

# Actuarial Study of Unemployment Insurance Funds

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## **Abstract**

The financing insurance scheme is tripartite; it includes the participation of three players in the economy: workers, employers and the state. Given the state's participation, this is required to ensure the proper allocation of resources and anticipate potential financial problems of the Unemployment Insurance (UI). Then, it is required to assess with a certain frequency the operation of the UI, especially the Solidarity Unemployment Fund (SUF). The SP (Superintendence of Pensions) developed a projection model that allows not only to project and assess the sustainability of Unemployment Funds but also to assess the impact of proposed insurance reforms. This paper presents the projections of Unemployment Funds (UF) obtained by using this model. Projections show that both the Solidarity Unemployment Fund and Individual Unemployment Accounts (IUA) are highly sustainable, even in times of economic crisis.

# 1 Introduction

The Unemployment Fund (UF) was introduced in Chile in 2002 in order to mitigate the *shocks* originated for the loss of employment<sup>1</sup>.

The UI design combines savings in Individual Saving Accounts, owned by the worker (IUA) and a common fund called Solidarity Unemployment Fund (SUF). Unemployed workers can access the IUA, prior compliance of certain requirements<sup>2</sup>. Moreover, if the worker meets other requirements (higher than the ones to access the IUA) and the funds saved in his/her Individual Account are not sufficient, they can access the SUF. Is this latter fund the one that provides the insurance component as such, given that it groups the risk of being unemployed, among all possible beneficiaries. Additionally, SUF payments do not depend on each worker's savings because they are a *defined benefit in nature*, so resources are distributed from the less to the more vulnerable in terms of capacity to smooth consumption.

There is an extensive economic literature that studies, both theoretically and empirically, the effect of traditional unemployment insurance designs in relation to the effort that unemployed individuals put in the search for a new job. In simple terms, the existence of defined benefits along with the problem of asymmetric information between the social planner and the individual regarding the real effort made by the latter in order to be employed, it implies that the individual is encouraged not to make the socially optimal effort to be employed as long as the insurance benefits last. This phenomenon is known as *moral hazard*.

The individual savings component of the UI was introduced under the logic of promoting the effort to search for a job because the unemployed individual was supposed to internalize the cost of benefits payment. That is, compared to traditional unemployment insurances, individual accounts would reduce the moral hazard effect during the unemployment condition<sup>3</sup>. In addition, the Chilean UI was designed considering the level of development of the country, its institutional framework and the importance of the informal sector in the labor market, which, in turn, already had extensive experience in individual account management in

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<sup>1</sup>Before the establishment of the UI there was an Unemployment Subsidy (this subsidy continues to apply to workers who do not belong to the UI). The requirements for accessing the subsidy are higher and the amounts of money of the benefits are lower than the ones given currently by the UI. For more information go to <http://www.ips.gob.cl/temas-laborales/151-subsidio-de-cesantia>. Additionally, workers with open-ended contract that had worked for at least 12 months continuously with the same employer and that had been dismissed due to company's needs have the same right to be compensated.

<sup>2</sup>See section 2 for further details on access requirements.

<sup>3</sup>Vodopivec and Raju (2002).

the case of pension savings, so the establishment of the UIA in UI did not represent a major challenge in this sense.

The Insurance financing scheme is tripartite; it includes the participation of three players in the economy: workers, employers and the state. The State makes an annual contribution to the SUF equivalent to 225,792 monthly taxation units, that is to say \$10,060 million the value of the U.T.M. (Spanish acronym for Monthly Taxation Units) on October 2015. Given the above, the State has the obligation to: *(i)* ensure the proper allocation of resources and *(ii)* anticipate potential financial problems of the UI. Indeed, the act N° 19.728 establishes for the Superintendent of Pensions (SP) and the Budget Office the obligation to make every three years an actuarial study to assess the sustainability of the Unemployment Insurance, especially the SUF. To fulfill this obligation, the UI has developed a model to project the evolution of both the Unemployment Funds (UF) based on micro-level data of members and performance data of the UF. This paper presents the projections of UF obtained by using such model.

The study is divided as follows: after this introduction, the second section describes the characteristics of the Chilean UI. The third section presents a summary of past actuarial studies. The fourth section describes the data used for the projections, the estimates that had to be made for the projection of the variables that comprise the model and a detailed description of the projection model, with its various components. In section five projections of UF are presented for two scenarios, a basic one and another one under economic crisis. Finally, in section six, conclusions are given.

## 2 The Unemployment Insurance in Chile

The UI is one of the components of the Social Welfare of the State of Chile whose goal is to protect workers when they are unemployed. Is a mandatory insurance that covers dependent workers ruled by the Labor Act and that start or re-start work activities starting in October 2002. It was created by act N° 19.728 that came into effect on October 2002 and improved by acts N° from 2009 and N° from 2015.

In its origins, the SC was designed relatively conservatively regarding the eligibility requirements for receiving benefits and the amounts of those benefits. However, the SC has been maturing in terms of coverage, performance and accumulation of funds, reforms have been planned that make both access and adequacy of benefits flexible. Thus, the 2009 reform allowed workers a fixed term to access the benefits of the SUF and by 2015 significantly increased the benefit amounts by increasing the replacement rates of both the IUA and the SUF and

Of the increase of the upper and lower limits of the latter.

Likewise, a new modality was established to prove the condition of unemployment and search for a new job. Previously, the worker was required to approach the Municipal Labor Intermediation Office (OMIL) on a monthly basis to update their situation. With the 2015 reform, accreditation was facilitated through the National Job Market (BNE). As a requirement for receiving SUF payments, SC members must update their CVs on the BNE website and be available for job interviews and job offers they receive through the site. This reduces transport costs and time for workers, and allows OMIL to focus its efforts on labor intermediation.

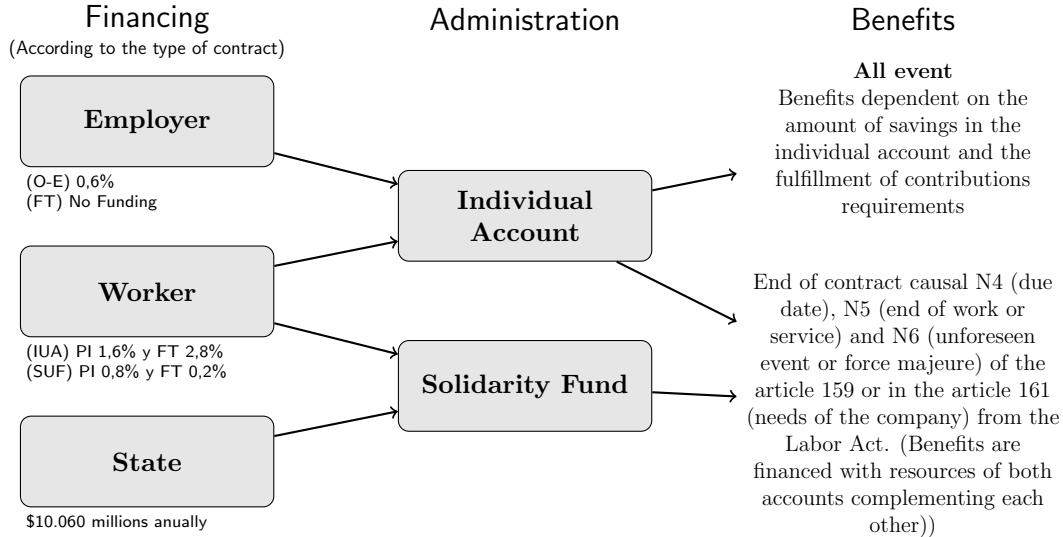
## 2.1 Financing

The UI is composed by two components: individual savings and a solidary social insurance. The savings component is destined to the IUA, which is financed with contributions from the worker and the employer equal to 0.6% and 1.6%, respectively, of the worker's salary in the case of workers with open-ended contract and only by the employer in the case of worker with fixed-term contract, or contract by determined project, work or service, on which the employer contribute with 2.8% of the worker's salary.

The solidary part, given through access to the SUF, is financed on one side by the contributions of employers that reaches 0.8% of the worker's salary with open-ended contract and 0.2% with fixed-term contract and, on the other side, with an annual contribution from the State of 225,792 Monthly Tax Units (MTU) equal to \$10,060 million considering the value of each MTU during October 2015.([Superintendencia de Pensiones, 2010b](#)).

Figure 1 shows financing, managing and access to UI benefits.

Figure 1: Unemployment Insurance Financing



## 2.2 Access to Funds and Benefits

In the case of workers with open-ended contracts, to have access to the IUA, workers have to end a work relationship and have, at least, 12 contributions associated with the insurance, it does not matter if the contributions are continuous or not. For workers with fixed-term contracts, the access starts on the sixth contribution, whether continuous or not. The number of drafts of months with payment received by the worker accessing the benefits of the UI at the sole cost of their Individual Accounts depends on the number of months the accumulated resources are able to finance. Decreasing monthly payments are given, starting on 70%, 55%, 45%, 40%, 35%, 30% and 30% of the average salary of the worker, payments that cannot be inferior to the minimal amounts established by the Solidarity Fund. This way, the payment is independent from the type of contract of the worker requesting the benefit.

To be a beneficiary of the SUF, regardless of the type of contract, workers must fulfill with: (a) have at least 12 monthly contributions, continuous or not, to the IUA, being the last 3 continuous and with the same employer<sup>4</sup>, (b) the end of the work relationship must not be by causes attributed to the worker<sup>5</sup>,

<sup>4</sup>Prior to the Reform of 2009, it was required for workers with open-ended-term contract to have at least 12 continuous contributions. Workers with fixed-term contracts did not have access to the IUA benefit.

