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Abstract[1]

The Chilean pension system was hit hard during 2020-2021 by the withdrawal of 25 per cent of the individual pensions funds accumulated by 2019, an amount equivalent to 20 per cent of Chile's GDP. We estimate here the impact of those withdrawals on new pension allowances, using a combination of official data sets and the IDB model for the actuarial projection of pensions, including its heterogeneity matrix to simulate the distribution of pension impacts. The withdrawal impact decreases in new retirees of future years until disappearing around the year 2065. We estimate respective impacts of about 31 percent and 37 percent for males and females' new self-financed pensions around the year 2022, which goes to about 56 percent among the third of the affiliates with the lowest savings. However, we found that the recent increase in non-contributory pensions more than counteracted this impact for roughly 90 percent of 2022 new retirees. Regarding labor markets shocks, we found only a moderate role for them in the long-term evolution of the pension system, as we also found to be the case of seven Caribbean countries (Cuba, Haiti, Dominican Republic, Jamaica, Trinidad and Tobago, Bahamas and Barbados). As an overall conclusion, we recommend studying contribution rates, because low-salary workers attain a substantial replacement rate with just the non-contributory pension, which casts doubt on whether a mandatory contribution is appropriate for them.

JEL classifications: H55, H68, J20
Keywords: Pensions, Covid-19, Labor markets

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[1] In Latin America and The Caribbean, there is very little research to date about the impact of COVID-19 on pension systems. In this context, the Department of Research and Chief Economist (RES), through the Latin American and Caribbean Research Network, together with the Labor Market and Social Security Division (LMK), through the Network for Pensions in Latin America and the Caribbean (PLAC Network), launched a research project to evaluate the impact of COVID-19 on pension systems in the region. This project analyzes the pandemic's impact on key aspects of pension systems such as replacement rates, contribution density, intergenerational equity, financial sustainability, and pension fiscal expenditure, among others. The study was applied in four countries of the region—Argentina, Chile, El Salvador, and Peru—and it addressed both defined benefit and defined contribution pension systems.

To carry out these studies and guarantee the homogeneity of the analysis methodologies for the different countries, a standard pension projection model developed by the PLAC Network was provided for the different country studies. Since 2015, the PLAC Network supports regional efforts for improving the institutional and technical capacity of pension entities.

The specific objectives for each country study were to: i) generate country-specific evidence on the impact of COVID-19 on pension systems, addressing the effect on key indicators; ii) calculate the pre-COVID and the short and long-term fiscal pressures stemming from the crisis; and iii) evaluate political implications and policy recommendations for the region.

This study was funded and undertaken with the support of the Latin American and Caribbean Research Network of the Inter-American Development Bank (IDB) as part of the "Evaluating the Impact of COVID-19 on Pension Systems in Latin America and the Caribbean." The authors thank Waldo Tapia, Edgar Robles, Ekaterina Cuellar, David Kaplan, a group of anonymous reviewers, and all participants in the Covid Pensions seminar in July-22, for very useful comments and review.

1. Introduction

Chile's pension system is deeply rooted in individual accounts. This system was installed in Chile during a period of profound reforms. Its novel central role for individual pension savings captured the attention of policymakers worldwide, as it meant a sort of laboratory case. About 40 years later, nearly all the economically active and civil population has been affiliated with their individual accounts system for their entire working life. In this context, total savings in 2019 amounted to about 80 percent of Chile's GDP. Until 2019, those savings were projected to pay for the majority of public pensions.

However, social unrest erupted in October 2019, and then Covid-19 broke out in early 2020. By December 2020, the Chilean Congress, in a historical process, approved the right of each individual to withdraw some (and in some cases even all) of the savings accumulated in their pension accounts.

It is impossible to overstate the relevance of this process for Chilean society. Early withdrawals of pensions funds (EWPFs from now on) were unthinkable before 2019, and then became legal, fast and easy. On three occasions during the Covid-19 crisis, the Chilean Congress—in response to popular pressure—passed a special law to allow for EWPFs.

Our focus is on exploring the impact of those withdrawals in future public pensions. For every country where individual accounts play a central role in the pension system, it is relevant to understand the way EWPFs behaved in Chile; in fact, EWPFs also occurred in Colombia, Peru, Mexico, Bolivia, El Salvador and Costa Rica. As such, it is critical to obtain a comprehensive understanding of the Chilean case in order to project the potential consequences of this type of events in other countries in Latin America and the Caribbean.

Overall, the public made almost maximum use of the chance to carry out EWPFs from their accounts. The vast majority of accountholders made EWPFs of the maximum legal level, which had a huge impact on most macro and micro level economic variables in Chile. In this context, the average withdrawal was about US$1,400, and there were about 28 million withdrawals. Total savings dropped from 82 percent of GDP in 2019 to 60 percent by the end of 2021, after the third and final EWPF (see Table 1 below).

In their design, EWPFs included nonlinear rules, which introduced sharp socioeconomic gradients among affiliates. Specifically, rules about minimums and maximums introduced gradients across savings levels, which in turn caused socioeconomic gradients in future pensions.

For example, given the rules of minimum amounts to be withdrawn, a substantial number of accountholders retired the majority or even the total of their savings. At the same time, due to rules on maximum amount established in the successive laws that allowed the EWPFs, many workers of medium to high savings levels withdrew only the standard 10 percent or less (Figure A2 in the Appendix shows the distribution of the percentage withdrawal by sex).

Table 1. Total Pension Funds as % of GDP

	Pensions funds as % of GDP
2011	58%
2012	60%
2013	62%
2014	68%
2015	69%
2016	69%
2017	72%
2018	71%
2019	82%
2020	76%
2021	60%

Source: Authors' calculations based on official data.

In order to project the impact of EWPFs on future pensions, we must address another critical issue that has a direct impact on pensions funds: labor market variables. Although this channel of transmission for Covid-19's impact on pensions seems smaller than the impact of EWPFs, both EWPFs and the labor markets shocks during 2020-2021 are integral components of Covid-19's impact on public pensions.

As such, the purpose of this study is twofold. First, we aim to document the timing and social gradient in the occurrence of EWPF and labor markets shocks. Secondly, we aim to project the impact of such withdrawals and labor market shocks on future public pensions.

To address the final impact for individuals we include here both contributory and non-contributory pensions in the analysis. Non-contributory pensions are an increasingly relevant component of the Chilean pension system. In fact, Chile recently introduced a major reform that increased the size and expanded the coverage of non-contributory pensions, making them an almost universal allowance. Hence, we add the change in the non-contributory pension in this study given its role in the discussion of pension impacts. The universal pension is about half the size of the minimum wage, is nearly equal for everybody and covers all individuals but the richest 10 percent. To be precise, the universal pension is decreasing for those with high self-financed pensions, but those retirees are in the richest 10 percent, so the universal pension is nearly flat for all beneficiaries. Therefore, in this new system, EWPFs and labor market shocks have nearly no direct relation with people's non-contributory pensions.

The methodology we use to analyze the short-term and long-term impacts of EWPFs and labor market shocks on pensions is based on an actuarial-economic model. We use a cell-based application of the conceptual model currently used by the IDB to carry out pension projections. This includes a heterogeneity matrix to simulate the distribution of future pension allowances in order to include in our simulation a socioeconomic gradient in the EWPFs and labor market shocks. This model arises from the participation of several teams, including technical representatives from about 10 countries.

The case of the more populated Caribbean countries is added into the study as a matter of comparison. Caribbean countries suffered labor shocks just as Chile and probably all countries did, and comparing the Chilean defined contribution system with defined benefit systems is informative.

This paper is organized as follows. In Section 2 we briefly introduce the Chilean pension system and its historical evolution. Afterwards, in Section 3 we describe the EWPFs, which comprise three massive episodes (each of them corresponding with the passage of a law by the Congress). In Section 4 we describe and analyze labor markets shocks that took place during 2020-2021, with special attention to socioeconomic gradients. Section 5 presents the data and methodology, and Section 6 discusses the results for the Chilean case. Finally, Section 7 focuses on the results for Caribbean countries, and Section 8 presents the main points of the discussion.

2. The Chilean Pension System

Since Chile was the first country to fully embrace an individual capitalization pension system, its case has been intensively explored in the literature. Only a brief description highlighting its main features is provided here.

The early years in 1980 were a period of profound reforms in nearly all spheres of public systems in Chile. In 1981, after at least a decade of analysis and discussion of the situation of the country's sparse pay-as-you-go systems, the individual capitalization system started for all new entrants into the labor market, as well a majority of under-45 individuals who opted out of the old system to join the new one. In the new system, private entities (called Pension Fund Administrators, known as AFPs by their acronym in Spanish) were designated to manage pension savings, including investment decisions. In general, since the inauguration of the new system the contribution rate was set at 10 percent, plus about 1 percent for the disability and survivorship fund (an insurance-like scheme) and about another 1 percent for the AFPs' fee. The amount of new self-financed pensions was set at the actuarially fair value, with the support of a modest non-contributory pillar. During this process, which started in 1981, the accumulation of pensions funds grew steadily, reaching 82 per cent of Chile's GDP at the end of 2019.

Along the way, some changes were introduced into the system. In 2002, new investment options for pension funds were created ("*Multifondos*"), and in 2004, a marketplace for insurance companies to meet with new retirees looking for annuities was developed (it is known by its acronym, "SCOMP"). In 2008, a more substantial reform strengthened all pillars of the system and designed a new non-contributory pillar. This new non-contributory pension expanded coverage, increased the pension amount and transformed the non-contributory pension into a right rather than a benefit; it also included a novel gradual approach in which the non-contributory pension was set as a decreasing function of the self-financed pension:

Finally, in 2022 the non-contributory system was replaced by a universal pension system, where a flat pension was awarded to all population 65 years old and over, with the exception of individuals in the top 10 percent of income and individuals with self-financed pensions above about three minimum wages (most of them already included in the top 10 percent of income).

Currently, the legal retirement age for the self-financed pension in Chile is 65 years old for men and 60 for women; for the non-contributory pension the age is 65 years for both men and women.

3. Early Withdrawals of Pension Funds in Chile and Their Socioeconomic Gradient

The necessity of economic relief during the Covid-19 crisis, and the political and historical context, explain the occurrence of EWPFs. In three occasions, all during the period 2020-2021, the Chilean Congress passed a law that allowed individuals to withdraw some of their pension savings from their individual accounts.

The time window for the first withdrawal went from December 2019 to December 2020, while the second went from March 2020 to March 2022. The third went from April 2021 to April 2022. Hence all the withdrawals are now completed.

The public made extensive use of all the three EWPFs. The pension oversight office published several statistical reports [3,4,5], which show that 92 percent of individual accounts were accessed under the first withdrawal, leaving about 12 per cent of individual accounts with no savings. This figure is fairly similar for the second and third withdrawals: about 90 percent of accounts with savings were accessed under the withdrawals, leaving about 10 percent of those accounts with no savings. In all three episodes, the average withdrawal among those who withdrew was about 35 percent of savings.

The rules of the withdrawals are very important to understand the socioeconomic gradients in the context of the EWPFs. In each of the three separate episodes the maximum permitted amount was established at 10 per cent of total savings, with a (voluntary) minimum of about US$1,500 and a (mandatory) maximum of about US$6,000. Thus, for each EWPF, affiliates with low savings were allowed to withdraw a potentially large share of their individual accounts, while people with very high savings were allowed to withdraw at most 10 percent or less.

3.1 The First Withdrawal Episode

The state pension oversight office published a data at the individual level ("microdata" from now on) with a 10 percent sample of withdrawals from the first episode, including individual's age, sex, total savings, date, and size of the withdrawal. These microdata provide a unique opportunity to explore this episode in more detail.

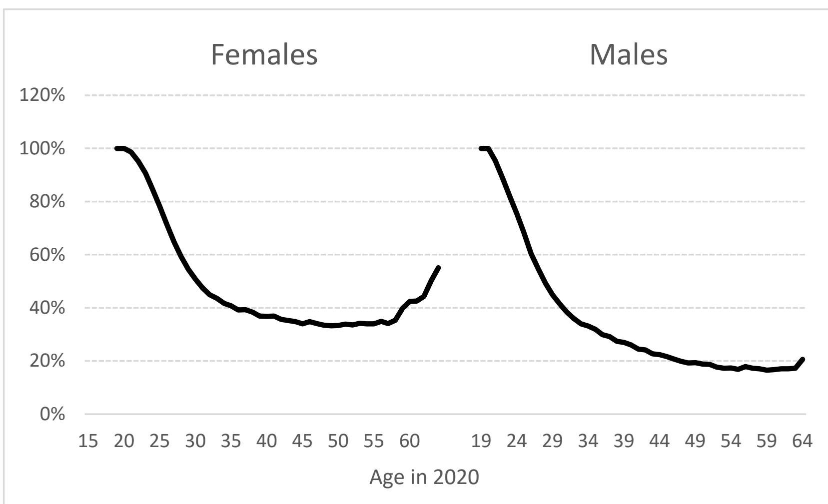
We use these microdata to count the number of accounts with withdrawals by sex and age, and we use aggregated official data to estimate the total number of accountholders by sex and age.

We then compute the share of accountholders who exercised the right to make the first withdrawal by age and sex.

We found that around 92 percent of accountholders made the first withdrawal (see Table 2). This is the case for both of men and women, and across most ages. Thus, we learn from here that there are not deep sex or age gradients in the "proportion that exercise the first withdrawal" behavior.

