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Impact of demographic changes on PAYGO pension systems: International analysis

fiap

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Executive Summary

In the PAYGO pension schemes, the contributions of active workers are used to pay the pensions of current pensioners, so their operation will be heavily dependent on the number of people of working age for each person of retirement age, i.e., the old-age dependency ratio (DR).

World Dependency Ratios

On studying the global DR situation, the analysis by continent reveals that:

- Although there are regions with younger demographics than others, the DR will decrease (the population will age) in all regions worldwide.
- Three continental groups were observed: (i) The older ones: Europe, North America, and Oceania; (ii) The middle-aged ones: Asia and Latin America and the Caribbean; and (iii) The low-aging continent: Africa.
- Asia and Latin America will age very quickly in the coming years. In fact, Latin America will become the region with the oldest inhabitants in the world, together with Europe, by 2100.

Within another 80 years, by 2100, all the countries in the sample will have DRs close to 1, i.e., approximately 1 worker would have to finance the pension of 1 retiree.

Contribution rates required for a standard sustainable PAYGO system

Another way of looking at the financial problem of PAYGO systems is to observe the contribution rate (CR) required for paying pensions that are 70% of salary.

In 1950, PAYGO systems were able to pay pensions without major problems (in Europe, France and Belgium required CRs close to 15%). In Latin America, in turn, the CRs required for this purpose were close to 6%.

However, CR adjustments will be unsustainable in the medium to long term. By 2050, Europe would require an average rate of 42%, while Latin America on average would require 25%, Chile 35.6%, Costa Rica 31.6%, and Uruguay 31%. By 2100 CRs will increase even more. In Europe and Latin America, CRs close to 50% will be required; in North America and Asia close to 45%, and in Oceania close to 40%. Costa Rica, El Salvador, Mexico, Chile, and Uruguay would require CRs bordering on 60%.

These high CRs cannot really be achieved, and even if they could be, they would greatly increase evasion and informality, exacerbating pension system financing issues. Countries with PAYGO systems would therefore resort to other mechanisms, such as raising the retirement age or sharply reducing benefits.

Comparative demographic effect on PAYGO vs. individually funded savings systems

Aging in Latin America would cause a 52% drop in pension amounts in PAYGO systems, and a 24% drop in the individually funded savings systems. I.e., the demographic impact on profits in a PAYGO system is more than double the impact on individually funded systems in Latin America. This difference is consistent across FIAP member countries.

Thus, PAYGO systems must be fully or partially replaced by individually funded savings systems, or by progressively incorporating voluntary individual savings mechanisms to make them sustainable. The situation is particularly worrying for Latin America, where aging will be so rapid that it will become the region with the oldest population, together with Europe, by 2100.

Furthermore, high levels of informality aggravate the financial problems of PAYGO and/or non-contributory pension systems.

I. Introduction

In PAYGO pension schemes, the contributions of active workers are used to pay the pensions of current pensioners, so their financing will be heavily dependent on the number of people of working age for each person of retirement age, i.e., the old-age dependency ratio[1] (DR). This implies that the PAYGO systems will be negatively affected by two demographic phenomena: on the one hand, higher life expectancy at retirement implies financing pensions for a larger number of senior citizens, and, on the other hand, the drop in the fertility rate (number of births per woman of childbearing age) implies a smaller number of people available to contribute to the system.

The purpose of this study is to show the magnitude of the impact of population aging on PAYGO systems and how this impact is significantly less on individually funded savings systems, as well as the situation of each country in an international comparison, with special emphasis on FIAP member countries, based on United Nation population estimates.

II. World Dependency Ratios

Graph 1 illustrates the global situation, with DR defined as the number of people between 25 and 64 years of age[2] (potential contributors) for each person of 65 or more (at retirement age), on each continent over time. This graph shows that:

- Although there are regions with younger demographics than others, the DR will decrease (the population will age) in all regions worldwide.
- Three groups of continents can be observed:
  - The oldest: Europe, North America, and Oceania with a DR close to 6 in 1950, and between 3 and 4 in 2020.
  - Medium aging: Asia, Latin America, and the Caribbean, which had a DR of around 10 in 1950 and close to 6 in 2020.
  - The Low Ageing Continent: Africa, which had a DR of 10.9 in 1950 and virtually the same in 2020 (10.7).