<sup>5</sup>Causes N° 4, 5 and 6 from Article 159 or the causes from Article 161 from the Labor Act grant the right to IUA.

(c) not having enough balance on the IUA to finance the SUF, on the amounts, replacement rates and periods pointed out by the law, (d) being unemployed at the moment of requesting the benefit and keep such condition while the benefit is being received, and (e) in the past five years, have not received more than ten payments<sup>6</sup>. In the case of fulfilling all these requisites, accessing the SUF is voluntary. The value of the payments and their respective limits are described on table 1 and 2<sup>7</sup>.

Table 1: Payments from SUF for workers with Open-ended Contract

Month	% Average wage (12 months)	Superior Value (\$)	inferior Value (\$)
1	70	525.000	157.500
2	55	412.500	123.750
3	45	337.500	101.250
4	40	300.000	90.000
5	35	262.500	78.750
6	30	225.000	67.500
7	30	225.000	67.500

Source: Elaborated by the authors at December 2015.

Table 2: Payments from SUF for workers with Fixed-term Contract

Month	% Average wage (12 months)	Superior Value (\$)	inferior Value (\$)
1	50	375.000	112.500
2	40	300.000	90.000
3	35	262.500	78.750
4	30	225.000	67.500
5	30	225.000	67.500

Source: Elaborated by the authors at December 2015.

### 2.3 Main results of the UI

On December 2015, the UI has more than 8.6 million of affiliates and close to 4.4 million of contributors a month, both numbers constantly increasing. The difference between the amount of affiliates and the contributors could be explained

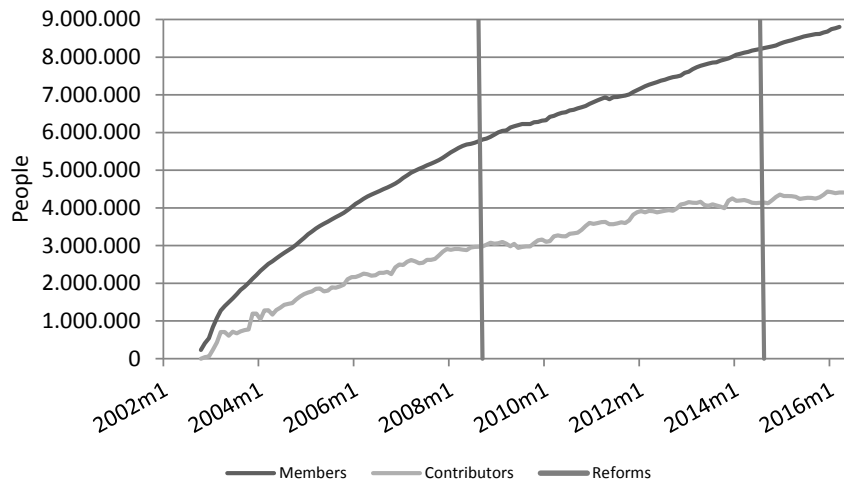
<sup>6</sup>This requisite was softened up by Act N° 20.829 on April 2015. Previously, it was required not have used the SUF more than two times in 5 years.

<sup>7</sup>The average percentage of the salary and the superior and inferior values were increased by Act N° 20.829 from April 2015.

due to, while the definition of affiliates considers all people who had contributed at least once to the UI, the contributors only considers the ones who effectively made a contribution during the reference period.

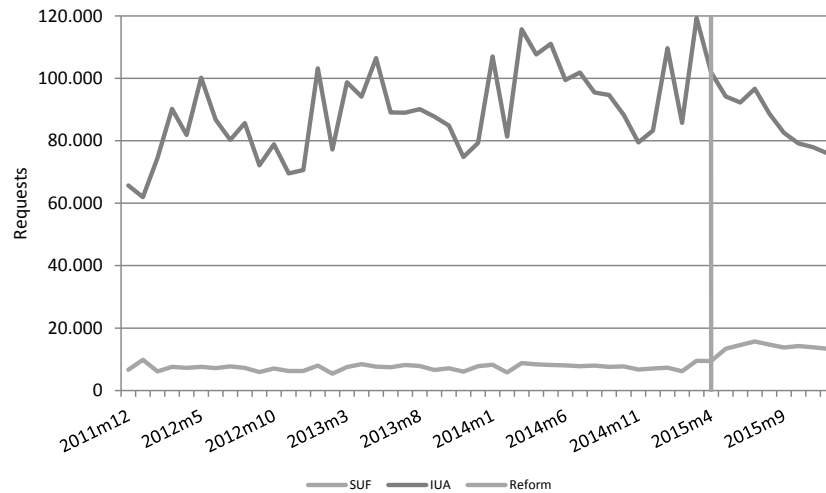
Even though the annual growing rate of affiliates has been 5% during the years 2013-2015, the same rate for contributors is 3% on the same period. On the other hand, figure 10 shows that the contributors have more volatility than the affiliates, which could be related to the seasonality of the employment numbers.

Figure 2: Contributors and members December 2015



Source: Elaborated by the authors based on data provided by the Statistics Center of the Superintendencia de Pensiones.

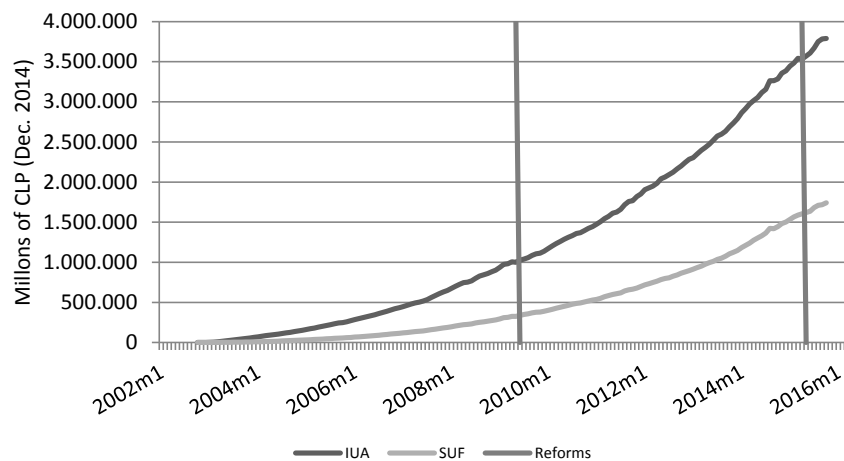
Figure 3: Monthly number of benefits paid by December 2015



Source: Elaborated by the authors based on data provided by the Statistics Center of the Superintendencia de Pensiones.

The number of total monthly beneficiaries of the UI reaches numbers close to 180,000 people on July 2015 (see Figure 3), but with high volatility. The beneficiaries of the SUF, including the one getting mixed financing, reaches close to 20,000 individuals per month, number that increased after the Reform of 2015. (Superintendencia de Pensiones, 2012).

Figure 4: Balance by December 2015



Source: Elaborated by the authors based on data provided by the Statistics Center of the Superintendencia de Pensiones.



Figure 4 shows the evolution of the balances of the UF (IUA and SUF). As we can see, both funds have had a progressive growth and, in general terms, uninterrupted. It is worth mentioning that the funds of the IUA have grown on a higher rate than the SUF.

While the value of the SUF reached to 1,696,628 million pesos on December 2015, (\$2,399 US Million December 2015), the added value of the IAU reached 3,702,674 million pesos (\$5,234 US Million December 2015). The annual growing rate of the SUF and the IUA has been 25% and 20% respectively in the period 2011-2015. These numbers suggest that the implemented reforms have not affected the funds accumulation or that, of negatively affected, the impact was compensated by others variables like profitability and the income by contribution. A summary of the Insurance evolution is shown on 4. In addition, the evolution in number of request since 200 is shown on 4.

Table 3: State of system, December every year

Year	Members		Contributors		IUA Balance		SUF Balance	
	<i>N</i>	$\Delta\%$	<i>N</i>	$\Delta\%$	\$	$\Delta\%$	\$	$\Delta\%$
2002	541.218	-	58.821	-	831	-	370	
2003	2.219.531	310,1	1.195.351	1.932,2	92.900	11.079,3	11.141	2.908,3
2004	3.202.703	44,3	1.712.716	43,3	215.770	132,3	42.393	280,5
2005	4.022.283	25,6	2.161.473	26,2	371.176	72	86.312	103,6
2006	4.716.167	17,3	2.500.465	15,7	582.853	57	154.379	78,9
2007	5.400.769	14,5	2.910.982	16,4	81.5382	39,9	235.811	52,8
2008	5.944.978	10,1	3.051.714	4,8	1.034.607	26,9	322.558	36,8
2009	6.316.955	6,3	3.163.072	3,7	1.337.767	29,3	457.520	41,8
2010	6.759.903	7	3.601.324	13,9	1.659.245	24	606.711	32,6
2011	7.127.930	5,4	3.886.283	7,9	2.044.965	23,3	770.883	27,1
2012	7.586.750	6,4	4.111.034	5,8	2.463.601	20,5	966.579	25,4
2013	8.014.792	5,6	4.253.773	3,5	2.948.777	19,7	1.211.810	25,4
2014	8.357.707	4,3	4.352.302	2,3	3.386.241	14,8	1.503.043	24
2015	8.679.484	3,9	4.434.705	1,9	3.702.674	9,3	1.696.628	12,9

(1) Source: Elaborated by the authors based on data provided by the Statistics Center of the Superintendence of Pensions.

(2) Values of balances expressed in millions of CLP, Dec.2014

(3) Period growth rates compared to the previous period.