The next important figure is the proportion of the total savings withdrawn by those who made the first EWPF. Using the microdata from the first episode it is easy to compute that proportion. We expect an age gradient, such as that older individuals would withdraw a lower proportion because they have higher savings and there are rules of maximum withdrawals. Figure 1 shows the results of this calculation. The proportion of the total savings withdrawn by those who exercised their first EWPF went from about 100 percent among young individuals to about 40 percent and 20 percent, respectively, among females and males in their 60s.

Figure 1. Proportion of Total Savings Withdrawn by Those Who Exercise Their First EWPF



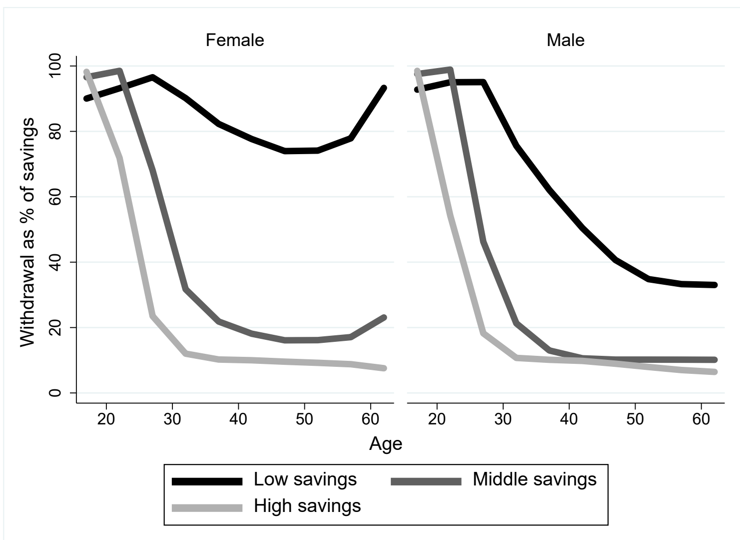
Source: Authors' calculations based on official microdata from the first withdrawal episode.

The sex gradient illustrated in Figure 1 is also reflected in the distribution of withdrawals in the first episode. Figure A2 in the Appendix shows that both men and women are concentrated at "10%" and "100%" of savings withdrawn, and it shows that females are more concentrated at

"100%" than men. The fact that women have lower accumulated savings than men in their individual accounts explain that result.

Next, we explore the EWPFs by savings level. Savings levels can work as a proxy for the socioeconomic level, since workers in certain positions tend to have better wages and better density of contributions, which together are very influential for the level of savings conditional on age and sex. In each age-sex bracket, we classify the accounts in the microdata from the first EWPFs into three groups of equal size: low, medium and high savings. These saving levels can be mapped directly into the heterogeneity matrix of the projection model, as we discuss later in Section 5.3.

Figure 2. Average EWPF (as % of savings) in the First Episode, among Those Who Withdrew, by Sex, Age and Savings Level



Source: Authors' calculations based on official microdata from the first withdrawal episode.

Figure 2 shows the age and sex profiles of withdrawals as percentage of savings. This figure illustrates that withdrawals as share of savings are higher among women and among young workers. Figure 2 also shows a substantial difference across savings levels. In the lowest third of savings (i.e., "low savings"), older individuals withdrew a substantially larger share of their savings (in the range of 80 per cent for women and about 50 percent for men). The distance of the lowest savings group from the other two groups is visible from the early age of 25. The middle and high savings groups are much more similar to each other.

This information about the first EWPF suffices to simulate the size and distribution of this first EWPF in pensions. We now turn to the second and third EWPFs.

3.2 The Second and Third Withdrawal Episodes

For the second and third EWPFs there is still no microdata available. However, there are official statistical notes [3, 4, 5]. We thus use them to compare the three EWPFs in order to take a first look at their similarities and differences.

The first column in Table 2 shows the number of EWPFs by episode as considered in the statistical notes. We added the second column (number of accounts with savings) to compute that more than 95 percent of potential EWPFs were exercised. Table 2 also illustrates that the withdrawal rate is fairly stable across the three episodes.

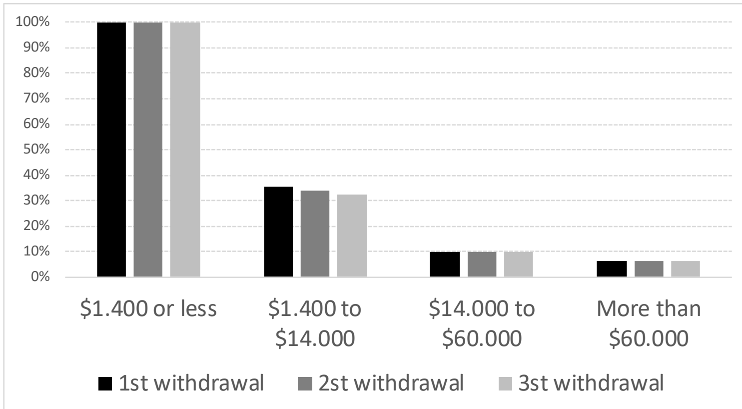
Table 2. Number and Size of EWPFs by Episode

	Numbers of accounts with withdrawals (a)	Numbers of accounts with savings (b)	Withdrawal rate (a/b)	Average withdrawal as % of savings
1st withdrawal	10,927,883	11,014,138	99%	40.3%
2st withdrawal	9,038,595	9,472,159	95%	37.0%
3st withdrawal	7,898,885	8,146,056	97%	35.9%

Source: Authors' calculations based on official statistical notes.

Then, Table 2 also shows that the average withdrawal as percentage of savings decreases slightly across episodes. This slight decrease from 40.3 per cent to 35.9 per cent is probably because individuals with low savings exhausted their savings with each successive EWPF. Hence, they could not withdraw more savings in the last episodes. This pushed down the average withdrawal in the direction of the base case, 10 percent. Indeed, Figure 3 shows that the average EPWS as percentage of savings is very similar across episodes if one controls by savings level. Table A2(b) in the Appendix shows that the distribution of EWPFs by saving levels moved slightly into accounts with higher savings, as we move from the first to the last EWPF. Here, we probably see a direct implication of the EWPF rules plus the behavior of making withdrawals as often as possible, rather than other behavioral explanation. Finally, the distribution of EPWS (as percentage of savings) by age are also quite similar across withdrawals episodes, as shown in Table A2(a) in the Appendix.

Figure 3. Withdrawals as Percentage of Savings by Saving Level and EWPF



Source: Authors' calculations based on official statistical notes.

In sum, the only substantial difference between the three EPWFs is the number of accounts with withdrawals. But the proportion of accounts with savings that experienced withdrawals, and the average proportion withdrawn is similar. There is a slight difference in the proportion withdrawn, explained by the fact that some individuals simply progressively exhausted their available savings with each successive EWPF. This situation altered the pool of individuals who could withdraw in each EWPF. For the modeling in Section 5, we assume that the age, sex and savings profiles that we obtain from the microdata of the first episode are also valid for the second and third EWPF.

4. Covid-19's Impact on Labor Markets and Its Socioeconomic Gradient

For this analysis we follow a group of variables in the labor market that are closely related to the pension system, namely: i) contributable wage, ii) participation wage, iii) employee rate and iv) the formality rate. The composition of these variables determines the proportion of individuals who contribute to their savings accounts in any given month.

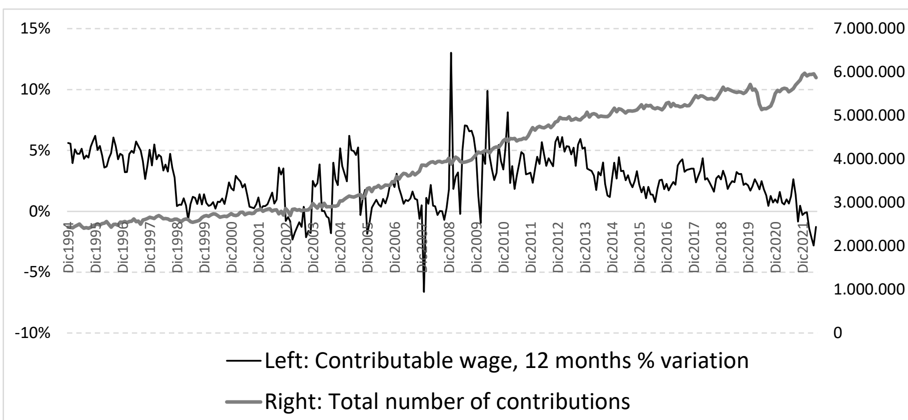
Of course, all those figures are strongly influenced by Covid-19 relief policies. However, the point here is the impact of labor market anomalies during 2020-2022 on future pensions, not the decomposition of such anomalies into their different elements.

4.1 Contributable Wage

The official data show a relatively minor Covid-19 impact on contributable wage of active affiliates. Figure 4 shows the contributable wage real growth rate with respect to 12 months before. This rate shows important changes in trends across the last 40 years, but it is usually above 2 percent, with the exception of recession times like 1997 ("Asian crisis") and 2007 ("Subprime crisis").

Figure 4 shows a recession-like drop in wage growth during 2020-2022. The case of males and females is similar. The wage growth declined to a crisis level of 1 percent in 2020 and 0 percent in 2021, and even lower at the beginning of 2022, the latest available data. The future evolution of the real growth rate of the contributable wage is very unclear, but for the simulation of the impact in this study, we assume a Covid-related wage shock of 0 percent real growth from 2020 to 2022.

Figure 4. Monthly Evolution of Real Growth in Contributable Wage and Total Number of Contributions Compared



Source: Official statistics from the pension office and inflation data from the Central Bank of Chile.

Regarding the socioeconomic gradient in the wage shock, there is not much information available. The Chilean labor survey does not include wage. Nonetheless, as an alternative for the analysis there are official statistics on the evolution of average contributable wage by AFPs. So we can explore the differences between the AFPs with lower average contributable wage and those with higher average contributable wage. In this case we observe some more volatility and more recuperation in the former type of AFPs rather than the latter. In general, however, no clear social gradient is observed.

In sum, the wage shock is relatively mild, and its socioeconomic gradient could be small, but there is considerable uncertainty regarding its future evolution.

4.2 Participation Rate

We now turn the attention into the participation rate. Usually this is measured as the proportion of the population in a given age-sex bracket that joins the labor market. The current specific definition of labor participation used in labor surveys largely follows an international standard developed by the OIT. It can be summarized in the following question: Did you work for pay at least one hour during the past week, or, if you did not, did you perform job search activities?

Figure 5 shows a clear shock on the labor force participation rate. At a glance, the figure shows that the shocks are focused on 2020 and are similar for both sexes, all age groups and all education levels, and they recover by late 2020 or early 2021. Going in more detail, it is a shock of about 10 per cent for men and 15 per cent for women. For women, the shock is somewhat larger in the lower educational group. In general, the associated socioeconomic gradient seems small. For the simulation of the Covid-related labor participation shock, we assume a relative 10 percent drop for men and 15 percent for women, lasting during 2020 and 2021. In sum, we see a uniform shock in the labor participation rate, with a low socioeconomic gradient.

4.3 Employee Rate

Now, conditional on being participating, the next variable that directly influences the pension system is the employee rate, since only formal employees contribute to the individual accounts in Chile. Figure 5 shows the employee rate, namely total employees over total participating individuals. The overall shock on this rate seems mild. Some variation in 2020 is observed, but no significant changes are seen. The analysis by age or educational level does not show a substantial socioeconomic gradient either.

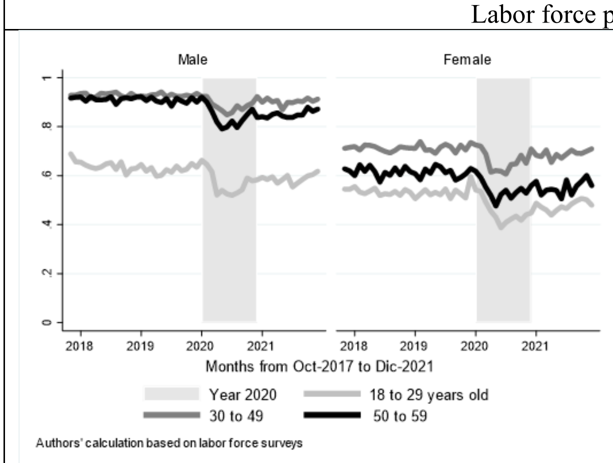
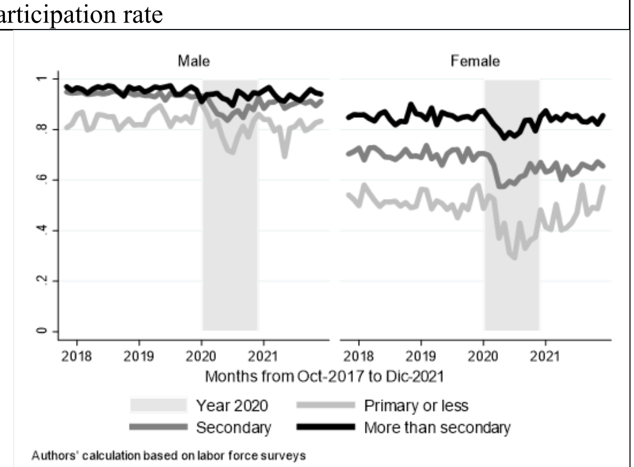
4.4 Formality Rate

Finally, conditional on the employee situation, the last variable we explored was the formality rate, since informal workers rarely contribute to the pension system. Similarly to the employee rate, Figure 5 shows some variation in this rate across 2020, but with no clear change, and no clear socioeconomic gradient either.

