-2014. Section 4 conducts an expenditure projection for these four countries to 2075, as well as describing the projection model, the assumptions of the base scenario, and the results. Section 5 includes the simulations and presents the results. Finally, Section 6 concludes and provides some reflections.

2. PUBLIC SPENDING ON PENSIONS IN LATIN AMERICA AND THE CARIBBEAN

Graph 1 shows public spending on pensions and other benefits in 2014 for 20 countries in Latin America and the Caribbean. For most of these countries, the information is obtained from their ministries of finance based on the budgetary execution of each expenditure line. In many cases, it has been possible to accurately discern pension spending in both contributory and non-contributory systems, but in others this has not been possible because the allocations incorporate other items such as subsidies, transfers, health and unemployment benefits, and social assistance, among others.[3] Thus, Graph 1 is illustrative and shows that the region as a whole spends an average of 4.5% of GDP, and that there is a good deal of heterogeneity across all countries.

3. In the next section we identify expenditures solely on pensions for four selected countries and show their evolution over the period 2005-2014.

Graph 1
Public spending on pensions and other benefits, 20 countries in Latin America and the Caribbean, 2014 (in percentages of GDP)



Sources: Ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

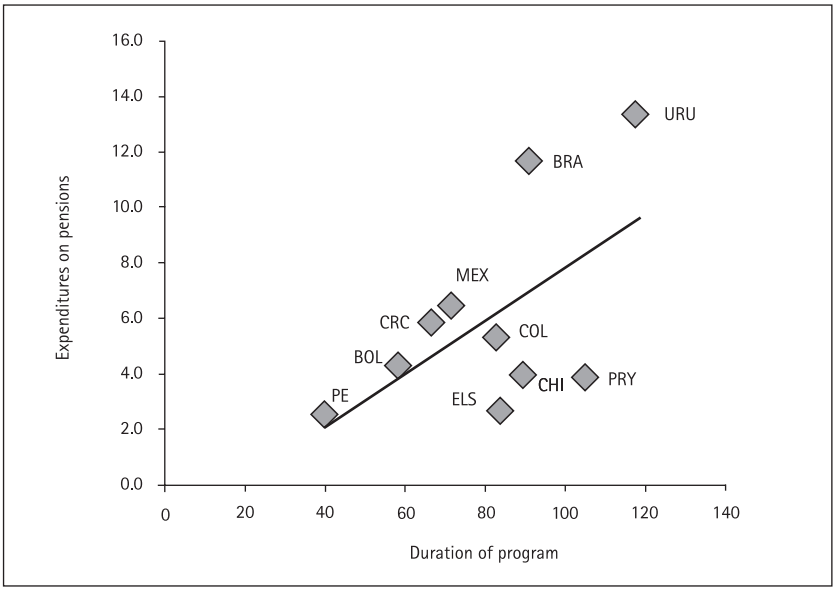
Uruguay predominates in the region, having allocated 13.4% of its GDP to spending on pensions and other benefits in 2014. It is followed by Brazil, at 11.7% of GDP; and then by countries such as Argentina, Mexico, Costa Rica, Colombia, and Nicaragua, all of which spend more than the average (4.5% of GDP). In contrast, there are other countries that spend relatively little - less than 2.0% of GDP - such as Guyana, Belize, Honduras, Trinidad and Tobago, Jamaica, and Guatemala. Meanwhile, still other countries have intermediate levels of spending, including Paraguay, Panama, El Salvador, and Peru, all of which allocate between 2.3% and 4.4% of GDP.

What factors explain the heterogeneity observed? Why do some countries spend more than others? What differences in efficiency exist, in terms of, for example, countries with similar spending levels but different proportions of the population covered by their pension systems? According to Mesa-Lago (2000), different levels of spending on pensions can be explained by several factors, which can be categorized into two basic groups: external factors and

internal factors. The external factors, which arise out of the context or the environment, include population aging, how long the pension program has existed (duration), and the percentage of pension coverage. In turn, the internal factors, which correspond to policy conditions in the individual countries, include factors such as the responsibilities assumed by the government during the transition period following structural reforms, the conditions of the previous pension system, and the existence of other public pension regimes, among others.

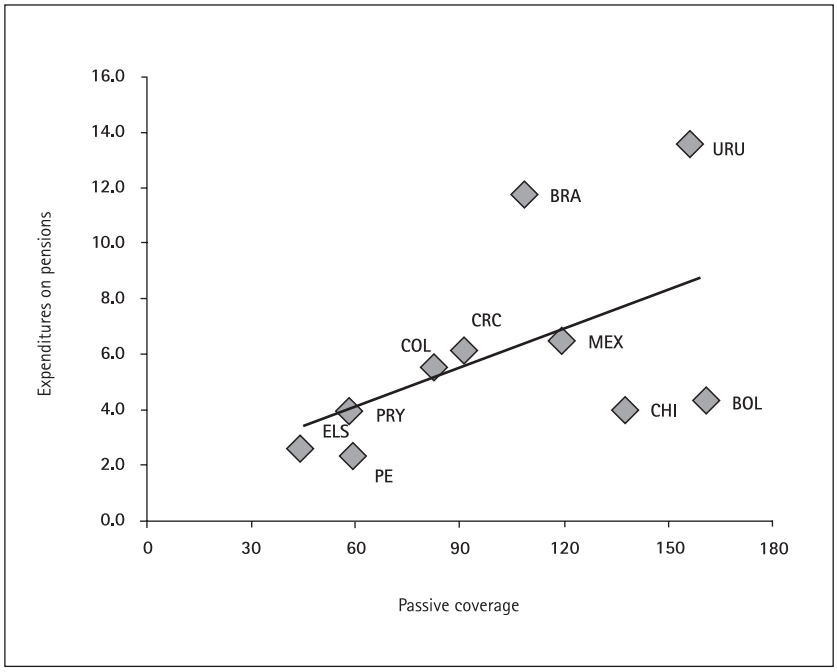
An initial analysis of external factors is set out in graphs 2 and 3. These graphs show the relationship between spending, program duration, and coverage of the systems in ten countries in the region. Duration (or how long a program has existed) is measured as the number of years that contributory systems have been active as at 2014, and coverage as the percentage of senior citizens (over the age of 65) who receive a contributory or non-contributory pension.

Graph 2
Relationship between pension spending and system duration, ten Latin American countries, 2014 (in percentages of GDP and years)



Note
Contributory system duration in measured as the number of years up to 2014.
Sources: Ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

Graph 3
Relationship between pension spending and passive coverage, ten Latin American countries, 2014 (in percentages of GDP and years)



Note
Passive coverage is defined as the number of senior citizens who receive a contributory pension or a NCP; this rate may be greater than 100%, because the numerator can take into account pensioners below the age of 65 in those countries where the retirement age is lower.
Sources: Ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

Thus, it can be seen, for example, that the greater the duration and/or coverage of the systems, the greater the fiscal spending appears to be, and vice-versa. For countries like Uruguay and Brazil, it is found that spending is positively correlated to the duration of their pension systems and their extensive coverage. Uruguay spends 13.4% of its GDP; its system has existed for 118 years and in practice covers the entire retirement-age population.[4] In

4. The level of coverage is greater than 100% because the numerator considers pensioners below the age of 65 (the retirement age in Uruguay is 60), while the denominator considers the population over the age of 65.

turn, Brazil spends 11.7% of its GDP, has a 91 year-old system, and also covers the whole population. Other countries with high coverage and long-standing pension systems are Chile and Mexico; however, their levels of spending differ. Mexico spends 1.6 times what Chile disburses but covers fewer people. Bolivia, for its part, is also an interesting case, as its relatively young system spends just 4.2% of its GDP but covers the entire population. Countries like El Salvador, Peru, Costa Rica, Colombia, and Paraguay have systems that cover between 40% and 90% of their retirement-age population, and spend between 2.7% and 6.0% of GDP.

Another external factor that is central to understanding pension spending is the level of population aging (Bosch et al. 2013). Aging is the combination of a lower fertility rate and a higher life expectancy. According to the projections of CEPAL (2013a), the region is currently enjoying a demographic bonus, which is to say there are many young people for every senior citizen, though this will not last for much longer. The population is poised to age in the coming decades, and quickly. This, without a doubt, has and will continue to have fiscal implications for the region as a whole; however, as we will see later, these differ from country to country.

In Table 1, we have grouped together ten countries according to their level of population aging, as per Mesa-Lago (2000). This factor has been measured through the old age dependency ratio, which accounts for the burden faced by the active population (aged between 14 and 64) in relation to the population over the age of 65 that they have to maintain. In addition to the spending levels, the two afore-mentioned external factors are observed: system duration in years and contributory and non-contributory coverage (Mesa-Lago 2000). The countries can be organized into three groups: the first is made up of Uruguay, Brazil, and Chile, which have advanced levels of aging (high dependency ratio) and, in theory, higher pension spending as a result according to Mesa-Lago (2000); the second is comprised of El Salvador, Costa Rica, Mexico, Colombia, and Peru, with moderate levels of aging and thus, theoretically, moderate public spending; finally, the third includes Paraguay and Bolivia, which should theoretically have the lowest fiscal costs due to their younger populations or incipient aging.

Table 1
Classification of aging in ten Latin American countries, by external factors and pension spending, 2014

Aging	Country	Aging index[1]	TFR[2]	Pension system duration (in years)	Level of passive coverage[3]			Spending (%)[4]
					Total	Contributory	Non-contributory	
Advanced	Uruguay	86.5	2.0	118	156.6	138.7	17.9	13.4
	Brazil	47.2	1.8	91	108.6	81.0	27.6	11.7
	Chile	67.4	1.8	90	137.2	104.4	32.8	4.0
	El Salvador	32.8	2.1	84	43.5	37.7	5.8	2.7
	Costa Rica	45.6	1.7	67	91.3	66.3	25.1	6.0
Moderate	Mexico	33.5	2.2	71	119.0	59.5	59.5	6.5
	Colombia	34.5	2.4	83	83.6	47.5	36.1	5.4
	Peru	32.8	2.4	41	59.3	40.9	18.4	2.4
	Paraguay	25.8	2.7	105	58.1	25.2	32.9	3.9
Incipient	Bolivia	21.9	3.1	59	160.9	28.5	132.4	4.2

Notes
[1] Individuals aged 60 and over for every 100 individuals under the age of 15.
[2] Average number of children per woman.
[3] May be greater than 100% because the numerator may take into account pensioners below the age of 65 in countries where the retirement age is lower than 65.
[4] From public budgets, as a percentage of GDP.
Sources: CEPAL (2013a, 2013b); ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

In the first group, an analysis of the cases of Uruguay and Chile is of interest. Both countries are undergoing a process of advanced aging and have long-standing pension systems with high levels of coverage, but different levels of spending. Uruguay spends three times more than Chile. The latter country's situation would appear to be more efficient from a fiscal standpoint, as it does not exert heavy pressure on state finances but still has extensive coverage. We will analyze this case in greater detail later.

In turn, the countries in the second group have relatively moderate expenditure levels - between 2.4% and 6.0% of GDP (except Mexico) - but at the cost of lower coverage. This group is made up of El Salvador, Costa Rica, Colombia, and Peru. Contributory coverage in these countries is low compared with the first group, but non-contributory coverage is not (except for El Salvador). It should be noted that the non-contributory program in the case of Mexico is of particular importance in relation to other countries, both those in its group and overall.

Paraguay and Bolivia constitute the third group, which should theoretically have lower costs due to their younger populations. However, this is not true of either of these countries, in that spending levels are similar to those of their counterparts in the second group. Paraguay spends around 3.9% of its GDP and covers around 58.1% of its retirement-age population; Bolivia, with a similar expenditure - 4.2% of its GDP - stands out for its reasonably high coverage, which is mainly explained by its non-contributory program.

Our analysis suggests that external factors are not the only determinants of spending levels. We have found, for example, that there are countries with similar levels of aging and coverage but different patterns of expenditure. We have also observed countries with very low coverage levels but high levels of spending. Thus, it must be other variables that are behind these differences in expenditure. These are the so-called internal factors, which, according to Mesa-Lago (2000), are specific to each country and depend on the design of the pension system and the various reforms that each country has implemented.