Table 4: Number of request, December every year

Año	IUA	SUF	Total
2009	66.431	5.882	72.313
2010	68.041	7.216	75.257
2011	65.703	6.622	72.325
2012	70.652	6.249	76.901
2013	79.262	7.748	87.010
2014	83.260	7.023	90.283
2015	75.954	13.364	89.318

(1) It consider mix requests as SUF requests.

(2) Source: Elaborated by the authors based on data provided by the Statistics Center of the Superintendence of Pensions.

### 3 Past Actuarial Studies

The initial norm of the Insurance established for the Unemployment Fund Administrator (UFA) the demand of making, every two years, an Actuarial Study assessing the sustainability of the UF, with special care for the SUF evolution. Three Actuarial Studies were made during this period. The first was made by [Johnson, Zurita, & Muñoz, 2004](#) (JZM) who used a representative agent by type of contract to model the flows of income and outcome of the UF. The main difficulty these authors faced to model the evolution of UF was the strong existing bias on the Insurance data at the moment, due to the progressive character of the affiliation, which was mandatory for all contracts signed past October 2002 and voluntary for contract prior to this date. Thus, the data showed a strong inclination towards workers with fixed-term contracts or contract by determined project, work or service. The results of the model confirmed the sustainability of the UF, however, its growing was strongly undervalued.

[Bravo, Castillo, and Ruiz-Tagle \(2007\)](#) developed the actuarial study corresponding to 2006 (BCR). The authors used the model developed on the actuarial study of 2004 as starting point, modifying the probability tree and adding heterogeneity to the contributions. As with the JZM model, the inclusion of a probability tree determines the different situations on which we can find a worker affiliated to the Insurance on every moment of time, which determines the UI income and outcome flows. On the other hand, to add heterogeneity to the contributions, the new model considers the disaggregation on socio-demographic level cell by gender age and economic activity sector, which allows capturing the particular dynamic of certain interest groups.

Adding these dynamic elements offers more precise long-term projections. The results of the BCR study confirmed the financial sustainability of the UF for the period between 2005 and 2015. Even more, projections are slightly affected by adding a crisis of similar characteristics to the one that happened on 1998-1999.

A weakness of the previous actuarial studies is the lack of connection between the macro-economic and patrimonial situation parameters of the Insurance. Thus, the actuarial study of 2008 developed by [Cerdeira and Coloma \(2009\)](#), faces this weakness by developing a general stability model. The model simulates the Chilean economy by making companies and people interact to balance the offer and demand of the capital and job markets. The UFA is included on the model as contributions collector and benefits payer organism. As with the models previously mentioned, the results suggest a growing profile of the IUA and the SUF, reaching 6% and 2.3%, respectively, of the GDP in 2024. Also, both funds continue to be widely positive and sustainable on a crisis scenario.

The UI Reform added by the Act N° 20.328 in 2009 established that is the SP and the Budget Office's responsibility to make, every three years, an actuarial study that allows assessing the sustainability of the Unemployment Insurance, specially the SUF. On this context, the fourth actuarial study, developed in 2012, was created based on a projection model developed by the SP. Said model combines a part of the traditional actuarial based on 108 cells representing the affiliates belonging to the UI and one with micro-data built from the prevision history of the representative sample from the universe of Pensions Fund Administrator (PFA) affiliates, named prevision history of affiliates and retired people on the PFA system (HPA). The main advantage of the model is the feasibility of changing certain parameters of actual functioning of the Insurance, with the goal of assessing different Insurance change proposals<sup>8</sup>.

The results of the fourth study created by [Quintanilla, Poblete, and Vega \(2012\)](#) say that the projections of the Unemployment Funds continue to be widely sustainable on normal scenarios and on economic crisis situations. The results of good performance of the funds facing crisis situations are confirmed when considering that during the economic crisis of 2008-2009, the fund did not suffered significant drops.

In consequence, all actuarial studies made prior to this document agree with the sustainability of the UF, on normal scenarios as well as facing economic crisis.

## 4 Projection Model of the Unemployment Insurance Funds

On the current version of the actuarial study it was chosen to move from a model that combines micro-data with added cells, towards a model that captures, on a better way, the heterogeneity on an individual level and that relates the performance of affiliates on the work market with their behavior on the UI regarding the decision of requesting benefits and choosing the financing of said benefits. This progress is possible thanks to the higher availability of UI affiliates data due to the maturity the system reached after 12 years of being inserted. Additionally, the model enables to add shocks to the employment that will allow detonating unemployment crisis and in benefits requests. Finally, the new model adds stochastic variation of the UI returns, which allows simulating a financing crisis together with an employment crisis.

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<sup>8</sup>See [Fajnzylber and Poblete \(2010\)](#) for the initial description of the actuarial model developed by the SP.

Following, the methodology and data used by the model are described at length.

## 4.1 Descriptive Data and Statistic

The main source of information used on these documents is the UI database, which gathers individual registration of affiliates, including variables like gender and age, also, information about periods contributed, like type of contract, salary, employer, economic sector, among others. The database allows building the contribution and no-contribution history of workers in UI. Also, it can create the individual history of benefits requests, the amounts and durations of said benefits and its financing source (IUA or SUF).

It is worth mentioning that on this study, unemployment is considered as the absence of contribution to the UI once the work relationship ended. Although these episodes could represent inactivity or employment on sectors not covered by the UI (including informal employment), in terms of the UI, individuals with no contributions could be eligible and request benefits of the UI.

Considering the base holds information of more than 9.8 million affiliates and that this study used contribution history of individuals, work with all the data becomes inefficient on computational terms. Then, estimates are made based on a random sample of 1% of affiliates up to January 2016.

The study focuses on affiliates that have less than 60 periods with no contribution between January 2009 and December 2014, so it considers only those who have not left the formal work market. Finally, periods of affiliates who have reached legal pension age (65 years old for men and 60 years old for woman) are excluded. The contribution history is built, incomes, type of contract, requests and withdrawal made for the selected sample, making a non-balance panel between the affiliation date and December 2014.

The main statistics associated to different states relevant for the model, this means, in contributed periods and prior to unemployment, for the selected sample are the following<sup>9</sup>.

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<sup>9</sup>The statistics for the member's universe considered in this study are presented in Appendix A.

Table 5: Average wage (Chilean pesos, Dec. 2014) and participation in contribution periods, per year and gender.

Year	Male		Female		Total
	\$	%	\$	%	\$
2009	507.536	66	430.890	34	480.968
2010	545.197	65	453.240	35	512.570
2011	575.491	64	471.551	36	538.138
2012	616.816	64	497.411	36	573.701
2013	662.533	64	534.079	36	615.630
2014	686.399	63	554.832	37	637.458
2015	702.096	63	573.005	37	653.753

Table 6: Average wage (Chilean pesos, Dec. 2014) and participation in contribution periods, per year and type of contract

Year	Fixed Term		Open - ended		Total
	\$	%	\$	%	\$
2009	329.902	22	524.120	78	480.968
2010	341.536	35	604.324	65	512.570
2011	352.397	35	637.116	65	538.138
2012	376.671	34	675.526	66	573.701
2013	405.161	33	717.124	67	615.630
2014	414.371	31	738.032	69	637.458
2015	418.936	30	752.770	70	653.753

In general terms, the evolution of the contributing members distribution as per gender, type of contract and age range shows the natural inclination of the UI maturation process: the participation of women contributing members and contributing members with open-ended contract has increased steadily in time (70% of members have an open-ended contract). Furthermore, it is no surprising that men's remuneration and the one of people with open-ended contract is higher than the remuneration of women and of people with fixed-term contract, respectively. Finally, it must be emphasized the significant increase of real remuneration of the contributing members in the seven represented years, which in added terms, reaches a 36%.

The two following tables show descriptive statistics for individuals that present some unemployment periods. It can be observed that individuals who have faced unemployment possess completely different characteristics compared to the total contributing members. Particularly, the average wage in the period prior to unemployment represents half of average remuneration of contributing members, there is an over-representation of individuals with fixed-term contract.

Table 7: Average wage (Chilean pesos, Dec. 2014) and participation in period prior to unemployment, per year and gender.

Year	Male		Female		Total
	\$	%	\$	%	\$
2009	250.485	70	201.385	30	236.445
2010	273.209	69	208.361	31	253.458
2011	282.760	67	224.806	33	264.712
2012	299.082	67	230.182	33	277.844
2013	320.081	67	241.857	33	295.285
2014	332.854	67	261.104	33	309.649
2015	334.925	67	269.380	33	313.859

Note: Type of contract and wage are observed within the last period prior the unemployment.

Table 8: Average wage (Chilean pesos, Dec. 2014) and participation in period prior to unemployment, per year and type of contract.

Año	Fixed Term		Open - ended		Total
	\$	%	\$	%	\$
2009	203.358	41	254.853	59	236.445
2010	211.293	69	348.395	31	253.458
2011	216.511	69	368.585	31	264.712
2012	227.498	69	385.486	31	277.844
2013	241.090	68	404.846	32	295.285
2014	253.520	66	419.688	34	309.649
2015	253.275	64	421.736	36	313.859

Note: Type of contract and wage are observed within the last period prior the unemployment.

## 4.2 Methodology

The main objective of the model is to assess the sustainability of the SUF, which results in projecting incomes and expenses over time which, in turn, are related to the accumulation and use of the IUA. Then, the first step is to project the accumulate capacity of the system, that is to say the volume and frequency which members pay contributions, (in our model would be the probability of work indistinctly), both variables determined by the type of contract and wage (among other variables). Second, the non-accumulation of the UF is determined, which is produced from unemployment benefits, distinguishing whether they are under the IUA or SUF.