4.5 Summary

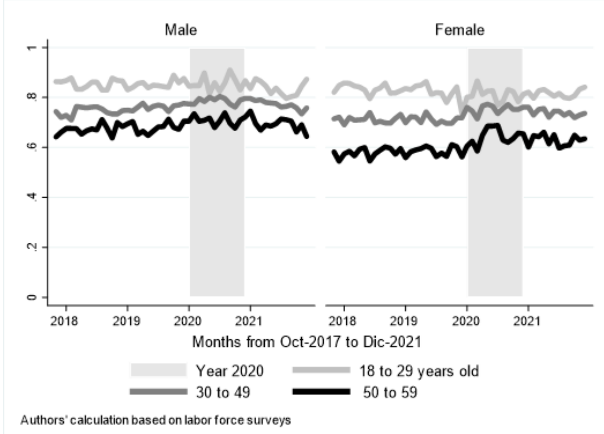
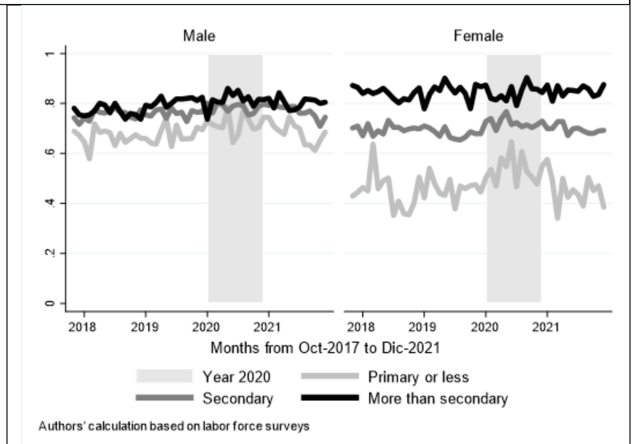
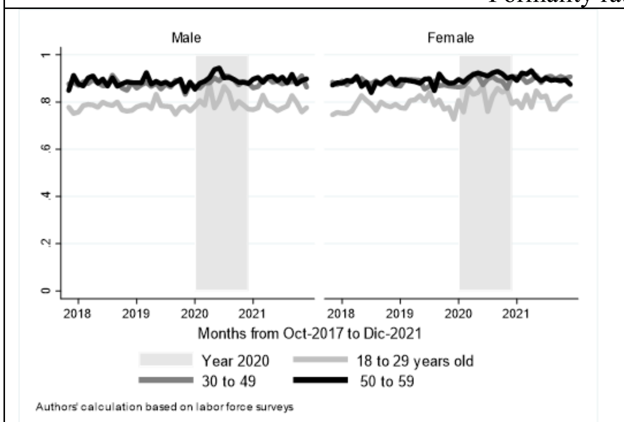
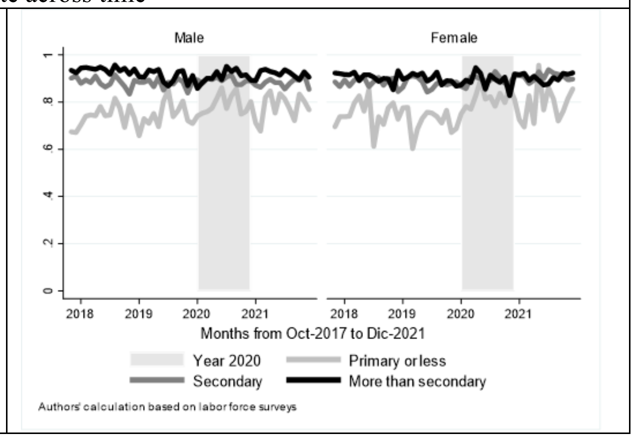
Summarizing, we found only a mild and temporary drop in the labor force participation rate, which implies a temporary drop in ratio of contributors to active affiliates. This is no surprise, since there is currently substantial evidence of a substantial rebound in the labor market: a recent survey shows a complete recovery to pre-pandemic levels in March 2022;[2] this complete recovery has occurred for both men and women. Furthermore, Figure 4 show the total number of contributors per month, which also displays a substantial recuperation. For wage, we found a small though still ongoing change in the real growth rate. In both wage and participation shocks, we do not find a substantial and clear socioeconomic gradient.

Figure 5. Labor Market Variables across Time

a) By age	b) By education
Labor force participation rate	
	

[2] At 19 de Abril de 2022, the prestigio-us survey center of *Universidad Católica de Chile* published the results from "Empleo -Covid-19 UC”, where, just like in other sources, total number of jobs were found to be higher than pre-pandemic levels.

Figure 5, continued

a) By age	b) By education
Employee rate across time	
	
a) By age	b) By education
Formality rate across time	
	

5. Methodology, Data, and the IDB Model

In this section, we first introduce the IDB model and the heterogeneity matrix. Then, we discuss how the EWPFs and labor markets shocks are built into the model, paying particular attention to the heterogeneity of the impact.

The methodology is based on an actuarial projection in which the main factors are risk rates estimated using recent data on events and exposures, and whose future value is assigned using criteria for risk control. The model is applied in cell-based form; a cell-based model is one based on a group of individuals (typical, age and sex brackets) rather than each individual alone (which is usually called microsimulation). In order to absorb the heterogeneity in the EWPFs and non-contributory pensions, the model includes a heterogeneity matrix (see below for a more detailed explanation).

5.1 The IDB Model

The IDB approach is a conceptual model that is currently available in "cell-based" format. It provides a transparent and actuarially sound framework to perform pension projections, in a rather open and accessible spreadsheet. It does not require any other software or special add-ins. It is a plain Excel file, totally autonomous, organized and standardized as to provide a robust and clear projection. It was developed first by standardizing the practices currently used by model-builders and adding some simplifications and some capabilities based on the authors' experience. All in all, it represents a good balance between transparency, complexity, and capabilities. Many conceptual and practical issues regarding the IDB model are discussed in the model's methodology report [2].

Another type of models is the "microsimulation." In microsimulations, each simulated individuals follows an independent and probabilistic trajectory. It seriously facilitates the inclusion of heterogeneity in labor trajectories and pension rules. on the other hand, however, most of the action became a bit obscure, and it is harder to keep a complete visual and actuarial soundness of the labor trajectories in the model. Perhaps a good model combines a good cell-based model with a microsimulation to support the inclusion of some micro-level issues.

The IDB model projects in a single year and single age environment, using the risk rate concept for all mayor transitions (affiliation into the system, deaffiliation from the system, retirement due to invalidity, retirement due to old age, death), where all risk rates are sex-age specific, and, potentially, can evolve across time.

The model manages different kind of pensions (old-age, disability, widows from either active workers, old age retirees and disability retires), and works with different combinations of capitalization, funded PAYG, and mixed systems, as well as additional disability-survivorship insurance from external companies.

5.2 The Heterogeneity Matrix

The heterogeneity matrix is an index of the relative position of affiliates in a given cohort, regarding "density of contributions" and "salary conditional on contributing." It is assumed here that a good approximation to the diverse labor market trajectories can be achieved by assuming that these relative positions are stable across the life cycle. Jumping ahead, Table A1 in the Appendix shows the matrix of relative density and wage that was computed for this study, containing the distribution of relative savings and density of contributions.

The idea of the matrix is that a relatively simple modelling can be less risky, easy to monitor and communicate, and yet have powerful capabilities. There are many heterogeneous dynamics than can be absorbed into this cell-based model by using the matrix. Furthermore, the heterogeneity in this study is added only in the final lines of the model using this matrix, avoiding an overload of calculus and instead adding many spreadsheets.

The matrix 10 rows and 10 columns for a total of 100 cells. Each row represents the "density of contributions" deciles and each column represents the "wage" decile. Both density and wage are conceptualized here as long term, meaning the lifetime average. In each cell we have data representing the relative position of individuals in that cell with respect to the entire cohort. For example, each cell may contain the relative density, the relative wage, and the proportion of the cell that fulfills some requirement (such as being eligible for public assistance), as seen in Table A1 of the Appendix. Later on, when we add the heterogeneous nature of the EWPFs into the model, we do so by introducing the size of EWPFs in each cell of the matrix.

It is important to mention that, implicitly, "wage" in pension projection models refers to productivity, and in this sense, it refers to unconditional wage, i.e., wage regardless of being in the labor market or not. It is worth mentioning this issue for a clear conceptual framework.

In the case of Chile, to estimate the necessary values on each cell of the heterogeneity matrix we used a public longitudinal monthly microdata covering about 22,000 individuals (called "*Historias Previsionales de Afiliados*"). This is a powerful and renowned data set, articulated with the largest and longest panel data set in Chile, which to date has had seven rounds (2002, 2004, 2006, 2009, 2012, 2015 and 2019). The sampling procedure started as a common initiative among several Chilean institutions, and it has been refreshed to add new individuals. The latter document containing all the details of the sampling procedure—in addition to the computation of sampling weights, attrition, sampling error and variances—is available on the state agency's website.[3]

[3] https://www.previsionsocial.gob.cl/sps/biblioteca/encuesta-de-proteccion-social/. In the first wave, 2002, the sample included only affiliated population, the second (2004) added new young people and a sample of non-affiliated populations. In 2015, new young people were again added.

These data follow each individual since their enrollment in the system. Therefore, we have access to every monthly contribution for every individual in the sample.

We focus on individuals aged 50-54 in order to avoid early and late career issues. For each individual in this age bracket, we compute her life-time density and life-time contributable wage, and with these data we classify each individual in a specific cell among the 100 cells in the matrix.

5.3 Adding the EWPFs into the Model

We start the projection in 2020, using 2019 as the last observed year because the EWPFs occurred during 2020-2022. We implemented two stages to add this into the model. In the first stage, we focus on the *average* effect of EWPFs by age and sex, and in the second stage we focus on the *distribution* of EWPFs. In the first stage, we:

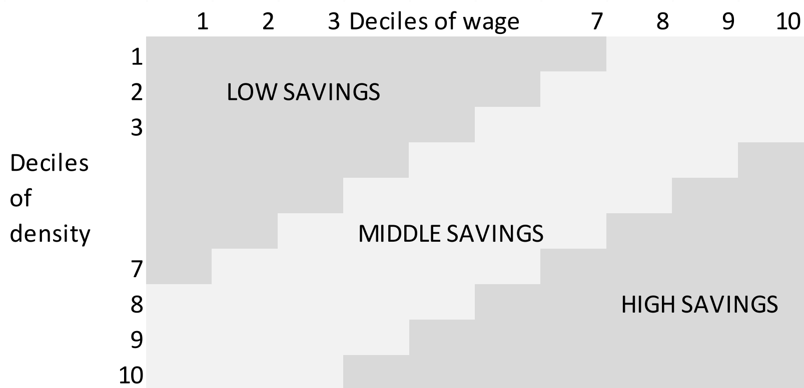
a) Take the proportion of individuals who withdrew and their average EWPF for the first episode in year 2020.
b) Combine results from the previous step with the age and sex *profiles* of withdrawals we discuss in Section 3.1.
c) Apply the resulting reductions in savings into each age and sex bracket in the model in that year.
d) For the second and third episode, add them together and follow along the same lines as a, b and c.

This procedure suffices for the model to capture the average effect of EWPFs on self-financed pensions, since in the Chilean individual capitalization system these pensions are actuarially fair and thus adjust automatically to changes in savings.

In the second stage, we focus on the distribution of the EWPFS, i.e., on the heterogeneity of withdrawals. The idea being that certain groups of individuals within the same cohort made a different use of the EWPFs (for the most part, due to the EWPF rules rather than subjective behaviors). The addition of this heterogeneity is relatively simple in the Chilean capitalization system, because the projection of the average case does not depend on the distribution of cases. This is so because the self-financed pension is a linear function of savings, whereas the non-contributory pension is the same pension for everybody. We can discuss distribution issues here without addressing the average self-financed pension or the non-contributory pension.

Figure 6 shows a division of the heterogeneity matrix into three savings levels. Each level comprises 33 percent of the individuals. We use those three savings levels as a proxy for a socioeconomic gradient, and we match them with the three savings levels in the analysis of the first EWPF in Figure 2.

Figure 6. Mapping the EWPF by Savings Level into the Heterogeneity Matrix



Source: IDB model.

Therefore, Figure 2 provides the EWPF heterogeneity that enters into the model. For the second and third EWPFs, we assume the same socioeconomics gradient as in the first one.

Now, the relative impact on retirement savings depends on the age at 2020-2021, because for young individuals in those years the change in retirement savings is minimal, as compared to the situation of relatively older active workers in 2020. For this reason, we model separately the situation of young, middle age, and older active workers in 2020.

5.4 Adding Labor Market Shocks into the Model

We focus here on age-sex conditional average impact on two dimensions: wage and density of contributions, leaving heterogeneity out of the analysis because it is probably a very minor component of the projection. This follows our analysis of the labor markets shocks in Section 4.

Regarding wage, the logic of the individual capitalization model allows one to easily add a special real wage growth rate during the first years of the projection. On its own, this means smaller average savings and therefore smaller self-financed pensions. It is worth noting that other pension systems, like PAYG systems, require the computations of some sort of "pensionable wage," which would probably be a bit more complex to add into a model.