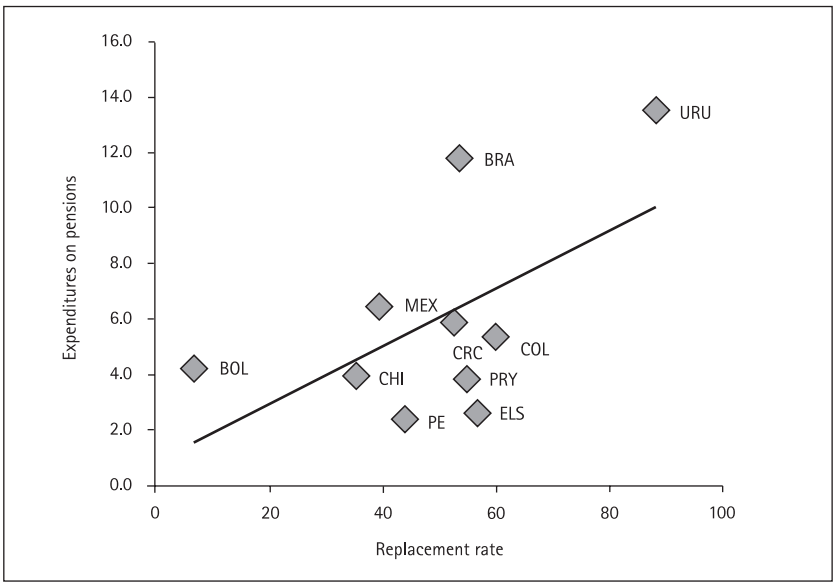
A first internal factor is related to the pension model selected by the countries when they conducted their reforms in the 1980s and 1990s.[5] Each of the countries had to assume fiscal commitments during the transition period, depending on the model selected. These commitments, associated with DB or DC systems, constitute the components of pension spending and affect it in different ways. One of the most important is the operating deficit of DB systems. Upon implementation of DC systems, the income from contributions to the preceding systems disappears or dwindles considerably, while pension spending remains constant or even increases, thereby generating a disparity that constitutes a deficit, which is met by governments. The timescale of this (and the expenditure) primarily depends on the type of reform.[6]

A second factor that we will analyze in more detail in the following sections are pension rules or parameters that governments opt to maintain as part of their DB systems. These parameters primarily affect the size of the deficit (and the expenditure). For example, Graph 4 shows the relationship between expenditure and replacement rates. The replacement rate refers to the percentage of the average salary that will be received as a pension, and is a very

5. Structural reforms can be grouped into three general models: replacement, mixed, and parallel (Mesa-Lago 2004). Under the replacement model, the DB system ceases to incorporate new affiliates and is completely replaced by a DC system. In the mixed model, the DB and DC systems are integrated so that the former provides a basic pension and the latter a complementary pension payment. Finally, in the parallel model, both systems coexist and it is up to contributors to choose which one to affiliate with. A fuller description of the pension systems in each country is provided in Annex B.
6. In this study we focus on expenditure, but since deficit is defined as expenditure minus income, its determinants are also valid for expenditure.

important parameter for measuring the generosity of DB systems.[7] It is found that the higher the replacement rates, the greater the spending on pensions and other benefits appears to be.

Graph 4
Relationship between pension spending and replacement rate, ten Latin American countries, 2014 (in percentages of GDP and years)



Note
The replacement rate is calculated as the weighted average of contributory and non-contributory systems; each rate is the ratio between the average pension and the average salary under each scheme. For Paraguay, 2012 data is used.
Sources: Ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

Other important parameters that influence the spending levels of DB systems are retirement age, form of pension indexing, and reference or average salary (used to calculate the replacement rate), among others. In general, and as we will see later, the more generous that these parameters are, the greater the spending on pensions will be.[8]

7. Several definitions of the replacement rate appear in the literature. For example, it can be defined as the ratio between pension and average salary across the population, or the ratio between pension and individual salary. Moreover, different definitions of the denominator exist - such as, for example, the average observed over a certain period, the last earnings received before retirement, or earnings after taxes, among others. The following articles serve as useful reference material on this subject: Whiteford (1995); Alessie *et al.* (1997); Mitchell and Phillips (2006).
8. A fuller description of the parameters for the selected countries is provided in Annex C.

A third internal factor that has an impact on spending is related to how DC systems are introduced and the commitments that governments decide to assume with respect to them. The first of these commitments are recognition bonds (RBs), which are debt securities that recognize contributions to the old system and are paid out to contributors who transfer to the new one.[9] Unlike the operating deficit, governments do not necessarily pay the bond in all countries and there are multiple means of estimating its value, which also means that its costs vary greatly. A second commitment is the minimum pension guarantee. Governments generally guarantee a minimum pension to affiliates who have not paid the sufficient amount into their individual account to finance this pension. The state therefore makes up the difference. Unlike the RB, this commitment is permanent, as there will always be new entrants to the job market who are unable to amass enough funds for a minimum pension.[10]

A fourth factor that affect levels of spending is public policies regarding NCPs. An ever-increasing number of countries in the region are adopting these programs. Although the literature identifies positive effects associated with NCPs in terms of poverty reduction, level of life satisfaction, and beneficiary and overall household health (Novella and Olivera 2014; Galiani and Gertler 2010), it also points out that NCPs directly increase public spending on pensions and constitute an ongoing commitment that increases over time (Bosch *et al.* 2013). The costs of these pensions depend primarily on the number of beneficiaries, on whether the system is universal or conditional, and on the generosity of the provision. In a context of population aging, the cost of providing this type of pensions will put public finances under increasing pressure, given that the projections suggest that the population over the age of 65 will have more than tripled by 2050 - as, concurrently, will the cost of NPCs.[11]

In the next section, we will analyze pension spending in the four selected countries in more detail. We will do so by placing special emphasis on the aforementioned internal

9. Normally, the RB takes effect at the moment of retirement or in the case of a claim due to disability or death, and can be paid in a lump sum or in monthly installments. It is a transitional fiscal cost for countries with replacement and parallel models and does not apply to countries with mixed models.
10. The fiscal cost generated by the minimum pension guarantee depends on the number of affiliates with insufficient savings, which in turn depends on factors such as salary level (productivity), frequency of contribution, profitability, and commissions, as well as the means of adjustment and the pension level. The minimum pension guarantee can be found in countries with replacement and parallel models rather than in those with mixed models, since affiliates receive basic payments from the public system.
11. According to Bosch *et al.* (2013), if 1% of GDP was spent on NCPs in 2014, and given a scenario of constant coverage and generosity, the cost will rise to 3% by 2050 due to aging alone. This will undoubtedly put pressure on public finances and will require governments to finds ways of financing these increased costs (Bosch *et al.* 2013).

factors and on the commitments undertaken by governments that employ DB, DC, and NCP systems.[12]

3. PENSION SPENDING IN CHILE, PERU, MEXICO, AND COLOMBIA

After analyzing the determinants of public spending on pensions, we will go on to show the evolution of this spending for the four selected countries over the period 2005-2014. We were unable to identify any institutions that keep consolidated information on this type of costs across the different countries; therefore, for this study it was necessary to collect figures on a country-by-country basis. We obtained the data on the official websites of the ministries of finance and the various bodies responsible for managing the different pension systems.

Table 4 sets out the evolution of pension spending for the period 2005-2014. The information is broken down by pension scheme, with specifications on whether each is DB, DC, or NCP.

For the case of Chile, it is observed that on average, for the period 2005-2014, pension spending totaled 4.4% of GDP, and showed a downward trend. Most of this expenditure is used for the primary DB system administered by the Social Welfare Institute (Instituto de Previsión Social, IPS; previously known as the Instituto de Normalización Previsional [Pension Standardization Institute, INP]), in which around 41% of expenditure is concentrated. However, this has been decreasing over the years, going from 2.3% in 2005 to 1.5% in 2014. This trend is explained in part by the replacement model adopted by Chile in 1981, under which the old system was closed off to new enrollments and the new DC system - the Private Pension System (Sistema Privado de Pensiones, SPP) - was introduced for new workers. Given its closure, IPS expenditure is transitional, depends solely on those pensioners and affiliates who remain, and dwindles to the point of disappearing over time.[13]

The second pension scheme, which is also DB, covers the armed forces and the police and consists of the National Defense Pension Fund (Caja de Previsión de la Defensa Nacional, CAPREDENA) and the Carabineros Pension Directorate (Dirección de Previsión de Carabineros, DIPRECA). On average, for the period 2005-2014, Chile spent 1.1% of its annual GDP on pensions of this type, accounting for 26% of total expenditures. This trend has also been downward.

12. It is important to note that in this study we only analyze pension expenditures and not the operating deficit.
13. Affiliates who opt to transfer to the new system are given a RB for the contributions they have made. For more details, see Arenas de Mesa and Gana (2005).

Table 2
Evolution of pension spending, four Latin American countries, 2005–2014 (% GDP)

Year	Chile[1]					Peru[2]						Colombia[3]						Mexico[4]				
	Total	DB		NCP	DC	Total	DB			NCP	DC	Total	DB			NCP	DC	Total	DB		NCP	DC	
		IPS	Militares	PBS	SPP		SNP	DL 20530	Caja Militar Policial	Pensión 65	SPP		Prima Media	Magisterio	Fuerzas Armadas	Colombia Mayor	RAIS		ISSSTE	ISSFAM	Adulto mayor	IMSS	Pensión ISSSTE
2005	5.02	2.27	1.30	0.40	1.05	3.62	1.52	1.76	0.04		0.29	3.50	1.86				1.65	3.08	2.30	0.04		0.74	
2006	4.68	1.98	1.30	0.40	1.00	3.12	1.36	1.51	0.04		0.21	4.38	2.87				1.51	3.24	2.40	0.04		0.81	
2007	4.49	1.79	1.30	0.40	1.00	2.86	1.08	1.46	0.04		0.28	4.11	2.71				1.39	3.38	2.40	0.04	0.06	0.88	
2008	4.47	1.89	1.30	0.36	0.92	2.40	0.93	1.31	0.04		0.12	4.45	2.98			0.07	1.40	4.08	2.93	0.04	0.09	1.01	
2009	4.38	1.95	1.30	0.51	0.62	2.42	0.98	0.85	0.52		0.08	4.19	2.75			0.07	1.37	4.36	3.00	0.05	0.11	1.17	0.03
2010	4.36	1.79	1.01	0.52	1.05	2.19	0.89	0.75	0.48		0.07	5.34	2.48	0.55	0.67	0.08	1.56	4.69	3.13	0.06	0.11	1.29	0.10
2011	4.18	1.68	0.97	0.48	1.04	2.33	0.97	0.68	0.52		0.16	5.06	2.47	0.52	0.64	0.10	1.33	4.82	3.21	0.06	0.10	1.38	0.07
2012	4.13	1.65	0.97	0.46	1.05	2.06	0.80	0.66	0.45	0.05	0.10	5.18	2.51	0.56	0.65	0.14	1.33	5.46	3.51	0.06	0.13	1.49	0.27
2013	3.98	1.56	0.96	0.43	1.03	2.04	0.79	0.62	0.46	0.08	0.09	4.88	2.39	0.58	0.67	0.13	1.11	5.82	3.76	0.07	0.17	1.63	0.18
2014	3.79	1.48	0.95	0.40	0.96	2.12	0.79	0.69	0.45	0.11	0.08	4.95	2.48	0.61	0.67	0.14	1.05	6.19	4.01	0.07	0.25	1.76	0.11

Notes

[1] Chile: SPP: expenditure on RB, minimum pensions, and APS.

[2] Peru: DL 20530 also includes expenditure on other closed systems; SPP are expenditures on RBs and minimum pensions.

[3] Colombia: Prima Media includes expenditures on Colpensiones and other closed systems.

[4] Mexico: ISSSTE includes expenditures on pensions, subsidies, and contributions; IMSS denotes expenditures on pensions for the transition generation, pursuant to the law of 1973, the minimum pension and the social contribution; the ISSSTE pension includes spending on RB.

- Annex D describes other variables, such as the old-age dependency ratio, coverage, and replacement rates, for which information on the population and the number of pensioners, pensions and average earnings, and macroeconomic variables on GP and the exchange rate, among others, are used in turn.

Sources: Ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

Thirdly, there are expenditures on the DC system (or SPP) for RBs minimum pensions, and solidarity contributions.[14] For the period under analysis, Chile spent almost 1.0% per year on the DC system, representing 22% of total expenditures.

Finally, there is spending associated with the PNC, known following the 2008 reform as the Basic Solidarity Pension (Pensión Básica Solidaria, PBS). On average, spending on these pensions amounted to around 0.4% of GDP per annum, representing 10% of total expenditures. The trend in these last two cases (spending on the SPP and PBS) appears to be constant.

Analysis of the Peruvian case indicates that pension spending accounts for 2.5% of GDP on average for the period 2005-2014, and, similarly to Chile, shows a downward trend.[15] As in Chile, most spending goes to the DB systems: the National Pension System (SNP; Legal Decree [DL] N° 19990), the civil servants scheme known as DL N° 20530, and the Police and Military Fund pensions. The remainder is used for SPP pensions and NCPs, which go under the name of Pensión 65.

For this period, Peru spent almost 1.0% of GDP on the SNP system, representing 40% of total expenditures. the trend observed is downward and is explained for reasons that differ from those corresponding to Chile's IPS. In Peru, this system did not close at the time of the reform but remained open for new enrollments, while the new system (SPP) was introduced to exist alongside it. Thus, in the years following the reform, many workers enrolled in or transferred to the SPP, thereby considerably reducing SNP income. This exerted considerable fiscal pressure on the state, which had to help to finance pension payrolls and implement successive parametric reforms - measures which seem to have helped ease the pressure.[16] As an open scheme, however, spending is not expected to disappear.

A second DB system of the Peruvian government is that corresponding to civil servants (DL N° 20530). On average, for the period 2005-2014, 1.0% of GDP was spent on this

14. In 2008, Chile adopted a new pension model known as the mixed system, which entailed, among other requirements, the creation of the state-run Solidarity Pension System (Sistema de Pensiones Solidarias, SPS) which in turn encompasses solidarity pension contributions (aportes previsionales solidarios, APS) to the SPP and the change of name and requirements of the non-contributory pension - the basic solidarity pension (pensión básica solidaria, PBS), previously known as the welfare pension (pensión asistencial, PASIS). For more details, see Arenas de Mesa and Gana (2005).
15. In comparison with Chile, expenditure in Peru is lower, but it is important to note that so too is coverage. As at 2014, Chile's system covered the entire retirement-age population, compared with 59.3% in Peru.
16. Replacement rates were gradually pushed down, the maximum pension was cut, retirement ages were increased, years of contributions went up, and the reference income period for pension calculation was extended, among other reforms. For more details, see Bernal *et al.* (2008).

program, accounting for 41% of total expenditures. The trend observed is also downward, and in this case is explained by the closure of the scheme in 2004. Because of the high fiscal costs and concerns that characterized it, a constitutional reform was implemented during that year to close the system off to new enrollments, the so-called "mirror effect" (pensions indexed to the salary received in the last position held) was eliminated, and other important parametric reforms were carried out.[17]

Thirdly, there is the spending on the Police and Military Fund, which amounted to 0.3% of the average annual GDP for the period 2005-2014 (12% of total expenditures). This expenditure appears to be remaining constant. This system has also been subject to important reforms, the most recent in 2012, through which a new system was created and the "mirror effect" was eliminated for new generations, in addition to the introduction of a series of additional benefits given to retirees.