To determine the periods of contributions to the UI and the amount of those contributions, the decision to work is modeled jointly to the determination of wages in contributions periods. The specification is as follows:

$$C_{i,t} = \mathbb{1}[\beta X_{i,t-1} + \gamma Z_{i,t} + \pi \eta_i + \mu_{i,t} > 0] \quad (1)$$

$$\ln(w_{i,t}) = \alpha + \delta Q_{i,t-1} + \theta R_{i,t} + \eta_i + \epsilon_{i,t} \quad (2)$$

Sub-indexes  $i$  and  $t$  represent members and units of time, respectively. The  $X$  vector includes the following variables: to have contributed, type of contract, contribution density, number of times that benefits have been requested and number of continuous contributions. All controls included in the  $X$  vector correspond to the observed in period  $t - 1$ . For its part, the  $Z$  vector groups those controls inherent to the worker, such as gender, age and squared age.

For its part, the salaries equation is estimated from the type of contract, lagging salary up to 3 periods and controls inherent to the worker grouped in vector  $R$ , such as the number of months in which contributions have been paid<sup>10</sup>, and gender. Since the observed distribution of wage is right censored by the taxable income cap and neatly a 10% of wage is over this value, new variables are included with the aim of characterize the effect of belonging to this group of wages. Dummy ariables that identify people above the 75th, 90th, and 95th percentile are included (all three conditions being met). A distance variable is generated with respect to the 75th percentile, for those below it, which is used in a linear and quadratic manner. In addition, a variable is added that identifies the people who are in the taxable cap. All controls, included in the vector  $Q$ , correspond to what was observed in the  $t - 1$  period. Finally, equation 2 includes

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<sup>10</sup>It was considered the number of months in which contributions were paid from the database of the pensions system members.



lagged IMACEC, as well as dummies for the months of September and December.

Both equations include a fixed effect per individual,  $\eta_i$ , or unobserved heterogeneity, to account the unobservable factors that affect both the decision to work and the level of salaries, which are constant over time for each individual.  $\mu_{i,t}$  y  $\epsilon_{i,t}$  represent the error in the equation regarding the probability to work and wage, respectively.

The joint assessment of equations 1 and 2 is carried out with maximum likelihood being integrated over all the distribution of the unobserved  $\eta_i$ .

$$\sum_i \ln \int \prod_t \left[ \left\{ \Phi(\beta X_{i,t-1} - \gamma Z_{i,t} - \pi \eta_i) \right. \right. \quad (3)$$

$$\left. \left. * \phi \left( \frac{\ln(w_{i,t}^{c=1}) - \alpha - \delta Q_{i,t-1} - \theta R_{i,t} - \eta_i}{\sigma} \right) \right\}^c \left\{ \Phi(\beta X_{i,t-1} - \gamma Z_{i,t} - \pi \eta_i) \right\}^{(1-c)} \right] dF(\eta)$$

The parameters resulting from the estimation of equation 3 are presented in Appendix B. In general, the controls have included the signs and expected magnitudes. The probability of contributing has a significant dependence on state, that it to say is strongly determined by having contributed in the previous period. Also, the probability of contributing is higher for permanent workers and for men; It is increasing with age, with the contribution density (proxy attachment to the formal labor market).

Both the probability of contributing and wage in each period from March 2016 are projected with estimated parameters from the equation 3. Thus, the profile of contributions and salaries for each individual is obtained in the sample, which allows the calculation of takeaways to the IUA and SUF according to the type of contract.

For those workers-periods when there is no contribution, eligibility of both IUA and SUF is calculated. As previously mentioned, unemployment is defined as such event in which the worker finishes an employment relationship. Three possible cases can be observed: (i) The worker cease an employment relationship and stop contributing, (ii) The worker cease an employment relationship and continues contributing (change of employer or contract) and (iii) The worker cease one of many employment relationships and continues contributing. As long as the la eligibility on IUA is conditional to cease, but not necessarily stop contributing, the eligibility on SUF is conditional to cease and not have any kind of paid work to access the benefits.

Therefore, it is necessary to define those people in some of the 3 mentioned cases through the following equation:

$$Pr(Unemployment_{i,t}) = \mathbb{1}[\beta + \lambda\Delta_{i,t} + \mu_i + \nu_{i,t} > 0] \quad (4)$$

Where vector  $\Delta$  includes type of contract, IMACEC in previous period, wage logarithm of the last 12 months, contribution density, number of continuous contributions, gender, age, experience, yearly trend and quarterly dummies.

Consecutively, the probability of asking for benefits, conditional to be unemployed and have the right to IUA, and the probability to opt for the benefits of SUF, are estimated. These probabilities will impact the fund expenses, depending on the benefits.

The probability of asking for benefits, conditional on contributing, is estimated as:

$$Pr(Ask_{i,t}|C_{i,t} = 1) = \mathbb{1}[\beta + \pi\Psi_{i,t} + \mu_i + \nu_{i,t} > 0] \quad (5)$$

The probability of asking for benefits, conditional on not contributing, is estimated as:

$$Pr(Ask_{i,t}|C_{i,t} = 0) = \mathbb{1}[\beta + \phi\Gamma_{i,t} + \mu_i + \nu_{i,t} > 0] \quad (6)$$

Equations 5 and 6 are estimated separately through a probit-panel with random effects. In the case of the first equation, variables of type of contract, age, experience, squared experience, lagged IMACEC, gender, number of times that benefits have been requested, wage logarithm of the last 12 months and contribution density. For the probability of asking conditional on not contributing includes the same variables, except the two last ones, using the logarithm of the last observed wage and contribution density by type of contract. Both equations have quarterly dummies.

Finally, the probability to opt for the benefits of SUF, conditional to ask for and have the right to SUF, is determined by the following equation:

$$Pr(Opt_{i,t}) = \mathbb{1}[\alpha + \rho\Gamma_{i,t} + u_i + \xi_{i,t}] \quad (7)$$

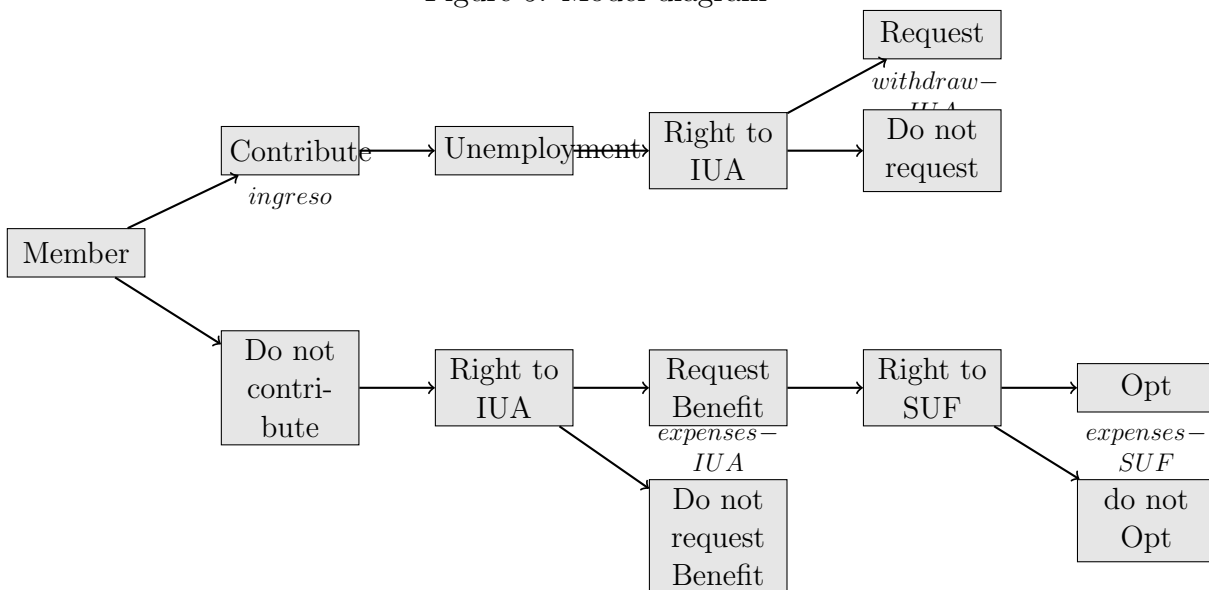
Vector  $\Gamma$  includes if contributing in the period, type of contract, experience, squared experience, lagged IMACEC, gender, observed wage logarithm of the last 12 months, number of times that benefits have been requested, annual trend and a dummy for the months after the 2015 reform.

The results of the estimates are presented in Appendix B.

After estimating  $y$  projecting the probabilities to ask for benefits of IUA and SUF, the eligibility of each  $i$  individual is computed in each  $t$  period. This is carried out iteratively considering the legal requirements mentioned in section 2.2 (such as the number of contributed months, type of contract, number of payments of the SUF in the last five years, etc.)<sup>11</sup>.

Summing up, the equations 1, 2, 4, 5, 6 and 7 allow projection of the UI members in terms of participation regarding contributions, unemployment periods, request forms and benefits eligibility. Each individual is considered up to the legal age of pension (60 y 65 years for women and men, respectively) or up to the final date of projection, March 2028. The following diagram 5 summarizes the probabilities tree.

Figure 5: Model diagram



#### 4.2.1 New Members

The previous section described the methodology to project contributing profiles, of integration and of request of benefits of the individuals already members of the UI. This section addresses the integration and behavior of individuals who will

<sup>11</sup>Given the information availability, it is not possible to verify the cause of the end of the employment relationship for access to SUF. For this reason the right to SUF is adjusted in order to reach the current use level, with a use rate of 51% on average during the projected period

become members in future years and, thus, also affect the ingress and egress of the UF.