Figure 4 shows that the real growth rate of contributable wage has being unstable, and about 2.5 percent during the decade before the Covid-19 crisis. Taking a conservative stance, we assumed a 1.7 percent growth rate for the long run. The same figure shows that the growth rate was below 1 percent in 2020 and 0 percent or even lower afterwards. Still, given the uncertainty of the future real growth rate of the contributable wage we assume 0 percent growth until 2022 and discuss the implications of different scenarios for the future evolution this rate.

The density of contributions, on the other hand, fully recovered after 2021, as shown in Sections 4.2, 4.3 and 4.4. During 2020-2021, the density of contributions changed by 5 and 8 percentage points for males and females, respectively (a relative shock of -10-15 percent). We added this easily into the model for the same reasons that it was easy to add the wage shock. Following Figure 5(a), we added the same relative density shock across age and sex groups.

5.5 The Base Case Scenario

We use official statistics to compute, by sex and age, at the start date of the analysis (December 2019, in our case, as we discussed earlier) the following variables:

- The number of active workers (year average).
- The average savings by active workers.
- The number of contributing active workers (year average).
- The average wage of contributing workers.
- An affiliation table (the transition into being an account holder).
- A disability table (risk rate for active worker to became beneficiaries of disability pensions), which is estimated based on the prevalence of disability pensions and the observed "disability & survivorship" insurance premium.
- The heterogeneity matrix without EWPFs, and with each EWPF (see Sections 5.2 and 5.3 for details).

For the projection, we assume:

- A real per capita GDP growth of 1.7 percent (this implies real 1.7 percent growth in wages conditional on age and sex).
- A real annual rate of financial return in pension savings of 5 percent.
- A real annual rate for annuitization of 2 percent.

- The population projection by United Nations.
- The population-level mortality rates available in United Nations projections.
- The mortality rates for pension-computation from regulatory documents [8].
- A constant heterogeneity matrix.
- The current ratio of new affiliates to total unaffiliated population, by sex and age, to remains constant.
- The current ratio of new disability pensions to total active affiliates, by sex and age, to remains constant.
- The current ratio of contributors over active affiliates, by sex and age, to remain constant.
- The current wage profiles by sex and age to remain constant.
- The current non-contributory pension to growth at the same rate as wage.

The model projects the average savings by age and sex, plus the number and average benefit amount of new old age, disability and survivor pensions; the average amount arising from two components: contributory pensions, which comes from "savings over actuarial factor," and non-contributory, which is the universal pension. All those figures can be decomposed using the heterogeneity matrix. Also, the model projects the number of active and passive workers by age and sex. To focus on the impact of EWPFs and labor market shocks on new retirees, we leave the current stock of pensions out of the simulation.

5.6 A Note about the Concept of "Density of Contributions" in the Model

Usually, the *cross-sectional* ratio of contributors over active affiliates is labeled the density of contributions. Yet, for pensions what matters at the end of the day is lifetime density, meaning the proportion of working life in which an individual made contributions into his retirement pension; thus it is very important to know about this *longitudinal* density *of* contributions.

Both concepts of density, the cross sectional and the longitudinal one, play a role in the projection of pensions. To simulate the proportion of active affiliates who contribute in any given projected year, the cross-sectional density is necessary. In projecting the future pensions, the model generates accumulated accounts (individual savings or accrued benefits, for example), which are in fact the result of the lifetime density.

Both cross-sectional and longitudinal density will be included in a pensions report. The cross section one will be stated clearly, and the longitudinal one would be represented, for example, by the sex-age average savings or average life contributed years.

The cross-sectional density is important for the projection model and has to be estimated from the data (it could be called the cross-section ratio of contributors over active affiliated individuals, to avoid confusion). The longitudinal one is also important, naturally, although it is usually captured indirectly through data or estimations of savings, accumulated contributed years, and the like.

In the present application of the Chilean case, the longitudinal data permit the computation of cross-sectional and longitudinal density, making it possible to explore this important issue. Figure A3 in the Appendix shows both measures, for age and sex, as of 2020, using the HPA longitudinal database. The figure shows that, in the case of Chile, they are quite similar.

Lastly, it is worth noting the importance of taking year averages for cross-sectional density, instead of the December value. Usually, only the figure for December in each year is available, and this month might poorly represent the year average. Figure A4 in the Appendix shows cross-sectional density in different months of 2020 and 2015 as well as the year's average, using the HPA longitudinal database. The figure shows that the value observed in December might overestimate the year average wage by as much as 5 percentage points, especially for the younger age brackets; and the figure also compares 2015 with 2020, showing that some years might be more volatile than others in this regard.

6. Results

6.1 Comparison of Distributions between Official Data, HPA, and Heterogeneity Matrix

Table A1 in the Appendix shows the heterogeneity matrix estimated according to the criteria discussed in Section 5.2. For the sake of clarity, we have divided the matrix into its two main components: i) lifetime relative density of contributions and ii) lifetime relative wages. We see there a higher dispersion of density for women, and a higher dispersion of wages for men.

In this section we focus on the evaluation of the heterogeneity matrix as a methodological framework to manage the complexities of projecting the diversity of labor trajectories.

First, we check an important simplification supporting the matrix, which is that individual's relative position on wage and density remains constant across the active life cycle, and therefore relative savings are constant across the individual's working life. We use the HPA database to compute the relative distribution of saving by sex and age, shown in Figure A1 in the Appendix. There we see substantial stability of relative savings across age, for both sexes.

Second, we compared the performance of a) our heterogeneity matrix approach, b) data from the Pension Regulation Office and c) the longitudinal database "*Historias Previsionales de Afiliados (HPA)*."

Figure 7 shows three different estimates of the distribution of savings accumulated in individual accounts by December 2020. Firstly, the figures show the distribution of total savings according to the official statistical data from the Pension Regulation Office. Secondly, the figure includes the distribution observed in the HPA database (see Section 5.2 for technical details). Thirdly, in light gray we graphed the simulations constructed with the heterogeneity matrix only; in this case we use the relative wage and the relative density to construct the relative savings (the real interest rate does not make a difference for the relative savings in this simple setting), using the observed 2020 value of average savings as pivot value.

Figures 7a and 7b show the estimations of individual total savings by December 2020 for men aged 55-60 and 35-40 years, respectively. As evident, estimations based on the heterogeneity matrix match closely the official data and the HPA longitudinal database; the situation is similar for females (Figures 7c and 7d).

Figure 7. Comparison of Different Estimations of Total Savings for December 2020

(a) Males, 55-60 (b) Males, 35-40

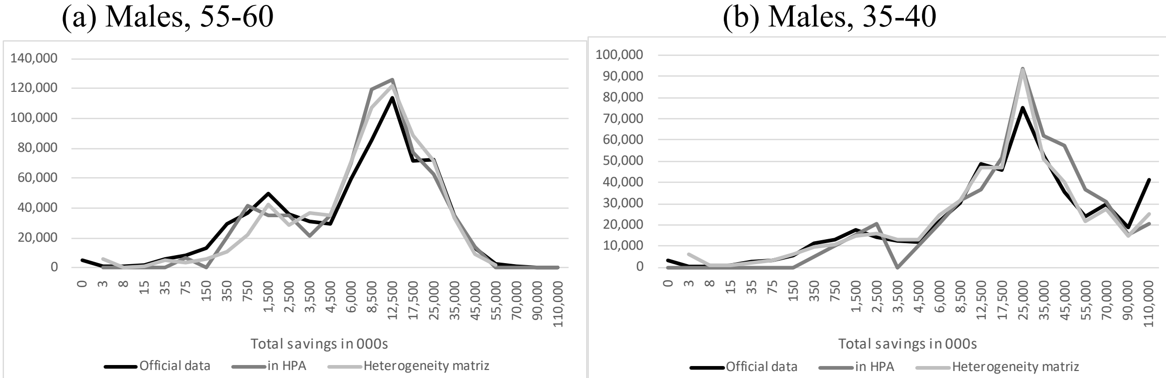
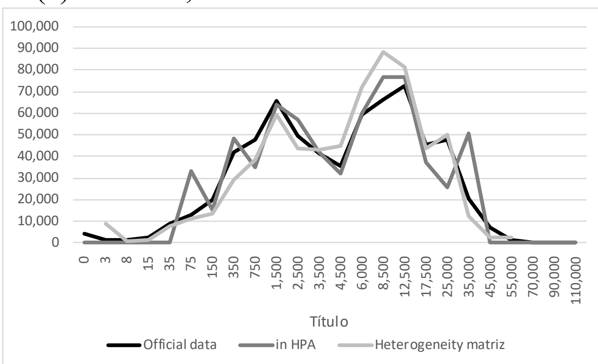
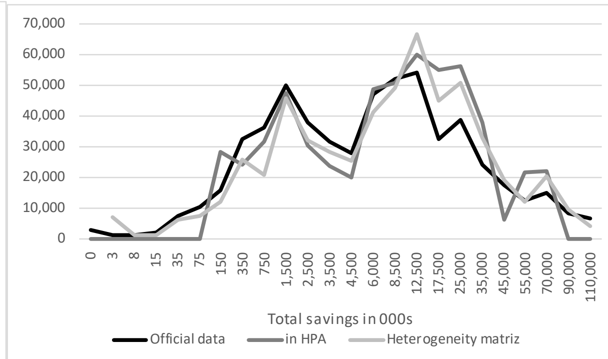


Figure 7, continued

(c) Females, 50-55



(d) Females, 35-40



Source: Authors' calculations

All comparisons in Figure 7 show a close relation between the estimated distribution using the heterogeneity matrix, the official data and the HPA data. Thus our heterogeneity matrix reproduces total savings satisfactorily. As such, the heterogeneity matrix might be useful for simulating a distribution of wages, densities and total savings.

6.2 Impact of Early Withdrawals on Savings

The projected impact of EWPFs on retirement savings, and therefore on self-financed old age pensions, depends on the age of the individual at the time of the EWPF. For a very young individual, for example, even a 100 percent withdrawal of funds would imply only a minor impact on her retirement savings. We focus on the impact for three ages groups as of 2019: young (20), middle age (40) and older active (60) workers in 2020, and we model the impact in both size and heterogeneity across savings group. Each saving group comprises 33 percent of the cohort. Section 5.3 provides further details on the methodology.

In Table 3 we present the results. This table summarizes some key findings regarding the impact of EWPFs on the Chilean pension system. For individuals close to retirement in 2019, we found that the average loss of retirement savings adds up to 31 percent for males and 37 percent for females. Among older affiliates in the low savings group, the EWPFs implied about a 56 percent decrease of savings in relation to the scenario with no retirement. The table shows that, not surprisingly, all three age categories and three saving groups are negatively affected by the EWPFs. In every age category, the groups with lower savings are those whose funds are reduced the most by the successive EWPFs.

Table 3. Estimated Impact of EWPFs on Projected Retiring Savings, by EWPF Episode and Savings Level

ACTIVE MALES		No EWPF	1°	1°+2°	1°+2°+3°
Young in 2020	**All**	**0%**	**7%**	**11%**	**11%**
	Low savings group	0%	10%	14%	14%
	Middle savings group	0%	8%	12%	12%
	High savings group	0%	7%	10%	10%
Medium in 2020	**All**	**0%**	**12%**	**20%**	**24%**
	Low savings group	0%	20%	32%	38%
	Middle savings group	0%	12%	21%	25%
	High savings group	0%	10%	18%	21%
Older in 2020	**All**	**0%**	**16%**	**25%**	**31%**
	Low savings group	0%	34%	48%	56%
	Middle savings group	0%	15%	24%	30%
	High savings group	0%	13%	22%	27%
ACTIVE FEMALES		No EWPF	1°	1°+2°	1°+2°+3°
Young in 2020	**All**	**0%**	**8%**	**11%**	**11%**
	Low savings group	0%	10%	14%	14%
	Middle savings group	0%	9%	12%	12%
	High savings group	0%	8%	10%	10%
Medium in 2020	**All**	**0%**	**13%**	**22%**	**25%**
	Low savings group	0%	21%	34%	37%
	Middle savings group	0%	14%	24%	26%
	High savings group	0%	12%	21%	23%
Older in 2020	**All**	**0%**	**19%**	**32%**	**37%**
	Low savings group	0%	32%	49%	57%
	Middle savings group	0%	21%	35%	39%
	High savings group	0%	18%	29%	34%

Source: authors' calculations.

The EWPFs thus changed not only the size but also the distribution of savings. Figure A5 in the Appendix shows the projected distribution of savings among new retirees in 2022 in four successive scenarios: before the occurrence of EWPF, with the first EWPF, then the scenario including the first and second EWPF, and finally the third EWPF. The figure shows that the prevalence of accounts with small savings doubles due to EWPFs, while the opposite is estimated for accounts with large savings.

6.3 Impact of Early Withdrawals on New Self-Financed Old Age Pensions

The impact of EWPFs on the distribution of new benefits arises closely from the previous analysis, since pensions equal total savings over an "actuarial factor."[4] The actuarial factor is higher for women, mostly because they retire earlier than men (60 instead of 65 years old) and they have a higher life expectancy. It is thus informative to learn about the average pension of new pensioners by sex, with and without the EWPFs. The estimation in this exercise shows a rather pessimistic picture. Figure 8 shows the estimated average amount of new self-financed old age pensions in 2022, by sex and saving group, in four scenarios: before the occurrence of EWPF, with the first EWPF, then the scenario including the first and second EWPF, and finally the third EWPF.