- Asia and Latin America will age very quickly in the coming years, with DRs of 2.7 and 2.8, respectively, by 2050, and 1.6 and 1.4, respectively, by 2100. Thus, Latin America will become the region with the oldest inhabitants in the world, together with Europe, by 2100.

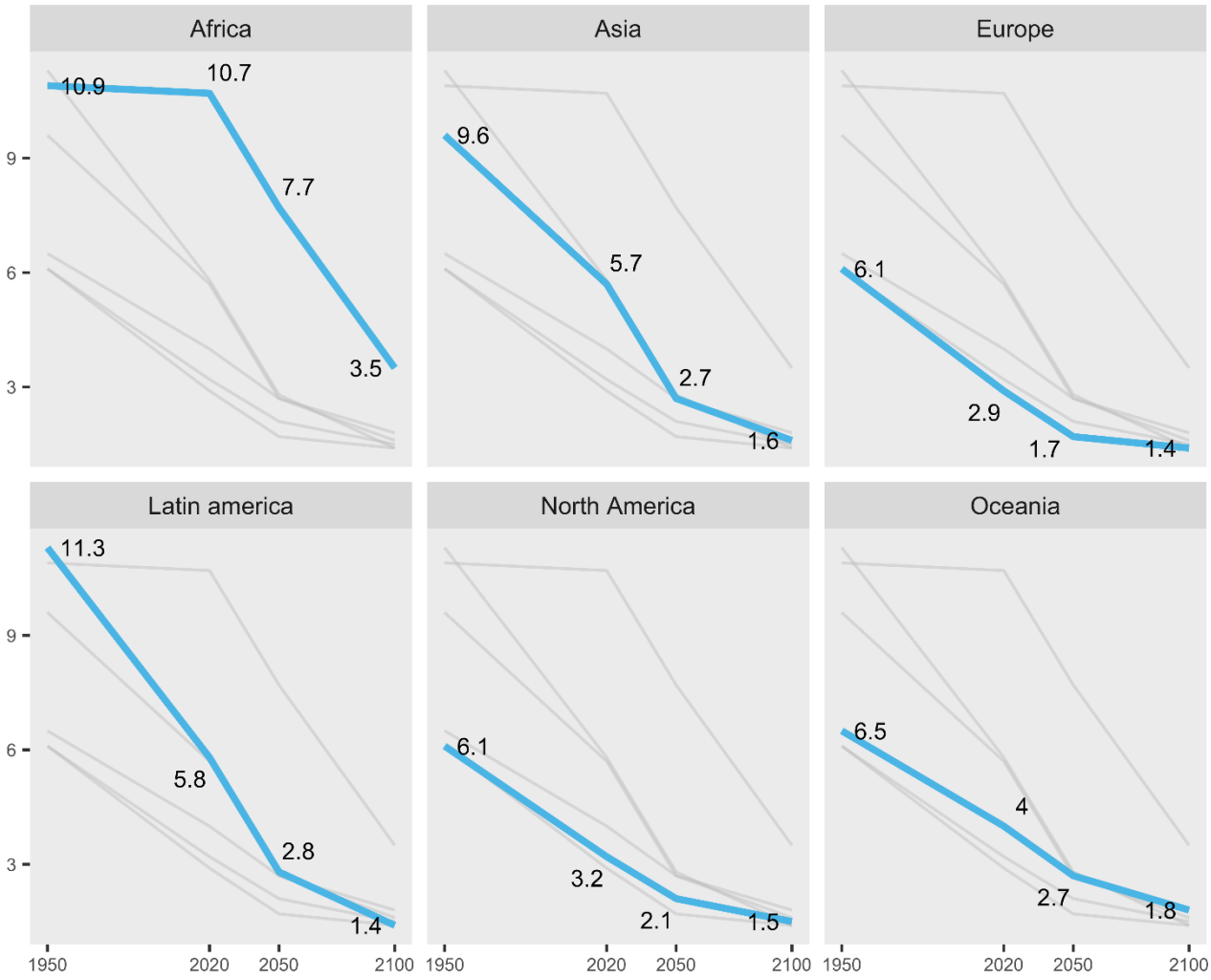
The data clearly explain the reasons for the parametric changes that have been made to the PAYGO systems worldwide, which aim to improve their deteriorated financial situation, reducing expenses (adjusting the pension formula to provide less generous benefits, or direct cuts in benefits) and/or increasing their revenue (increase in the official or early retirement age, contribution rates, or taxable ceiling), mainly in Europe. It is also evident that the speed of population aging in Latin America and Asia in the coming years will make the financial situation of the PAYGO systems in these regions

[1] The dependency ratio is actually the number of people aged 65 and over for each person of working age, so, strictly speaking, we are referring to its inverse throughout the study. This ratio is also known as the potential support ratio.