Each month, new members are obtained, according to the type of contract, on the basis of a random selection and as replacement of new *effective* members between 2009 and 2014. This group's selection rate is calculated in a way that the total number of new members each month is consistent with the 1% sample used with the rest of the members<sup>12</sup>. As a result, each year and projection month there is a group of individuals that represents the new members of that particular period<sup>13</sup>. It is important to mention that it is crucial to select new members according to the period of integration, given the marked seasonal variability observed in statistics. In general terms, there is a significant increase of new members between November and February every year, and such new members are younger, they present more fixed-term contracts and their salaries are much lower compared with the ones of members that incorporated the system the remaining months of the year. For more information see appendix C.

It is assumed that the behavior of new members, who were selected to participate in the study, starting on January 2015, will be the same behavior that was observed the first 18 months, since their incorporation to the system<sup>14</sup>. From the month 19, the contributing, wages and the request of new members' benefits is modeled in the same way as for the rest of the members, according to section 4.2.

#### 4.2.2 Unemployment Funds Returns

With the aim to project the profitability that unemployment funds will have in the analyzed period and the risk linked to investments, the methodology of the risk model developed by [Berstein, Fuentes, and Villatoro \(2013\)](#) is used. For this purpose, each one of the UF (IUA and SUF) is presented through 5 asset categories, which at the same time are represented through indexes; this combination is performed through weighting factors. All these elements were determined according to the referent current portfolio, regarding each fund. The asset categories used are: domestic financial intermediation, national fixed income, foreign fixed income, national variable income, foreign variable income. The mapping process of the effective investment of UF in these categories is very simple as the investment of the AFC (Unemployment Insurance Manager for its acronym in Spanish) has been near to the reference portfolio, since these categories were established

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<sup>12</sup>There is not enough evidence that allows demonstrating the existence of a variation in the number of new members as a percentage of the workforce.

<sup>13</sup>For example, for the projection of July 2017, there is a new group of members, taken from each July, from 2009 to 2014.

<sup>14</sup>For the salary growth projection of the new members in the first 18 month, the same premise of 1.25% annual of *Pension at a Glance 2015* of the OECD was used.

in 2009, so the natural result is weightings equivalent to referential portfolios.

Table 9: Weights and used indexes

N°	Category	Index	% IUA	%SUF
1	Domestic financial intermediation	RASP_IF	45%	10%
2	National fixed income	RASP_RF	45%	75%
3	Foreign fixed income	LEGATRUU	10%	5%
4	National variable income	INFOCES	0%	5%
5	Foreign variable income	MSCI ACWI	0%	5%

(\*) Data obtained from bloomberg.

The correlation observed between effective returns obtained by the AFC and returns of the portfolio composed by indexes and the weights factors already mentioned is of 91% and 97% for the IUA and the SUF, respectively, which proves the proximity to an effective inversion strategy and to a referential investment portfolio.

An important assumption of the adopted methodology is that weightings will continue being during the entire projection. This assumption is based, on one hand, in the idea that current referent portfolios would function properly (LeFort and Mejido (2014)), so it is reasonable to think that there will be no drastic changes in the next ten years. And, on the other hand, it is not possible to predict specific changes.

From those historical returns of asset categories involved and their expected weighting, the evolution of returns is modeled through a random process with diffused leaps. Following the methodology used in Berstein et al. (2013) it is assumed that the real monthly return of the  $i$  asset will evolve according to:

$$dS_{i,t}/S_{i,t} = \mu_i dt + \sigma_i \epsilon_{i,1t} \sqrt{dt} + \lambda [\kappa_i + \delta_i \epsilon_{i,2t}] \quad (8)$$

The term  $\mu_i$  is the long-term return of the  $i$  asset with standard deviation  $\sigma_i$ . The second term,  $\epsilon_{i,1t}$ , represents a random shock that affects the return of the  $i$  asset. It is assumed that the return is subjected to diffuse leaps that represent financial crisis, and that such leaps take place with  $\lambda$  probability. The terms  $\kappa_i$  y  $\delta_i$  incorporate return deviations and long-term standard deviations. It is assumed that the shock  $\epsilon_{i,2t}$  is independent from  $\epsilon_{i,1t}$ .

The parameter  $\lambda$ , that represents the probability of financial crisis occurrence in the projection period is fixed in 10%. This implies that in 10 years of projection, unless 1 is expected to be in crisis. In the projection of a normal scenario,

the crisis is distributed uniformly in time, while the projection of the crisis scenario is assumed to concentrate all crisis periods in 2019.

In order to calculate equation 8 data of returns of the indices that represent the asset categories considered from January 2002 to December 2014 are used. The average returns, standard deviations and the co-relation among assets from August 2007 and January 2009 are considered parameters of crisis, while the evolution observed in the rest of the table is used to obtain all the important parameters in normal periods.

Table 10 shows monthly returns and standard deviation of such returns for a data gathering period for each asset, in normal and in crisis times. It can be observed that both the National and Foreign Variable Income (VI) experiments important falls in crisis times, while the National Fixed Income (FI), that represents a major percentage of the portfolio in both the IUA (75%) and the SUF (45%), has low returns in normal times, but moderate falls in crisis times. The Foreign Fixed Income, for its part, shows a counter-cyclical behavior, which means that it tends to have better returns in crisis times, while financial intermediation has certain moderate return levels, relatively smooth in certain times.

Table 10: Assets returns - Normal and crisis periods

Types	Normal Period		Crisis Period	
	Return	Standard Deviation	Return	Standard Deviation
<b>National FI</b>	0.5%	1.1%	-0.2%	0.9%
<b>National VI</b>	1.0%	4.6%	-2.7%	4.5%
<b>Foreign VI</b>	0.6%	3.7%	-2.8%	5.7%
<b>Foreign FI</b>	-0.1%	2.4%	0.8%	6.3%
<b>Financial interm.</b>	0.2%	0.5%	0.1%	1.1%

When computing the correlation of returns of different assets in normal times, it can be appreciated that, the National Fixed Income (most important tool in portfolios) is positively correlated with the Foreign Fixed Income and with the instruments of financial intermediation, being the most important factor the magnitude of the latter. The National Variable Income is negatively correlated with all kinds of assets, except the Foreign Variable Income, considering that this has a positive relationship with the Foreign Fixed Income.

In periods of crisis, the National Fixed Income has a positive correlation with the National Variable Income and negative with the rest of the assets. The National Variable Income, in turn, correlates negatively with the Foreign Fixed Income and positively with other kinds of assets. The Foreign Fixed Income shows negative correlations with national instruments of any kind, showing the power of

diversification that funds have.

Table 11: Correlation among assets - Normal periods

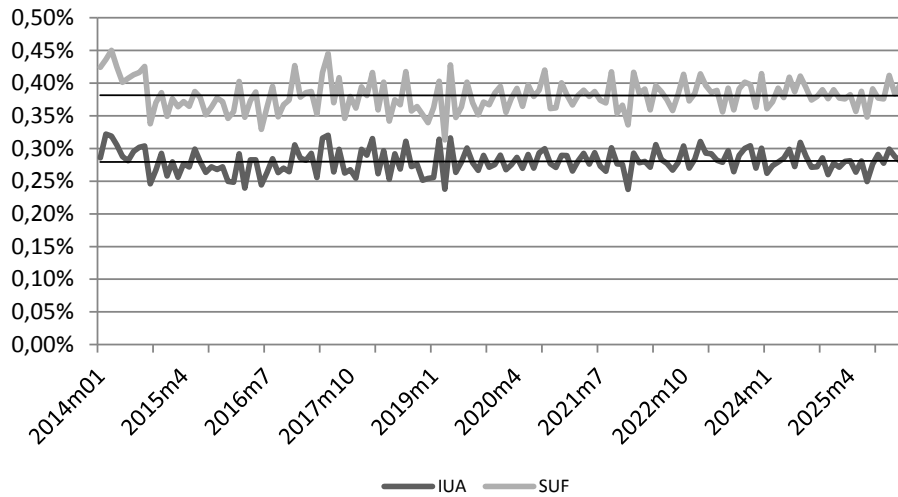
	FI National	VI National	VI Foreign	FI Foreign	Financial Intermediation
National FI	1				
National VI	-0.042	1			
Foreign VI	-0.265	0.365	1		
Foreign FI	0.088	-0.110	0.257	1	
Financial Interm.	0.587	-0.031	-0.050	0.189	1

Table 12: Correlation among assets - Crisis periods

	FI National	VI National	VI Foreign	FI Foreign	Financial Intermediation
National FI	1				
National VI	0.166	1			
Foreign VI	-0.373	0.533	1		
Foreign FI	-0.644	-0.436	0.200	1	
Financial Interm.	-0.032	0.300	0.152	-0.272	1

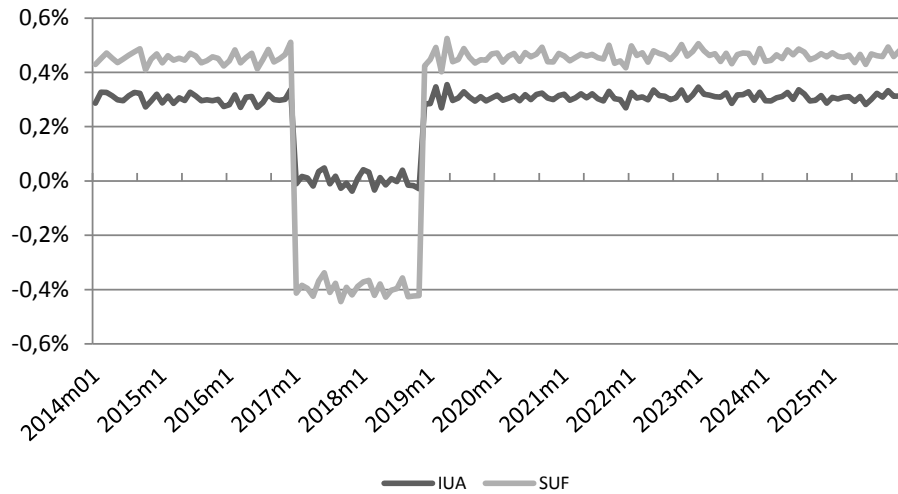
2,000 simulations that project the returns of each kind of asset along with IUA and SUF returns for 10 years are carried out from previous inputs. Graphics 6 and 7 show the average return in each period for a projection under normal and crisis periods, respectively.