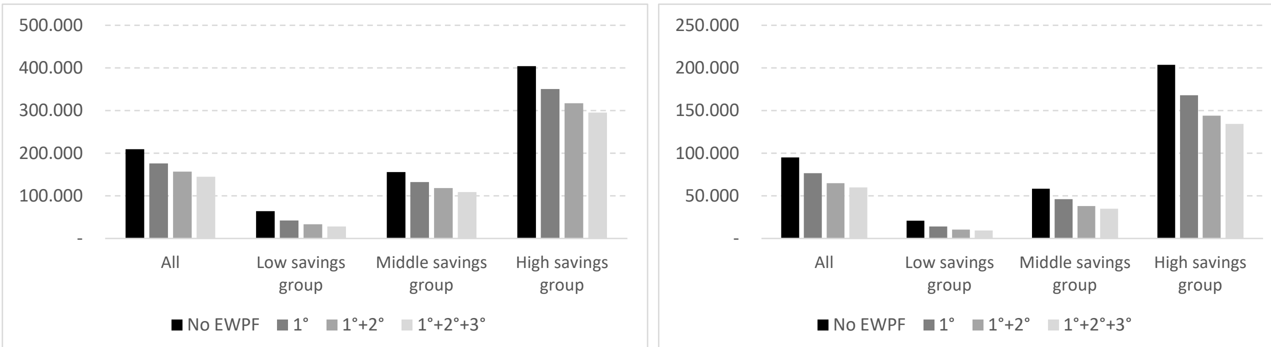
Figure 8 shows several important issues. First, even without EWPFs, men and women self-financed pensions are on average much smaller than the minimum wage: about $200,000 and $100,000 for men and women, as compared with a minimum wage of about $300,000 in $ of 2019. Second, the figure shows the sharp, though not surprising, difference in self-financed pension allowances across saving groups. In the case of men, the third of affiliates with the largest savings self-financed a pension roughly eight times that of affiliates in the lowest third of savings; this figure is even more pronounced among women.

Third, with the three EWPFs, the estimated self-financed pensions are only about $145,000 and $60,000 for men and women, respectively. Moreover, after the third withdrawal, the average pension allowance in the group of females with the lowest savings is close to zero.

[4] The actuarial factor reflects the future mortality (and the future mortality of the spouse and other relatives who are entitled to a pension), plus the expected interest rate and pension parameters. Currently, the actuarial factor is about 188 for males aged 65 and 237 for women aged 60. It is worth mentioning that the interest rate embedded in the actuarial factor has been substantially higher during 2022, which implies a sudden growth in the allowances of new pensions during the current year.

Figure 8. Projected Distribution of New Pension Benefits in 2022 by EWPF and Savings Group

(a) Males (b) Females



Source: Authors' calculations.
Notes: Males are evaluated at 65 years old, females at 60 (legal retirement ages). Constant Chilean pesos of December 2019.

The impact of EWPFs on pensions is softer on individuals who were of middle-aged or young in 2020-2021, as shown in Table 3. The projection of pension allowances of new old age retirees from year 2022 to 2100 is shown in Figure A6 in the Appendix, including the projected future impact of EWPFs.

6.4 Impact of Early Withdrawals on Replacement Rates

The "replacement rate" (RR) is a common measure among pension reports. It is generally defined as the pension allowance over the recent wage. A deeper analysis of RR goes beyond the goals of this study, but the RR can take many forms, can embody a wide array of issues within a pension system, and is quantitatively sensitive to several variables. We use here two measures of the RR:

1. Pension allowance over recent wage in a year basis (RR1). For the denominator, the idea is to include the zeros for months without contributions, i.e., to compute the monthly wage that replicates the individual's yearly income. This measure is closer to the idea of consumption smoothing. We chose a three-year window for this measure.
2. Pension allowance over average last contributed wage (RR2). This measure is not sensitive to the individual's density of contributions, but it can avoid having

very low wages in the denominator.[5] This measure can be easier to interpret and communicate because the average "wage with zeros" for individuals with low density might be very low.

In cases where the density of contributions is 100 percent, as in hypothetical cases or in some institutional settings (such as the armed forces), both RRs reach the same value.

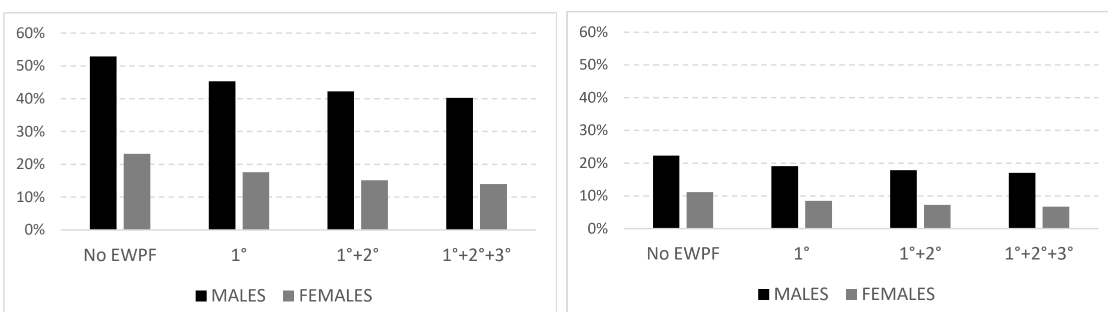
Figure 9 shows the RRs by sex, with and without EWPFs. It shows several features of the current situation of the Chilean pension system. First, Figure 9 shows that with EWPFs, RRs are estimated to experience a substantial drop, even more so for females. While men's RRs fell about 25 percent due to EWPFs, the drop for women would be around 40 percent.[6]

Second, without EWPFs, men's RRs would have been about twice those of women. This is due partly to their later legal retirement age (65 for men versus 60 for women), partly to their life cycle of contributions (which occurs a bit later in the case of women), and partly to the age profile of wages. The men-women difference is slightly smaller in the RR2, in relative terms, because leaving density out of the pictures erases some of women's disadvantage in this regard.

Figure 9. Estimated Impact of EWPFs in Self-Financed Replacement Rates for New Old Age Pensions in 2022, by Sex

(a) Pension allowance over recent wage with zeros

(b) Pension allowance over last wage



Source: Authors' calculations.
Note: Males are evaluated at 65 years old, females at 60 (legal retirement ages).

[5] As can be seen in the case of RR2, which results in awkwardly large values if non-contributory pensions are added. An average recent wage of 1 dollar, for example, combined with a non-contributory pension of 200 dollars, implies a 20,000 percent RR!
[6] This does not match exactly with the average drop in saving because RR is the interplay between wages and pension allowances at the individual level.

Third, RR1 is not low for men. However, since the average wage includes zeros, this pension allowances can be quite low. In fact, males' average pension without EWPFs in Figure 9 is $200,000, which is only about 2/3 of minimum wage. Finally, the RR2s appear quite low.

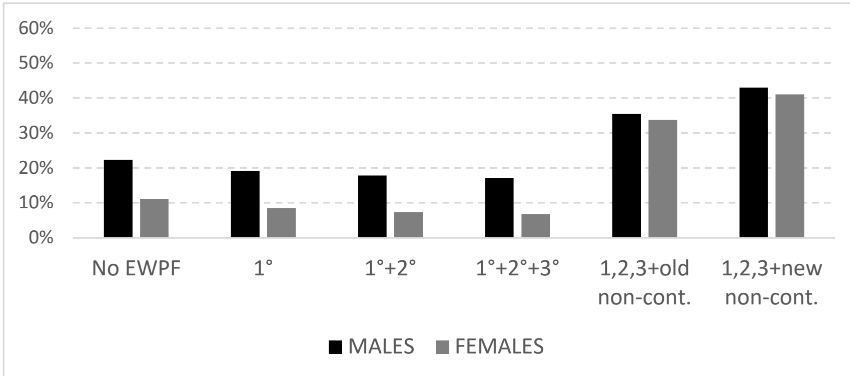
6.5 The Change in Non-Contributory Pensions as a Counterforce for Early Withdrawals

As discussed in Sections 1 and 2, in 2022 the Chilean pension system underwent a change in its non-contributory pillar, replacing the old *pensión solidaria* with the new *pensión garantizada universal*. This section explores the extent to which the change in this pillar counteracted the impact of EWPFs on total pensions allowance. To do so, future pensions with the old and with the new non-contributory pensions are estimated using the model.

The *pensión garantizada universal* (PGU) is awarded to the lower 90 percent of the income distribution, with basically the same allowance for every beneficiary. Even though beneficiaries with a relatively higher self-financed pension obtain only a fraction of the PGU, they are mostly in the higher 10 percent that does not receive PGU in the first place. Even with EWPFs, the PGU allowance is nearly the same for all beneficiaries, which explains why the direct fiscal impact of EWPFs might be very small. For the calculations in this study, we assumed for simplicity that the PGU allowance is equal for all beneficiaries, regardless of their savings.

Before presenting a detailed analysis, it is interesting to add the old and new non-contributory pensions into the replacement rate of Figure 10. In this case we present the RR2 (i.e., the pension allowance with respect to the last wage), to avoid the very high replacement rates that are obtained if zeros are counted in the computation of recent wage.

Figure 10. Estimated Impact of EWPFs and Non-Contributory Pensions on "replacement rate with respect to the last wage" for New Old Age Pensions in 2022, by Sex



Source: Authors' calculations.
Note: Males are evaluated at 65 years old, females at 60 (legal retirement ages). Old non-contributory refers to "*pensión solidaria*," while new non-contributory refers to "*pensión garantizada universal.*" It is assumed here for simplicity that non-contributory pensions start at 60 for women (the legal age for non-contributory pensions is 65 for men and women).

Figure 10 shows that the new non-contributory pillar is more generous than the old one. This is because it has a higher allowance and is less focalized. It also shows how, on average, both the old and the new non-contributory pillar are enough to counteract, on average, the entire impact of EWPFs.

But due to the profound non linearities in the change in non-contributory pensions, a better look at the situation requires some distributive analysis. Table 4 shows the financial analysis by savings decile, focused on the estimated new pensioners in 2022.

Table 4 shows that the change in the non-contributory pillar was substantially gainful for all savings groups, with the exception of the higher decile, where there is not access to the PGU. It also shows how these gains were more substantial, in relative terms, for the lower deciles. Table 4 also shows that deciles 7,8, and 9 experienced a bigger gain with respect to the 6^{th} decile, due to the extension in focalization, specially among females.

And very important to note, the last column of Table 4 shows that the change in non-contributory pensions more than compensated the decrements due to the EWPFs.

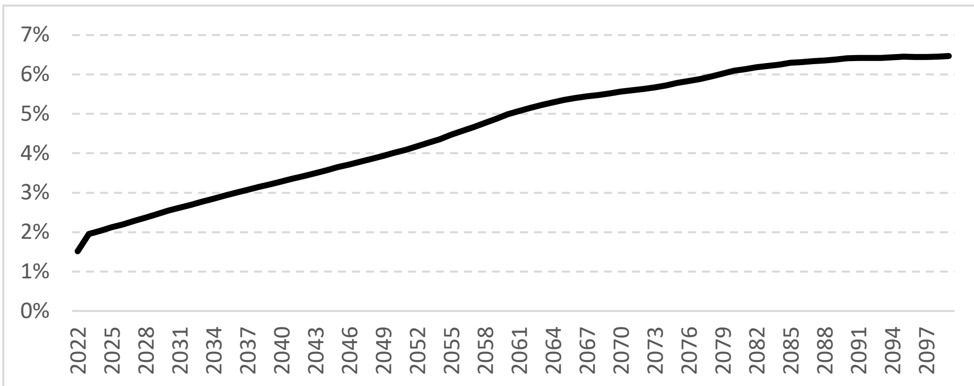
Table 4. Financial Analysis by Savings Decile: Estimated Change in Non-Contributory Pensions and Estimated Impact of EWPFs among New Old Age Pensions in 2022 by Sex

Savings decile	Self financed pension in $ without EWPFs	Self financed pension in $ with EWPFs	Old non-contributory pension in $	New non-contributory pension in $	Impact of EWPFs on selfinanced pension in $	Impact of change in non-contributory pensions in $	Total impact in $	Combined impact of EWPFs and change in non contributory
	(a)	(b)	(c)	(d)	(e)=b-a	(f)=d-c	e+f	(e+f)/a
MALE:								
Low	157	0	148.867	153.000	-157	4.133	3.976	2539%
2	6.565	4.998	146.699	153.000	-1.567	6.301	4.735	72%
3	40.648	30.948	135.165	153.000	-9.700	17.835	8.135	20%
4	108.225	82.399	112.296	153.000	-25.826	40.704	14.878	14%
5	155.632	118.493	96.253	153.000	-37.139	56.747	19.608	13%
6	191.627	145.899	84.072	153.000	-45.729	68.928	23.199	12%
7	236.740	180.246	0	153.000	-56.494	153.000	96.506	41%
8	307.431	234.067	0	153.000	-73.363	153.000	79.637	26%
9	418.914	318.947	0	153.000	-99.967	153.000	53.033	13%
High	730.001	555.799	0	0	-174.203	0	-174.203	-24%
FEMALE:								
Low	322	0	148.811	153.000	-322	4.189	3.867	1200%
2	2.721	1.638	147.999	153.000	-1.084	5.001	3.917	144%
3	11.174	6.725	145.139	153.000	-4.449	7.861	3.412	31%
4	26.086	15.700	140.092	153.000	-10.386	12.908	2.521	10%
5	45.223	27.217	133.617	153.000	-18.005	19.383	1.378	3%
6	65.286	39.292	114.134	153.000	-25.993	38.866	12.872	20%
7	95.160	57.272	0	153.000	-37.888	153.000	115.112	121%
8	129.757	78.095	0	153.000	-51.662	153.000	101.338	78%
9	190.861	114.870	0	153.000	-75.990	153.000	77.010	40%
High	336.933	202.784	0	0	-134.148	0	-134.148	-40%

Source: Authors' calculations.
Notes: Males are evaluated at 65 years old, females at 60 (legal retirement ages). Constant Chilean pesos of December 2019. Old non-contributory refers to "*pensión solidaria*," while new non-contributory refers to "*pensión garantizada universal*." It is assumed here for simplicity that a) non-contributory pensions start at 60 for women (the legal age for non-contributory pensions is 65 for men and women), and b) *pensión solidaria* stays constant across retired life (the legal pension allowance increases about 7 percent in real terms, starting at age 75).