[2] According to FIAP´s data, as of 2018, the average age of entry into the formal labor market is 27 in Chile and Peru and 26 in Colombia, so this age bracket is probably a better reference for dependency ratio calculations than the 15-64 bracket. Further information is available in Pension Notes 39.

unsustainable, so they will also have to make parametric adjustments and/or significantly increase public financing to eliminate existing deficits.

Graph 1.- Old-age Dependency Ratios (people aged 25-64/people aged 65 and over) by continent - 1950-2100



Source: FIAP with United Nations data and estimates. The mean fertility variant estimate is considered, assuming that it will converge to its replacement level at a rate estimated by using past data for the respective region.

Likewise, Table 1 shows the DR for different countries in the Americas, Asia, Europe, and Oceania. It is clear how the situation changes over time:

- In 1950, in Europe alone, most countries had DRs below 6, with the lowest values in France (4.5) and Belgium (4.8). In Latin America, only 2 countries had DRs lower than 6, Uruguay (5.6) and Bolivia (5.9).
- In 2020, all European countries under study, except for Russia, had DR levels lower than or equal to 3. Finland, Italy, Greece, and France have values below 2.5. The case of Japan is noteworthy, with a value of 1.7, the lowest DR in the world, and with a healthy DR of 8.2 in 1950.
- By 2050, i.e., in only 30 years, there will be very pronounced changes. All European and North American countries will have DRs below 2.1, with values of only 1.2 in Japan, Italy and Spain. There will be very substantial drops in all Latin American countries: the DR will be 2 in Chile, 2.2 in Costa Rica, 2.3 in Uruguay and 2.5 in Colombia.
- By 2100 all the sample countries will have extremely low DRs. They will be 1.1 in Greece, Italy and Spain, 1.2 in Chile, Costa Rica, El Salvador and Uruguay, and 1.3 in Colombia. In China the DR will be 1, i.e., only 1 worker would finance the pension of 1 retiree.

One must bear in mind that when considering all individuals between 25 and 64 as potential contributors, the informality rate of 56% of the average workforce in Latin America in 2021, according to the International Labor Organization (ILO), is not considered. This means that, in reality, less than half of workers contribute to pension systems in the region, highlighting the seriousness of the problem currently facing the PAYGO and/or non-contributory systems[3].

[3] It is worth mentioning that labor informality also affects those affiliated to the individual savings system, through contribution gaps, which reduce the balance available to build a pension.

Table 1.- Old-age Dependency Ratios (People aged 25-64/People aged 65 and over) by Country – 1950-2100

Country or region	1950	2020	2050	2100
Africa	10.9	10.7	7.7	3.5
Asia	9.6	5.7	2.7	1.6
China	8.4	4.6	1.7	1.0
Japan	8.2	1.7	1.2	1.1
Europe	6.1	2.9	1.7	1.4
Russia	9.1	3.7	2.1	1.7
Denmark	5.6	2.6	2.0	1.5
Finland	7.2	2.3	1.8	1.3
Norway	5.5	3.0	2.0	1.4
Sweden	5.3	2.5	2.0	1.4
United Kingdom	5.0	2.8	1.9	1.4
Greece	6.5	2.4	1.3	1.1
Italy	5.9	2.3	1.2	1.1
Spain	6.5	2.8	1.2	1.1
Austria	5.1	2.9	1.6	1.3
Belgium	4.8	2.7	1.8	1.4
France	4.5	2.4	1.6	1.2
Germany	5.5	2.5	1.6	1.3
Netherlands	6.1	2.7	1.8	1.4
Switzerland	5.5	3.0	1.6	1.4
Latin America	11.3	5.8	2.8	1.4
Dominican Republic	11.6	6.9	3.3	1.5
Costa Rica	11.8	5.3	2.2	1.2
El Salvador	8.7	5.6	3.4	1.2
Mexico	11.4	6.2	2.8	1.3
Panama	9.9	5.8	2.8	1.5
Bolivia	5.9	9.0	5.6	2.3
Chile	11.3	4.4	2.0	1.2
Colombia	10.4	6.2	2.5	1.3
Peru	10.5	5.8	3.1	1.5
Uruguay	5.6	3.3	2.3	1.2
North America	6.1	3.2	2.1	1.5
Canada	6.1	3.0	2.0	1.5
United States	6.2	3.2	2.1	1.5
Oceania	6.5	4.0	2.7	1.8
Australia	6.2	3.2	2.1	1.4

Source: FIAP with United Nations data and estimates. The mean fertility variant estimate is considered, assuming that it will converge to its replacement level at a rate estimated by using past data for the respective region.

III. Contribution rates required for a standard sustainable PAYGO system[4]

Another way to analyze the financial problem of PAYGO systems is to ask what contribution rate (CR) should be achieved in the countries under study to maintain the benefits that these systems provide over time. In response, Table 2 assumes that the system's target replacement rate (RR) is 70% of the current average salary[5].

- As expected, PAYGO systems were able to pay pensions without major problems in 1950, when CRs close to 15% in France and Belgium. In Latin America, in turn, the CRs required for this purpose were close to 6% on average, with Uruguay having the largest CR in the region (12.4%).
- The CRs required for fulfilling the purpose increased sharply in 2020. Worldwide, 82 countries with PAYGO systems have increased the contribution rate to address the demographic problem. In fact, Italy, France, and Greece (with mostly PAYGO systems to date) had contribution rates of 33%, 27.8% and 26.5% in 2020, according to OECD data[6], these values are close to those deemed necessary in Table 2, namely 30.3%, 29.6% and 29.2%. In Europe and North America, the CRs required exceed 20%, while in Japan (the oldest country) they exceed 42%, i.e., workers would receive just over half their salary.
- Adjustments to the CR will be unsustainable in the midterm. By 2050, an average rate of 42% would be necessary in Europe. Japan, Italy and Spain would require CRs close to 60%. Latin America would require a rate of about 25% on average (35.6% in Chile, 31.6% in Costa Rica and 31% in Uruguay). Considering that more than half the Latin American workforce is informal, the CRs in this region should be even greater, and with significant state expenditure for financing the non-contributory pension system.
- By 2100, no country or region in the sample (except for Africa) showed realistic figures. In Europe and Latin America, CRs close to 50% will be required; in North America and Asia close to 45%, and in Oceania close to 40%. Costa Rica, El Salvador, Mexico, Chile, and Uruguay would require CRs bordering on 60%, almost 6 times more than the average effective contribution of Latin American pension systems today. One case to highlight is China, which would require a CR of 70%.

[4] The analysis naturally assumes that the contribution rate is the only adjustment parameter, i.e., the retirement age and the pension calculation method remain constant.

[5] See methodological note at the end of the document. In Annex, the scenario with a lower TR target (50% of the current average salary) is simulated.

[6] 2020 data from the report: Pensions at a Glance 2021, OECD.

- It is worth mentioning this exercise assumes that the PAYGO system is self-financing and therefore does not receive State contributions. Likewise, it is assumed that all people between 25 and 64 years of age work and contribute, i.e., there is no labor informality or evasion.
- These high CRs cannot be achieved, and even if they could be, they would greatly increase evasion and informality, exacerbating pension system financing issues. Countries would therefore resort to other mechanisms such as raising the retirement age or sharply reducing benefits. This is why some specialists compare the PAYGO system to a pyramid scam, since the young people financing the pensions of current retirees, with great personal effort, will not receive the same pensions they helped finance when they retire (commonly called "intergenerational inequality").

Table 2.- Contribution rate required for obtaining a replacement rate[7] of 70% per country in a PAYGO system, 1950-2100

Country or region	1950	2020	2050	2100
Africa	6.4	6.6	9.1	19.9
Asia	7.3	12.4	25.7	44.0
China	8.4	15.2	41.4	69.4
Japan	8,6	42.1	60.6	65.0
Europe	11.6	24.5	42.2	51.7
Russia	7.7	18.7	33.9	4.,7
Denmark	12.4	27.4	34.7	46.9
Finland	9.8	31.0	39.6	53.4
Norway	12.7	23.5	35.2	48.6
Sweden	13.2	27.5	34.7	49.5
United Kingdom	14.1	25.3	37.2	50.9
Greece	10.8	29.2	53.6	61.6
Italy	11.8	30.3	59.3	63.2
Spain	10.7	24.7	57.9	64.6
Austria	13.7	24.0	44.7	53.7
Belgium	14.5	25.5	39.8	51.7
France	15.7	29.6	43.7	56.4
Germany	12.8	28.4	45.0	53.4
The Netherlands	11.5	26.2	39.4	51.7
Switzerland	12.7	23.5	42.6	50.8

Source: FIAP with United Nations data and estimates. The mean fertility variant estimate is considered, assuming that it will converge to its replacement level at a rate estimated by using past data for the respective region.

[7] The replacement rate is the pension amount as a percentage of income received prior to retirement.

Table 2.- Contribution rate required for obtaining a replacement rate of 70% per country in a PAYGO system, 1950-2100 - Continuation

País o región	1950	2020	2050	2100
Latin America	6.2	12.1	25.4	49.6
Dominican Republic	6.0	10.2	21.5	47.1
Costa Rica	5.9	13.3	31.6	60.8
El Salvador	8.1	12.4	20.3	59.5
Mexico	6.1	11.3	25.1	55.6
Panama	7.1	12.0	24.9	46.2
Bolivia	11.8	7.8	12.5	30.5
Chile	6.2	15.8	35.6	60.1
Colombia	6.7	11.2	27.7	55.2
Peru	6.7	12.0	22.6	46.6
Uruguay	12.4	21.4	31.0	58.1
North America	11.4	21.9	33.4	46.9
Canada	11.6	23.3	35.2	47.9
United States	11.4	21.8	33.2	46.8
Oceania	10.7	17.5	25.9	39.4

Source: FIAP with United Nations data and estimates. The mean fertility variant estimate is considered, assuming that it will converge to its replacement level at a rate estimated by using past data for the respective region.

IV. Comparative demographic effect on PAYGO vs. individually funded savings systems

As previously mentioned, the financial situation of the PAYGO systems depends on the old-age dependency ratio (DR) which is affected by two demographic phenomena, namely the increase in life expectancy at retirement and the drop in the fertility rate. In individually funded savings systems, on the other hand, pension amounts are affected only by the increase in life expectancy at retirement, since the accumulated balance must be divided over a longer period of time. Due to the above, the demographic impact on individually funded systems will be substantially less.

To demonstrate the above point, Table 3 shows the impact of demography on each system between 2020 and 2050. The effect is estimated in different ways for each system:

1. In PAYGO systems, the reduction in the number of people of working age for each retiree (DR) entails a proportional drop in the funds available for paying pensions. Hence, in this case, the percentage drop in the RR (or pension amount) is estimated as the percentage drop in the DR[8].
2. In individually funded savings systems, the increase in life expectancy implies a longer period to be financed, entailing a proportional

[8] The estimate does not consider changes in real wages, which can occur in either direction.

drop in pension amounts[9]. Hence, the percentage increase in life expectancy at 65 is equivalent to the percentage drop in the RR.

The results in Table 3 show that aging causes a 52% drop in RRs in Latin American PAYGO systems, and only a 24% drop in individually funded savings systems. I.e., the demographic impact on returns in a PAYGO system is more than double the impact on individually funded systems. This difference is consistent across FIAP countries. The difference in the drop in RRs in the Dominican Republic is 32 percentage points (pp), 16 pp in Mexico, 31 pp in Chile and Colombia, and 20 pp in Uruguay. It is worth mentioning that the effect of aging on the PAYGO system in Uruguay almost triples the effect on the individually funded savings system.

Table 3.- Drop in the replacement rate due to demographic factors between 2020 and 2050 – Latin America and FIAP countries

Country or region	Drop in the RR due to the drop in the DR (PAYGO)	Drop in RR drop due to increased life expectancy (individually funded)
Latin America	-52%	-24%
Dominican Republic	-49%	-17%
El Salvador	-39%	-28%
Mexico	-52%	-36%
Bolivia	-31%	-36%
Chile	-54%	-23%
Colombia	-56%	-25%
Peru	-55%	-28%
Uruguay	-31%	-11%

Source: FIAP with data and estimates of the United Nations. The mean fertility variant estimate is considered, assuming that it will converge to its replacement level at a rate estimated by using past data for the respective region.

V. Conclusions

The impact of demographic change on PAYGO systems is real and significant. From the data studied, one can conclude that:

- Population aging is occurring rapidly all over the world. Hence, 82 countries increased the contribution rate in their PAYGO systems between 1995 and June 2022; 64 increased the retirement age, and 67 adjusted the pension calculation formula or reduced benefits outright[10].
- The contribution rate required for paying sufficient pensions in these system by 2050 will be impossible. The situation will be even worse by the year 2100.
- Demographic change will mainly affect PAYGO systems, so they must be fully or partially replaced by individually funded savings systems, or by progressively incorporating voluntary individual savings

[9] The real effect is less, since this calculation does not consider the returns generated in the additional period of pension payments due to life expectancy increases.

[10] Additional information in the parametric reforms report.

mechanisms to make them sustainable. 17 countries had incorporated individually funded savings systems by 1999, 39 did so in 2009 and 46 in 2022.[11]

- The situation is particularly worrying for Latin America, where aging will be so fast that it will become the region with the oldest population by 2100, together with Europe. Furthermore, high levels of informality aggravate the financial problems of PAYGO systems.

Methodological note

For a standard PAYGO system it is assumed that:

- All individuals of working age contribute to the pension system and all individuals receive a pension on retirement.
- All workers earn a wage equal to the average wage.
- The revenue of the system (contributions) is equal to the expenditure (payment of pensions) at each moment in time, so there is no deficit or surplus.

The following formula is used for obtaining the CR required in Table 2:

$$Contribution\ revenue = Pension\ expenditure$$

$$CR * Current\ salary * Number\ of\ people\ (25-64) = RR * Current\ salary * Number\ of\ people\ (65+)$$

$$CR = RR * \frac{Number\ of\ people\ (65+)}{Number\ of\ people\ (25-64)}$$

$Assuming\ RR = 70\%$:

$$CR = 0.7 * DR$$

$TC = Contribution\ rate, RR = Replacement\ rate, DR = Dependency\ ratio$

$The\ target\ replacement\ rate\ is\ calculated\ as\ a\ percentage\ of\ the\ current\ salary$

[11] Source: FIAP based on OECD data; the United States Social Security Agency; and Szczepański, M- and J. Turner (Ed.) (2014). Social Security and Pension Reform International Perspectives. This refers to lone individually funded systems; individually funded systems competing with PAYGO systems, and individually funded systems as a complement to PAYGO systems.

Annex

In order to be more flexible with regard to the required RR, Table 2.b shows the CR required to reach a RR of 50% of the current average salary for each region and the FIAP countries. As you can see, to achieve this RR goal:

- By 2050, the CRs increase considerably, being 30.2% in Europe and 18.2% in Latin America. Costa Rica reaches 22.6%, Chile 25.4%, Colombia 19.8% and Uruguay 22.2%.
- In 2100 the CRs will be unattainable, in Europe it reaches 37% and in Latin America 35.4%. CR should be higher than 40% in Costa Rica, El Salvador, Chile and Uruguay and slightly lower than this figure in Mexico and Colombia.

Table 2.b.- Contribution rate required for obtaining a replacement rate of 50% per continent and FIAP countries in a PAYGO system, 2050-2100

Country or region	2050	2100
Africa	6.5	14.2
Asia	18.4	31.4
Europe	30.2	37.0
Latin America	18.2	35.4
Dominican Republic	15.4	33.7
Costa Rica	22.6	43.4
El Salvador	14.5	42.5
Mexico	18.0	39.7
Panama	17.8	33.0
Bolivia	8.9	21.8
Chile	25.4	43.0
Colombia	19.8	39.4
Peru	16.1	33.3
Uruguay	22.2	41.5
North America	23.9	33.5
Oceania	18.5	28.2

Source: FIAP with data and estimates of the United Nations. The mean fertility variant estimate is considered, assuming that it will converge to its replacement level at a rate estimated by using past data for the respective region.

References

- World population prospects 2022, United Nations Population Division. "Population Dependency Ratios – Both sexes" is used. The variable used is "Annual potential support ratio [25-64/65+]". “Medium Variant” is used for the estimates. Information available here.

- “Reinstalling PAYGO Pension would require quadrupling contributions,” Study Series No.116. Chilean Association of AFP’s.

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