Figure 6: Projected average monthly return - Normal projection



Source: Prepared by the authors.

Figure 7: Projected average monthly return - Under crisis projection



Source: Prepared by the authors.

It is worth emphasizing that in both projections the probability of crisis is 10%, however, in the projection under crisis such periods are concentrated in a specific year (2019) which constitutes a scenario high level of financial stress, whereas in the normal projection, the periods under crisis are equally probable, but occur evenly throughout the projection period. The foregoing indicates that the



average returns of both series are similar, but the extension of the crisis resulted in a lower accumulated return at the end of the period, along with a fund higher stress. Additionally, the real average return simulated in both return is similar to the effective observed, which reaches 0.28% IUA and 0.38% SUF in real monthly average since 2002.

These series of simulated returns are used in order to capitalize the value of the UF month by month, thus allowing the introduction of the dimensions of market risk at which unemployment funds are exposed in the projections, considering also that the construction of referential portfolios limits the risk and adjust the length of the inversions to the inversion scenario expected by the Unemployment Funds.

## 5 Projection

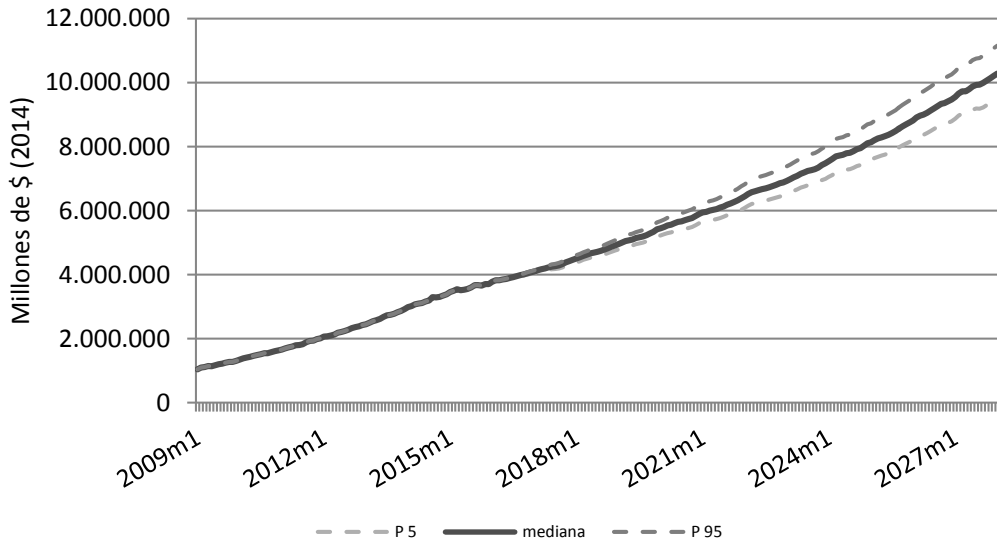
Once the previously described estimates have been carried out, it is possible to project the future behavior of the sample individuals, described in section 4.1. This is an iterative process, that is to say, variables that determine individual's behavior are calculated period by period, as with the variables that allow the identification of the right to be eligible in the UI and receive the eventual payments in case of unemployment.

In detail, in every period and for every individual, the contributing or non-contributing condition and the correspondent wage, in case the individual is paying contributions, are projected. Based on this, individual accounts balances are calculated according to the series of corresponding return. For unemployed individuals (non-contributing condition), the probability of asking for benefits from the estimates made is calculated, by using this probability the condition to ask for or opt to a SUF is imputed randomly, prior verification of eligibility conditions for each one of the UF. Additionally, to each projected period, the behavior of the new members is added, according to the mentioned previously in section 4.2.1.

Once the state for each period and individual is projected, 2,000 stochastic series of return mentioned in section 4.2.2 are applied to each individual, in each  $t$  for both the same situation and the under crisis situation. When this process Project all periods up to March 2028, a distribution of the accumulated balances in each period is generated, from which 5 percentile, median and 95 percentile is presented. Finally, the balances are added to all individuals belonging to the sample and graded according to the population size in order to obtain the amounts from IUA and SUF in each period.

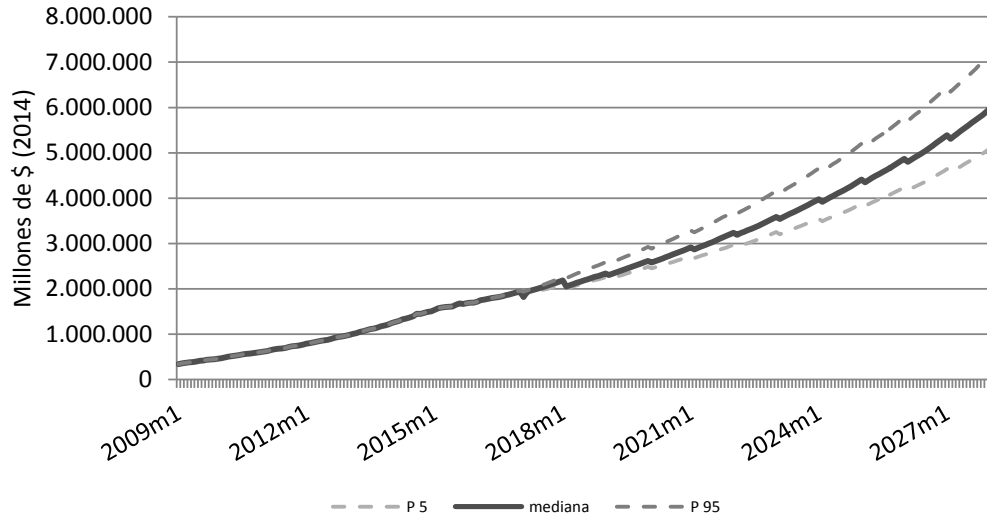
Figures 8 and 9 shows resultant series for IUA and SUF, respectively. Both fund show a positive and sustained growth rate for the projection period. The yearly growth rates for these funds are 9% y 11%, for IUA and SUF, respectively, for median return scenario.

Figure 8: Balance IUA - Normal Projection



Source: Made by the authors based on a Projection Model of the Superintendencia of Pensions.

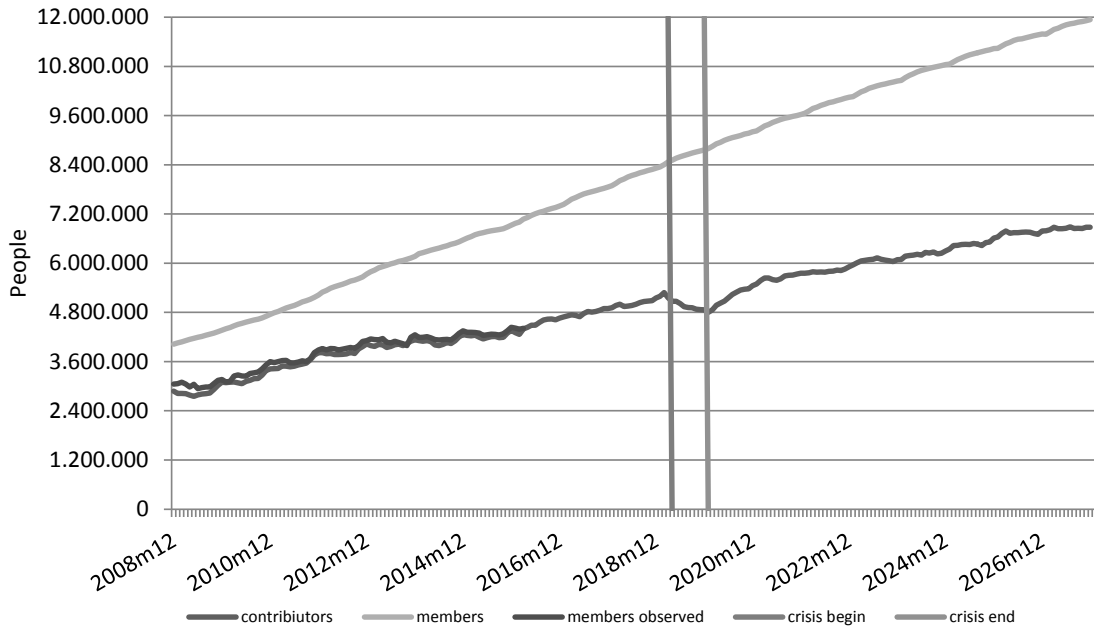
Figure 9: Balance SUF - Normal Projection



Source: Made by the authors based on a Projection Model of the Superintendence of Pensions.

Additionally, a scenario considering the employment crisis that diminishes the probability to contribute in 5.5% per individual was projected which in average causes a fall in 4.9% in the number of contributors in the first month under crisis, with a peak of 5.5% with regard to the same month last year. The highest fall regarding contributors is 7.5%. It is the result of the proportional change in the increase of unemployment rate of 3.9 percentage points approximately. For the last parameter, the reference is the crisis from 1997 to 1998 in which the unemployment increases en 4.7 percentage points (from 6.4% to 11.1%). Figure 10 shows observed and projected series of members and contributors for normal and crisis cases.