The expansion of non-contributory pensions comes, of course, with a fiscal cost. Fiscal spending on the universal pension is not complex to Project, as it arises directly from the population projection, and because the PGU is nearly a flat benefit. (Although it takes a decreasing value for individuals with high self-financed pensions, those individuals are for the most part already excluded because they belong to the richest 10 percent of the population). A good estimation of the PGU's fiscal cost can be made made by multiplying the total population 65 and older by the level of the benefit ($180,000 Chilean pesos in 2022, $153,000 in Chilean pesos of December 2019, approximately US$220) times 90 percent (the means-tested goal). For the first full year of the new scheme (2023), we estimate a fiscal cost of 1.96 percent of GDP, growing steadily over time until reaching 6.5 percent in the year 2100, as shown in the following figure.

Figure 11. Projected Cost of Universal Pension ("PGU") as a Proportion of GDP



Source: Authors' calculations.
Notes: The lower value for 2022 is because the PGU program works only partially during its first year.

Finally, as we project that both new self-financed pensions and the PGU allowance growth over time at approximately the same rate, it is possible to infer that the impact of the latter on the former is sustained across future years.

6.6 The Impact of Labor Market Shocks

For the impact in labor force discussed in Section 4.2, we found a minor impact on the average benefit of new old-age labor markets, of about 0.5 percent in males and 1 percent in females, lasting for the first 40 years of the projection and peaking at about 2040.

For the impact on the real growth rate of the contributable rate, it depends in the future evolution of this rate. Nevertheless, this channel introduces a probably moderate impact on self-financed pensions. If the real growth rate recovers its long-run value without compensating for past losses (that is, if there is a permanent shock in wages), the impact on self-financed pensions could be relatively small, in the vicinity of 5 percent for both sexes. If the rate recovers and also compensates for past losses (so that the wage recovers its long-run trend), the impact on self-financed pensions could be very small.

7. The Case of Caribbean Countries

To further explore the impact of Covid in pension systems, we discuss the case of Caribbean countries next. In this case we focus on the potential impact on contributory pension systems of Covid shocks on labor markets.

Because there is not much public information available about the recent evolution of their pension systems, we will rely here on Ilostat[7] labor markets data to simulate a "theoretical individual" who experience the average labor market impact and later on goes under the pension rules.

All independent Caribbean countries with a population of at least 200 thousand individuals are included here. In order of size, they are Cuba, Haiti, Dominican Republic, Jamaica, Trinidad and Tobago, Bahamas and Barbados.

First, we turn the attention to the labor market. We focus on the labor participation rate, the unemployment rate and the employee rate (percent of employment in the employee category), as the main determinants of the quantity of formal jobs. Figures 12 to 15 show the yearly evolution of each of those three dimensions from 1991 to the (projected) year 2023, by gender, as published in Ilostat.

It is clear from those figures that Covid had a clear shock on the labor force rate, which recovers to a great extent by 2023 and could probably recover entirely by 2025. The unemployment rate, on the other hand, shows a relatively mild shock, to a great extent recovered by 2033. The employee rate, finally, shows almost no Covid impact. The following table summarizes the observed impacts from Figures 12 to 15.

[7] https://www.ilo.org/wesodata

Table 5. Summary of Labor Markets Shocks during 2020, Largely Recovering to by 2025

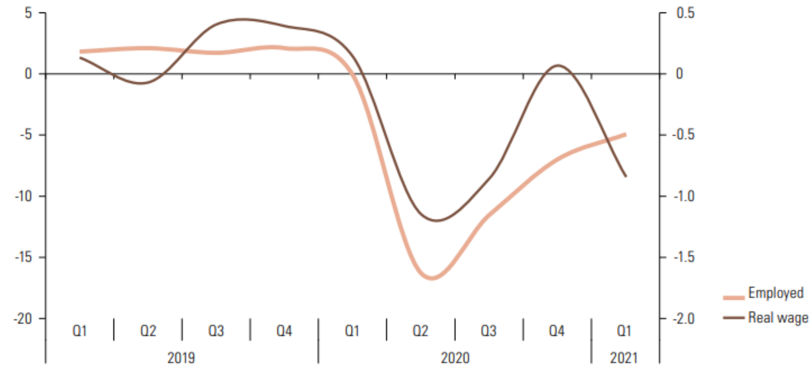
Country	Absolute drop in labor force rate as % of population (males - females)	Absolute increase in unemployment rate (males - females)	Absolute drop in employee rate (males - females)
Bahamas	11% - 8%	4% - 2.5%	None
Barbados	Unclear - 1.5	3% - 1%	None
Cuba	5% - 2%	1% - 1%	None
Dominican Republic	7% - 4%	2% - 3.5%	None
Haíti	1% - 1%	2% - 2%	4% - 1%
Jamaica	5% - 4%	2% - 2.5%	None
Trinidad and Tobago	4% - 3%	1% - 1%	None

Source: Authors' calculations based on Figures 12 to 15.

Now, a hypothetical individual that experience, on average, the labor markets shocks in Table 5 would have a minor impact on her contributory pension situation. From a life cycle perspective, having about two years with about 90 to 95 percent of the normal labor career has a small impact on pension projection—even more so because of pension rules (Table 6 summarizes the pension rules for normal old-age pensions in our selection of Caribbean countries): most countries require between 10 to 20 years of contributions (Cuba requires 30), which seems a much larger quantity than a loss of 5 percent of two or three years in an individual's career.

This overall conclusion does not change much if we add the impact of wage. Even though we are not aware of recent information on wages in the selected countries, with the exception of Dominican Republic, we can take the variation in real GDP as a proxy. Similarly, we can follow the idea that variation in the real wage goes along the variation in the employment numbers, as can be seen, for example, in the following figure from Cepal (2021):

Figure 12.[8] Latin America: Rates of Variation in the Number of Persons Employed and Real Wages, 2019 to First Quarter of 2021



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official figures.

Thus, if the wage shock follows the employment shock, then it is probably a mild wage shock. Again, the impact of pension might be small also because of the pension rules: three countries compute the pensionable benefit based on the best five years of contributions, and another country computes them based on recent wage only. There is thus less chance for this wage shock to influence the pension situation.

Perhaps the main argument to expect a low impact on contributory pensions from Covid-related labor market shock is that high informality implies that the subpopulation that joins the contributory pension system is highly selective. That subpopulation is probably much less affected by labor markets shocks. To explore this issue, we review the evidence on available actuarial or economic documents. In Barbados, the 16th actuarial valuation (2017) shows the evolution of the National Insurance Fund's number of insured individuals from 2007 to 2017 (Figure 1.2, page 8) and NIF's insurable wage (Figure 1.3, page 8); these figures do not show a clear correlation with the GDP contraction of -5.1 percent in 2009.[9] In Jamaica, the National Insurance Scheme report for 2016 (published 2018), portrays the evolution of NIS's contributors in Table A2-2 on page 101, showing no clear correlation with Jamaica's GPD contraction of -4.3 percent in 2009. In Dominican Republic, Table 4 on page 27 in *Informe Final Determinantes de las Pensiones* (2018) shows the evolution of contributors from 2003 to 2018 in the *Sistema Dominicano de Pensiones*, and Figure 2 on page 30 shows the evolution of the contributable wage from 2004 to 2018; both

[8] Economic Commission for Latin America and the Caribbean (ECLAC), Economic Survey of Latin America and the Caribbean, 2021 (LC/PUB.2021/10-P/Rev.1), Santiago, 2021.
[9] All the GDP figures in this paragraph are taken from World Bank database.

figures show no clear association with lower GDP growth of 0.9 percent on year 2009. In Trinidad and Tobago, the "Tenth actuarial valuation of the National Insurance System as of 30 June 2016," published 2018, contains the evolution of contributors in Figure 1.5 on page 11, from 2004 to 2016, where again no clear association is found with the GDP contraction of -4.4 percent in 2009.

In sum, we expect from this analysis a low impact on contributory pensions from Covid-related labor market shock.

Table 6. Old Age Pension Rules in Selected Countries

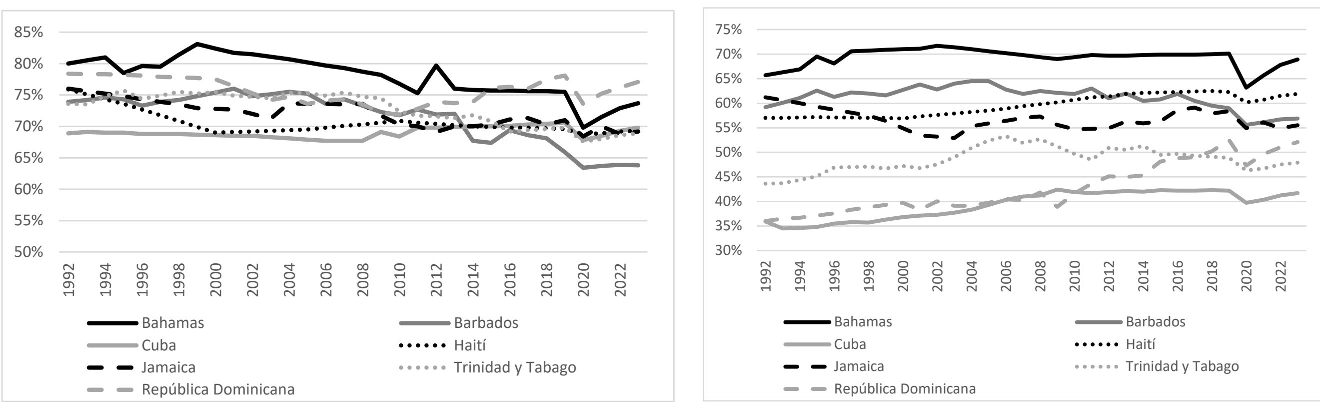
Country	Eligibility	Benefits
Bahamas	Age 65 with at least 500 weeks of paid contributions.	30% of the insured's covered wage, which is increased by 1% of the covered wage for every 50 weeks of paid or credited contributions exceeding 500 weeks. The covered wage is based on the insured's average weekly earnings in the best five years of contributions in which at least 26 contributions were made.
Barbados	Age 67 with at least 500 weeks of paid or credited contributions, including at least 150 weeks of paid contributions.	For individuals aged 56 or older (younger) in 2002, 40% (2%) of the insured's average annual earnings plus 1% (2% to 1.25% depending on contributions years). Average annual earnings are based on the insured's covered earnings in the best five years of contributions; if the number of years worked is less than 15 years, the average is based on the insured's total covered earnings.
Cuba	Age 65/60 for men/women, with at least 30 years of employment.	60% of the insured's average monthly earnings in the best five years of earnings in the last 15 years of employment plus 2% of average monthly earnings for each year of employment exceeding 30 years is paid.
Dominican Republic	Individual capitalization for all individuals 45 or younger in 2003	Annuity (also, programmed withdrawals).
Haíti	Age 55 with at least 20 years of contributions.	33.3% of the insured's average monthly earnings in the last 10 years is paid. Average earnings are not adjusted based on inflation.
Jamaica	Age 65 with at least 520 weeks of paid contributions and an annual average of 10 weeks of paid or credited contributions during the working life.	*Basic benefit*: J$3,400 a week is paid if the insured had an annual average of 39 weeks of paid or credited contributions; J$2,550 for average 26 to 38 weeks; or J$1,700 for average 10 to 25 weeks.

		Earnings-related benefit: J$0.06 a week is paid for every J$13 of employee or employer contributions paid during the working life.
Trinidad and Tobago	The retirement age is flexible, from age 60 to age 65, with at least 750 weeks of paid or credited contributions.	TT$130.78 to TT$941.40 a week plus TT$1.41 to TT$13.00 a week for every 25 weeks of contributions exceeding 750 weeks is paid. The minimum monthly old age pension is TT$3,000.

Source: Public information on official websites.