Finally, spending associated with the SPP and Pensión 65 is not particularly high. On average, for the period of analysis, 0.2% of GDP was spent on RBs and on minimum and complementary pensions under the PPS; while 0.1% of GDP was spent on Pensión 65. However, it should be noted that, unlike Chile, the Peruvian NCP system is relatively new (implemented in 2011) and its coverage - and with it, its cost - is expected to increase.

In Colombia, total spending on pensions was found to account for 4.6% of GDP on average for the period 2005-2014. Unlike Peru and Chile, the trend is slightly upward. This is explained by both the pressure exerted by the primary DB system, known as the Average Premium Scheme (Régimen de Prima Media, RPM; made up of Colpensiones and other special schemes), as well as the commitments assumed as part of the DC, known as the Solidarity-Based Individual Savings Scheme (Régimen de Ahorro Individual con Solidaridad, RAIS). For this period, an average of 2.6% of GDP was spent on the RPM, while 1.4% was spent on the RAIS (55% and 30% of total expenditure, respectively).

The Colombian pensions model is similar to the Peruvian one in that it is parallel, with DB and DC systems coexisting. However, there are significant differences in spending levels. The explanation would appear to lie in how both systems interact, in the link between minimum pensions and the minimum wage (MW) and in the parametric reforms implemented. Unlike in Peru, in Colombia, workers can transfer from the RAIS to Colpensiones at any time, and most do so just before retiring because the latter system provides more generous pensions than the former. Another difference is that minimum pensions of an equal value to the

17. For more details, see Annex C and Bernal *et al.* (2008).

MW are disbursed in Colombia, which has a direct impact on public spending. According to Bosch et al. (2015), Colombia still needs to make substantial reforms to the parameters of its DB systems.[18]

Other DB systems in Colombia that absorb a significant proportion of expenditure are those corresponding to the teaching profession and the armed forces. On average, for the period of analysis, 0.6% of GDP per year was spent on the former and 0.7% on the latter, together accounting for 13% of total expenditures. However, in the future, a downward trend is expected in the case of the pension for teachers, because Legislative Act N° 01 of 2005, as well as the 2013 pronouncement of the Court of Justice, stipulated that special schemes are no longer permitted, save for that of the armed forces.

Finally, total spending on the NCP system, known as Colombia Mayor, accounted for 0.1% of GDP on average for the period 2005-2014. As in Peru, this system is relatively new (implemented in 2008), and so increases in both coverage and spending are to be expected. Meanwhile, Mexico's pension spending also corresponds to an upward trend. On average, for the period of analysis, it increased to 4.5% of GDP. It is also seen that the largest proportion of expenditure (68%) goes toward the DB system administered by the Institute of Social Security and Services for State Workers (Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado, ISSSTE), to the DC system known as the Retirement Savings System (Sistema de Ahorro para el Retiro), which covers private-sector workers and is administered by the Mexican Social Security Institute (Instituto Mexicano de Seguridad Social, IMSS). On average, 3.1% of GDP was spent on the ISSSTE 3.1%, compared with 1.2% on the IMSS. Both show a marked upward trend.

The reason for the high spending on the ISSSTE and its upward trend would appear to be rooted in the absence of parametric reforms for many years. According to Tapen (2012), the previous system did not specify a minimum retirement age or minimum years of contribution. Workers could retire after completing 30 years of service and obtain a pension equivalent to 100% of their salary. If the pension fell to below the value of two times the MW, it was adjusted to that value. All of this had a direct impact on public spending. For this reason, the system was reformed in 2007 and closed off to new enrollments. The old rules were kept in place for existing pensioners, but were changed for contributors. A minimum retirement age and minimum years of contributions were introduced, and the replacement rates were reduced. For future workers, a new DC system called Pensión ISSSTE was created.[19]

18. For more details, see Annex C and Bosch *et al.* (2015).
19. After 15 years of service, workers also obtained a pro-rata pension. The contribution rate is 8%. For more details, see Annex C, as well as OCDE (2016), and IFA (2015).

In the case of the IMSS, the strong pressure on spending is explained by the transition generation. When Mexico carried out its pension reform in 1995, it opted for a replacement model similar to the Chilean one, in which workers remained enrolled in the new system and retired under its rules. However, unlike Chile, workers who were already contributing (the transition generation) were given the option of retiring in line with the rules of the old system (Law 73). Because pensions paid under these rules are more generous than those corresponding to the DC-based IMSS (Law 97), most workers chose them.[20] This option is expected to continue until 2037. Starting in that year, new generations (enrolled in the IMSS from 1997) are expected to retire under the rules of the DC, thereby reducing pension spending.

The remainder of expenditures go to pensions corresponding to the Social Security Institute for the Armed Forces (Instituto de Seguridad Social para las Fuerzas Armadas, ISSFAM), Pensión para Adultos Mayores (previously Pensión 70 y Más), and the new DC system, Pensión ISSSTE.

As can be seen above, expenditures appear to depend not so much on the reform models selected (replacement, parallel, or mixed) as on internal factors related to the pension rules that governments elect to retain as part of their DB systems, how these are related to DC systems during the transition period, and the decision to implement parametric reforms continually. These are the factors that appear to explain in large part the main differences observed from country to country. As a result of these internal policies, Chile and Peru appear to be embarking on a path of declining expenditures, while the course pursued by Colombia and Mexico is going in the other direction. The first two countries seem to be managing their spending levels relatively well, but Chile has shown itself to be more efficient, in that its systems cover a much high proportion of the adult population than do Peru's. In turn, Mexico's coverage is almost 100%, but apparently at a much higher cost than Chile. Spending efficiency in Colombia is lower even than that of Peru: it spends almost twice as much with only slightly better coverage.

Although this initial analysis gives us an idea of how countries in the region are managing their pension spending, it is not enough to provide a complete overview. It is necessary to analyze what will happen in the long term, especially in a context of population aging. We will consider this matter in the next section.

---

20. Tapen (2012) estimates that retirement under Law N° 73 is advisable for almost all affiliates from the transition generation. Only those with income in the highest decile of the distribution and 40 years of contributions would be best served retiring under the rules of Law N° 97.

4. PROJECTION MODEL AND RESULTS

In this section, we carry out pension-spending projections for the four countries. The time horizon of analysis is 2015 to 2075, which is broad given the consideration of long-term commitments. However, it is important to note that the greater the number of years considered, the greater the uncertainty in terms of the evolution of the economy and income, among other factors. Therefore, the purpose of our projections is not to forecast future pension spending with exactitude, but to give an idea of the general trend and the fiscal pressure it will place on these countries.

4.1. Model

The projections were carried out using a model that employs the methodology of the International Monetary Fund (Clements *et al.* 2013). By following this methodology, we could determine public pension expenditure, *PE*, as a percentage of GDP, as follows:

$$\frac{PE}{PBI} = \frac{Pob_{65}}{Pob_{14-64}} * \frac{Pens}{Pob_{65}} * \frac{\bar{P}}{\frac{PBI}{\iota}} * \frac{Pob_{14-64}}{\iota} \quad (1),$$

where Pob_{65} denotes the population aged 65 or over, Pob_{14-64} the population aged between 14 and 64, *Pens* the pensioned population, $\bar{P}$ the average pension, and ι the number of workers in the economically active population (EAP).

This identity tells us that public pension expenditure is the product of four ratios: the ratio of old-age dependency $O(t)$; eligibility $E(t)$; the replacement rate $G(t)$; and the inverse of the employment ratio $L(t)$. The old-age dependency ratio measures population aging and is calculated as the population aged 65 or more over divided by the population aged between 14 and 65, $\frac{Pob_{65}}{Pob_{14-64}}$. The eligibility ratio is measured as the number of pensioners out of the retirement-age population, $\frac{Pens}{Pob_{65}}$. This ratio depends on both system coverage and the rules for obtaining a pension; the greater the coverage, the greater the number of potential pensioners, and the more generous the rules - for example, low retirement ages or years of contribution - the greater the number of pensioners. The third ratio captures pension generosity and is known as the replacement rate; we calculated it as the average pension divided by the average income of the EAP, $\frac{\bar{P}}{\frac{PBI}{\iota}}$. Finally, the inverse of the employment ratio, $\frac{Pob_{14-64}}{\iota}$, captures the changes in the participation of the workforce and how these affect future pension system eligibility (the more workers there will be today, the more pensioners there will be tomorrow); the replacement rates (through workers' earnings); and the GDP (more product will be generated).

Using this formula, we projected public spending on pensions as a percentage of GDP in one year - say, t_2 - from the information on expenditures in the year t_1 and from the variations in the dependency, eligibility, and replacement rate ratios, and the inverse of the employment ratio:

$$\frac{PE}{PBI}(t_2) = \frac{PE}{PBI}(t_1)\frac{O(t_2)E(t_2)\,G(t_2)\,L(t_2)}{O(t_1)E(t_1)\,G(t_1)\,L(t_1)} \tag{2}$$

We carried out the projections for periods of five years and our analysis horizon of 2015 to 2075. We considered public expenditures as those stemming from the commitments assumed in the DB and NPC systems, rather than expenditures on DC systems.[21] The reason is that the DC systems are determined in a different way. For example, spending on RBs depends on the number of affiliates that transfer from the old to the new system and how its value is calculated. The minimum pension depends on the savings accumulated by each worker in their individual accounts. If this is insufficient to finance the value of the minimum pension, the state makes up the difference and this has an impact on public spending. The model is not applicable in these cases. For this reason, our projection underestimates true spending on pensions; however, it provides a good idea of the trend and the fiscal pressure that countries will face in the future.

We carried out the projection for Chile, Peru, Colombia, and Mexico. To this end, we analyzed the information for the different pension schemes in each country, including that of the armed forces and civil servants, which entailed using the formula provided above to project the expenditures on each scheme. We took as initial values the expenditures shown in Table 2 (for 2014). For the population data, we used information from the United Nations (Population Division), which publishes projections on populations aged 14 to 64 and those aged over 65. In the base scenario, we used the projections that assume a scenario of average fertility rates.[22] The inverse of the employment ratio took as an initial

21. This generally consists of the payment of minimum pensions, RBs, solidarity contributions (for example, in Chile) or social contributions (for example, in Mexico).
22. The fertility rate represents the average number of children that a woman would have if she lived through to the end of her childbearing years and had children according to current age-specific rates. This is the primary demographic variable that determines changes in volume and structure by population ages and, accordingly, the United Nations projects its future evolution based on different hypotheses: the medium or recommended hypothesis, low hypothesis, and high hypothesis. The medium or recommended hypothesis holds that fertility will reach population replacement rates, which means a total fertility rate (TFR) of 2.1 children per woman sometime before 2050. The low hypotheses employ a TFR of 1.6 children per woman, below the replacement rate; and the high hypothesis projects a TFR of 2.6 children per woman, above the replacement rate. For more details, see United Nations (2014).

value that observed in 2014, which is assumed to be constant across the entire projection horizon. The coverage or eligibility ratios continued their current trend, unless the country explicitly established a change in the future (for example, system closure).[23] In the case of NCPs, it is assumed that coverage will continue to follow the current trend until the entire retirement-aged population living in poverty is covered.[24] The replacement rate is assumed to be constant across the entire projection horizon, unless information is available on reforms that anticipate their variation (this implicitly assumes that the pension parameters retain, for example, the manner of calculating pensions).

4.2. Results of the base scenario

Table 3 shows the results of the base scenario. Overall, we found that although countries already spend between 1.8% and 6.4% of their GDP on their public pensions and NCPs, this spending will rise between two and fourfold in the long term.

In the case of Chile, spending is seen to increase from 3.0% of GDP in 2015 to 5.1% in 2075, which represents a 1.7-fold increase. Given that the IPS is a closed system, its spending is projected to fall to the point of disappearing around 2030. However, the armed forces and police scheme is open and, while it is assumed that its coverage will follow the current trend (slightly downward), its spending on pensions is expected to increase significantly, from 1.0% to 2.7% of GDP over the period of analysis. A similar trend is observed for the PBS (ex PASIS), spending on which increases from 0.5% to 2.4% of GDP over the same period. These results are consistent with those obtained by Arenas de Mesa et al. (2008), who estimate that, in the base scenario, the incremental fiscal effect of the SPS will stand at around 0.8% of GDP by 2025.[25]

Peru will also come under greater pressure in terms of its pension spending. Our projections find that this will be 3.5 times greater, increasing from 1.8% in 2015 to 6.3% of GDP in 2075. Most of this expenditure will be on the open DB systems: the SNP and the Military and Police Fund (Caja Militar Policial). Despite the implementation of the reforms, spending on the former will increase from 0.7% to 3.1%, and the latter from 0.4% to 2.0% of GDP over the period of analysis. In contrast, DL N° 20530 expenditures will fall to nothing by 2040, given that the scheme was closed in 2004. Finally, spending on Pensión 65 will increase considerably, from 0.1% to 1.1% of GDP.

---

23. This is the case of the IPS in Chile, the DL N° 20530 in Peru, the teachers' scheme in Colombia, and the ISSSTE in Mexico.
24. For the case of Chile, see Arenas de Mesa et al. (2008); for Colombia and Peru, see Olivera and Zuluaga (2014). In the case of México, 65% coverage is assumed.
25. Our projection only takes into account the PBS, while the above-mentioned authors take into account the PBS and the APS.

Table 3
Projection of public pension expenditure: base scenario, four Latin American countries, 2015-2075 (percentage of GDP)[1]

Year	Chile				Peru					Colombia					Mexico[2]				
	Total	BD		NCP	Total	DB			NCP	Total	DB			NCP	Total	DB		NCP	DC
		IPS	Military	PBS		SNP	DL 20530	Caja Militar Policial	Pensión 65		Prima Media	Magis-terio	Fuerzas Armadas	Colombia Mayor		ISSSTE	ISSFAM	Adulto mayor	IMSS
2015	2.98	1.53	1.00	0.45	1.81	0.69	0.59	0.41	0.12	3.90	2.48	0.61	0.67	0.14	6.43	4.17	0.07	0.28	1.91
2020	3.21	1.24	1.36	0.61	2.13	0.90	0.62	0.38	0.23	4.24	2.61	0.59	0.86	0.18	7.74	5.07	0.08	0.36	2.23
2025	3.16	0.78	1.62	0.76	2.29	1.02	0.55	0.39	0.33	4.95	3.12	0.62	0.99	0.21	9.50	6.05	0.10	0.41	2.94
2030	2.91	0.03	1.92	0.96	2.41	1.17	0.46	0.39	0.39	5.76	3.73	0.63	1.14	0.26	11.75	7.27	0.13	0.49	3.87
2035	3.30	0.04	2.13	1.13	2.61	1.35	0.33	0.49	0.45	6.57	4.37	0.61	1.28	0.30	14.80	8.90	0.17	0.59	5.15
2040	3.61	0.04	2.29	1.28	2.81	1.55	0.14	0.61	0.52	7.09	4.85	0.54	1.36	0.34	14.92	9.21	0.22	0.71	4.79
2045	3.79	0.05	2.35	1.39	3.13	1.77	0.00	0.76	0.60	7.69	5.42	0.45	1.45	0.38	14.00	8.85	0.27	0.83	4.05
2050	4.06	0.05	2.46	1.55	3.59	1.99	0.00	0.92	0.69	8.26	6.00	0.32	1.52	0.42	12.40	8.01	0.32	0.93	3.14
2055	4.39	0.00	2.63	1.76	4.13	2.23	0.00	1.11	0.78	8.80	6.60	0.15	1.59	0.46	10.63	6.87	0.38	1.04	2.34
2060	4.77	0.00	2.78	1.99	4.70	2.49	0.00	1.33	0.88	9.40	7.24	0.00	1.65	0.51	9.14	5.50	0.45	1.17	2.03
2065	4.96	0.00	2.81	2.15	5.26	2.73	0.00	1.55	0.98	10.16	7.84	0.00	1.77	0.55	7.26	3.82	0.53	1.31	1.60
2070	5.04	0.00	2.77	2.27	5.77	2.93	0.00	1.78	1.06	10.91	8.41	0.00	1.90	0.59	4.86	1.78	0.61	1.44	1.02
2075	5.09	0.00	2.71	2.38	6.26	3.10	0.00	2.01	1.14	11.67	8.99	0.00	2.04	0.64	2.98	0.42	0.70	1.56	0.31

Notes

[1] Present value (VP) 2015-2075, with 4% discount rate: Chile 89.6% of GDP; Peru 71.2% of GDP; Colombia 156.5% of GDP; Mexico 255.9% of GDP.

[2] The IMSS is included because it disburses DB pensions (Law N° 73) up to 2035-2040. After these years, it is assumed that there will still be expenditures because the pensions of retirees and their survivors will be paid at that time.

Sources: CEPAL (2013a); United Nations (2014); institutes of statistics; ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

in the case of Colombia, total pension expenditures will increase threefold over the period of analysis. In 2015, Colombia spent 3.9% of its GDP on pensions corresponding to the RPM, teachers, the armed forces, and Colombia Mayor. Meanwhile, Colombia's pension expenditures are projected to increase to 11.7% of GDP by 2075. As with the Peruvian case, most will be spent on the open DB systems. It is estimated that spending on the RPM (primarily made up of Colpensiones) will increase from 2.5% of GDP in 2015 to 9.0% in 2075, which amounts to a 3.6-fold increase. In the case of the armed forces, a threefold rise is projected, from 0.7% in 2015 to 2.0% in 2075. Spending on pensions for teachers will be phased out gradually, pursuant to the Legislative Act of 2005 and the Court ruling of 2013, which closed the scheme. Greater expenditures on Colombia Mayor (4.6 times greater) is projected, rising from 0.1% to 0.6% of GDP for the same period. These results can be compared with those estimated by Clavijo *et al.* (2013) and by Bosch *et al.* (2015).[26]

The projection for the case of Mexico, unlike the other countries, shows a different trend. Our estimates find that Mexico's current spending levels (6.4% of GDP) will follow an upward trend through to 2040, at which point they will reach 15.0% of GDP; then, starting from that year, they will gradually fall to 3.0% in 2075. The reasons for the pronounced growth through to 2040 are future retirements of current ISSSTE affiliates (under rules that are quite generous) and the IMSS transition generation (given that they can retire with DB pensions, pursuant to Law N° 73). From that year, on the other hand, it is anticipated that new generations will retire under current DC rules and pension spending will therefore fall. However, it is estimated that these lower expenditures will contrast with the higher future disbursements of the Pensión para Adultos Mayores and armed forces schemes. It is estimated that the former will multiply 5.5-fold, going from 0.3% in 2015 to 1.6% in 2075, while the latter will rise from 0.1% to 0.7% of GDP in the same period. Our results are consistent with those obtained by Tapen (2012) and the Financial and Actuarial Institute (Instituto Financiero y Actuarial, IFA), which evaluates the economic and population challenges faced by the ISSSTE (IFA 2015).

As has been seen, in the long term the four countries analyzed will spend between two and four times more than what they currently disburse. This rise depends not only on external

26. Clavijo *et al.* (2013) estimate that, in the absence of reforms, net present value (NPV) of the Colombian public system's pension debt will be around 96.3% of 2013 GDP over the period 2013-2050. For their part, Bosch *et al.* (2015) estimate 129% of 2014 GDP, but use a longer period of analysis (2013-2075). Our calculation yields a greater NPS, 156.5% of 2015 GDP, for the same period. The main differences compared with the above-mentioned authors are that, on the one hand, our PV is gross - that is, it only takes into account expenditures; and, on the other, we assume that the Colpensiones coverage will remain at similar levels as at present.

factors such as demographic trends but also on internal factors that are dependent on the countries, such as the role they opt to give to DB systems and their maturation, the generosity of pension rules, and how these are related to DC systems and the policies related to NCPs.

In the first place, we find that, despite the countries having relatively young populations, demographic trends show that they will age, thereby pushing up pension costs. In 2010 there were 38 million adults aged 65 or more; in 2050 this figure is projected at 140 million. This means that the percentage of adults aged 65 or over out of the total population will triple, as concurrently will old-age dependency. In 2010, this ratio indicated that there were 9.6 working age individuals for every retirement-aged adult; in 2050, there will only be 3.2 (Bosch *et al.* 2013).[27] How will this affect pension systems? There will be an increase in the number of pensioners (and consequently in spending) as well as a decrease in the number of contributors (who ultimately are those who sustain pension financing through their contributions). The increased number of elderly people with a longer life expectancy will mean a rise in pension expenditures that will endure over time, pushing up system payouts and, therefore, adversely affecting their sustainability. At the same time, with respect to revenues, the lower fertility rate will reduce sources of financing due to the lower number of workers - and hence of contributors - in the economy.[28]

In our projections, we incorporate these democratic trends through variations in the old-age dependency ratio (see Equation 2), such that the more it increases, the greater the rise in associated expenditures. Our estimates suggest that Mexico will be subject to the largest increase in population aging (9.7 people of working age for each elderly adult in 2015, and just 1.9 in 2075), bringing with it a pronounced upward trend in expenditures. Peru will also undergo considerable population aging (9.7 in 2015 and 2.2 in 2075), while the increases in Colombia and Chile will be comparatively moderate (from 8.8 and 7.1 workers for each senior citizen in 2015 to 2.3 and 1.9 in 2075, respectively).

Second, a key factor in explaining the rising trend in expenditures appears to be the continued importance of DB systems and their maturation: for example, decisions by

27. This increase in the retirement-aged population is due in turn to the increase in their life expectancy at birth – in 2010, this was estimated at 74.2, but is estimated to reach 80.3 by 2050 – combined with a decline in the TFR from 2.1 in 2010 to 1.8 in 2050. For more details, see Bosch *et al.* (2013).
28. In theory, given a reduction in the number of workers that uphold the economy and, at the same time, an increase the number of dependent elderly people, the support rate falls, so an increase workers' contributions will be required to fund the benefits received by the elderly. However, these reforms are very difficult to implement and are beyond the scope of this study.

governments on whether to keep these systems open or closed, or whether to extend or reduce their scope as part of coverage-expansion policies. If they decide to keep them open, given that the population will age, governments will inevitably have to continue spending on these systems. In our projections, we incorporate this through variations in the eligibility or coverage ratio. As of 2015, in the four countries studied, in practice all the governments operated open schemes of this kind and used almost all their funds for this area on the payment of the corresponding pensions.[29] By 2040, on the other hand, the outlook is different for Chile and Peru, but not for Colombia and Mexico. The former two countries will allocate a smaller proportion of their spending on DB systems, while the latter two will not. In the case of Chile, the IPS is closed and spending is concentrated on the open military system; in Peru, spending is focused on the SNP and the military system, given that both remain open. As to Colombia, spending in that year is projected to be more than 6.7% of GDP and will be targeted toward Colpensiones and the armed forces, since these systems are open. Mexico, for its part, will allocate around 14% of its GDP on 95% of its total expenditures in this category; although the systems are closed in practice (ISSSTE and IMSS) this will not have an immediate effect, given that it will be future rather than current generations that are affected.[30]

A third factor that determines spending levels is the generosity of DB system parameters. One indicator that allows this factor to be seen is the relationship between the pension and average contributory earnings (replacement rate). Pensions equivalent to or greater than 100% of average income indicate that these systems give retirees pensions above the rate of pay that the economy provides to workers, generating incentives for them to leave the workforce at an early age in order to retire. This is true of the ISSSTE and the IMSS in Mexico and of Colpensiones and special schemes such as that for teachers in Colombia. We also observe that the sharp increase in spending on these systems is due to the effect that the increase in the MW has on pension values. As pensions are indexed each year, so that they do not fall below the MW, the growth thereof is the key factor in determining the evolution of increased pension spending. Because the increase in the MW normally exceeds that of average income, the average pension/income ratio tends to increase over

29. Between 85% and 96%, whether on the civilian schemes (IPS, SNP, Colpensiones, ISSSTE, IMSS), the military and police schemes (CAPREDENA, DIPRECA, Caja Militar Policial, Cajas de Retiro, ISSFAM) or special schemes (DL N° 20530, the teaching profession). For Mexico, expenditure on the IMSS has been taken into account, given that pensions are paid (through to 2037) under DB rules.
30. In the case of the ISSSTE, the reform does not change the rules for current pensioners, and although it introduces retirement ages and reduces replacement rates for current contributors, these will have a minimum value of 50% of income, which may continue increasing in relation to contributions.

time, and expenditure along with it.[31] Despite this, our projections are conservative and assume that this relationship remains constant (in real terms), except for those cases where information is available on reforms that anticipate its variation (for example, in the cases of Peru and Mexico).[32]

Finally, expenditure also increases due to the commitments assumed with respect to all NPC programs. As at 2015, all the countries analyzed had implemented programs of this kind. Chile and Mexico have the greatest coverage, and therefore spend the most. Peru and Colombia, for their part, are still expanding their coverage, so their coverage is relatively limited. At 2075, our projections show that, as with DB systems, aging will exert upward pressure on spending on these programs, prompting a fivefold increase in the case of Chile, Colombia, and Mexico, and a nine fold rise in the case of Peru.

5. SIMULATIONS

In this section, we explore two simulations for projecting public spending in Chile, Peru, Colombia, and Mexico. A first scenario explores what would happen to these expenditures given the occurrence of an external demographic shock, while the second analyzes how the projections change when an internal policy is implemented that affects NCPs.

These two scenarios are important because they enable analysis of what would happen to expenditures in the presence of external or internal shocks. We define external shock as a scenario in which estimated fertility rates are lower than expected and correspond to the

---

31|. Although the objective of this rule that pensions should not fall below the MW is that pensions do not lose their value over time and constitute an effective protection against old-age poverty, at the same time it has a negative impact on system sustainability in that pension obligations increase substantially and distort workers' incentives, making it advantageous for them to retire early. This rule also limits public policies that the state may have implemented in relation to the job market, since any potential increase in the MW must factor in, at the same time, the fiscal cost arising from its impact on the pension system. For more details, see Annex C.

32. Other parameters that explain the trend of rising expenditure are the number of years of contributions and the retirement age required to obtain a pension. In general, the greater the number of years of contributions and/or the lower the retirement age, the greater the gap between contributions and pensions. If contributions are insufficient to finance pensions, governments will end up subsidizing the systems. Again, the systems of Mexico and Colombia possess some of these characteristics (see Annex C for further details). Another relevant rule is average income (or reference income) used for the pension calculation. In general, short periods encourage workers to declare high earnings at the end of their working life in order to increase their pension, generating higher pension expenditures for the system. Moreover, when the pension is calculated based on short employment periods, it favors workers with higher income, since they have an earning profile with a steep slope over their working life - to the detriment of lower-income workers, whose earning profile has a flatter slope.

hypothesis of low fertility.[33] This type of shock is exogenous to the countries and is due to demographics. An internal shock, on the other hand, is the result of decisions taken by countries - for example, through a public policy that extends the NCP to the entire retirement-age population or which increases its generosity. In our simulation, we assume the first policy and keep its generosity constant.

As far as our model is concerned, the first scenario implies a higher dependency ratio due to the smaller size of the active population aged between 14 and 64 compared with the population over the age of 65. We simulate the second through a greater eligibility ratio where, beginning with each country's starting point in 2015, the number of pensioners gradually rises (at a constant rate) until it covers 100% of the retirement-age population in 2075.

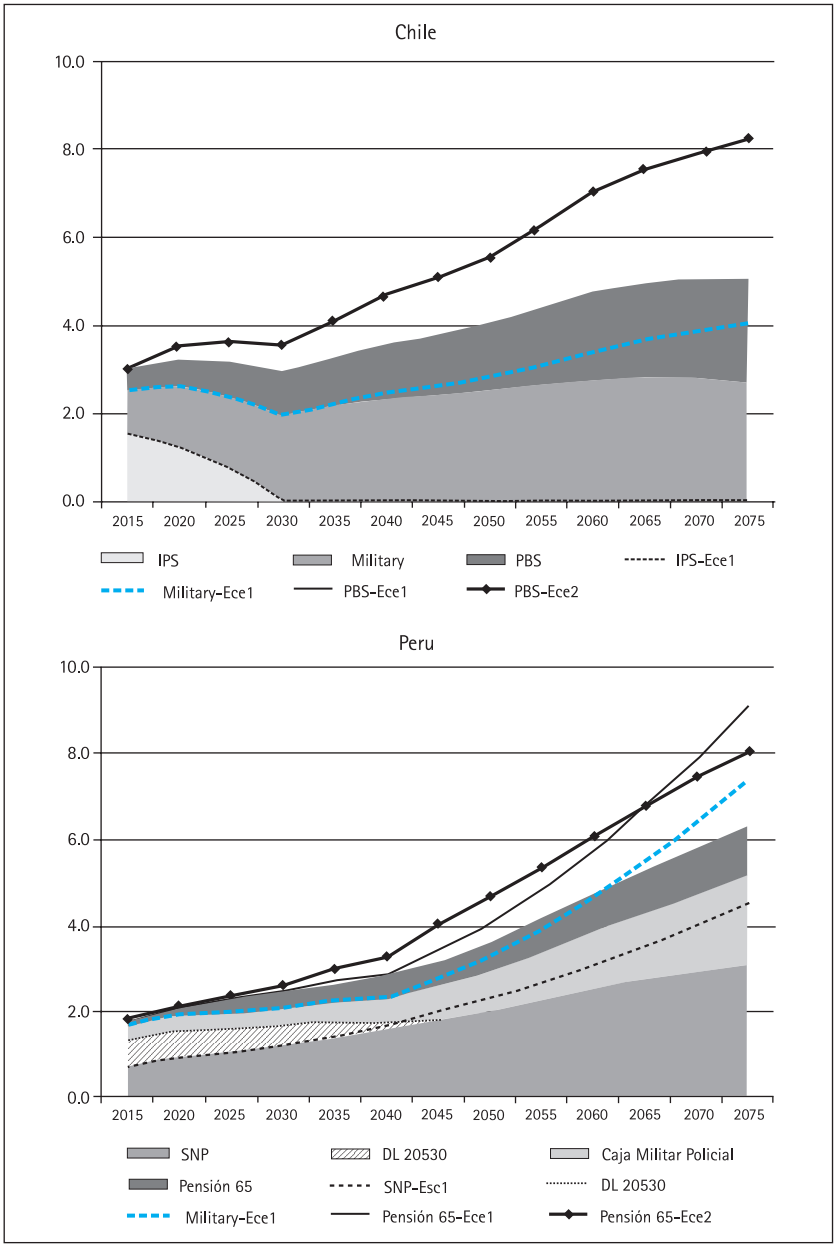
The figures in Graph 5 set out the results of both scenarios. These are compared with those of the base scenario. Overall, we observe that public spending increases considerably starting from 2035. The scale of the change, however, varies depending on the country and the scenario.

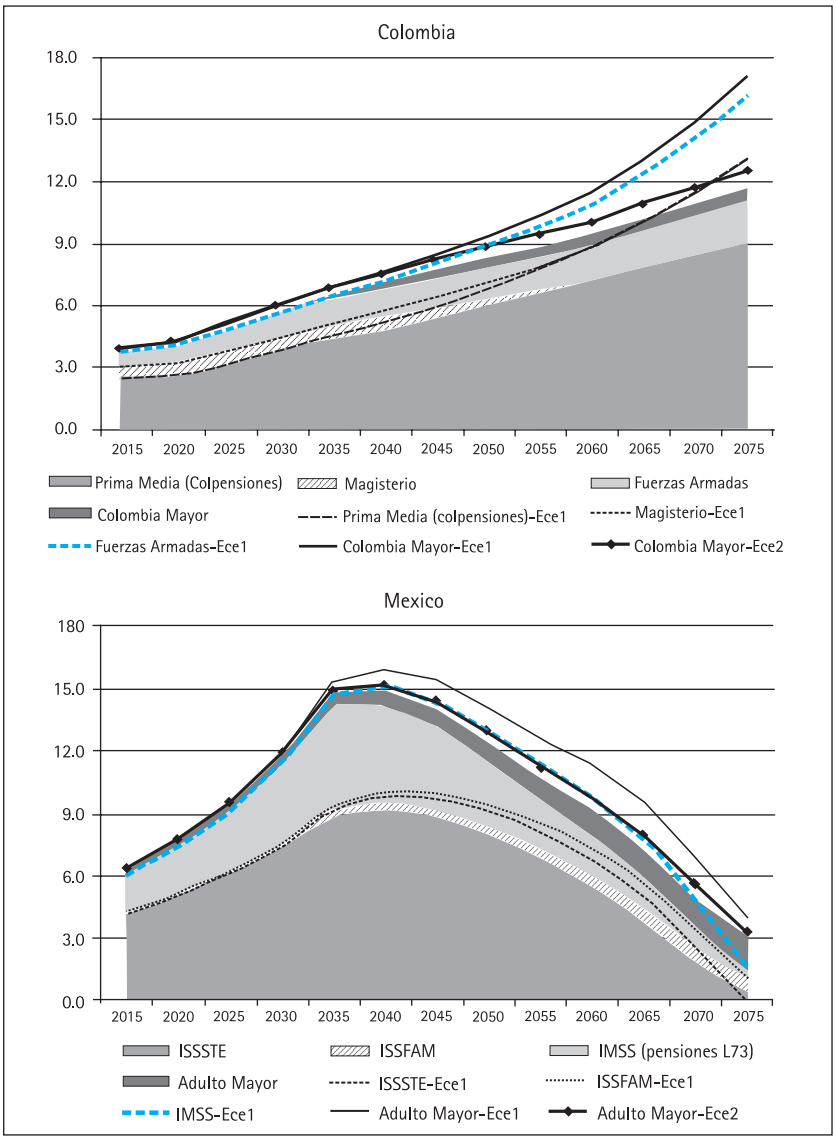
In the first scenario (hypothesis of increased aging or lower fertility), the expenditures of Colombia and Mexico are those that increase the most in relation to the base scenario. In Colombia, total spending increases from 11.7% to 17.0% of GDP in 2075; this corresponds mainly to Colpensiones, the scheme most affected by aging. At present value, this increased spending translates into 14.1 points of GDP for the period of analysis compared with the base scenario. This will undoubtedly put pressure on the budget and on public finances. In Mexico, the story is similar. At present value, the increased spending translates into 14.6 points of GDP for the same period. The rise will occur starting in 2035, and will be mainly associated with the ISSSTE, the scheme that will require the most funding to pay for the pensions of those who retire in those years, given that there will be even less contributors due to the lower fertility rate and the fact that it is a closed system.

In the cases of Chile and Peru, pension expenditure will also be affected by population aging, albeit to a lesser extent. In the base scenario, total expenditure is estimated at 5.1% and 6.3% of GDP in 2075, respectively; meanwhile, in the low fertility scenario, spending rises to 7.6% and 9.0%, respectively. In Peru, the most affected system is the SNP, while in Chile it is the armed forces pensions. In both cases, the increase in spending becomes more pronounced starting in 2040 and, overall, translates into 7.2% and 6.3 points of GDP at present value, respectively.

33. The low hypothesis holds that fertility would reach 1.6 children per woman, below the population replacement level. For more details, see United Nations (2014).

Graph 5
Projection of public pension expenditure: scenarios of low fertility and universal NCPs, four Latin American countries, 2015–2075 (in percentages of GDP)





Notes

- VP 2015-2075, with 4% discount rate.
- Sce1 (low fertility scenario): Chile (96.8% of GDP); Peru (77.5% of GDP); Colombia (170.6% of GDP); Mexico (270.6% of GDP).
- Sce2 (universal NCPs scenario): Chile (110.9% of GDP); Peru (81.4% of GDP); Colombia (163.8% of GDP); Mexico (260.8% of GDP).
- The estimates are shown in Annex E.

Sources: CEPAL (2013a); United Nations (2014); institutes of statistics; ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

In the first scenario (hypothesis of increased aging or lower fertility), the expenditures of Colombia and Mexico are those that increase the most in relation to the base scenario. In Colombia, total spending increases from 11.7% to 17.0% of GDP in 2075; this corresponds mainly to Colpensiones, the scheme most affected by aging. At present value, this increased spending translates into 14.1 points of GDP for the period of analysis compared with the base scenario. This will undoubtedly put pressure on the budget and on public finances. In Mexico, the story is similar. At present value, the increased spending translates into 14.6 points of GDP for the same period. The rise will occur starting in 2035, and will be mainly associated with the ISSSTE, the scheme that will require the most funding to pay for the pensions of those who retire in those years, given that there will be even less contributors due to the lower fertility rate and the fact that it is a closed system.

In the cases of Chile and Peru, pension expenditure will also be affected by population aging, albeit to a lesser extent. In the base scenario, total expenditure is estimated at 5.1% and 6.3% of GDP in 2075, respectively; meanwhile, in the low fertility scenario, spending rises to 7.6% and 9.0%, respectively. In Peru, the most affected system is the SNP, while in Chile it is the armed forces pensions. In both cases, the increase in spending becomes more pronounced starting in 2040 and, overall, translates into 7.2% and 6.3 points of GDP at present value, respectively.

In the second scenario (universal NCPs), we find that spending also increases significantly in relation to the base scenario. In this case, Chile and Peru are the countries whose expenditures increase the most. In Chile, this is mainly because the amount spent on the PBS is relatively high in comparison with the other countries, so any internal policy that extends this benefit will also push up spending. At present value, the increase represents 21.3 points of GDP for the period 2015-2075. Meanwhile, Peru's spending rises not only due to the pensions disbursed by Pensión 65 (which are not as high as in Chile, but higher than in Colombia and Mexico), but also to the increase in its coverage.

In the cases of Colombia Mayor and the Adulto Mayor program in Mexico, spending also increases slightly, going from 0.6% and 1.6% of GDP in 2075 in the base scenario to 1.5% and 2.4% in the new scenario, respectively. At present value, these increases represent 7.3 and 5.0 points of GDP, respectively. [34]

34. It should be noted that this scenario does not assume any future increase in the value of NCPs. If both changes were to be simulated (universalization and increased pension value), expenditures would go up even more.

What can be inferred from these scenarios is that pension spending is sensitive to both demographic factors and the internal factors pertaining to each country. Faster aging prompted by lower fertility rates means that the countries will have to allocate more funds to their pensions, and especially to DB systems that remain open. Moreover, public policies that extend NCPs to the entire adult population entail mounting commitments in the long run, which are often not projected or budgeted.

6. CONCLUSIONS AND REFLECTIONS

In this study, we have analyzed the determinants of public spending on pensions and projected its evolution through to 2075 for four countries in the region: Chile, Peru, Colombia, and Mexico, with pension spending defined as that allocated to DB and NCP systems, using the projection model of Clements et al. (2013). We find that although countries already spend between 1.8% and 6.4% of their GDP on pensions, this spending will increase between two and fourfold in the long term.

Moreover, we find that the rise in costs depends not only on external factors in each of the countries such as population aging, but also on internal factors that depend on domestic policy, such as the role of DB systems and their maturation, the generosity of pension rules, how these are related to DC systems, and policies related to NCPs.

Two simulations were also performed in this study. The first assumed a more pronounced aging scenario (external shock), and the second, the universalization of NCPs (internal shock). We find that pension spending is sensitive to these shocks. Lower fertility rates within the population and consequent greater aging means that countries will have to allocate even more funding to their pensions, especially to DB systems. Moreover, public policies that extend NCPs to the entire adult population entail greater fiscal commitments in the long run, which will have an impact on public finances.

An initial consideration is that countries in the region need to give more attention to the aging process and its long-term consequences, and especially to the fiscal sustainability of pension systems. The region's expenditure remains high due to the DB schemes and the transition costs to FC schemes (RBs, minimum pensions, solidarity contributions); what is more, in addition to these schemes, a new liability is now being assumed: NCPs. It should be borne in mind that these liabilities are long-term and sensitive to demographic and internal-public-policy changes.

A second reflection is that it is necessary to project and budget pension spending on an ongoing basis, and to design and implement reforms in a timely fashion. For example, in

developed countries, population aging and low economic growth rates are already exerting considerable fiscal pressure and jeopardizing the sustainability of pension programs. In response, these countries are increasing the official retirement age. The United States did so at a very early stage, in 1983, gradually raising the retirement age from 65 to 67 years of age. Similar policies have been adopted by Denmark, Germany, the United Kingdom, and the Netherlands.[35] Within the region, each country needs to consider what reforms it needs to implement. It should not be forgotten that only the ongoing design and timely implementation of such reforms will prevent major fiscal pressures in the future.[36]

Finally, it is recommendable that the countries implement policies to assure the financing of future pension commitments. An interesting case is Chile, which has created a Pension Reserve Fund for the payment of minimum pension and NCP guarantees, financed by savings of 1% of GDP from the structural surplus rule. This demonstrates a precaution that is already being taken to assure a source of financing for future pension expenses and thus avoid fiscal pressures.[37] It should be recalled that, ultimately, any deficit will be covered by governments from general revenues, whether by raising taxes or reducing spending in other sectors.

35. See Bernal and Vermeulen (2014) for more details.
36. Another interesting policy that is widely used by developed countries is generational accounting. This method proposes the exact measurement of the costs and benefits of the fiscal policy for each generation; as such, it yields information that allows the implications of current policies on future generations to be visualized, and is thus highly relevant to the design of long-term public policy (Auerbach *et al.* 1994).
37. Policies of this type can be observed in developed countries. Nations such as Sweden, Japan, and South Korea have reserve funds that exceed 25% of their GDP. Moreover, the United States, Canada, and some European countries seem to be reserving funds for future pension spending (Holzmann 2013). In the region, except for Chile and Mexico, which have funds totaling 3.8% and 3.6% of their GDP, respectively, such policies are not implemented.

ANNEXES

The following annexes contain information regarding NCPs, descriptions of the different pension systems in Chile, Peru, Colombia, and Mexico, pension rules, information on the variables and parameters used to conduct the estimations, and the results of our simulations.

Annex A

Non-contributory pensions

Social or non-contributory pensions (NCPs) are financial transfers made by the state to retirement-aged adults that are not associated with their contributions (Holzmann et al. 2009); indeed, in many cases, individuals may have made no contributions whatsoever during their working life. Possible reasons for individuals failing to save in a contributory system are associated with informality, as those who work on this basis are under no obligation to do so and their earnings are very close to subsistence levels. It is for this reason that NCPs have been created to allow senior citizens to withdraw from the job market with a secure stream of income, so that they do not slide into poverty or continue working well into old age or for their whole lives (Novella and Olivera 2014). NCPs also have positive impacts on levels of life satisfaction and on the health of beneficiaries and their households. In this regard, Galiani and Gertler (2010) conducted an impact evaluation of the 70 y Más program in Mexico; while Galiani et al. (2016) report evidence of positive effects on the mental health of beneficiaries.

However, previous studies also find that these programs could affect savings and the availability of work. Piggot *et al.* (2008) use a life-cycle behavioral model to explore the effects of the incentives pertaining to non-contributory programs on savings decisions (and labor supply). They find that NCPs create a break in the inter-temporal utility of individuals, making it optimal for them to increase their consumption during the initial periods. The effect will depend on the transfer size relative to an individual's average income.

Two different types of NPC schemes can be identified. The first is universal and benefits all individuals starting at a given age. Generally, this scheme expands pension coverage quickly, but it is fiscally costly and susceptible to political pressures to increase both benefit value and the number of beneficiaries. In the region, Bolivia is the only country that disburses this type of pension to everyone from the age of 60. The second is the conditional scheme. As its name suggests, individuals must meet certain conditions to obtain this benefit. These may include being below the poverty line or having an income level below a certain threshold. Brazil, Peru, Colombia, and Chile all employ this type of scheme; because it is conditional, its scope in terms of coverage and fiscal costs is smaller than that of universal systems. Systems of this type are also vulnerable to political pressures.

Annex B

Description of civil pension systems

B.1. Chile

Chile, as one of the first countries in the region to reform its pension system, is an important Latin American benchmark. In 1981, Chile replaced its DB public pension system with a DC private pension system (Sistema Privada de Pensiones, SPP). The former is administered by the IPS, while the private system is made up of pension fund administrators (administradoras de fondos de pensiones, AFP) and is supervised by the Pensions Superintendency (SP).

In 2008, the Chilean government proposed a new pension reform whose central aims were threefold: (i) to create a new SPS, returning to the state its role as guarantor of the social security of the poorest 60% of the population; (ii) increasing pension coverage for the most vulnerable groups: young people, women, and independent workers; and (iii) improving the SPP by increasing its responsibilities and bolstering voluntary pension saving (APV).

As a consequence of the new reform, Chile's replacement pension model made way for the so-called mixed system, made up of four pillars. Pillar 0, the so-called Solidarity Pillar, has a redistributive function. In Chile it includes, on the one hand, the PBS program, aimed at individuals with limited economic resources who have not contributed to any pension system; and, on the other hand, the APS system, targeted at those who have paid less than the required minimum into the private system. It should be noted that these benefits (PBS and APS) have replaced the PASIS and the state minimum pension guarantees (garantías estatales de pensión mínima, GEPM) that were in place before the reform. Pillar 1 refers to the private pension and DB plan; Pillar 2 has a large proportion of affiliates and is made up of the PPS; finally, Pillar III is the voluntary system.

B.2. Peru

The Peruvian pension system is made up of three main schemes: the DL N° 19990 (called the SNP); the DL N° 20530 (called cédula viva), and the SPP. The first two are administered by the state by way of the Pension Normalization Office (Oficina de Normalización Previsional, ONP) and form part of the Public Pensions System (Sistema Público de Pensiones, SNP); and the third is administered by private firms known as AFPs.

The SNP is a DB system whose main characteristic is the disbursement of fixed entitlements and non-defined contributions. By 1992, this system had begun to show signs of a financial imbalance that was due to several factors, which meant that the contributions of active workers were insufficient to cover the payment of pensions and, as a result, the Treasury

started to make up the difference. At present, this system remains underfinanced, though the situation has improved.

In this context, an alternative and parallel pension system was set up that year, administered by the private AFPs. Thus, the SPP was created, a DC system in which the contributions made by each worker are deposited into their individual accounts, the value of which increases each month through contributions and the profits generated by accumulated fund investments.

In turn, DL N° 20530 has its origins in very old laws that granted pensions for life, paid for by the Treasury, to a very small group of civil servants in recognition of their work. Over time, both the benefits and the number of beneficiaries grew and the system became a source of fiscal concern. Underfunding was even more severe than in the case of the SNP because of its more generous rules and the so-called "mirror effect" (pensions that were indexed based on pay). In 2004, a constitutional reform was carried out that closed this system off to new workers for good, did away with the mirror effect, and implemented other parametric reforms. At present, although the system remains underfinanced, the deficit has been reduced markedly.

Finally, there is a NCP system known as Pensión 65: a nationwide solidarity assistance program administered by the Ministry of Development and Social Inclusion (Ministerio de Desarrollo e Inclusión Social, MIDIS). The system was established in 2011, and as of January 2012, it disburses a pension of 125 soles to low-income (extremely poor) individuals over the age of 65 who are not enrolled in any contributory pension system.

B.3. Colombia

The General Pension System (Sistema General de Pensiones, SGP) was created by Law N° 100 in 1993 and came into effect starting in 1994. It is made up of two professional systems: the RPM with defined entitlements, administered primarily by Colpensiones (ex ISS); and the RAIS, administered by AFPs. These systems, in turn, are administered by the Financial Superintendence of Colombia.

The RPM is a public common fund that is financed by the contributions of all affiliates, who cannot make voluntary payments. Conversely, RAIS consists of individual savings funds exclusively owned by the affiliates who can contribute on a voluntary basis to increase the value of the pensions they will receive in the future.

As to redistribution mechanisms, two funds exist: the Solidarity Pension Fund (Fondo de Solidaridad Pensional, FSP); and the Minimum Pension Guaranty Fund (Fondo de Garantía

de Pensión Mínima, FGPM). The former is universal in that it covers the entire Colombian population, and includes two types of sub-accounts: a solidarity account, which seeks to complement the pension system contributions of affiliates who are unable to continue paying in; and a subsistence account, which is a direct pension benefit. The FSP finances the NCP program known as Colombia Mayor (formerly known as the Senior Citizen Social Protection Program [Programa de Protección Social al Adulto Mayor, PPSAM]). The second fund is financed by RAIS affiliates and is aimed only at topping up their pensions to allow them access to the minimum pension.

It is important to mention that, as in Peru, Colombia has a parallel pension model in which affiliates can contribute to either of the systems - RPM or RAIS - until retirement age; until 2013, this was 55 for women and 60 for men, but was changed to 57 and 62, respectively, starting in 2014.

B.4. Mexico

In 1943, the Pension System in Mexico was created through the IMSS as a redistribution (or DB) system in which the contributions of active workers at the time financed retirement pensions for the entire population. These pensions proved to be insufficient once the number of individuals entitled to IMSS pensions exceeded the quantities allocated to the fund. Thus, in 1973, the Congress restructured the IMSS pension system: pensions were now calculated based on the average income during the preceding five years and the number of weeks during which a worker contributed.

Later, in July 1997, with a view to assuring the sustainability of the pension system in the medium and long terms, the structural reform of the Social Security Law (Ley del Seguro Social) came into effect; this law provided for the restructuring of the Pension System in Mexico, transforming it from a DB to a DC model.

Today, the Mexican pension system is made up of two main programs: the IMSS, to which formal private sector workers contribute, and the ISSSTE, for public sector employees. Both pension systems were reformed in 1997 and 2007, respectively. The ISSSTE came under sole public administration for public sector workers in 2007, and named the Pensión ISSSTE. At present, these two systems function as DC plans based on individual accounts. In the case of the IMSS, the funds are managed by retirement fund administrators (administradoras de fondos para el retiro, AFORES) and are supervised by the National Commission for the Retirement Savings System (Comisión Nacional del Sistema de Ahorro para el Retiro, CONSAR).

Workers' individual accounts are generally composed of three sub-accounts: retirement, redundancy, and old-age, collectively known as RCV (retirement, redundancy and old-

age), and are used to finance the pensions. In addition to the payments made by each worker, pensions are also financed by a contribution by the employer as well as the social contribution of the federal government, equivalent to 5.5% of the daily MW. The individual accounts also include a voluntary savings sub-account and a Housing Fund sub-account.

As with other countries where structural reforms have been carried out, Mexico is currently undergoing a transition period. Workers who were active when the IMSS reform was implemented, at the time of retirement can select the type of pension they want to receive: from either the DB (Law N° 73) or the DC (Law N° 97) programs. These transitional rules entail maintaining two different pension systems (Law N° 73 and Law N° 97) simultaneously over a prolonged period. All current and future pensions pertaining to Law N° 73 represent a liability for the government, while those corresponding to Law N° 97 are financed through individual accounts. As to the minimum pensionable age, under both laws it is 60 for early retirement, and 65 for old-age.

In addition to these systems, Mexico also has other pension programs such as those of state governments, public universities, and parastatal companies, which together cover 2% of the EAP.

Moreover, Mexico also has several NPC plans for old-age, at both the federal and state levels. The most important is the Pension for Senior Citizens (Pensión para Adultos Mayores) program created in 2013, which is financed by the federal government and administered through the Secretariat of Social Development (Secretaría de Desarrollo Social, SEDESOL) During its early stages, this program was called Pensión 70 y Más and was aimed at individuals over the age of 70. The program has now been extended to everyone who does not receive any old-age pension from a social security institution and disburses 525 Mexican pesos (US $40) per month, paid bimonthly, and a one-off payment of 1,000 pesos (US $77) in the event of the beneficiary's death.

Annex C

Table C1 Selection of DB and non-contributory system parameters, four Latin American countries, 2015

Country	System	Retirement age	Years of contributions	Replacement rate for pension calculation	Reference income or remuneration	Minimum pension	Maximum pension	Readjustment
Peru[1]	SNP	65 years.	20 years.	x% of reference income + 2% for every year of contributions after 20 years.[2]	Average remuneration over the last 60 months.	PEN 415 (USD 125)	S/. 857 (USD 260)	Discretionary
	DL 20530	Not applicable.	Not appicable; only years of service: 12 years	Men: 1/30 of reference salary for each year of service. Women: 1/25.	Average remuneration over the last 12 months.	PEN 415 (USD 125)	2 UIT (USD 2,393)	Discretionary
	Caja Militar Policial	Not applicable.	Not applicable; only years of sevice: 20 years.	Current affiliates: 100% of earnings of active officers of the same rank. New affiliates: 55% of the reference salary.	Average remuneration over the last 60 months.	Minimum remuneration of active personnel.	2 UIT (USD 2,393)	Discretionary
	Pensión 65	65 years.	Not applicable, disbursed to individuals classified as extremely poor according to the well-being index.	Not applicable.	Not applicable.	PEN 125 (USD 38)	PEN 125 (USD 38)	Discretionary
Chile[3]	IPS (ex INP)	Men: 65; women: 60.	SSS: men: 15 years + 0,5 contribution density; women: 10 years.	SSS: 50% of reference income for the first 500 weeks + 1% for every 50 additional weeks. Maximum: 70%. Maximum: 70%.	Average monthly base salary for the last five years.	CLP 218,000 (USD 129, below the age of 70); CLP 140,000 (USD 238, 70-75 years); CLP 150,000 (USD 254, 75 and over).	n. d.[4]	n. d.
			CANAEMPU. EMPART: 10 years.	CANAEMPU, EMPART: given percentage of reference income determined by the number of contributions divided by 30 (35 in the case of EMPART). Maximum: 100%.	CANAEMPU: average monthly base salary for the last three years. EMPART: 5 years.		N. D.	N. D.

Country	System	Retirement age	Years of contributions	Replacement rate for pension calculation	Reference income or remuneration	Minimum pension	Maximum pension	Readjustment
Chile	Military	Not applicable..	Not applicable; only years of service: 20 years.	100% of the most recent taxable earnings from service, on the basis of 1/30 for each year of service calculated for retirement.	Most recent earnings plus pension entitlements.	Minimum remuneration of active personnel.	Maximum remuneration of active personnel.	Inflation
	PBS (ex PASIS)	65.	Not applicable; disbursed to individuals corresponding to the poorest 60% of the population with at least 20 years of residency in the country.	Not applicable.	Not applicable.	CLP 89,764 (USD 152)	CLP 89,764 (USD 152)	Inflation
Colombia[5]	Prima Media (Colpensiones)	Men: 62; women: 57.	26 years.	65, 5-0.5*s, where s is the MW number that represents the base income for calculating pension payment (ingreso base de liquidación, IBL) (+ 1.5% IBL for every 50 weeks in addition to the minimum number, on a decreasing basis according to income level).	The IBL is an average of the contributions over the last ten years.	Current statutory minimum wage (SMLV, USD 205).	25 SMLV (USD 5,115).	Equal to the SMLV.
	Teaching profession	55.	20 years.	75% of the reference salary.	Most recent salary.	SMLV (USD 205).	N/D	Equal to the SMLV.
	Fuerzas Armadas	40-45.	Not applicable; only length of service: 20 years.	7%-95% of the reference salary.	Most recent salary plus pension entitlements.	Minimum remuneration of active personnel.	Maximum remuneration of active personnel.	N/D
	Colombia Mayor	Mem: 60; women: 55.	Not applicable; given to individuals classified as extremely poor (SISBEN 1 or 2).	Not applicable.	Not applicable.	COP 75,000 (USD 24).	COP 75,000 (USD 24).	N/D

Country	System	Retirement age	Years of contributions	Replacement rate for pension calculation	Reference income or remuneration	Minimum pension	Maximum pension	Readjustment
Mexico[6]	ISSSTE[7].	Men: 51-60; women: 49-58. Gradual increase from 2010 to 2028.	Men: 30 years; women: 28 years.	100% of the reference salary; upon reaching 15 years (men) or 10 years (women) of contributions or 55 years of age, a percentage of one's income is received (between 50 and 95%).	Most recent salary.	2 MW (USD 154).		Equal to the MW.
	ISSFAM	50-65.	Not applicable; only length of service: 20 years.	x% of salaries of active officials of the same rank based on years of service + 80% of this total.[8]	Most recent salary plus pension entitlements.	Minimum remuneration of active personnel.	Maximum remuneration of active personnel.	N/D
	Adulto Mayor	65.	Not applicable; given to Mexicans by birth or those with at least 25 years of residency in the country.	Not applicable.	Not applicable.	MXN 662 (USD 40).	MXN 662 (USD 40).	N/D
	IMSS[8]	60.	500 weeks (10 years).	x% of SBC, in relation to the age of the pensioner.(10)	Average earnings over the last 60 months.	MW (USD 127).	25 MW (USD 3,175).	Equal to the MW.

Notes

[1] There exist small pension schemes run by former state-owned firms that were privatized in the 1990s: the Special Fishing Scheme (Régimen Especial Pesquero), among others.

[2] x = 50% if the affiliate was born before 1947; x = 45% if they were born between 1948 and 1953; x = 40% if they were born between 1954 and 1963; x = 35% if they were born between 1964 and 1973; and x = 30% for the remaining affiliates.

[3] The 21 ex-pension funds are concentrated in the IPS; the main ones are: SSS, EMPART and CANAEMPU.

[4] Not determined.

[5] Other pension systems exist such as Ecopetrol, Congresistas, Magistrados and Fonpet, among others.

[6] Other special schemes exist, such as Petróleos Mexicanos (PEMEX), Comisión Federal de Electricidad (CFE), IMSS employees (IMSS-RJP), and schemes pertaining to state governments and other institutions (Central Bank and Supreme Court, among others).

[7] The parameters correspond to the old system, but following the 2007 reforms (rules in force as of 2010),the new DC system was created starting that year (Pensión ISSSTE).

[8] x = 50% if the affiliate has 20 years of service; increases 1-2% for every additional year, until reaching 90%.

[9] Corresponds to the 1973 Social Security Law (Ley del Seguro Social) DB pension rules. In the IMSS, affiliates in transition (enrolled through to 1997) can choose between this or the DC pension.

[10] At 60 years of age: x = 75% of the SBC; 61 years of age: x = 80% of the SBC; 62 years of age: x = 85% of the SBC; 63 years of age: x = 90% of the SBC; 64 years of age: x = 95% of the SBC; 65 years of age: x = 100% of the SBC.

Sources: legislation from each country; compiled by the author.

Annex D

Old-age dependency ratios, coverage, and replacement rate

Table D1
Old-age dependency ratio, four Latin American countries, 2005–2014

Year	Chile	Peru	Colombia	Mexico
2005	8.71	12.23	10.03	11.73
2006	8.52	12.04	10.06	11.54
2007	8.34	11.85	10.02	11.33
2008	8.16	11.66	9.92	11.11
2009	7.99	11.47	9.79	10.89
2010	7.83	11.28	9.62	10.69
2011	7.63	11.08	9.48	10.51
2012	7.45	10.89	9.33	10.33
2013	7.27	10.69	9.16	10.16
2014	7.10	10.01	8.98	9.95

Note
The old-age dependency ratio is defined as the proportion of working-age individuals to each senior citizen.
Source: United Nations (2014); compiled by the author.

Table D2
Replacement rate, four Latin American countries, 2005-2014 (in percentages)

year	Chile					Peru						Colombia						Mexico				
	Total	DB		NCP	DC	Total	DB			NCP	DC	Total	DB			NCP	DC	Total	DB		NCP	DC
		IPS	Militares	PBS	SPP		SNP	DL 20530	Caja Militar Policial	Pensión 65	SPP		Prima Media	Magis-terio	Fuerzas Armadas	Colombia Mayor	RAIS		ISSSTE	ISSFAM	Adulto Mayor	IMSS
2005	139.05	63.25		31.31	44.49	45.08	29.38	13.81			1.89	39.20	32.16			6.34	0.70	51.58	9.29	0.83		41.46
2006	137.53	60.64		31.66	45.23	44.85	29.29	13.41			2.14	42.46	34.32			7.34	0.80	51.80	9.49	0.82		41.49
2007	136.63	57.91		32.56	46.16	43.50	28.19	12.98			2.32	45.22	35.85			8.44	0.93	68.79	9.66	0.81	16.33	41.99
2008	147.62	55.19	7.12	38.37	46.95	41.65	27.16	12.06			2.43	59.42	37.25	3.52	7.92	9.66	1.06	81.26	10.17	0.81	28.45	41.83
2009	149.04	52.63	6.92	40.97	48.52	40.54	26.79	11.25			2.50	53.80	30.04	3.75	7.78	11.01	1.22	83.86	10.73	0.82	30.16	42.15
2010	151.68	50.62	6.73	40.44	53.89	42.20	26.35	10.91	2.04		2.90	59.86	31.14	4.05	7.52	15.75	1.40	84.58	11.44	0.85	29.85	42.44
2011	149.72	46.98	6.54	38.67	57.53	41.94	26.02	10.57	2.17		3.18	64.62	31.80	4.22	7.42	19.55	1.63	87.19	14.00	0.88	29.41	42.90
2012	145.80	44.41	6.34	36.21	58.84	55.11	25.78	10.23	2.29	13.42	3.41	67.47	31.89	4.45	7.27	22.03	1.83	98.08	13.50	0.91	40.38	43.28
2013	143.07	42.70	6.18	34.19	60.00	57.29	25.23	9.97	2.36	16.05	3.67	77.59	33.33	4.66	7.03	30.53	2.04	108.36	14.00	0.94	49.75	43.68
2014	137.25	40.40	6.00	32.81	58.04	59.29	24.46	9.73	2.70	18.43	3.97	83.62	33.98	5.12	6.19	36.08	2.25	119.05	14.50	0.97	59.53	44.04

- Notes
- Passive coverage is defined as the percentage of senior citizens who receive a contributory pension or a NCP.
- The level of coverage may be greater than 100% because the numerator may take into account pensioners below the age of 65, while the denominator takes into account the population over the age of 65.
- Retirement ages under the main systems:
  - Chile: 65 for men, 60 for women.
  - Peru: 65 for both sexes.
  - Colombia: 60 through to 2014, 62 thereafter, for men; 55 years through to 2014, 57 thereafter, for women.
  - Mexico: 60 under the IMSS (Law N° 73); there is no minimum age in the ISSSTE.
- For more details, see Annex C.

Sources: Ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

Table D3
Replacement rate, four Latin American countries, 2005–2014 (in percentages)

Year	Chile					Peru						Colombia						Mexico				
	Total	DB		NCP	DC	Total	DB			NCP	DC	Total	DB			NCP	DC	Total	DB		NCP	DC
		IPS	Militares	PBS	SPP		SNP	DL 20530	Caja Militar Policial	Pensión 65	SPP		Prima Media	Magis-terio	Fuerzas Armadas	Colombia Mayor	RAIS		ISSSTE	ISSFAM	Adulto Mayor	IMSS
2005	21.74	17.65		6.28	38.42	66.69	41.86	119.85			64.41	36.59	42.59			5.24	44.86					
2006	20.29	16.65		4.50	36.23	57.95	37.46	105.91			37.76	48.38	57.97			4.43	40.49	16.60	24.10	34.57		14.53
2007	20.20	15.73		4.45	36.93	57.21	35.37	106.44			47.03	43.21	52.55			4.04	38.59	13.28	24.10	34.88		15.53
2008	20.63	17.30		5.59	39.97	50.33	28.18	101.85			42.26	35.86	55.24			3.71	34.67	12.62	26.95	36.85		17.24
2009	21.73	18.61		6.30	41.24	40.38	28.20	69.34			40.58	38.77	66.64			3.84	34.28	13.91	27.41	40.06		19.91
2010	24.41	17.68	64.04	6.40	39.31	34.90	25.26	62.79			42.14	46.09	57.29	97.49	63.78	3.63	30.93	14.40	25.74	44.89		20.85
2011	25.27	17.77	63.07	6.21	39.90	31.65	23.03	57.62			37.46	42.75	56.73	90.65	62.51	3.34	28.90	15.91	22.16	46.89	2.55	22.39
2012	26.76	18.31	64.90	6.27	41.63	24.02	21.68	56.27		4.76	36.97	41.01	56.13	89.29	63.91	3.15	24.80	14.99	24.04	43.42	2.31	23.40
2013	27.96	17.91	65.14	6.17	43.71	21.78	20.52	52.96		4.48	35.42	34.63	50.10	86.95	66.70	2.99	25.61	14.73	24.42	47.82	2.35	25.01
2014	28.58	17.83	65.83	6.01	44.96	26.38	20.48	58.64	101.93	4.27	34.93	32.92	50.06	82.17	74.33	2.84	30.24	14.00	23.91	43.08	2.57	25.54

Notes

- The replacement rate is defined as the average pension divided by the average income of the EAP (pension/[GDP/EAP]).
- The total replacement rate is calculated as the weighted average of the replacement rates for each scheme, and their coverage.

Sources: Ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

Annex E

Results of the simulations

Table E1
Scenario 1: Most rapid aging, four Latin American countries, 2015-2075 (percentages of GDP)

Year	Chile				Peru					Colombia					Mexico				
	Total	DB		NCP	Total	DB			NCP	Total	DB			NCP	Total	DB		NCP	DC
		IPS	Militares	PBS		SNP	DL 20530	Caja Militar Policial	Pensión 65		Prima Media	Magis-terio	Fuerzas Armadas	Colombia Mayor		ISSSTE	ISSFAM	Adulto Mayor	IMSS
2015	2.98	1.53	1.00	0.45	1.81	0.69	0.59	0.41	0.12	3.90	2.48	0.61	0.67	0.14	6.43	4.17	0.07	0.28	1.91
2020	3.21	1.24	1.36	0.61	2.13	0.90	0.62	0.38	0.23	4.24	2.61	0.59	0.86	0.18	7.74	5.07	0.08	0.36	2.23
2025	3.16	0.78	1.62	0.76	2.29	1.02	0.55	0.39	0.33	4.95	3.12	0.62	0.99	0.21	9.50	6.05	0.10	0.41	2.94
2030	2.95	0.03	1.94	0.97	2.44	1.19	0.47	0.39	0.39	5.84	3.78	0.64	1.16	0.26	11.91	7.37	0.13	0.49	3.92
2035	3.42	0.04	2.21	1.17	2.70	1.39	0.34	0.50	0.46	6.79	4.52	0.63	1.32	0.31	15.32	9.21	0.17	0.61	5.33
2040	3.84	0.05	2.43	1.36	2.83	1.64	0.00	0.65	0.55	7.52	5.15	0.57	1.44	0.36	15.88	9.80	0.23	0.76	5.09
2045	4.15	0.05	2.57	1.53	3.41	1.93	0.00	0.82	0.66	8.38	5.91	0.49	1.58	0.41	15.35	9.70	0.29	0.91	4.44
2050	4.59	0.06	2.78	1.75	4.03	2.23	0.00	1.03	0.77	9.29	6.75	0.36	1.71	0.47	14.06	9.08	0.36	1.06	3.56
2055	5.16	0.00	3.09	2.07	4.79	2.60	0.00	1.29	0.91	10.28	7.71	0.18	1.86	0.54	12.54	8.10	0.45	1.23	2.76
2060	5.89	0.00	3.43	2.45	5.70	3.02	0.00	1.61	1.07	11.47	8.84	0.00	2.01	0.62	11.31	6.81	0.56	1.44	2.51
2065	6.48	0.00	3.67	2.80	6.70	3.47	0.00	1.98	1.25	13.06	10.08	0.00	2.27	0.71	9.53	5.02	0.70	1.72	2.10
2070	7.01	0.00	3.86	3.15	7.80	3.96	0.00	2.40	1.44	14.87	11.47	0.00	2.60	0.81	6.84	2.51	0.87	2.03	1.44
2075	7.61	0.00	4.06	3.55	9.03	4.48	0.00	2.90	1.65	17.04	13.13	0.00	2.98	0.93	3.91	0.00	1.06	2.38	0.47

Notes

- In the case of Mexico, the IMSS is included because it will pay DB pensions (Law N° 73) through to 2035-2040; after these years, it is assumed that there will still be expenditures because retirement and survivor's pensions will be paid.
- VP 2015-2075, with 4% discount rate. Chile (96.8% of GDP); Peru (77.5% of GDP); Colombia (170.6% of GDP); Mexico (270.6% of GDP).

Sources: CEPAL (2013a); United Nations (2014); institutes of statistics; ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

Table E2
Scenario 2: NCP expansion, four Latin American countries, 2015–2075 (percentages of GDP)

Year	Chile				Peru					Colombia					Mexico				
	Total	DB		NCP	Total	DB			NCP	Total	DB			NCP	Total	DB		NCP	DC
		IPS	Militares	PBS		SNP	DL 20530	Caja Militar Policial	Pensión 65		Prima Media	Magis-terio	Fuerzas Armadas	Colombia Mayor		ISSSTE	ISSFAM	Adulto Mayor	IMSS
2015	2.98	1.53	1.00	0.45	1.81	0.69	0.59	0.41	0.12	3.90	2.48	0.61	0.67	0.14	6.43	4.17	0.07	0.28	1.91
2020	3.52	1.24	1.36	0.92	2.13	0.90	0.62	0.38	0.23	4.29	2.61	0.59	0.86	0.22	7.76	5.07	0.08	0.38	2.23
2025	3.62	0.78	1.62	1.22	2.34	1.02	0.55	0.39	0.37	5.09	3.12	0.62	0.99	0.36	9.56	6.05	0.10	0.47	2.94
2030	3.56	0.03	1.92	1.61	2.59	1.17	0.46	0.39	0.56	6.04	3.73	0.63	1.14	0.53	11.86	7.27	0.13	0.59	3.87
2035	4.16	0.04	2.13	1.99	2.97	1.35	0.33	0.49	0.80	6.97	4.37	0.61	1.28	0.70	14.97	8.90	0.17	0.76	5.15
2040	4.69	0.04	2.29	2.36	3.26	1.55	0.00	0.61	1.11	7.54	4.85	0.54	1.36	0.78	15.18	9.21	0.22	0.98	4.79
2045	5.07	0.05	2.35	2.68	4.01	1.77	0.00	0.76	1.48	8.19	5.42	0.45	1.45	0.88	14.36	8.85	0.27	1.20	4.05
2050	5.55	0.00	2.46	3.09	4.64	1.99	0.00	0.92	1.73	8.81	6.00	0.32	1.52	0.97	12.89	8.01	0.32	1.42	3.14
2055	6.26	0.00	2.63	3.63	5.32	2.23	0.00	1.11	1.97	9.42	6.60	0.15	1.59	1.08	11.18	6.87	0.38	1.58	2.34
2060	7.01	0.00	2.78	4.23	6.04	2.49	0.00	1.33	2.23	10.07	7.24	0.00	1.65	1.18	9.75	5.50	0.45	1.77	2.03
2065	7.52	0.00	2.81	4.71	6.75	2.73	0.00	1.55	2.47	10.90	7.84	0.00	1.77	1.29	7.94	3.82	0.53	1.99	1.60
2070	7.88	0.00	2.77	5.11	7.40	2.93	0.00	1.78	2.69	11.70	8.41	0.00	1.90	1.38	5.61	1.78	0.61	2.19	1.02
2075	8.21	0.00	2.71	5.50	8.00	3.10	0.00	2.01	2.89	12.52	8.99	0.00	2.04	1.49	3.37	0.00	0.70	2.37	0.31

Notes

- In the case of Mexico, the IMSS is included because it will pay DB pensions (Law N° 73) through to 2035-2040; after these years, it is assumed that there will still be expenditures because retirement and survivor's pensions will be paid.
- VP 2015-2075, with 4% discount rate. Chile: 110.9% of GDP; Peru: 81.4% of GDP; Colombia: 163.8% of GDP; Mexico: 260.8% of GDP.

Sources: CEPAL (2013a); United Nations (2014); institutes of statistics; ministries of finance and social welfare; social security superintendencies and institutions; compiled by the author.

BIBLIOGRAPHY

ALESSIE, Rob; Arie KAPTEYN and Frank KLIJN
1997 "Mandatory Pensions and Personal Savings in the Netherlands." In: *De Economist,* vol. 145, no. 3, pp. 291-324.

ALONSO, Javier; Carmen HOYO; David TUESTA
2014 "Un modelo para el sistema de pensiones en México: diagnóstico y recomendaciones." Working Paper No. 14/07. Mexico: Banco Continental (BBVA)/Centro de Estudios Económicos.

ARENAS DE MESA, Alberto; Paula BENAVIDES; Leonardo GONZÁLES and José Luis CASTILLO
2008 "La reforma previsional chilena: proyecciones fiscales 2009-2025." Santiago de Chile: Dirección de Presupuestos-Ministerio de Hacienda.

ARENAS DE MESA, Alberto and Pamela GANA
2005 "Proyecciones del gasto fiscal previsional en Chile, bonos de reconocimiento: 2005-2038." Santiago de Chile: Dirección de Presupuestos-Ministerio de Hacienda.

AUERBACH, Alan J.; Jagadeesh GOKHALE and Laurence J. KOTLIKOFF
1994 "Generational Accounting: A Meaningful Way to Evaluate Fiscal Policy." In: *The Journal of Economic Perspectives,* vol. 8, no. 1, pp. 73-94.

BERNAL, Noelia; Ángel MUNOZ; Hugo PEREA; Johanna TEJADA and David TUESTA
2008 *Una mirada al sistema peruano de pensiones.* Lima: Banco Continental-BBVA/Centro de Estudios Económicos.

BERNAL, Noelia and Frederic VERMEULEN
2014 "The Impact of an Increase in the Legal Retirement Age on the Effective Retirement Age." In: *The Economist,* vol. 162, no. 2, pp. 115-145.

BOSCH, Mariano; Solange BERSTEIN; Francesca CASTELLANI; María Laura OLIVERI and Juan Miguel VILLA
2015 "Diagnóstico del sistema previsional colombiano y opciones de reforma." Nota técnica No. 825. Washington D.C.: Inter-American Development Bank.

BOSCH, Mariano; Ángel MELGUIZO and Carmen PAGES
2013 *Mejores pensiones, mejores trabajos: hacia la cobertura universal en América Latina y el Caribe.* Washington D.C.: Inter-American Development Bank.

CEPAL
2013a "Estimaciones y proyecciones de población a largo plazo 1950–2100." Santiago de Chile, 2013." Santiago de Chile: CEPAL. <http://www.cepal.org/es/estimaciones-proyecciones-poblacion-largo-plazo-1950-2100>.

2013b "Observatorio demográfico, 2013." LC/G.2615-P. Santiago de Chile: CEPAL.
2013c "Panorama social de América Latina 2013. 2015 "Informe anual." Reporte técnico. CEPAL.

CLAVIJO, Sergio; Alejandro VERA; David MALAGÓN; Nelson VERA and Margarita CABRA
2013 "El pasivo pensional de Colombia: cálculo de su valor presente neto y sensibilidades paramétricas." Bogotá: ANIF. <http://anif.co/sites/default/files/uploads/Anif-pensiones0913_0.pdf>.

CLEMENTS, Benedict; David COADY; Frank EICH; Sanjeev GUPTA; ALVAR KANGUR; Baoping SHANG and Mauricio SOTO
2013 "The Challenge of Public Pension Reform in Advanced and Emerging Economies." Document No. 275. Washington D.C.: International Monetary Fund.

SEDESOL
2010 "Informe final del estudio de impacto del programa de atención de adultos mayores 70 y más." Mexico: SEDESOL.

GALIANI, Sebastian; Paul GERTLER and Rosangela BANDO
2016 "Non-contributory Pensions." In: *Labour Economics*, vol. 38, pp. 47-58. <http://www.sciencedirect.com/science/article/pii/S0927537115001219>.

HOLZMANN, Robert
2013 "Sistemas de pensiones en el mundo y sus reformas: factores, tendencias y desafíos mundiales." In: Revista Internacional de Seguridad Social, vol. 66, no. 2, pp. 1-34.

HOLZMANN, Robert; David A. ROBALINO and Noriyuki TAKAYAMA (eds.)
2009 *Closing the Coverage Gap: Role of Social Pensions and other Retirement Income Transfers.* Washington D.C.: World Bank Publications.

IFA
2015 "Informe financiero y actuarial. IFA 2015." ISSSTE. <http://www2.issste.gob.mx/images/downloads/instituto/quienes-somos/ifa_2015.pdf>.

KOTLIKOFF, Laurence J.
1996 "Privatizing Social Security. How it Works and Why it Matters." In: *Tax Policy and the Economy,* vol. 10, pp. 1-32. Cambridge, Massachusetts: National Bureau of Economic Research.

LEVY, Santiago and Norbert SCHADY
2013 "Latin America's Social Policy Challenge: Education, Social Insurance, Redistribution." In: *The Journal of Economic Perspectives,* vol. 27, no. 2, pp.193-218.

MESA-LAGO, Carmelo
2000 *Estudio comparativo de los costos fiscales en la transición de ocho reformas de pensiones en América Latina.* Santiago de Chile: CEPAL.

2004 *Las reformas de pensiones en América Latina y su impacto en los principios de la seguridad social.* Santiago de Chile: CEPAL.

MITCHELL, Olivia S. and John W. R. PHILLIPS
2006 "Social Security Replacement Rates for Alternative Earnings Benchmarks." Working Paper No. DT/20006/-6. Pennsylvania: The Wharton School, University of Pennsylvania.

NOVELLA, Rafael and Javier OLIVERA
2014 "Mental Retirement and Non-contributory Pensions for the Elderly Poor in Peru." Discussion Paper DPS 14 5. Lovain: KU Leuven-Center for Economic Studies.

OCDE, ORGANIZACIÓN PARA LA COOPERACIÓN Y EL DESARROLLO ECONÓMICOS
2016 "Estudio de la OCDE sobre los sistemas de pensiones: México." Reporte técnico. Paris: OCDE.

OLIVERA, Javier
2009 "Welfare, Inequality and Financial Consequences of a Multi-pillar Pension System. A Reform in Peru." ECINEQ Working Paper 2010-152. Verona: SSRN.

OLIVERA, Javier and Blanca ZULUAGA
2014 "The Ex-ante Effects of Non-contributory Pensions in Colombia and Peru" In: *Journal of International Development,* vol. 26, no. 7, pp. 949-973.

PIGGOT, John; David ROBALINO and Sergi JIMENEZ-MARTIN
2008 "Incentive Effects of Retirement Income Transfers." In: *Closing the Coverage Gap: The Role of Social Pensions and Other Retirement Income Transfers.* Washington D.C.: World Bank Publications.

SINHA, Tapen
2012 *Estimating Future Pension Liability of the Mexican Government.* Inter-American Development Bank

UNITED NATIONS
2014 "World Population Prospects: The 2012 Revision, Methodology of the United Nations Population Estimates and Projections." ESA/P/WP.235. New York: United Nations-Department of Economic and Social Affairs-Population Division.

WHITEFORD, Peter
1995 "The Use of Replacement Rates in International Comparisons of Benefit Systems." Discussion Paper No. 54. Sidney: Social Policy Research Centre.