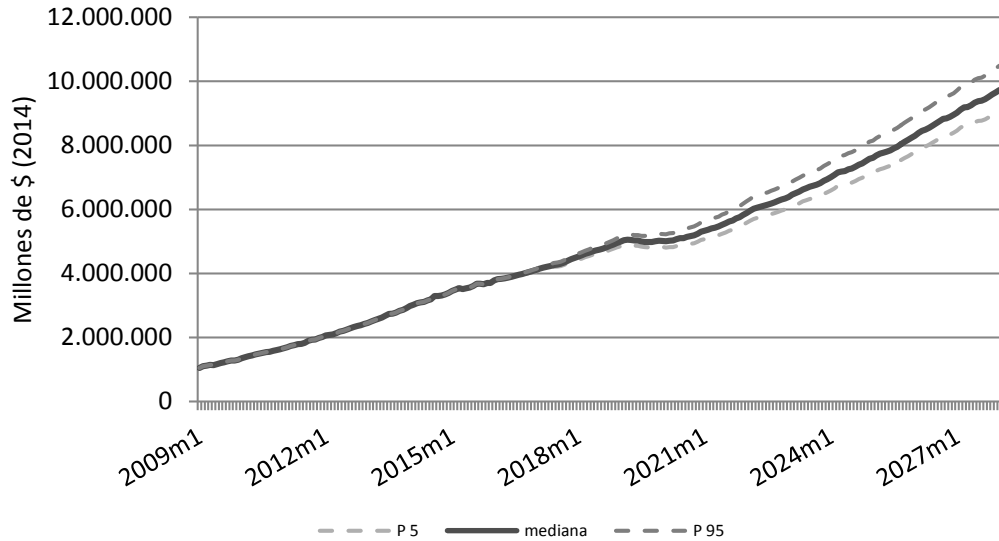
Figure 10: Contributors y Members



Source: Made by the authors based on a Projection Model of the Superintendence of Pensions.

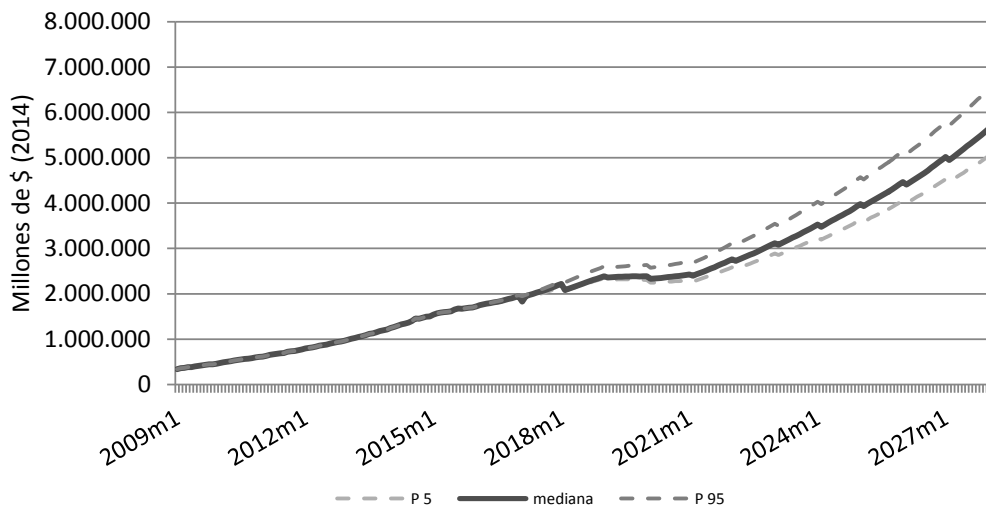
Figures 11 and 12 show accumulation of the IUA and of the SUF considering jointly the employment crisis (decrease of contributors and increase of number of request for benefits) and UF returns (decrease in the rate of return on investments). Meanwhile the IUA shows a slight decrease in the growth rate during crisis period, the SUF would present a growth rate near to zero. However, once the crisis period is over, the growth rate would be similiar to normal scenario.

Figure 11: IUA Balance - Crisis Projection



Source: Made by the authors based on a Projection Model of the Superintendence of Pensions.

Figure 12: SUF Balance - Crisis Projection

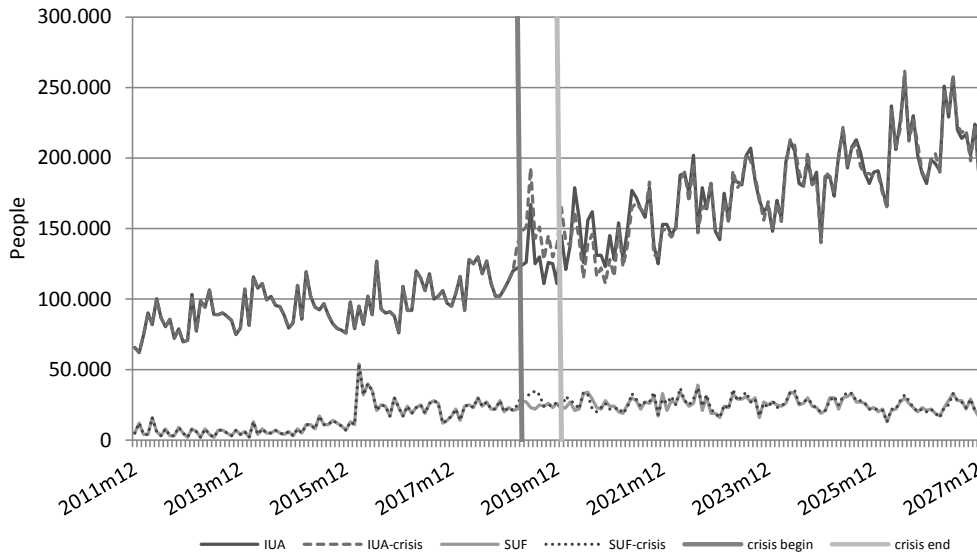


Source: Made by the authors based on a Projection Model of the Superintendence of Pensions.

In addition, figure 13 shows the effect on requests of IU benefits by fund (normal and crisis cases). It is observed that IUA requests increase considerably and steadily, with a monthly growth rate of 1,6% in normal scenario with median

returns. For its part, the number of requests for SUF do not significantly increase through the projection, with an average of 25,000 requests in normal scenario with median returns.

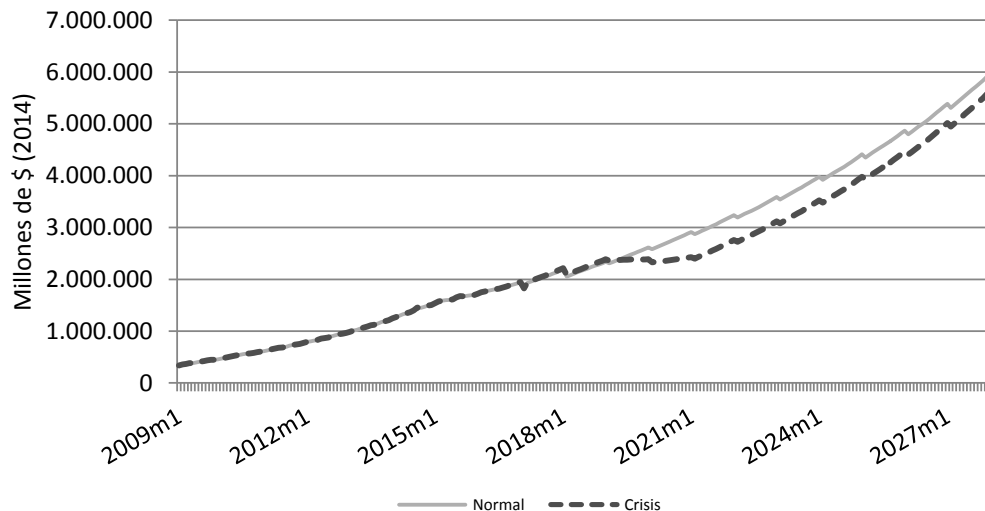
Figure 13: Request by fund



Source: Made by the authors based on a Projection Model of the Superintendencia of Pensions.

Finally, figure 14 compares normal and crisis scenarios evolution of SUF balance, both with median returns.

Figure 14: Saldo FCS



Source: Made by the authors based on a Projection Model of the Superintendence of Pensions.

## 6 Conclusions

The Superintendence of Pensions has the legal obligation to conduct an actuarial study that assesses UI sustainability. To this end, the Superintendence has developed a model that allows to capture heterogeneity at the individual level which relates the affiliate's performance in the labor market with the UI performance regarding the decision of requesting benefits and the election of financing said benefits. In addition, the model allows the introduction of shocks to employment, which will detonate the unemployment crisis and the request of benefits. Finally, the new model incorporates stochastic variation from the returns of the UF, which allows the simulation of financial crisis along with unemployment crisis. This document presents the projections of UF obtained by using this model.

The results indicate that, as in previous actuarial studies, projections of Unemployment Funds remain largely sustainable in a normal scenario, in the sense that growth rates are positive and sustained in the projection period. On the other hand, under crisis assumptions as modeled in this study, the SUF would experience zero growth rate. This last situation is worrying because of SUF is precisely the solidarity component of IU.

It should be mentioned that the current accumulation of the funds is due in part to the conservative design that the SC had in its origins. The reforms of the 2009 and 2015 have advanced in the direction to increase the coverage of the

benefits and the amount of the benefits financed by both the IUA and the SUF. Likewise, the reform of 2015 established a new modality to accredit the condition of unemployment and search for a new job through the BNE. The results of this new institutionality in the rate of use of the SUF are yet to be evidenced.