Figure 13. Labor Force as Percentage of Population by Country and Year

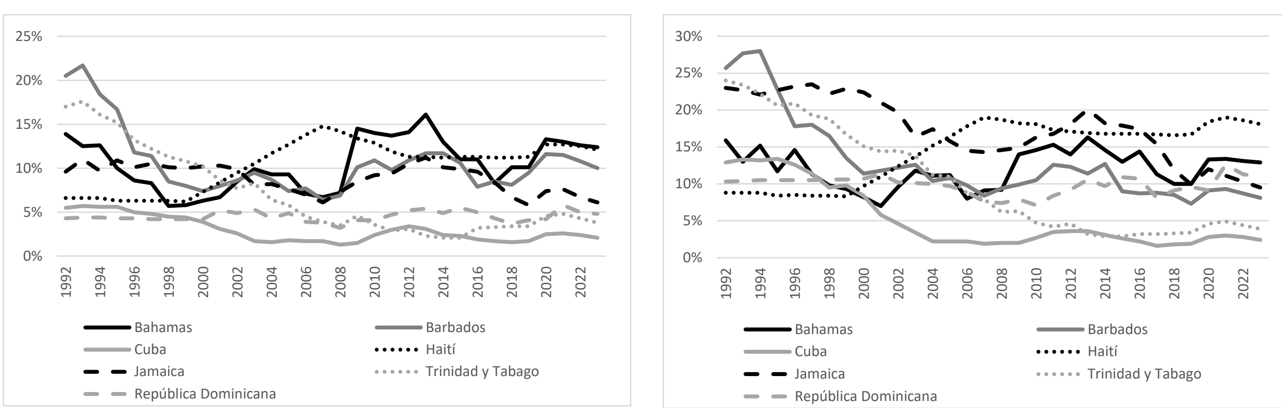
(a) Male (b) Female



Source: ILO statistics.

Figure 14. Unemployment Rate, by Country and Year

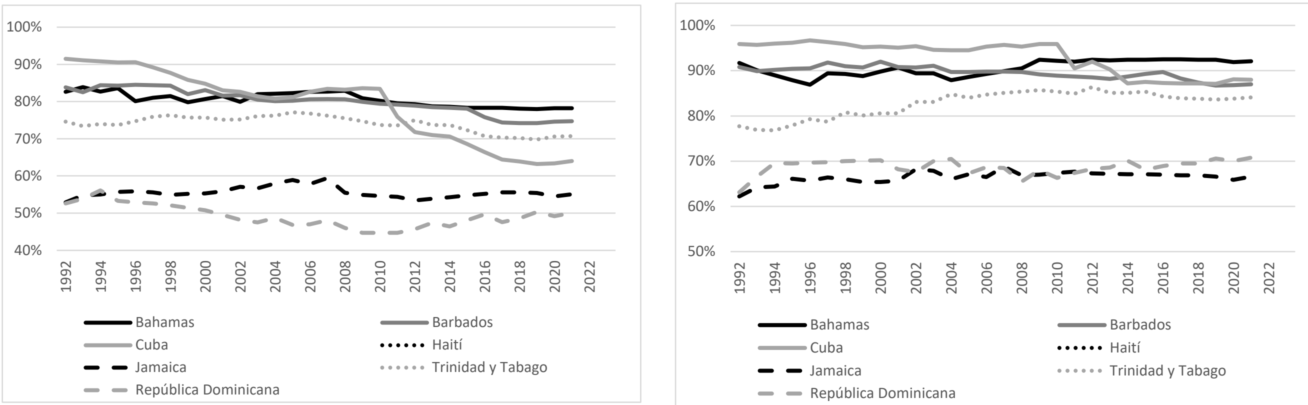
(a) Male (b) Female



Source: ILO statistics.

Figure 15. Employees as Percentage of Total Employment, by Country and Year

(a) Male (b) Female



Source: ILO statistics.

8. Discussion

It is perhaps impossible to know if Chile's early withdrawal of pensions funds (EWPFs) would have happened in the absence of the Covid-19 crisis. What can be estimated is their profound impact on the Chilean pension system. The total savings were 82 percent of GDP in 2019 and dropped to 60 percent by the end of 2021, after the third and final EWPF. Most of the eligible population chose to exercise their right to make an EWPF.

Based on different data sources, this study estimates a drop of about 31 percent and 37 percent on self-financed pension allowances of new pensioners in 2022, an impact that slowly goes away for new pensioners of future years. We additionally estimate that the EWPFs' non-linear rules introduced a sharp socioeconomic gradient; we project about twice the impact on pension allowances for new retirees in the 33 percent of lowest savings, as compared with the highest 33 percent.

At the same, Chile introduced an ambitious expansion in non-contributory pensions, increasing their size and scope (from the original *pensión solidaria* to the new *pensión garantizada universal*, PGU). This change is found in this study to more than compensate the effect of EWPFs. However, the new non-contributory pension (*PGU*) implies a sizable fiscal cost, expected to grow from about 2 percent of GDP in 2023 to about 6.5 percent of GDP in the very long run.

The Covid-19 impact on labor markets seems much smaller than EWPFs, with formal labor markets recovering to a substantial degree by the end of 2022. A similar conclusion is presented in ILO (2021). Now, rather than the density of contributions, the variable that is still struggling to recover is real wage growth, possibly due to high inflation in this period, plus the impact of nominal rigidities. It is hard to propose a path for the future evolution of real wages, in particular if and when future real growth rates are going to compensate for the current slowdowns. The scenario of normal growth from 2023 and afterwards nevertheless suggests relatively small labor market impacts on pension allowances. In this sense, the Chilean case is similar to that of Caribbean countries, though in those countries the impact on self-financed pension allowances might be smaller due to the rules of pensions (DB instead of DC); in any case, in Caribbean countries the labor careers of the somewhat select subpopulation that joins the formal labor market (which includes the public sector) might on average be only slightly affected by Covid-19.

Probably the most salient policy recommendation from the Chilean EWPFs experience is the importance of maintaining the social validation of any pension scheme. At the end of the day, it is a matter of risk. It the public is not at ease with its pension system, the stage is set for the unknown. EWPFs in Chile did not follow, apparently, any line of emergency relief, with a large share of withdrawals going to upper-income groups, apparently without a technical framework to support this policy.

Another policy recommendation is the protection of the formal labor market, distinguishing between contributory and non-contributory pensions. It may not be necessary to require mandatory contributions (which are probably going to increase from 10 to 16 percent, depending on the next pension reform) by low-salary workers, on the verge on informalization, when the new non-contributory pension (which may also increase in the next parametric reform) might already provide a replacement rate much higher than the recommendations in ILO convention N1°102 [9].

The idea of an empirical replacement rate merits discussion. With respect to average recent annual wage, we found a 53 percent and 23 percent average replacement rate for males and females, respectively; in regard to the last wage, we found respective rates of 22 percent and 11 percent. In both cases, we found that EWPFs introduced a relative drop of about 24 percent and 40 percent for males and females, respectively. The empirical replacement rate measure, however, might become very confusing, due to a) alternative definitions, b) the wide distribution of rates across the population, c) the wide array of explanations behind the results, d) the influence of wage growth, e) the impact of small groups of the population in the mean or median replacement rate and e) the role of non-contributory pensions.

One limitation of our study is the scarcity of data about the second and third EWPF, and the probable lower quality of data on non-active affiliates. Our initial estimate of the total impacts of EWPFs appeared lower than those observed in official figures for 2022, thus we adjust downward estimates of EWPFs impact so as to balance the different pieces of information. Another limitation, in the labor market impact arena, is that the Covid-19 is still ongoing, so it is hard to propose scenarios for the future. Finally, it is important to mention that our trend projection from 2022 to 2100 might differ from the actual experience of 2020, 2021 and 2022, because those are very atypical years in many dimensions. For example, the number of new pensioners decreased substantially in the last two years, presumably due to the Covid-19 economic shock, and also because the technical interest rate for the computation of new pension allowances experienced a sizable increase, therefore increasing the size of new pension allowances.

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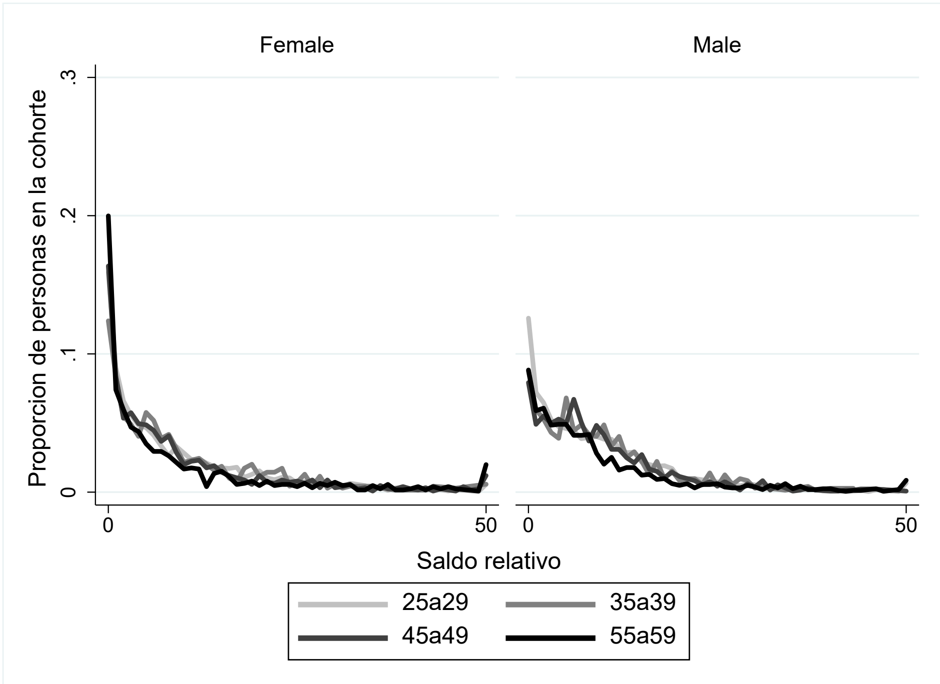
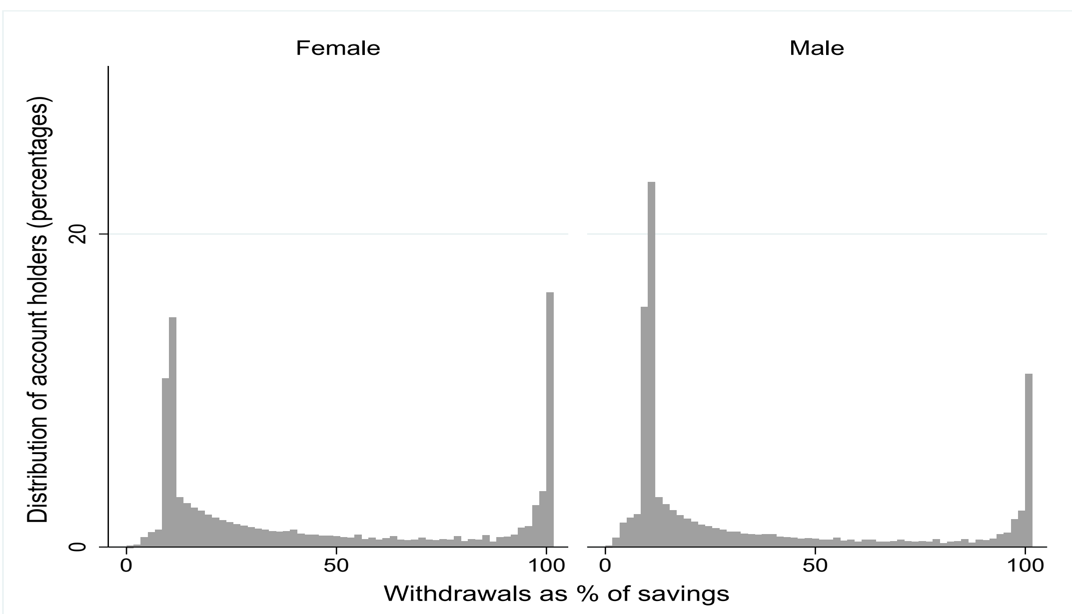
Appendix: Tables and Figures

Figure A1. Distribution of Relative Savings Conditional on Sex and Age as of 2020



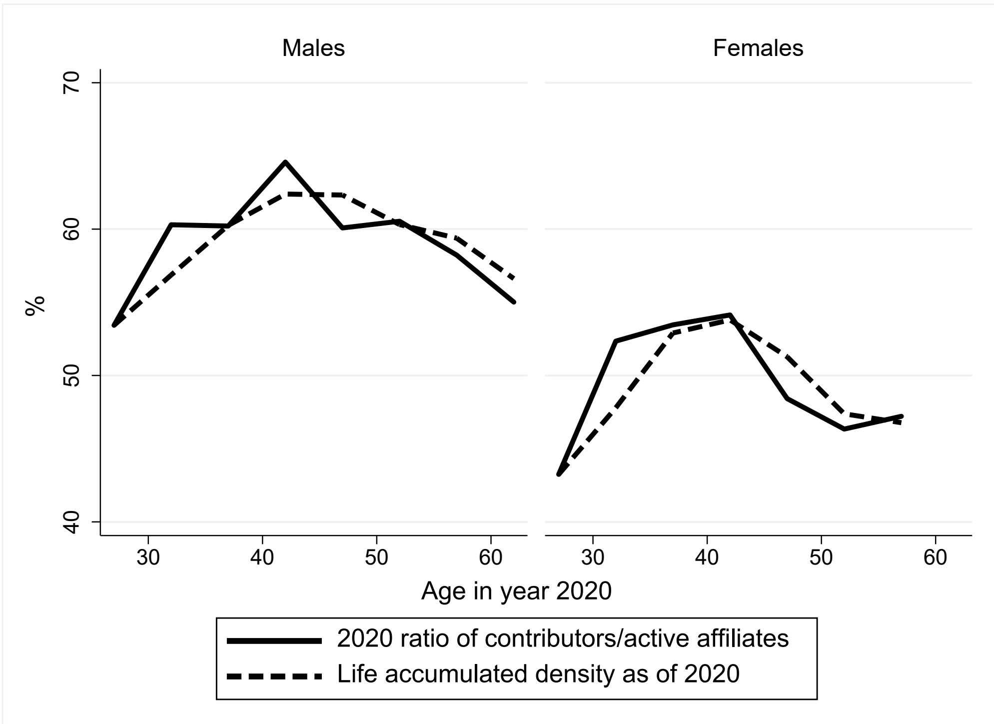
Source: Authors' calculations.

Figure A2. Distribution of the Proportion of Total Savings Withdrawn in the First Episode by Those Who Exercised the EWPF



Source: Authors' calculations based on official microdata from the first withdrawal episode.

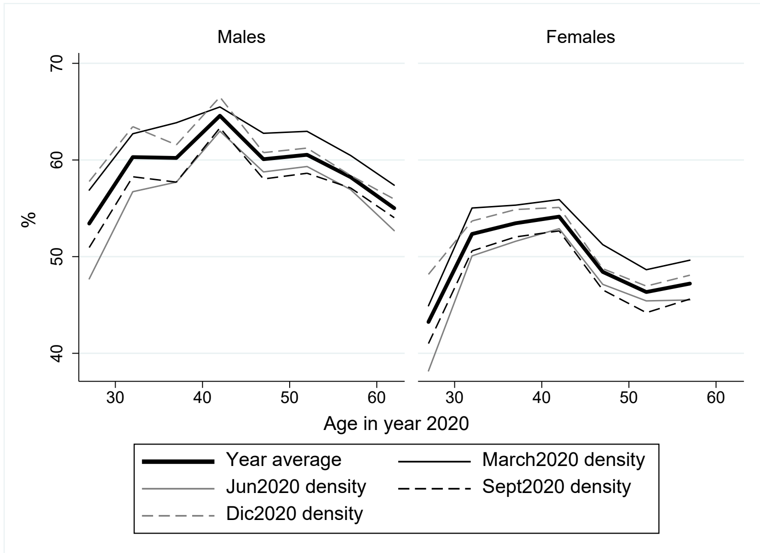
Figure A3. Lifetime and Ratio of Contributors over Active Affiliated Individuals by Age, Sex and Month in 2020



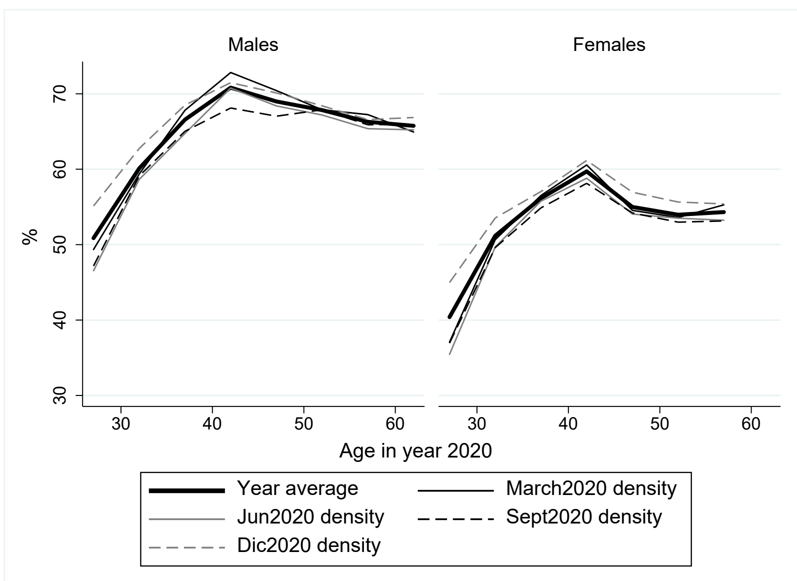
Source: authors' calculations based on the *Historias Previsionales de Afiliados* longitudinal database.

Figure A4. Ratio of Contributors over Active Affiliated Individuals by Age, Sex and Month, 2015 and 2020

(a) 2015



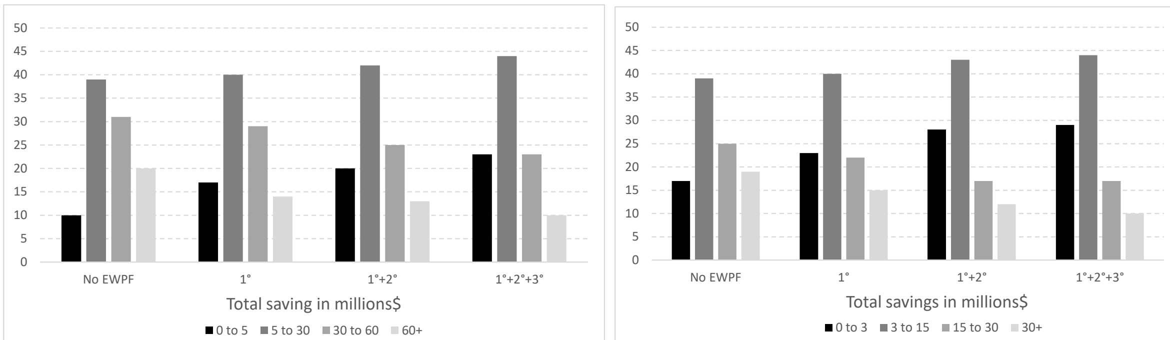
(b) 2020



Source: Authors' calculations based on the *Historias Previsionales de Afiliados* longitudinal database.

Figure A5. Projected Distribution of Total Savings of New Retirees in 2022 by EWPF and Savings Group

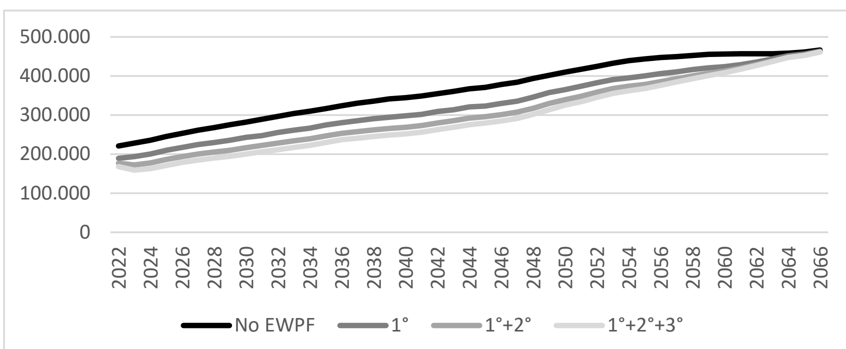
(a) Males (b) Females



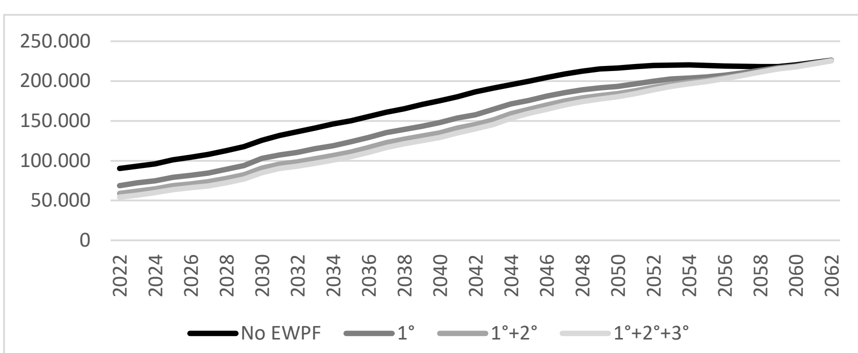
Source: Authors' calculations.
Notes: Males are evaluated at 65 years old, females at 60 (legal retirement ages). Constant Chilean pesos of December 2019.

Figure A6. Projected Average amount of New Old Age Pensions by EWPF Episode

(a) Males



(b) Females



Source: Authors' calculations.
Notes: Males are evaluated at 65 years old, females at 60 (legal retirement ages). Constant Chilean pesos of December 2019.

Table A1. Relative Density and Wage in the Heterogeneity Matrix

MALES	RELATIVE DENSITY									
	1	2	3	4	5	6	7	8	9	10
1	0.10	0.13	0.13	0.13	0.18	0.18	0.18	0.18	0.17	0.18
2	0.41	0.41	0.45	0.43	0.43	0.45	0.45	0.46	0.45	0.46
3	0.65	0.66	0.66	0.68	0.68	0.68	0.68	0.68	0.66	0.68
4	0.86	0.84	0.84	0.86	0.86	0.84	0.86	0.86	0.84	0.86
5	0.99	0.99	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
6	1.13	1.14	1.14	1.16	1.14	1.14	1.14	1.14	1.14	1.14
7	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.27	1.26
8	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37
9	1.49	1.49	1.49	1.49	1.47	1.49	1.49	1.49	1.49	1.49
10	1.62	1.61	1.61	1.61	1.61	1.61	1.62	1.62	1.62	1.64
MALES	RELATIVE WAGE									
	1	2	3	4	5	6	7	8	9	10
1	0.11	0.22	0.29	0.34	0.39	0.43	0.47	0.53	0.65	1.10
2	0.25	0.37	0.41	0.46	0.51	0.58	0.65	0.77	1.01	1.92
3	0.30	0.43	0.49	0.56	0.62	0.69	0.80	0.97	1.28	2.30
4	0.39	0.50	0.57	0.63	0.68	0.77	0.91	1.09	1.36	2.19
5	0.43	0.55	0.61	0.66	0.73	0.81	0.92	1.11	1.43	2.38
6	0.43	0.58	0.65	0.72	0.81	0.90	1.03	1.24	1.57	2.57
7	0.50	0.64	0.72	0.79	0.87	0.96	1.11	1.32	1.68	2.66
8	0.53	0.66	0.74	0.84	0.92	1.03	1.18	1.35	1.69	2.57
9	0.58	0.72	0.82	0.91	1.01	1.13	1.28	1.49	1.87	2.60
10	0.58	0.80	0.95	1.09	1.23	1.42	1.70	2.10	2.60	3.44
FEMALES	RELATIVE DENSITY									
	1	2	3	4	5	6	7	8	9	10
1	0.04	0.07	0.07	0.07	0.07	0.07	0.09	0.09	0.07	0.02
2	0.18	0.18	0.20	0.20	0.20	0.20	0.22	0.20	0.22	0.22
3	0.38	0.38	0.38	0.38	0.38	0.38	0.42	0.38	0.38	0.38
4	0.58	0.60	0.60	0.60	0.60	0.63	0.60	0.60	0.56	0.51
5	0.89	0.85	0.85	0.87	0.83	0.85	0.85	0.87	0.87	0.80
6	1.12	1.07	1.10	1.10	1.12	1.10	1.12	1.10	1.12	1.10
7	1.34	1.30	1.32	1.34	1.34	1.34	1.36	1.32	1.36	1.34
8	1.61	1.59	1.59	1.59	1.56	1.59	1.61	1.59	1.61	1.63
9	1.77	1.77	1.83	1.86	1.83	1.86	1.81	1.83	1.81	1.83
10	2.19	2.19	1.99	1.99	2.03	2.03	2.01	2.01	2.03	2.03
FEMALES	RELATIVE WAGE									
	1	2	3	4	5	6	7	8	9	10
1	0.21	0.38	0.50	0.59	0.71	0.71	0.94	0.94	1.46	3.01
2	0.26	0.39	0.49	0.59	0.69	0.79	0.89	1.23	1.49	1.49
3	0.27	0.39	0.49	0.60	0.68	0.79	0.93	1.18	1.65	3.31
4	0.27	0.40	0.49	0.59	0.68	0.79	0.95	1.16	1.83	2.17
5	0.22	0.39	0.50	0.58	0.69	0.79	0.94	1.19	1.63	2.89
6	0.21	0.40	0.51	0.60	0.68	0.79	0.96	1.20	1.69	2.84
7	0.31	0.40	0.50	0.60	0.69	0.79	0.96	1.21	1.66	2.80
8	0.30	0.40	0.51	0.60	0.69	0.80	0.96	1.17	1.66	3.14
9	0.27	0.42	0.50	0.61	0.70	0.80	0.96	1.22	1.68	2.92
10	0.25	0.25	0.48	0.59	0.69	0.77	0.97	1.19	1.69	3.02

Source: Authors' calculations based on longitudinal database ("*Historias Previsionales de Afiliados*").

Table A2. Distribution of Accounts with Withdrawals

(a) By age

Distribution of accounts with withdrawals by age

Age	1st withdrawal	2st withdrawal	3st withdrawal
25 or less	9.8%	7%	6%
26 to 35	26.7%	26%	25%
36 to 45	22.6%	24%	25%
46 to 55	20.9%	22%	23%
56 to 65	15.5%	17%	17%
66+	4.3%	4%	4%
Total	100.0%	100.0%	100.0%

(b) By savings level

Distribution of accounts with withdrawals by savings level

Savings level	1st withdrawal	2st withdrawal	3st withdrawal
$1.400 or less	21.9%	19.1%	18.8%
$1.400 to $14.000	41.2%	40.9%	40.1%
$14.000 to $60.000	29.4%	32.9%	34.2%
More than $60.000	6.7%	6.3%	6.1%
no data	0.6%	0.7%	0.8%
Total	100.0%	100.0%	100.0%