Finally, it is important to mention that there are still methodological issues that may affect the results of the estimates. For example, none of the models so far developed incorporates behavioral changes on the affiliates when facing incentive changes in the design of UI. Thus, depending on the reform, if it cannot incorporate such, rates and the probabilities of insurance will always be biased. In this sense, independent from the incorporation of changes in the April 2015 Reform, it is not possible to capture the effect on behavior that this will cause in the future, but there will be a change in the level of expenditure of the UF. These situations, along with studies that explore the reason of the low use of insurance are pending challenges.



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## A Unemployment Insurance Series

Table 13: Average remuneration (Chilean pesos, Dec. 2014) in contributing periods, per year and age range

Year	15 - 34 years		35 - 50 years		Mayores de 50 years		Total
	\$	%	\$	%	\$	%	
2009	439.645	49	532.406	41	477.608	10	480.968
2010	463.190	48	572.481	41	507.780	11	512.570
2011	484.134	47	606.127	41	521.666	12	538.138
2012	512.045	46	651.595	40	555.835	13	573.701
2013	540.924	46	712.129	40	587.904	15	615.630
2014	554.514	44	743.382	39	607.946	16	637.458
2015	560.044	43	771.305	39	623.250	18	653.753

Table 14: Average remuneration (Chilean pesos, Dec. 2014) in periods prior cessation, per year and age range

Year	15 - 34 years		35 - 50 years		Mayores de 50 years		Total
	\$	%	\$	%	\$	%	
2009	211.857	57	267.959	35	262.515	8	236.445
2010	223.944	57	295.919	34	274.660	9	253.458
2011	233.295	57	310.702	33	279.172	10	264.712
2012	244.239	57	326.590	33	294.097	11	277.844
2013	253.640	57	354.343	31	331.067	12	295.285
2014	266.138	56	372.260	31	346.232	12	309.649
2015	263.737	55	380.564	32	353.917	14	313.859

Note: Type of contract and wage are observed within the last period prior the unemployment.

Finally, the following tables shows statistics for those individual who face unemployment periods and request for benefits.

Table 15: Average remuneration (Chilean pesos, Dec. 2014) and participation of unemployed people who ask for benefits, per year and age

Year	Male		Female		Total \$
	\$	%	\$	%	
2009	286.415	73	207.498	27	266.849
2010	318.638	71	215.100	29	289.799
2011	343.062	68	238.654	32	310.923
2012	369.959	70	259.473	30	337.847
2013	405.734	69	267.917	31	365.833
2014	415.822	69	290.341	31	378.814
2015	430.708	68	306.400	32	391.334

Note: Type of contract and wage are observed within the last period prior the unemployment.

Table 16: Average remuneration (Chilean pesos, Dec. 2014) and participation of unemployed people who ask for benefits, per year and type of contract

Year	Fixed Term		Open - ended		Total \$
	\$	%	\$	%	
2009	251.245	49	276.844	51	266.849
2010	267.673	63	324.282	37	289.799
2011	282.307	63	356.328	37	310.923
2012	307.991	61	380.229	39	337.847
2013	324.872	57	415.484	43	365.833
2014	337.827	57	429.932	43	378.814
2015	341.615	55	449.003	45	391.334

Note: Type of contract and wage are observed within the last period prior the unemployment.

Table 17: Average remuneration (Chilean pesos, Dec. 2014) and participation of unemployed people who ask for benefits, per year and range age

Year	15 - 34 years		35 - 50 years		Mayores de 50 years		Total
	\$	%	\$	%	\$	%	\$
2009	240.610	48	289.012	42	280.580	10	266.849
2010	260.354	47	317.309	42	299.324	11	289.799
2011	272.442	46	347.772	41	325.645	12	310.923
2012	294.309	47	382.345	39	348.135	14	337.847
2013	325.919	47	404.001	38	377.041	14	365.833
2014	325.583	47	440.854	38	378.668	15	378.814
2015	336.724	47	442.649	37	423.157	16	391.334

Note: Type of contract and wage are observed within the last period prior the unemployment.



## B Estimates

Table 18: Results for the joint estimation of contributing probability and wage to be obtained

VARIABLES	(1)	(2)
	cotiza_salarios cotiza	salarios
n° cotizaciones totales en $t$		0.000*** (0.000)
=1 contrato indefinido		0.051*** (0.006)
=1 si es mujer	-0.080*** (0.019)	-0.011** (0.006)
distancia inferior al p75		-0.024*** (0.001)
distancia inferior cuadratica al p75		0.000*** (0.000)
percentil 75		0.262*** (0.010)
percentil 90		0.279*** (0.014)
percentil 95		0.189*** (0.019)
tope		0.090*** (0.023)
IMACEC en $t - 1$		0.005*** (0.000)
logaritmo del salario en $t - 1$		0.167*** (0.010)
logaritmo del salario en $t - 2$		0.144*** (0.006)
logaritmo del salario en $t - 3$		0.128*** (0.005)
Septiembre		0.058*** (0.009)
Diciembre		0.066*** (0.009)
cotiza en el periodo $t - 1$	2.556*** (0.020)	
=1 contrato indefinido en $t - 1$	0.167*** (0.021)	
densidad en $t - 1$	0.697*** (0.042)	
n° de veces que pide beneficios	0.012*** (0.005)	
cot_conti	0.005*** (0.000)	
edad	0.032*** (0.006)	
$edad^2$	-0.000*** (0.000)	
Constant		9.961*** (0.535)
	38	
Observations	47,335	47,335
LogLike	-30438	-30438

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 19: Results for the joint estimation of contributing probability and wage to be obtained (continuation)

VARIABLES	(1) verosimilitud
$\sigma^2$	-0.818*** (0.004)
$\eta_1$	-2.549*** (0.110)
$\eta_2$	-2.239*** (0.107)
$\alpha$	1.441*** (0.210)
$p$	0.130*** (0.016)

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 20: Result of the estimation of probability to be unemployed

VARIABLES	(1)	(2)
	cesantia	lnsig2u
=1 contrato indefinido	-0.407*** (0.003)	
IMACEC en -1	-0.063*** (0.001)	
logaritmo del salario en 12 meses	-0.123*** (0.002)	
densidad	-0.055*** (0.007)	
=1 si es mujer	-0.144*** (0.004)	
cotizaciones continuas con el mismo empleador en $t$	0.001*** (0.000)	
edad	-0.003*** (0.000)	
experiencia	-0.009*** (0.001)	
tendencia anual	0.373*** (0.003)	
trimestre 2	-0.321*** (0.004)	
trimestre 3	-0.271*** (0.004)	
trimestre 4	-0.149*** (0.004)	
Constant	3.480*** (0.050)	-2.768*** (0.015)
Observations	3,264,738	3,264,738
Number of rut	69,773	69,773
LogLike	-600930	-600930

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



Table 21: Result of the estimation of probability to request benefits being contributing

VARIABLES	(1) pide_cotiza pide	(2) lnsig2u
=1 contrato indefinido	-0.248*** (0.012)	
edad	-0.007*** (0.001)	
experiencia	0.399*** (0.008)	
experiencia cuadratica	-0.033*** (0.001)	
IMACEC en $t - 1$	-0.021*** (0.001)	
=1 si es mujer	0.154*** (0.011)	
logaritmo del salario en 12 meses	0.209*** (0.008)	
densidad	-0.082*** (0.026)	
número de veces que pide beneficios	0.239*** (0.003)	
trimestre 2	0.587*** (0.013)	
trimestre 3	0.620*** (0.013)	
trimestre 4	0.460*** (0.012)	
Constant	-2.072*** (0.107)	-1.523*** (0.037)
Observations	126,018	126,018
Number of rut	50,626	50,626
LogLike	-61178	-61178

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 22: Result of the estimation of probability to request benefits not being contributing

VARIABLES	(1)	(2)
	pide.no_cotiza pide	lnsig2u
=1 contrato indefinido	0.213*** (0.032)	
edad	-0.020*** (0.001)	
experiencia	0.835*** (0.012)	
experiencia cuadratica	-0.063*** (0.001)	
IMACEC en $t - 1$	0.000 (0.001)	
=1 si es mujer	0.354*** (0.018)	
logaritmo del salario en $t - 1$	0.391*** (0.007)	
densidad plazo indefinido	1.044*** (0.043)	
densidad plazo fijo	1.062*** (0.040)	
número de veces que pide beneficios	0.477*** (0.005)	
trimestre 2	0.097*** (0.011)	
trimestre 3	0.075*** (0.012)	
trimestre 4	-0.051*** (0.012)	
Constant	-8.507*** (0.109)	0.539*** (0.018)
Observations	520,641	520,641
Number of rut	42,012	42,012
LogLike	-87912	-87912

Standard errors in parentheses  
\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table 23: Result of the estimation of probability to opt to SUF

VARIABLES	(1)	(2)
	opta opta.fcs	lnsig2u
cotiza	-0.412*** (0.030)	
=1 contrato indefinido	1.206*** (0.046)	
experiencia	-0.379*** (0.033)	
experiencia cuadratica	0.023*** (0.004)	
IMACEC en $t - 1$	-0.020*** (0.002)	
=1 si es mujer	0.369*** (0.033)	
logaritmo del salario en 12 meses	-0.555*** (0.031)	
número de veces que pide beneficios	-0.093*** (0.007)	
m_pos2015	0.004*** (0.000)	
Constant	9.427*** (0.439)	-0.393*** (0.131)
Observations	16,065	16,065
Number of rut	13,293	13,293
LogLike	-9054	-9054

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## C New members

In this section, the seasonality of some characteristics of new members in the period 2009-2014 is shown:

