

Crisis and unemployment: modeling the Chilean Unemployment

Insurance program

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Traditional unemployment insurance schemes are a relatively scarce commodity in developing countries, partly due to the extent of their informal labor markets and their reduced monitoring capacity. In 2002, Chile introduced a novel unemployment insurance program based on a combination of individual accounts and a Solidarity Fund (SF). Following a conservative approach, its initial design established stringent eligibility requirements to access the pooled component of the program. This translated into a fast accumulating Solidarity Fund. In preparation for the reform debate, a projection model was developed to evaluate the expected impact of alternative changes to the eligibility and benefit rules on the level of coverage and sustainability of the Solidarity Fund. This article describes this projection model and the results that were used to justify a significant coverage enhancing reform that was enacted in May 2009. The model includes a microsimulation component, based on longitudinal administrative data from the pension system and econometric models for the choice of contract and take-up decisions. The results of the microsimulation component are used to feed a traditional actuarial model. Results suggest that even after the changes introduced by the 2009 reform, the Solidarity Fund would remain sustainable in face of a large unemployment crisis and under the most pessimistic scenario.

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1. Introduction

Traditional unemployment insurance schemes are a relatively scarce commodity in developing countries. A common explanation for this is the relative importance of informal labor markets in and the reduced monitoring capacity of the labor supervising authorities.³ Potential moral hazard effects associated with traditional risk-pooling arrangements are exacerbated when individuals can switch between formal and informal employment.

Instead of opting for a traditional risk-pooling scheme, Chile introduced in 2002 a novel Unemployment Insurance program (represented by the Spanish acronym SC) based upon a combination of compulsory savings in individual accounts (UIA) and an unemployment Solidarity Fund (SF). The fund acts to complement individual accounts in the financing of a defined benefit for workers who comply with certain requirements.

In its initial design, the system restricted access to the Solidarity Fund (SF) only to workers with open ended contracts, who were laid off from their firms, who had insufficient savings in their individual account, and who had registered at least 12 continuous contributions at the moment of their application for benefits. As a result of these access restrictions and a scarce use of the SF by eligible individuals, the SF has presented sustained growth since its creation and the actuarial studies undertaken to this date suggest that, if maintaining the initial rules, this situation should continue in the coming years.⁴

Various measures were proposed to improve on the initial design which finally translated into a reform of the system, passed in January 2009. The most important changes were related to the SF: access requirements were relaxed for workers with an open-ended

³ For a discussion of unemployment insurance schemes in developed and developing countries, see Vodopivec (2004).

⁴ See for example Bravo et al (2007) and Cerda and Coloma (2009).

contract, and access was provided for workers contracted per project, job, or service or those with fixed term contracts.⁵ This study presents the main results of simulations of the expected evolution of the SC under the changes introduced by the reforms.

Focusing on the first large system reform, and focusing on some subtle changes to its parameters, a projection model was developed which shares the characteristics of traditional actuarial studies, but which also allows sufficient flexibility to simulate counterfactual changes to the micro-regulations. The model has two main components: a model based on micro-data coming from the pension system which simulates the evolution of the Unemployment Insurance during its first 15 years *as if* it had begun in 1988. The result of this model under different scenarios is fed into a traditional actuarial model based upon the study of Bravo et al. (2006). Together with the description of both models and their interaction, results are presented for different simulations under the rules existing before, and after, the reform of 2009.

The results confirm, firstly, that having maintained the rules that existed before the reform, the SF would have continued to grow in a significant form, even in the face of a large economic crisis. Secondly, the simulations in the reform scenario show that even under the most pessimistic of assumptions in terms of intensity of use of the benefits financed by the SF, its balance will remain stable over time. In terms of coverage, the results show that while the coverage of the system in terms of individuals eligible for benefits if becoming unemployed increases slightly thanks to the reform, the quality of the benefits is substantially superior, thanks to the access to SF financed benefits.

⁵ Here after, these contracts will be referred to as “fixed term contracts”.

In other words, the conservative initial design was reevaluated after a prudent timeframe of the functioning of the system and, given the recent evolution and a careful modeling of the potential future effects, a relaxation of the access requirements for solidarity benefits was undertaken, under a reasonable certainty that the system would remain sustainable over time.

2. - Description of the Unemployment Insurance program and earlier Projections

2.1. - Description of the program (before the 2009 reform)

The Chilean Unemployment Insurance (SC) was introduced in 2002, as a program designed to increase the protection of private dependent workers in the event of a loss of employment.⁶ Affiliation to the SC is mandatory for all contracts awarded posterior to October of 2002 and voluntary for those contracts existent before this date.

This system combines an individual savings component (Unemployment Individual Accounts, UIA) and a collective insurance fund, the Solidarity Fund (SF), which receives contributions from employers and the Chilean State.

The system financing structure is determined by a workers' contract type. Workers with indefinite contracts, in the pre-2009 reform scenario, contribute 2.2% of their covered income to the UIA and 0.8% to the SF.⁷ Workers with fixed term contracts contributed 3% of their covered income to the UIA, without the possibility of accessing the SF.⁸ Table 1

⁶ An early description of the program and its origins can be found in Acevedo et al (2006). More recent descriptions (in spanish) can be found in Berstein et al (2007) and Berstein (2010).

⁷ The covered income considered by the SC corresponds to the gross income of the worker, up to a maximum of 90 *unidades de fomento (UF)*. The UF is an inflation indexed unit of account equivalent, as of April 1st 2011, to 45 US\$.

⁸ After the 2009 reform, fixed term contracts contribute 2.8% and 0.2% to the UIA and SF, respectively.

summarizes the main characteristics of the system in terms of contributions to the different accounts and eligibility for benefits provided by the UIA or the SF.

With regards to benefits, eligible workers with a fixed-term contract are only allowed to withdraw their entire UIA funds in one payment. Workers with open-ended contracts who are not eligible for benefits financed by the SF, can access their UIA funds in one or more payments, up to a maximum of 5. The total number of withdrawals and the amount of the first withdrawal depend on the number of months during which a worker has contributed. The amount of the second, third and fourth withdrawal corresponds to 90%, 80% and 70% respectively of the amount of the first withdrawal. The amount of the fifth and final withdrawal corresponds to the funds remaining in the UIA.

Those workers eligible for the SF are allowed to choose between a benefit financed entirely by their UIA (in the form described above) and a defined benefit financed firstly by the resources accumulated in their UIA and, once these are consumed, by funds provided by the SF. These benefits are calculated as a fraction of the average covered income over the last 12 months, with minimum and maximum amounts. Table 3 presents the replacement rate of these defined benefits, including the maximum and minimum amounts.⁹

⁹ The minimum and maximum values are readjusted annually according to the variation in the Consumer Price Index during the preceding 12 months. These values are adjusted on the 1st of February of each year.

Table 1 – General Characteristics of the Chilean UI System, before the 2009 reform

	Workers with fixed term contracts	Workers with open-ended contracts
<i>Contribution to each fund type (% of covered income)</i>		
Unemployment Individual Account (UIA)	Employer (3%)	Employer (1.6%) + Worker (0.6%)
Solidarity Unemployment Fund (SF)	No contribution	Worker (0.8%) + Yearly contribution by the State ¹⁰
<i>Requirements to access benefits:</i>		
Unemployment Individual Account (UIA)	<ul style="list-style-type: none"> • 6 continuous or discontinuous contributions since affiliation or last benefit • Accreditation of termination of contract 	<ul style="list-style-type: none"> • 12 continuous or discontinuous contributions since affiliation or last benefit • Voluntary or involuntary termination of contract
Solidarity Unemployment Fund (SF)	<ul style="list-style-type: none"> • Unable to access these benefits 	<ul style="list-style-type: none"> • 12 continuous contributions • Laid off for fortuitous events, greater forces or due to requirements of the contracting firm • Insufficient resources in the UIA to self-finance the SF benefits, in the amounts and periods defined by law • Unemployed at the moment of application

Source: Law 19.728.

¹⁰ The State contributes a fixed annual amount. Said amount increased during the first 6 years of the system as a function of the coverage provided, and remained constant thereafter (225.792 *Unidades Tributarias Mensuales*, equivalent as of December 2010 to US\$18.1 million).

Table 2 – Calculation of Payments credited to the Individual Capitalization Account (workers with open-ended contracts), pre-2009 reform

Months with Contributions	Number of payments	Amount of the first Withdrawal
Between 12 and 18	1	Capital accumulated in the UIA (UIAC)
Between 19 and 30	2	UIAC / 1.9
Between 31 and 42	3	UIAC / 2.7
Between 43 and 54	4	UIAC / 3.4
More than 55	5	UIAC / 4

Source: Article 15 Law 19.728.

Table 3 - Guaranteed Replacement Rate and Minimum and Maximum Amounts for Payments charged to the SF, pre-reform 2009¹¹

Month	% of Average Remuneration of Preceding 12 months	Minimum Value	Maximum Value
First	50%	US\$ 172	US\$ 331
Second	45%	US\$ 143	US\$ 298
Third	40%	US\$ 122	US\$ 265
Fourth	35%	US\$ 102	US\$ 232
Fifth	30%	US\$ 80	US\$ 199

Source: Effective from 01.02.2009 until 01.05.2009, www.spensiones.cl

Funds accumulated in UIAs and the SF must be invested in financial instruments by the Unemployment Funds Administrator (AFC) according to a set of quantitative regulations and subject to a system of awards and punishments, both established by the law which created the SC.

¹¹ Converted to US\$ using the April 1st 2011 exchange rate of Ch\$479.46 per US dollar.

Accumulated funds can only be invested in those instruments authorized for the most conservative fund (type E funds) of the Pension System, that is, fixed return instruments (national or foreign).¹² The AFC system of awards and punishments is based upon the return obtained in comparison with that achieved by the three highest performing E-type funds, and the three lowest performing E-type funds. In practice, the nominal return of Unemployment Insurance Funds was persistently below the benchmark during the first years, which resulted in a permanent punishment applied to the management fee charged by the AFC.¹³ This situation is partially explained by the smaller initial size of the Unemployment Funds, and the illiquidity of some fixed return instruments owned by the Pension Fund Administrators, which were not available for purchase by the AFC.

2.2. - Evolution

Seven years after the initiation of the System, the number of affiliates of the SC exceeded six million, of which 3 million were actively contributing in April 2009 (see Figure 1).

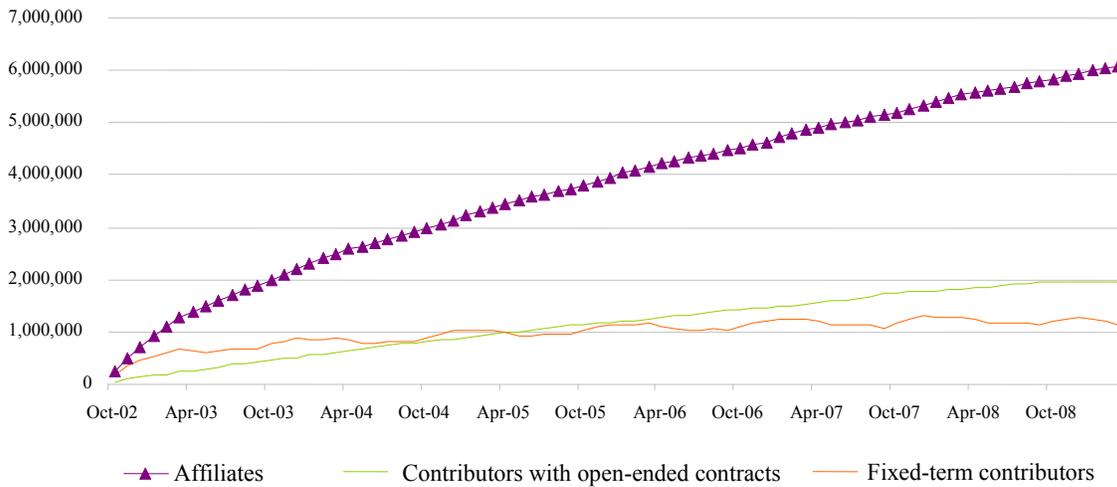
Due to the SC affiliation mechanism – obligatory only for new contracts – covered workers have been strongly biased towards those with fixed term contracts, which tend to experience a higher rate of rotation and hence a greater propensity to be affiliated with the SC. In December of 2003 this type of contract represented 63% of the contributors to the SC system, shrinking to only 35% in April 2009.¹⁴

¹² The Chilean pension system is based on individual savings accounts. Each participant can choose between 5 funds, which vary with the fraction that can be invested in variable income instruments.

¹³ Castañeda and Fajnzylber (2007) analyze the considerations which should guide the investment policy for unemployment funds. They propose the differentiation of the investment policy between funds coming from the UIA and those corresponding to the SF.

¹⁴ This figure coincides with the 35% estimated for the general labor market according to household surveys (CASEN 2006).

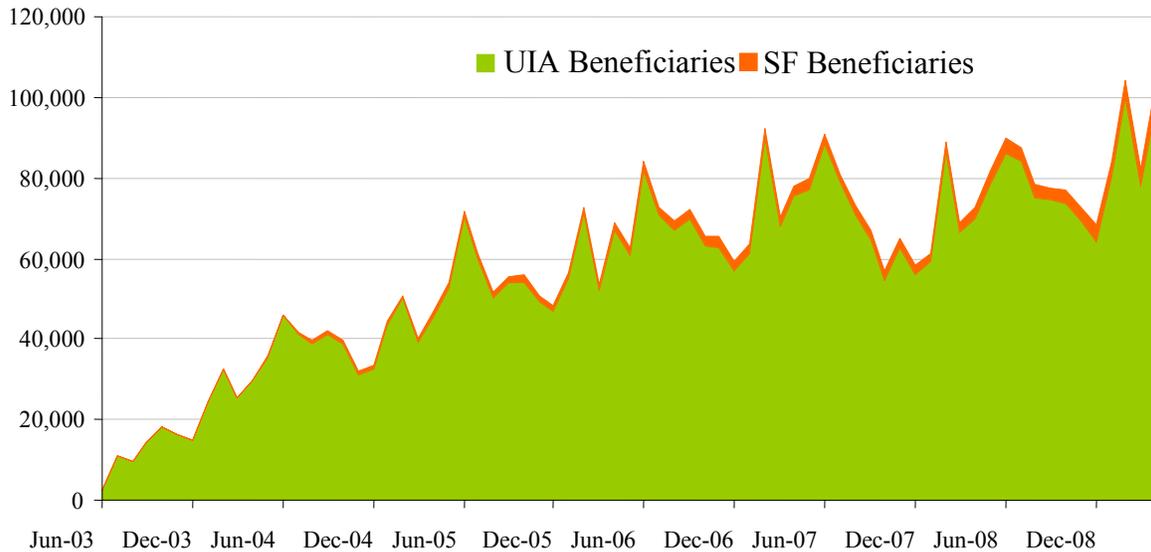
Figure 1 - Evolution of Unemployment Insurance program.



Source: Author's calculations using the Unemployment Insurance program database.

With respect to the number of beneficiaries, it is observed that although an important group of workers have benefited from the SC through withdrawals from their individual accounts (4.1 million affiliates as at April 2009), only a minority group accessed the SF benefits (130 million workers with open-ended contracts, or 2.5% of the total beneficiaries). The following figure shows the evolution of the number of beneficiaries of the System during its first seven years of operation.

Figure 2 - Beneficiaries of the Unemployment Insurance program.



Source: Author's calculations using the Unemployment Insurance program database.

To determine the quality of the benefits awarded by the SC, the following table shows both the average benefit amount and the average replacement rates observed in the system as a function of contract type. Clear differences appear between replacement rates of workers with open-ended contracts and workers with fixed-term contracts but specially between benefits financed entirely by the UIA and those complemented by the SF. This is principally due to the fact that benefits from the UIA correspond to the balance in the account (a function of the history of previous contributions) while benefits complemented by the SF are calculated as a function of objective replacement rates.

Table 4 – Average amounts and replacement rates of benefits awarded by the SC during 2008.

	Average size of first payment			Replacement Rate of First Payment*		
	Open-ended contract	Fixed Term Contract	Total	Open-ended contract	Fixed Term Contract	Total
Financing of Benefit						
Withdrawal from UIA	US\$251	US\$229	US\$235	13.06%	7.90%	10.77%
Access to the SF	US\$250		US\$250	48.97%	-	48.97%

Note: (*) In the case of benefits provided without access to the SF, the replacement rate was calculated as the UIA balance divided by the average covered income and by the minimum between the number of months without a contribution and 5.

Source: Author's calculations using the Unemployment Insurance program database.

2.3. - Coverage of the SF

From the previous table it is clear that benefits financed both from the UIA and the SF are substantially superior to benefits financed exclusively from the UIA. Although it is predictable that this situation would change as the balances in the individual accounts increases, the scarce utilization of benefits financed by the SF is notable. This situation could be explained in part by the difficulty in accessing the benefit, principally due to the requirement of 12 continuous periods of contributions.¹⁵ However even among those workers that fulfill all requirements, a high percentage (close to 45%) of individuals who are observed opt out of the SF option, and only accessing their benefits from the UIA. This could be motivated by cost-benefit considerations (if for example the first payment of the UIA were superior to that of the SF or the person expected to find new work before the receipt of the resources from the SF), by transaction costs (the obligation of attending the

¹⁵ Reyes (2005) estimates that approximately 20% of SC contributors contributed during the previous 12 months.

Municipal Labor Insertion Office to certify that work is being sought) or due to a lack of information.¹⁶

As a consequence of the lack of utilization of the benefits financed by the SF, this fund has experienced a sustained growth since its creation. As of December 2009, the SF had accumulated 605 million dollars, and projections from two actuarial studies suggest the prolongation of this behavior until September 2015, the final period included in their analysis.¹⁷ Zurita et al. (2004) project a 28% growth rate until December 2014, while Bravo et al. (2005) estimate a growth of approximately 35%. Both studies agree that the SF would be sustainable in the face of crisis.¹⁸

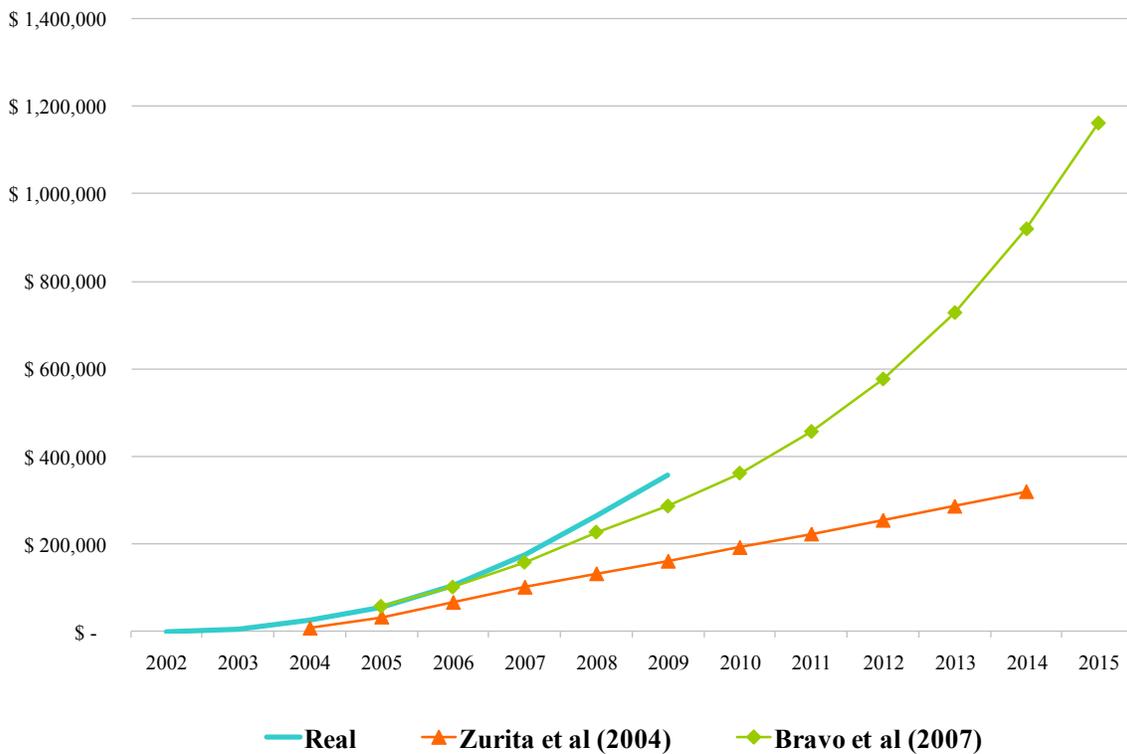
The following figure shows the SF projection generated by the actuarial studies of 2004 and 2006, as well as the effective value of the fund since its creation up until 2009.

¹⁶ Berstein et al. (2007) demonstrate that eligible beneficiaries of the FCS who opt to finance their payments with resources provided by the UIA maintain higher balances and fewer periods without contributions after the benefit than those individuals who opt to finance their payment with resources provided by the FCS.

¹⁷ The Insurance Law established (until April 2009) that an obligatory actuarial study be realized by the AFC every two years which would allow for the evaluation of the sustainability of the Unemployment Fund and the FCS.

¹⁸ See Bravo et al (2006), Zurita et al (2004) for more details.

**Figure 3 – Effective Value of the SF and 2004 and 2006 actuarial models
(Ch\$ million)**



Source: Author's calculations using official statistic and results from actuarial studies.

Ultimately, the actuarial studies seem to indicate that, having followed the original regulations, the SF would continue to accumulate funds, without necessarily fulfilling the protective goal for which it was designed. In order to improve the protective component of the SF, it was suggested that modifications should be introduced that would tend to facilitate the access to benefits or increase the value of the associated services: increasing the amount of benefits or improving the complementary benefits awarded by the system (labor reinsertion, training courses, etc.).

3. - The Projection Model

To evaluate and discriminate between alternative reform proposals, a flexible simulation model was developed to assess the impact on benefits and UIA and SF balances under specific changes in micro-regulations. Following the line of the 2004 and 2006 actuarial studies produced for the AFC, the projection model includes a traditional actuarial model based on 108 cells representative of the affiliates belonging to the SC. The novelty was the introduction of a micro-data model, based on administrative contribution histories for a representative sample of affiliates to the pension system. This micro-data model simulates the evolution of the SC during its first 15 years, under the hypothetical circumstance in which it would have initiated in 1988. Having real individual histories, the model allows the simulation of the evolution of certain key parameters of the actuarial model below certain assumptions, both in the pre-reform situation and under changes in the design of the UI scheme. With this information it is possible to project the value of the UIA and SF between September 2009 and December 2015.

3.1. - The Micro-data Model

3.1.1. - The Administrative Database of Pension Histories

To perform a reasonable projection of the SC, either under the pre 2009 regulations or under alternative parameters, two factors are of particular relevance: first, the system still is in its maturing phase, which implies that the composition of affiliates is strongly biased towards workers with higher labor force rotation than the general population. This raises the significant challenge of modeling how the composition of affiliates should be varied during the next 10 to 15 years. Secondly, the access to benefits and the decision to apply for these benefits are strongly related to the history of contracts and contributions of each

worker, which is difficult to capture in traditional actuarial models due to the strong heterogeneity in the population.

In order to advance in this direction, the decision was taken to utilize a representative sample of participants in the pension system, known as the Administrative Database of Pension Histories (HPA). The sample includes approximately 24,000 individuals affiliated to some pension fund manager. For the analysis, the period between 1988 and 2002 was considered as a proxy of the contribution history of the affiliates of the SC between 2002 and 2016. This period was chosen due to the similarities between the unemployment rates observed in this period and those corresponding to the first few years of the SC.

Two key elements were not available in the HPA database to model the evolution of the SC: the type of contract of a particular labor relationship and the cause of cessation of work. The first element is necessary to calculate the contributions and the right to access different benefits delivered by the system, and the second element allows for the verification of the right to the SF. The first element, the contract type, is observed in the administrative records of the SC, which allows for a direct econometric estimation. The second element, cause of cessation, is only available for individuals who apply for benefits, which makes it more difficult to properly impute from available data. Instead, potential benefit eligibility was determined based on contribution histories and a simple behavioral model for the probability of applying for the different types of benefits was estimated, implicitly accounting for the missing termination data. With this information in hand a simulation was run for affiliation to the UI system, the accumulation of rights and benefit use.

The following sections explain in more detail the method employed to impute the type of contract and the probability of applying for benefits.

3.1.2. - Imputation of Contract Types

In the preceding section, it was noted that the HPA lacks information regarding contract type. To impute this condition, information was used from a representative sample of affiliates of the SC in September 2006. This database contains information regarding age, gender, contract type, contributions, and average income for each worker.

Instead of trying to impute the contract type for every moment in time, the type of contract was imputed for each labor relation. This can be justified by the fact that 87.21% of the individuals present in the sample of SC affiliates don't change contract during a work relation. In fact, 96% of labor relations that begin with open-ended contracts finish as open-ended contracts, and 86% of those that begin with fixed-term contracts end as such.

In this way, various functional specifications were tried (presented in table 5), using as a dependent variable the initial contract type for each labor relationship and as explanatory variables characteristics particular to the person, and the duration and average covered income for the relationship in question.¹⁹

In general terms, the different models produce reasonably similar results. For its simplicity, reasonable goodness of fit, as well as for its ability to adjust reasonably well to the ratio

¹⁹ It is worth pointing out that none of the models include the age of the person as an independent variable. This was motivated by the strong selection bias that affects affiliates of the SC due to the affiliation mechanism (associated with labor turnover). This bias requires placing special attention on the utilization of information of actual affiliates to project for future affiliates. In particular, older individuals in the SC tend to exhibit a greater propensity to have fixed-term contracts than younger workers, which is contradictory with the evidence presented in representative household surveys. According to CASEN, 2006, the prevalence of permanent contracts is 53.2% among dependent workers between 20-40 years of age, and 71.2% among dependent workers between 40-60 years of age.

historically observed between open-ended contracts and fixed-term contracts in the SC, the linear probability model represented in the final column was ultimately chosen. This model includes as independent variables the number of months with contributions in each labor relationship, average income, a dichotomous gender variable, along with interactions between this and the duration of work and average income.

In the chosen specification, the probability that a relationship would have an open-ended contract depends positively on the duration of said relationship, on remuneration, and on being female. The duration effect on the probability is lower for women.

Table 5 – Predictive Models of the Imputation of Contract Type.

	Logit	Logit	Probit	LPM	LPM
Truncated Duration	0.07405 (97.27)**	0.04368 (40.31)**	0.04410 (108.88)**	0.01257 (72.06)**	
Income	0.00643 (189.91)**	0.00947 (211.41)**	0.00344 (200.04)**	0.00186 (260.13)**	0.00071 (202.80)**
Female	-0.15173 (11.79)**	0.04954 (3.93)**	0.04178 (6.28)**	0.09920 (56.14)**	0.07698 (42.83)**
Female*Income	0.00405 (55.57)**	0.00275 (39.82)**	0.00148 (45.03)**	0.00001 (2.20)*	0.00006 (8.55)**
Female*Duration	-0.00926 (10.33)**	-0.00271 (2.97)**	-0.00500 (10.34)**	-0.00167 (13.28)**	-0.00124 (9.65)**
Income*Duration	-0.00014 (55.24)**	-0.00004 (14.71)**	-0.00008 (62.53)**	-0.00001 (50.55)**	
(Duration) ²		0.00017 (5.60)**		-0.00005 (12.17)**	
(Income) ²		-0.00001 (120.28)**		-0.00000 (155.56)**	
Duration					0.00717 (102.32)**
Constant	-0.98688 (136.52)**	-1.28096 (162.82)**	-0.51749 (128.72)**	0.24895 (177.33)**	0.43168 (425.67)**
Observations	910810	910810	910810	910810	910810
R ²				0.13	0.09
Absolute value of the Z statistic provided in parenthesis					
* coefficient significant at 5%; ** coefficient significant at 1%					
Income in thousands of \$					

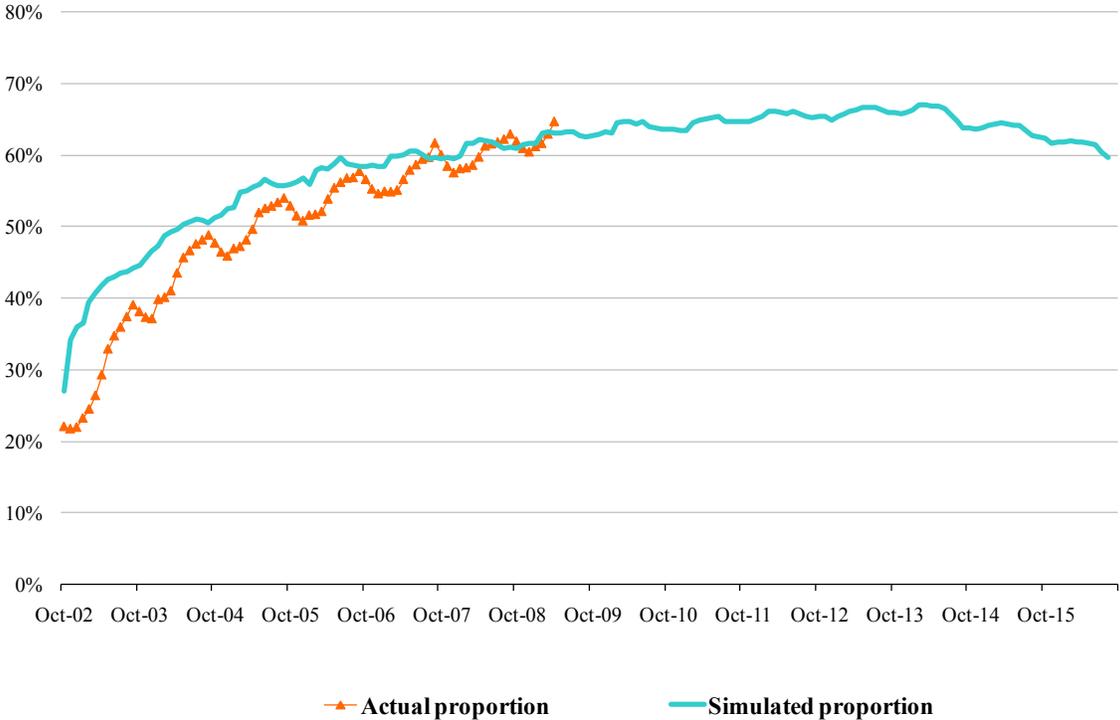
Source: Author's calculations based on data from the Unemployment Insurance.

The coefficients obtained from the lineal estimation of the SC were used to predict contract type in the labor relationships of the HPA data base.

The results of this imputation, in comparison with the actual historical proportion of contract types, are displayed in the following figure. It is observed that in October of 2002, the number of contributors with an open-ended contract according to the simulation is greater than the true number by nearly 10 percentage points. However, this tendency tends to decrease in time, and in October of 2005 differs by only 5 percentage points. Although the proportion of open-ended contracts predicted is systematically greater than the observed

value, the principal attribute of this projection is its ability to reasonably predict the evolution over time, converging to a figure similar to the observed value in the population of dependent workers.²⁰

Figure 4 - Proportion of Open-ended contracts



Source: Author’s calculations based on micro-simulation model.

3.1.3. - Imputation of take-up probabilities

Currently, an important percentage of individuals that cease contributing and that fulfill the contributions requirements don’t apply for benefits from the SC. Furthermore, nearly 45% of workers eligible to access the SF don’t opt to do so. In order to project the evolution of the Insurance system, it is fundamental that a model be available which allows for the

²⁰ According to the survey CASEN (2006), the proportion of open-ended contract workers in the population of dependent workers was 65%.

estimation of the probability of applying for benefits, especially when one wishes to evaluate proposals which would change the eligibility requirements. For this reason, special emphasis has been placed on a model to generate this probability which will serve as a reference for posterior projections.

In order to estimate the probability of applying for benefits, the same representative sample of SC affiliates was employed, including information related to benefits. With this data, every individual who was potentially eligible for benefits was categorized into one of eight possible states, depending on the type of benefits they were eligible for²¹ and the contribution status in the following month.²²

For workers with open-ended contracts the following states were defined: able to access SF and contributed in the following month, access to SF and no contribution, access to UIA and contribution, access to UIA and no contribution, and not able to access benefits. For workers with fixed-term contracts: able to access UIA and contributed, access to UIA and no contribution, and not able to access benefits. The probability of applying for benefits was estimated for each potential state in every moment in time.

The estimation process was defined according to the available options in each state. For workers potentially eligible for the SF, an ordered logit model was estimated, due to the fact that individuals faced the decision of applying for SF benefits, applying for UIA benefits, or not applying for benefits (in this order). However, for workers with access to

²¹ The potential rights were determined as a function of the current accumulated UIA balance and the number of contributions. The cause for termination of the labor relationship was not included due to the fact that this information was only available for individuals who have applied for benefits. However, the estimated probabilities of applying to benefits implicitly embed the cause for termination of the labor relationship.

²² Historically, an important proportion of affiliates apply for benefits in the same month in which they have contributed. This situation should tend to decrease due to normative changes passed at the end of 2007. For the development of the micro-data model, however, the modeling of this possibility is necessary during the initial years.

the UIA, this probability was estimated using a bivariate logit, where the dependent variable took the value of 1 if the worker applied for the benefit using their individual account and 0 if benefits were not sought.

The independent variables included in the different models were covered income,²³ a dichotomous variable for gender, and the interaction between this variable and income. Also, the number of months without a contribution in each observed gap was included (“posterior gap”).

Table 6 summarizes the results of these estimations for each state. It is observed that all coefficients are significant except for the association between female and income for states 1, 2 and 4.

²³ In order to allow for comparison of results, the maximum covered wage threshold in the pension system (60 *Unidades de Fomento*) was used, which is lower than the threshold in the Unemployment Insurance system (90 *Unidades de Fomento*).

Table 6 – Estimation Result with Option of Application to the SF

	Open-ended/ Elig. for SF/ Contributed	Open-ended / Elig. for SF/ No contribution	Open-ended / Elig. for UIA/ Contributed	Open-ended / Elig. for UIA/ No contribution	Fixed-Term/ Elig. for UIA/ Contributed	Fixed-Term / Elig. for UIA/ No contribution
	Ordered Logit S1	Ordered Logit S2	Logit S3	Logit S4	Logit S5	Logit S6
Income	-0.0019 (16.00)**	-0.0003 (2.32)*	-0.0019 (21.99)**	0.0002 (2.22)*	-0.0005 (16.88)**	0.0028 (56.11)**
Female	-0.3645 (5.42)**	-0.1391 (2.44)*	-0.4103 (6.38)**	-0.1370 (2.74)**	0.0718 (3.27)**	0.9015 (48.13)**
Female*income	-0.0001 (0.50)	-0.0003 (1.41)	-0.0010 (3.87)**	-0.0003 (1.44)	-0.0032 (26.39)**	-0.0031 (28.21)**
Posterior Gap		0.2278 (38.13)**		0.1405 (26.13)**		-0.0026 (1.27)
Constant			-4.2725 (151.22)**	-1.5626 (48.98)**	-2.9951 (363.35)**	-1.3214 (103.54)**
Observations	872054	14296	634053	22422	1383733	142421

Absolute z-statistic in parenthesis
* significant at 5%; ** significant at 1%
Income in thousands of \$

Source: Author's calculations using the Unemployment Insurance data base.

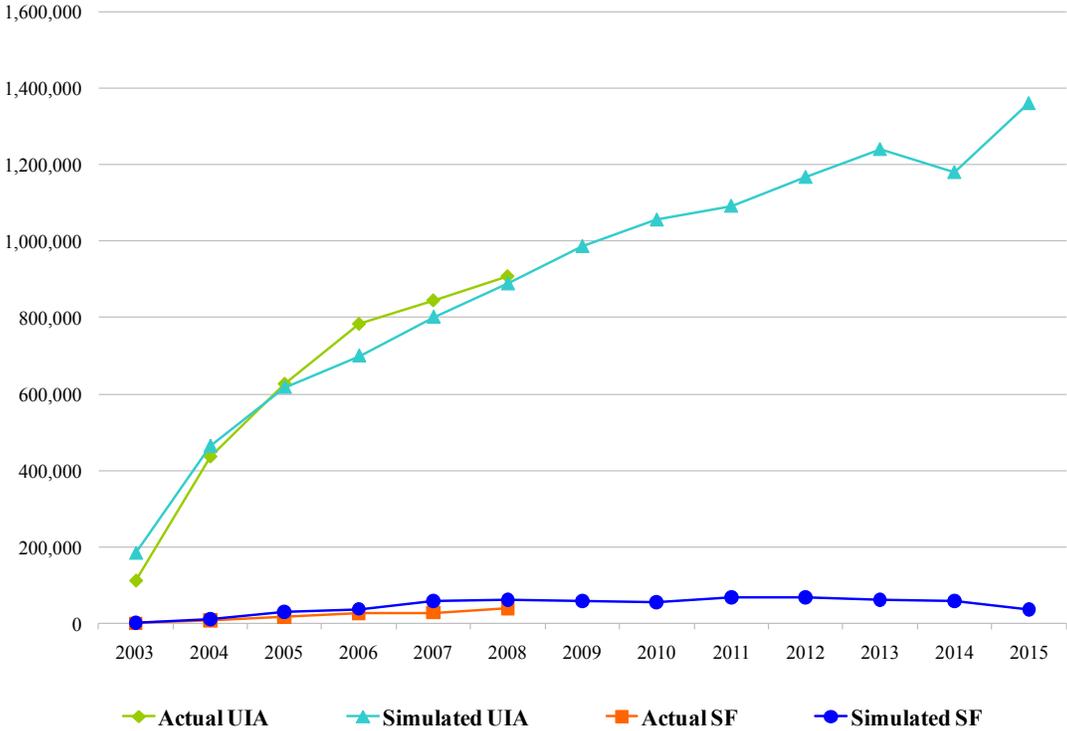
In a similar process to the imputation of contract type, the information from these models was used to project the probability of applying for benefits for all individuals in the sample and every point in time.

Once contract type and the probability of applying for benefits are imputed, it is possible to simulate the evolution of the SC by employing the HPA data base from its hypothetical creation in 1988 until 2002, using the pre-reform rules.

The number of UIA and SF beneficiaries that result from this simulation are presented in the following figure. The UIA beneficiaries have experienced sustained growth of approximately 18% annually since 2003, which is consistent with the moderate accumulation of resources in these accounts. Growth is not experienced, however, in the

number of SF beneficiaries for the projected years, representing just 3% of total benefits of the SC by the end of the period.

Figure 5 – Actual and projected number of UIA-SF beneficiaries (annual Data)



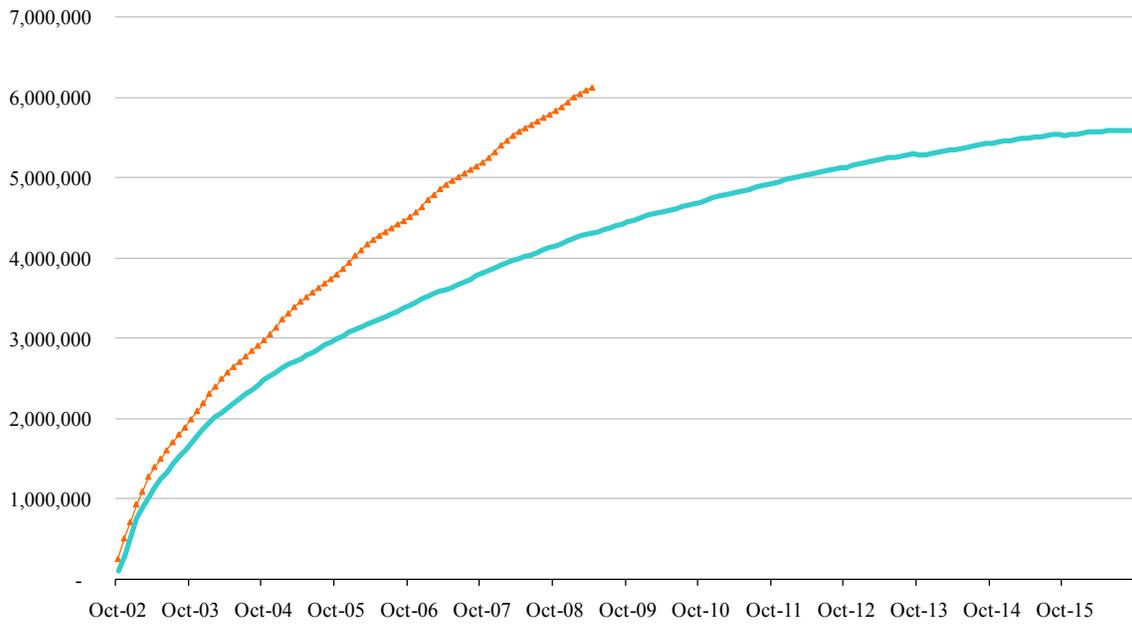
Source: Author’s calculations based on micro-simulation model.

3.1.4. - A Comparison for the first 5 years.

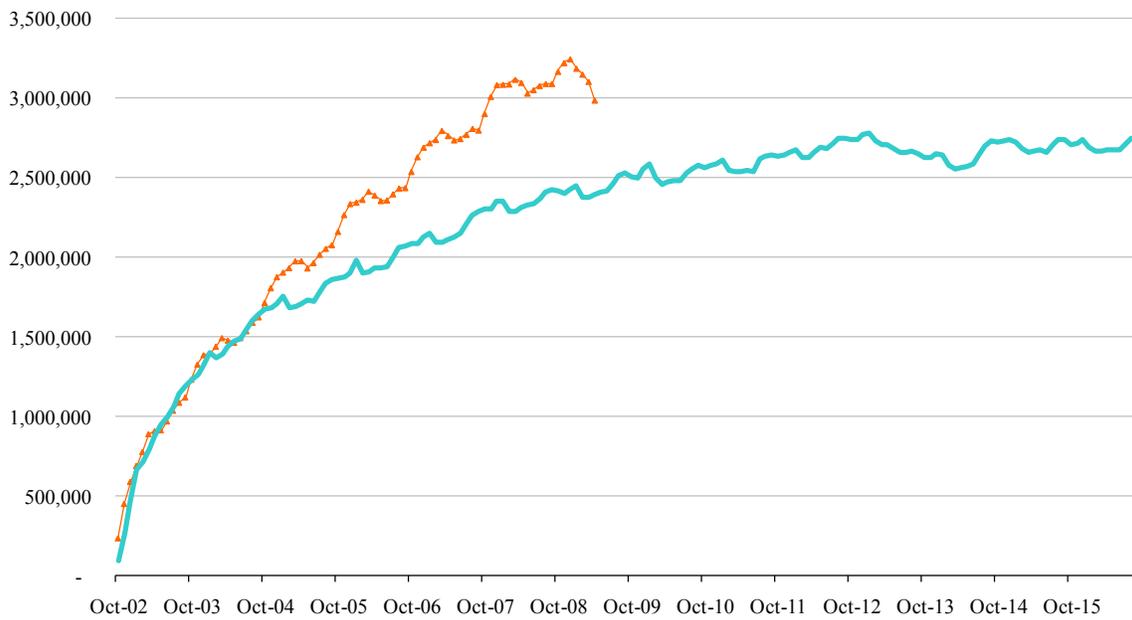
As a first step in validating the results from this model, the consistency between some of the model’s variables and the real evolution of the SC in its initial years was verified. The following figure represents the actual and simulated results in terms of affiliates and contributors to the SC. The model tends to significantly under-estimate the number of affiliates of the system. This could be due to the fact that the comparison is between two distinct periods in economic history (1988-1992 and 2002-2006).

However, more important for the fund projections is the projection of the number of contributors. In this dimension the HPA model follows quite closely the recent trend.

Figure 6 – Actual v/s simulated affiliates and contributors from micro-simulation model



Actual affiliates Simulated affiliates



Actual contributors Simulated contributors

Source: Author's calculations based on micro-simulation model.

Another key element in the System projection is the covered incomes of participants. Figure 7 displays the pattern of actual and simulated average real incomes for the contributors to the SC. Real salaries present a trend which grows in time, consistent with increases in productivity and the gradual introduction of higher income workers into the SC. Simulated real incomes were adjusted in order to adjust the initial level to the remunerations observed in the SC.²⁴ This adjustment is fundamental since the income flows to the FC and the payments of the SF depend directly on the salary level of contributors.

Figure 7 – Actual v/s simulated evolution of average covered earnings



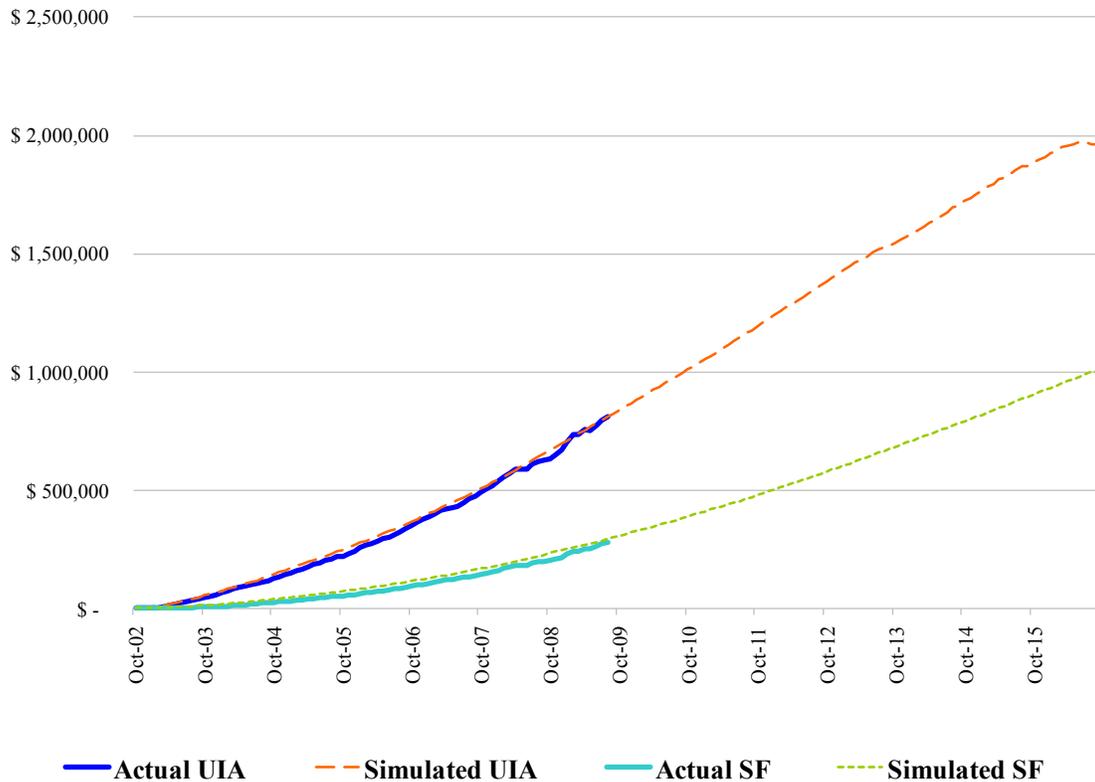
Source: Author’s calculations based on micro-simulation model.

²⁴ A factor was applied to salaries in the HPA data base so that the levels were similar to those observed in the SC data.

Finally, a crucial test lies in the ability to compare the results of the HPA model for the value of the Unemployment Fund with its recent evolution. As can be seen in figure 8, the results of the HPA model correspond quite closely to the actual results, both for funds accumulated in the UIAs and those accumulated in the SF.

Like the actuarial studies of 2004 and 2006, the tendency of growth in both funds is confirmed with the results of the projection using the HPA model. According to this model, in 10 years the UIA will quadruple in value and the SF will reach approximately US\$2.1 billion.

**Figure 8 – Actual and projected balances in UIA and SF
(Millions of pesos - December 2001)²⁵**



Source: Author’s calculations based on micro-simulation model. Ultimately, the HPA model is able to approximate in a reasonable form the reality in various relevant dimensions, particularly in terms of the value of the UIA and the SF. The objective of this model is not, however, its utilization to undertake projections. As has been discussed, the HPA model is constructed based upon the history between 1988 and 2002, which does not exactly mirror the real evolution of the SC. The HPA model was designed to provide certain inputs for a traditional actuarial model, particularly the expected evolution of certain key parameters such as the potential right to access benefits and the probability of applying for these, both under the actual conditions as well as under

²⁵ The Chilean peso exchange rate was, as of December 2010, Ch\$468.37 per US\$.

changes in regulations. In what follows, a description will be provided of the actuarial model used for the projections and simulations, and the interaction between both models.

3.2. - The Actuarial Model

The actuarial model in this study was adapted from Bravo et al. (2006). It is a simplification of reality in which contributors are divided into 108 cells defined by two gender categories, 9 age groups and 9 economic sectors. Based upon an initial situation, the individuals representative of each cell accumulate funds and apply for benefits according to a series of parameters which evolve over time. The initial parameters of this model are estimated from the most recent observations, while the evolution in time (under pre- and post-reform rules) is obtained from the HPA model.

Two basic elements can completely characterize the actuarial model: the projection of contributors and their remunerations, and a probability tree.

The projection of contributors to the SC and their distribution in the 108 cells were obtained from Bravo et al. These projections are accompanied by the average covered incomes for each cell and moment in time. The probability tree attempts to capture the different situations that a SC contributor confronts, as well as the expected rate of withdrawal of funds from the UIA or the SF, in the case that benefits are requested.

Combining the projection of the contributors with the probability tree, it is possible to project the contributions and withdrawals from different funds, the number of beneficiaries of each type, and finally the evolution over time of the Unemployment Funds.

It should be noted that the model takes as exogenous parameters the rate of return of both funds, and the administrative fee charged by the AFC.²⁶

3.2.1. - Evolution of contributors and covered wage

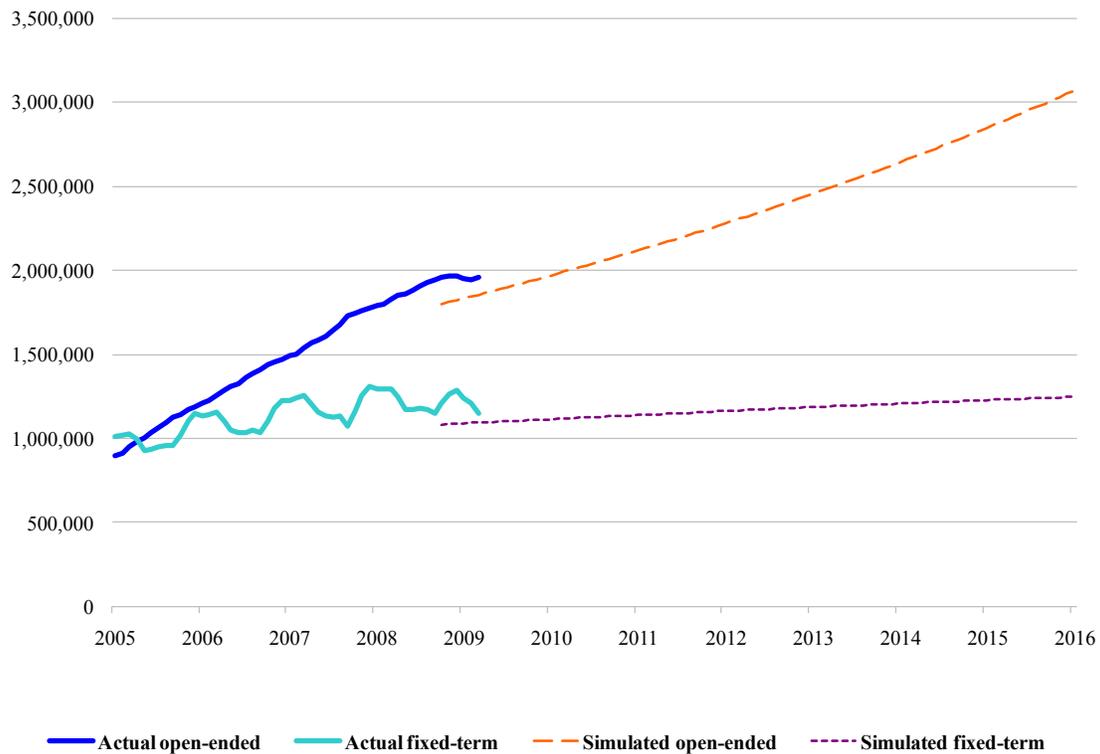
Evolution of Contributors

As of April 2009, the number of affiliates of the SC reached 6.1 million, while the number of contributors approached 3 million. To obtain a projection of contributors, the annual growth rate estimated in the actuarial model developed by Bravo et al. (2006) was applied to the average of the contributors in 2008.

To obtain the projection of contributors in the model of Bravo et al., the structure of the population was projected over the universe of potential affiliates of the SC taking as a starting point the actual structure of the population of contributors. The structure in terms of gender and age ranges of the workforce was obtained using information from the National Statistics Institute (INE, 2003) and the 2003 version of the main Chilean household survey called *Encuesta de Caracterización Socioeconómica Nacional* (CASEN). In order to obtain the projection of employed individuals per cell, the monthly sectoral participation rate was imposed. The same distribution was assumed for both genders and for all age groups. Obtaining the number of contributors was achieved by using coverage rates found by Perticará (2005). These rates were applied to private salaried workers. According to these estimations, it is expected that in September of 2015 the number of contributors will reach approximately 4 million.

²⁶ Specifically, a constant future real rate of return of 3% per annum is assumed, and a monthly commission of 0.05% of the balance. In an extended version of the model, the evolution of certain macroeconomic variables - like employment, unemployment, salaries and interest rates - should be jointly modeled, allowing to endogenously predict the financial return of funds.

Figure 9 – Projected number of contributors by type of contract



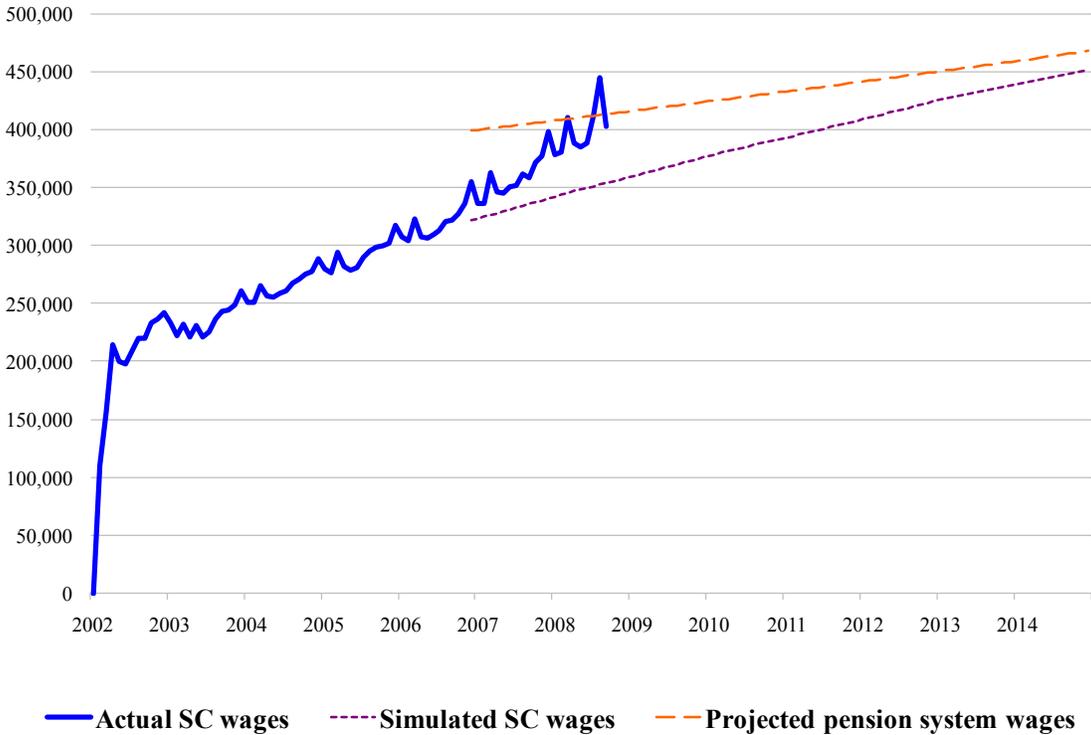
Source: Official statistics and projections based on Bravo et al (2007).

Covered Income of Contributors

When analyzing historical rates of covered remuneration of workers affiliated to the Insurance, a clear difference is observed in the average income per contract type. While remunerations for workers with open-ended contracts, as of April 2009, approached \$484 thousand, for contributors with fixed-term the salary only approached \$278 thousand. At the same time, the growth rate of wages also differs by contract type, being 6% and 4% for workers with open-ended and fixed-term contracts respectively. To project remunerations, the growth rate in the salaries of contributors to the SC was adjusted for the growth experienced in salaries of contributors to the Pension System. This process was undertaken

due to the expectation that once the SC reaches its stage of maturity the salaries observed in said UI scheme will be comparable to those observed in the pension system. Figure 10 presents this adjustment in salaries.

Figure 10 – Actual and projected SC average wages

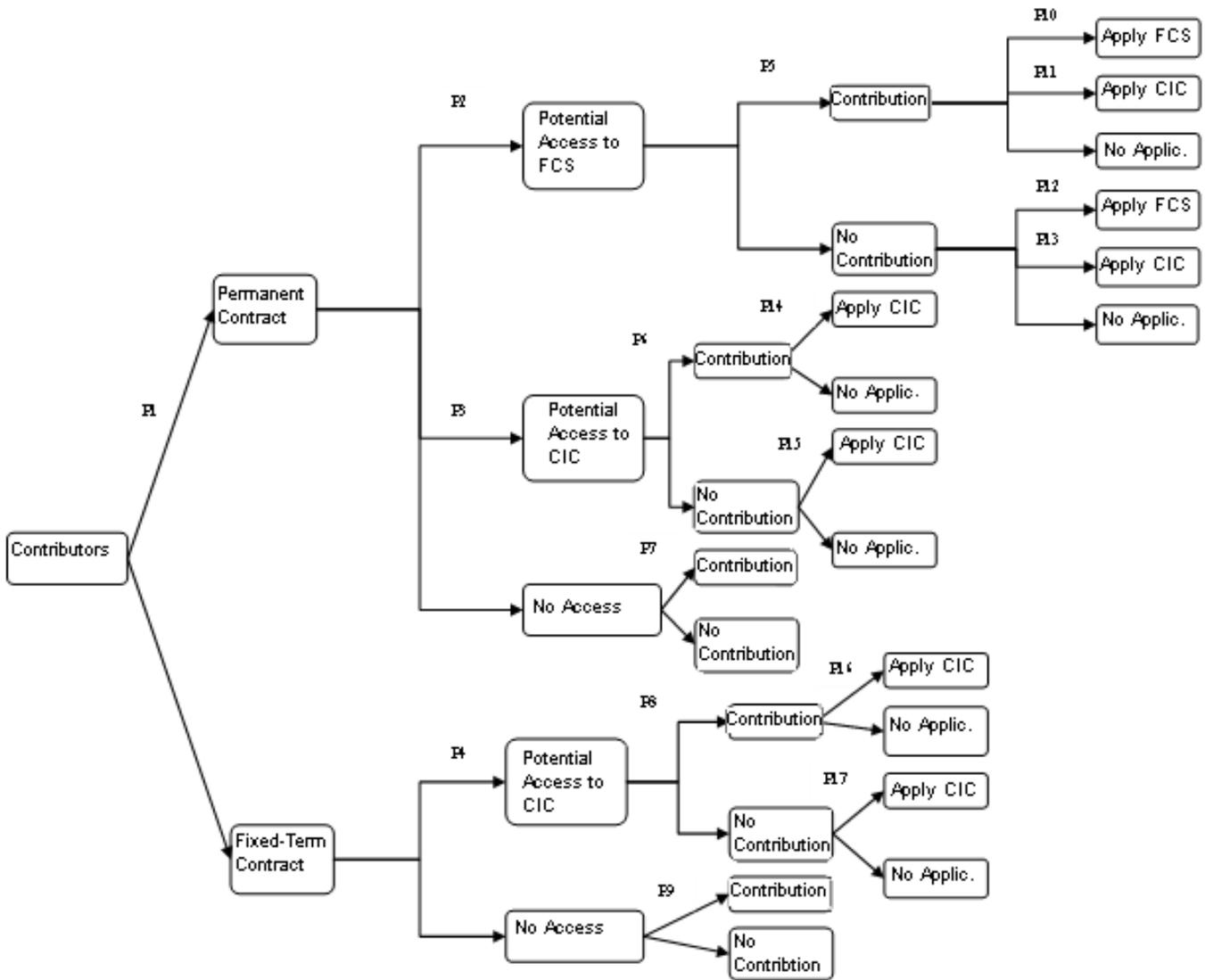


Source: Official statistics and author’s calculations.

3.2.2. - Probability Tree

To determine inflows and outflows from the Unemployment Fund, a modeling of different potential states for workers is necessary. The following figure represents the modeling process chosen for this program in the pre-reform situation, which captures the contractual situation of the individual (open-ended or fixed-term), the potential right to benefits defined as a function of the history of contributions and accumulated funds, the continuity of contract (whether or not a contribution is made in the following period), and the potential applications for benefits.

Figure 11 – Probability tree for a contributor to the SC – pre-reform



For the implementation of the probability tree, 17 probabilities must be estimated, which defines 13 sources of inflow and outflow to the Unemployment Fund. The first branch of the tree defines contract type for contributors to the Insurance (p1). The second determines if individuals fulfill the requirements of access to some type of benefit (p2, p3, p4)²⁷. The third branch characterizes contributors according to the period which will follow (p5, p6, p7, p8, p9). The final branch identifies whether a benefit was applied for and which type of benefit. At this point, it was decided that the possibility that contributors would apply for benefit despite being actively contributing be included. This situation is frequent among individuals with a fixed-term contract, which is partially due to the fact that it was not necessary to certify an unemployment status before applying for benefits.²⁸

Scenarios

One of the main goals of this study is the analysis of the sustainability of the Unemployment Funds, both under the pre-reform situation and under changes introduced by the 2009 reform. For this purpose, two scenarios of analysis were generated. In the first, pre-reform rules of the Insurance were maintained in terms of number and type of contributions to the system. The second, consisting of the 2009 reform, provides contributors with fixed-term contracts with access to the SF and loosens the requirements

²⁷ As in the HPA model, only the balance and the number of contributions were considered as requirements to have access to benefits.

²⁸ This situation has diminished in recent years due to the implementation of a new set of rules towards the end of 2007 which require the verification of this status by the AFC.

for individuals with open-ended contracts who wish to access the SF.²⁹ The following table summarizes the assumptions employed.

Table 7 – Simulation Assumptions

Scenario	Access for fixed-term contract holders to the SF	Contribution requirements to access the SF	Contribution requirements to access the UIA	Number of months of benefits supported by the SF
Base - Pre-reform	No	<ul style="list-style-type: none"> ▪ Fixed term: No access ▪ Open-ended: 12 continuous contributions 	<ul style="list-style-type: none"> ▪ Fixed term: 6 continuous or discontinuous ▪ Open-ended: 12 continuous or discontinuous 	<ul style="list-style-type: none"> ▪ Fixed term: No access ▪ Open-ended: 5
Post-reform	Yes	Fixed term and Open-ended: <ul style="list-style-type: none"> ▪ 12 continuous or discontinuous in last 24 months ▪ 3 most recent - continuous with the same employer 	<ul style="list-style-type: none"> ▪ Fixed term: 6 continuous or discontinuous ▪ Open-ended: 12 continuous or discontinuous 	<ul style="list-style-type: none"> ▪ Fixed term: 2 ▪ Open-ended: 5

Note that in the reform scenario, the decision was taken to establish a mechanism similar to a “contribution-density” in order to allow access to the SF. This format is consistent with the requirements of various European countries to access unemployment insurance benefits. In Germany and the Czech Republic, it is necessary to have worked for at least 12 months in the preceding 3 years; in Portugal the benefit can be accessed only if an individual has worked at least 540 days in the last 24 months; in Poland work is required in 12 of the last

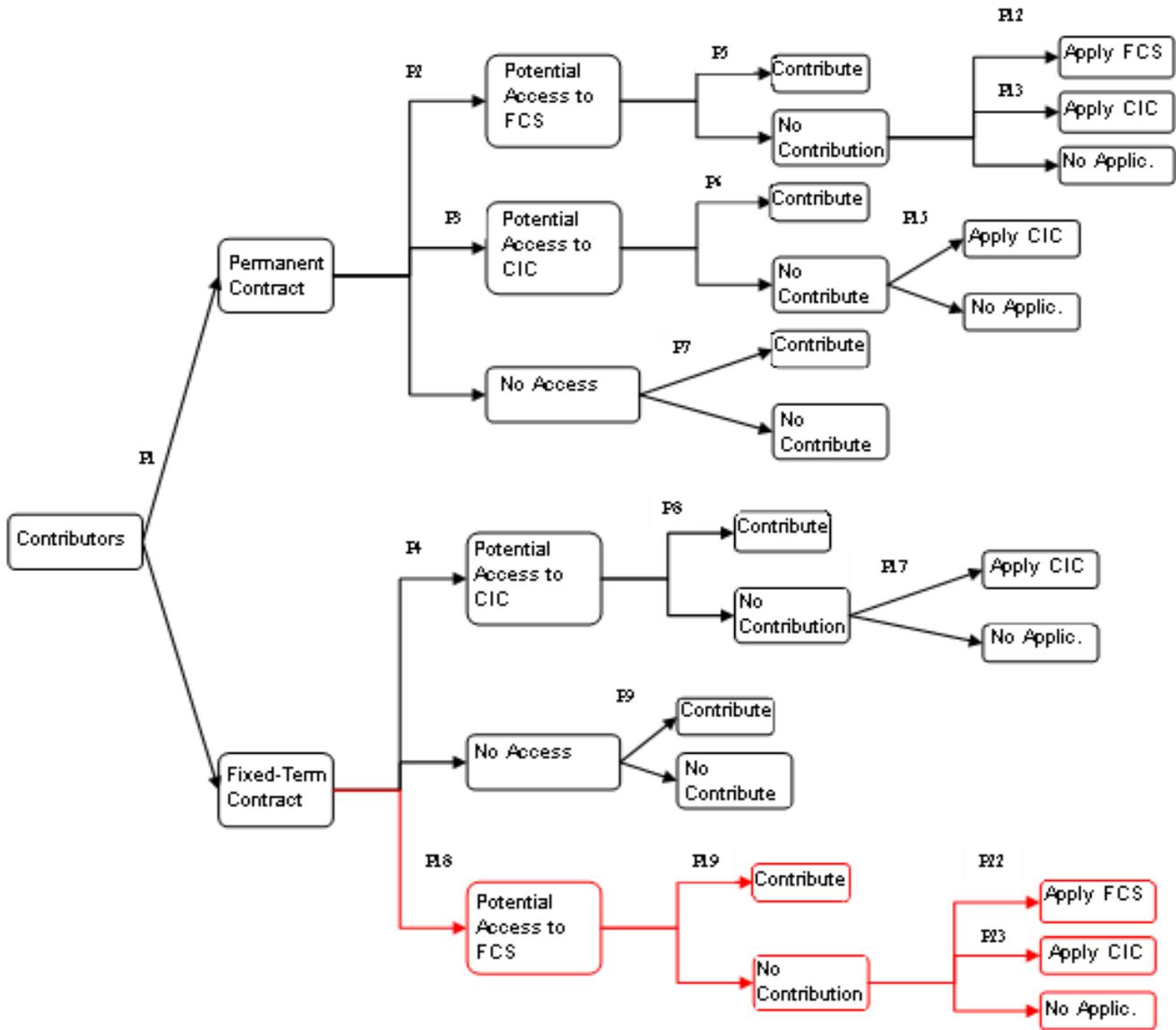
²⁹ Also, minimum and maximum benefits of the FCS were increased: \$88 thousand and \$190 thousand for the first payment, \$73 thousand and \$171 thousand for the second, \$64 thousand and \$152 thousand for the third, \$56 thousand and \$133 thousand for the third, and \$48 thousand and \$114 thousand for the fifth.

18 months, and finally in both Sweden and Holland, the benefit can only be accessed if the worker has been occupied for the last 6 months.³⁰

Figure 12 presents the probability tree that was used in the reform scenario which accounts for the possibility of accessing benefits financed by the SF by workers with fixed-term contracts. Also, the statuses in which individuals apply for benefits whilst simultaneously contributing are eliminated, in order to be consistent with the new supervision system. The new probability tree presents 23 probabilities which define 18 states of inflows and outflows.

³⁰ Information extracted from Beyer (2000).

Figure 12 – Probability tree for a contributor to the SC – Reform Scenario



For both scenarios, the initial probabilities were obtained using the monthly data base sent by the AFC to the Chilean Pension Supervising Authority (SP). This base contains information relating to number of affiliates, socio-demographic characteristics such as age and gender, as well as including the history of contributions and benefits of workers.³¹

The following table presents the value of these probabilities in September of 2008. As is observed, the proportion of workers with open-ended contracts was approximately 60%. Considering the balance and history of contributions, a high percentage (45%) of contributors with open-ended contracts were potentially able to access the SF. Considering the access to the SF or funds in individual accounts, the proportion of individuals covered by the Insurance was greater for workers with open-ended contracts (78%) than for individuals with fixed-term contracts (65%). A greater proportion of contributors to the SC with fixed-term contracts ceased contributing from one month to the next relative to workers with open-ended contracts. It is also observed that contributors with fixed-term contracts made greater use of the fund without being unemployed.

The greatest difficulty of any actuarial model, and especially one which is only 7 years away from its creation, involves the prediction of the evolution of its parameters (probabilities) moving towards the future. In this study, it was decided to use aggregate data for certain parameters (such as the proportion of workers with an open-ended contract) and the results of the HPA model would be used for the remaining parameters. The second column of Table 10 includes the final estimated probabilities for the base-scenario (pre-reform).

³¹ See *Circulares* 1611 and 1620 of the SC for a complete description of the data base.

Table 8 – Initial and Final Probabilities in Base Scenario (pre-reform)

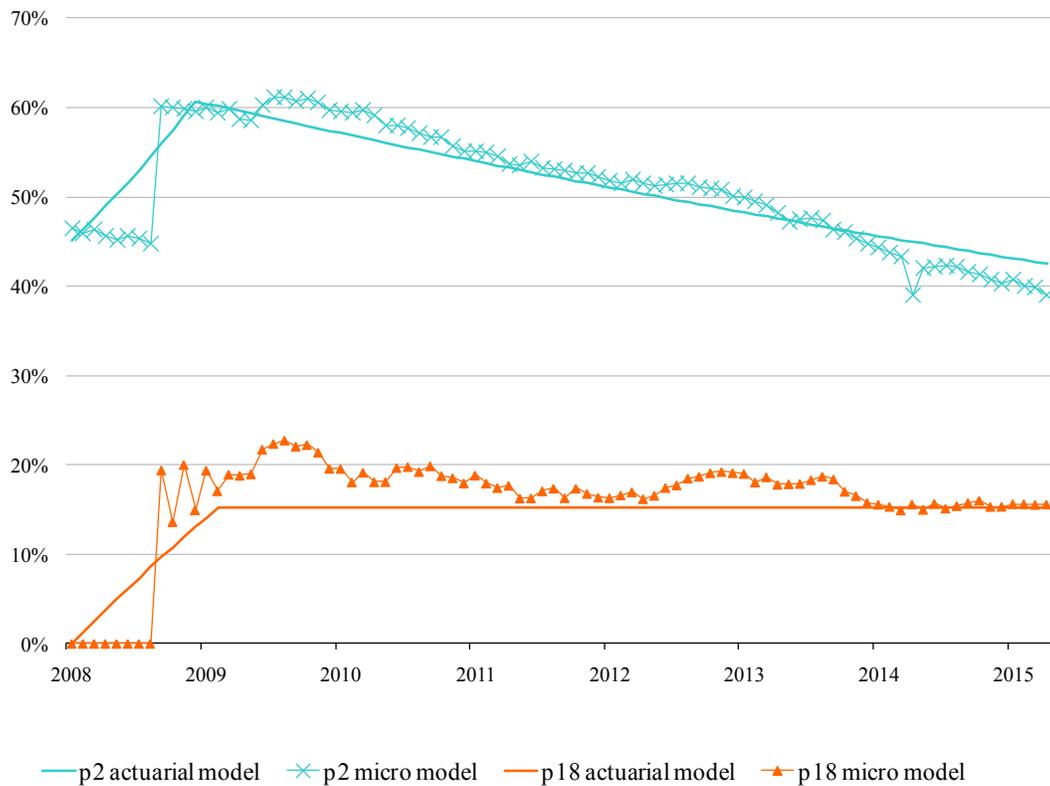
				Observed in September 2008	Estimated in September 2015
Contract			p1	62.96%	67.63%
With Access to					
	SF	Open-ended	p2	45.16%	42.52%
	UIA	Open-ended	p3	33.71%	47.03%
	SF	Fixed-Term	p18	0.00%	15.16%
	UIA	Fixed-Term	p4	64.76%	63.44%
Contributes in t+1					
	Access to SF	Open-ended	p5	97.26%	97.26%
	Access to UIA	Open-ended	p6	93.97%	93.97%
	Access to Nothing	Open-ended	p7	90.32%	90.32%
	Access to SF	Fixed-Term	p19	0.00%	92.20%
	Access to UIA	Fixed-Term	p8	88.39%	87.74%
	Access to Nothing	Fixed-Term	p9	87.35%	86.72%
Applies for UIA					
Applies for UIA					
	Contributes	Open-ended	p11	0.46%	0.00%
Applies for UIA No					
	Contribution	Open-ended	p13	34.76%	0.00%
	UIA Contributes	Open-ended	p14	0.73%	0.00%
	UIA No Contribution	Open-ended	p15	27.40%	27.40%
	UIA Contributes	Fixed-Term	p16	2.63%	0.00%
	UIA No Contribution	Fixed-Term	p17	32.13%	32.13%
Applies for SF					
Applies for SF/					
	Contributes	Open-ended	p10	0.07%	0.00%
Applies for SF/No					
	Contribution	Open-ended	p12	12.21%	33.46%
	SF /No Contribution	Fixed-Term	p22	0.00%	36.40%

Source: Author's calculations from the Unemployment Insurance data base and projections from the micro-simulation model.

The terminal value of p_1 (the probability of possessing an open-ended contract) was obtained from Bravo et al. (2006).³² To project the probability of access to benefits and the probability of contribution, a linear interpolation was made between the initial value observed in the SC data and the final value estimated by the HPA model. If after applying this process differences existed in the level of said probabilities, an adjustment was made using a factor obtained from the HPA model, such that the probabilities would be exactly equal. As an example, figure 13 presents the evolution of probabilities associated with potential right to access by open-ended and fixed term contracts estimated by the HPA model, and those used in the actuarial model.

³² According to the CASEN 2006 this proportion reached 65%.

**Figure 13 – Examples of probability adjustments from micro to actuarial models
(probabilities p2 and p18)**



Source: Author’s calculations based on micro-simulation model

This method was also employed to adjust the “extraction rate” of funds; this is the fraction of accumulated funds which are withdrawn from the Unemployment Fund by an individual who applies for benefits. In order to obtain the amount withdrawn from individual accounts, the “extraction rate” was estimated as a function of the type of benefit applied. For individuals who applied for benefits from the SF, this rate measures the percentage of covered salary that is withdrawn from the UIA and the SF. If individuals apply for benefits from the UIA, the rate represents the total benefit received as a fraction of the balance accumulated in every cell.

In general, to simulate the evolution of the SC in the post-reform scenario, the HPA model was consequently modified and the resulting probabilities incorporated in the actuarial

model. The probabilities associated with applying for benefits in the post-reform scenario were modeled in a different manner, due to the lack of knowledge when analyzing worker behavior for workers with fixed-term contracts in the situation in which they are able to access the SF. Three scenarios were defined which attempt to capture the range of application assumptions for both contract types.

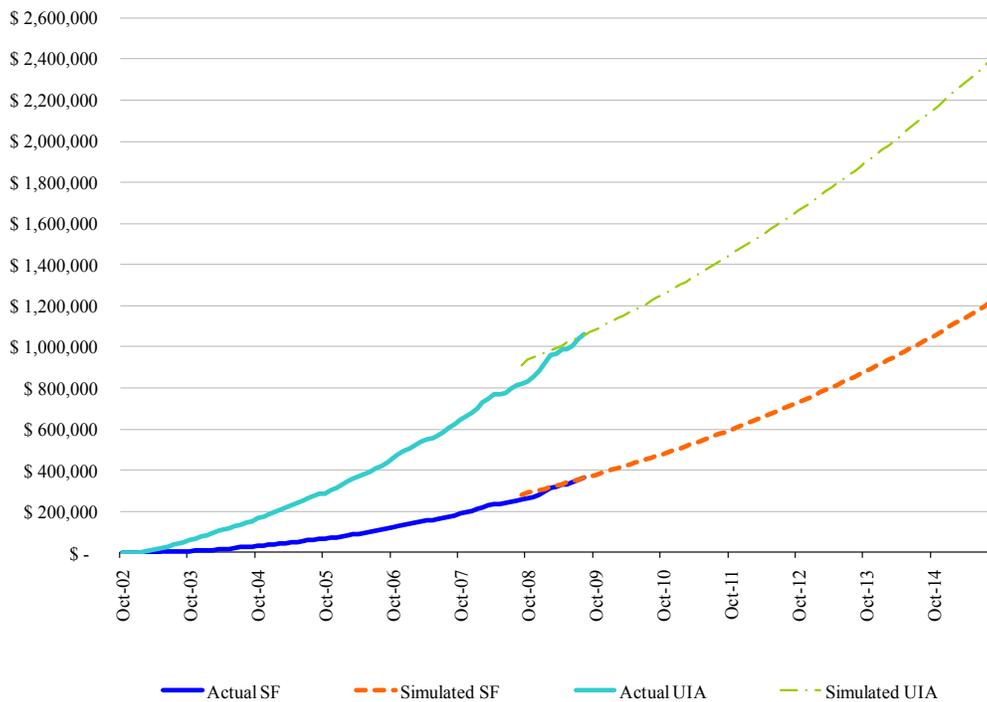
Individuals who are able to access the SF and who lose their jobs can either apply for SF benefits, apply for UIA or not apply for benefits. As mentioned above, 60% of workers with open-ended contracts who become unemployed and are able to access the SF do not apply for benefits and nearly 45% of those who applied for benefits opted for the UIA. Given this situation and applying a conservative criterion for the SF, the decision was taken to privilege the SF over the UIA for contributors with an open-ended contract. In the scenario, denominated the *optimistic* scenario, contributors with open-ended contracts do not modify their behavior pattern (the logit parameters are kept constant) in terms of opting for SF or UIA, while it is assumed that individuals with open-ended contracts that decide to apply for benefits always opt for the SF. In the *intermediate* scenario, it is assumed that both individuals with open-ended contracts and contributors with fixed-term contracts, in the case they apply for benefits, always opt for the SF option. The *pessimistic* scenario captures a more demanding situation, under which it is assumed that workers with open-ended contracts, when applying, always opt for the SF alternative, and contributors with fixed-term contracts, when eligible, always apply for benefits from this fund. The results of these scenarios are presented in the following section.

4. - Results

4.1. - Base Scenario Projections (pre-reform)

The Unemployment Fund projection that is generated by the actuarial model in the base scenario reveals a sustained growth both in terms of the SF and the UIA. The value of the SF in September 2008 approached US\$542 million and would reach a value of US\$2,500 million by the end of the analysis period. The UIA tripled its value in the 7 years of projection, from US\$1,800 million in September 2008 to US\$5,000 million in September 2015. As in earlier studies, the actuarial model supports the growth trend in the Unemployment Funds.

**Figure 14 – Projected balance in SF and UIA under Base Scenario 2002-2015
(Millions of Chilean pesos – as of September 2008)**



Source: Official statistics and author’s calculation based on actuarial model.

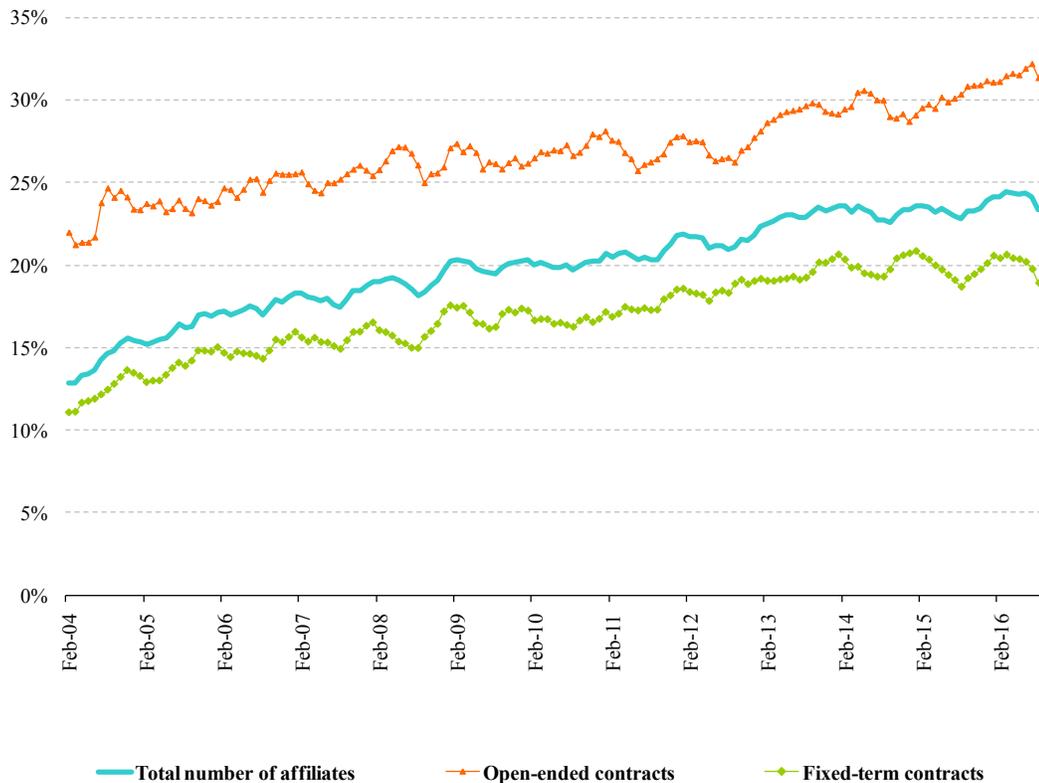
The coverage type provided by the SC in the case of unemployment is strongly determined by the requirements of access to benefits. The following figure shows an estimation of the current situation and proposed future coverage as a function of the type of benefits affiliates would have access to in case of unemployment, under the HPA model. The graph demonstrates that as the system matures, the percentage of affiliates without coverage tends to decrease from nearly 40% in July 2008, to approximately 32% in December 2015. Said increase in coverage, however, is fundamentally due to an expansion in affiliates’ personal funds, which, as will be seen shortly, tend to offer relatively low replacement rates. Finally, it is projected that the scarce protection provided by the SF (approximately 6% of individuals who lose their jobs) would not improve significantly in the coming years.

Figure 15 – Potential Coverage in case of Unemployment, 2002-2015
Base Scenario



Source: Author’s calculations based on micro-simulation model. The previous figure provides an image of the type of coverage provided to individuals in the event of unemployment. The quality of this coverage is presented in the following graph, using the replacement rate as a measure of quality. This indicator was calculated as the ratio between the amount of the benefit and a worker’s salary. Although a growing tendency is observed in the replacement rate received by beneficiaries of the SC, this differs substantially by contract type, ranging from 17% for fixed-term workers, to 27% for those with open-ended contracts. This difference reflects the more favorable replacement rate obtained via benefits received from the SF, than those obtained exclusively using the UIA.

**Figure 16 – Average Replacement Rate in Unemployment Events
Total Affiliates Covered by Contract Type at the Moment of Last Contribution**



Source: Author’s calculations based on micro-simulation model.

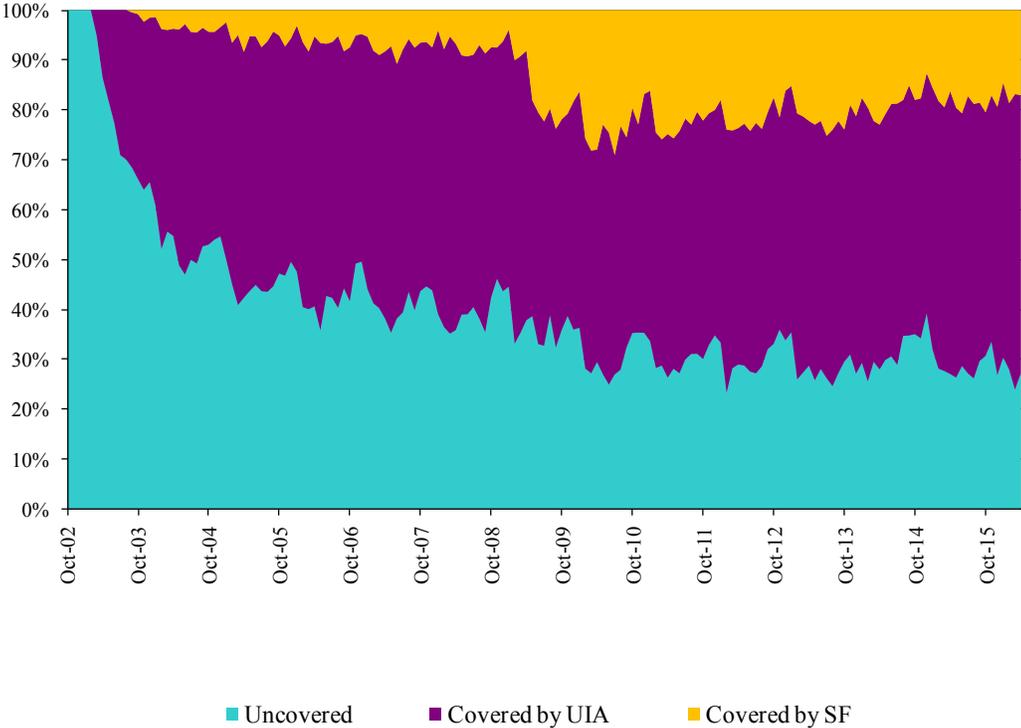
4.2.-Post-reform Scenario Projections

The main goal for modifying the SC was the improvement of the protection of affiliates in case of unemployment. As is appreciated in the following figure (comparable to the coverage figure presented earlier), by allowing workers with fixed-term contracts access and reducing the access requirements for the SF, a considerable increase in coverage is achieved through this option, reaching 20% of individuals who are projected to be unemployed in December of 2015. At the same time, this should imply an increase in the quality of benefits, given that individuals who had been receiving low replacement rates

due to only being able to access their individual accounts, would see an increase in their replacement rate when they access the SF with the proposed changes.

The initial impact in terms of the coverage of the SF is shown to gradually decrease given that affiliates will tend to accumulate larger balances in their individual accounts, surpassing in some cases the minimum requirement to access the SF (since they are able to self finance the 5 corresponding payments.)

**Figure 17 – Potential Coverage in case of Unemployment Events, 2002-2015
Post-reform Scenario**

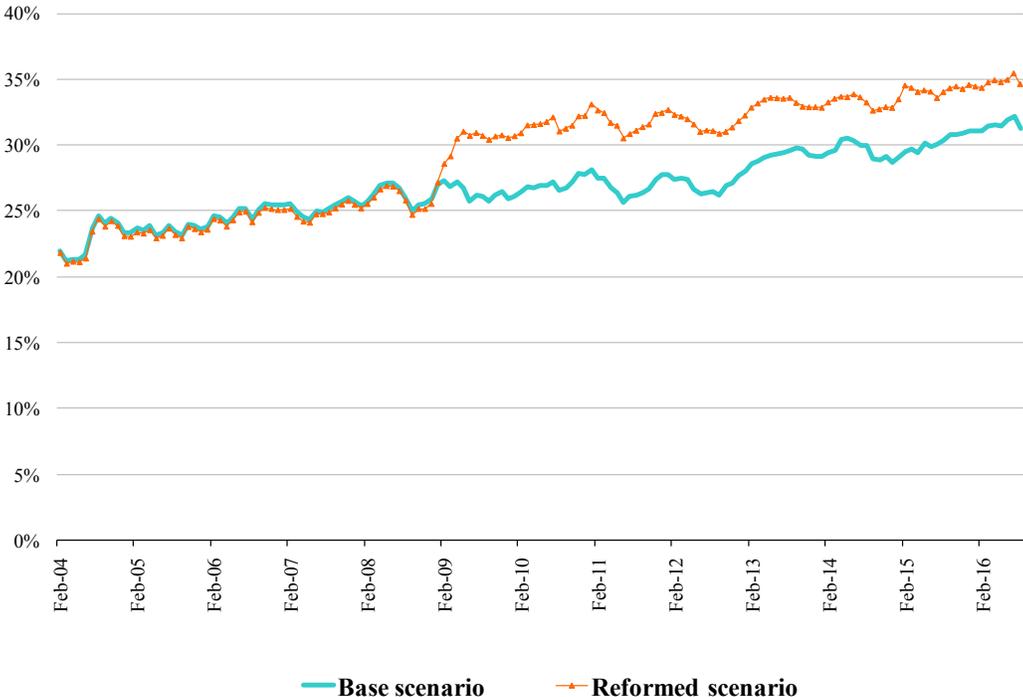


Source: Author’s calculations based on micro-simulation model.

The following graphs display the increase in quality of coverage, measured as the replacement rate in case of unemployment, under pre- and post-reform scenarios. The impact on affiliates is presented separately for those with open-ended contracts, and those with fixed-term contracts, given that the measurement should affect them in different forms. For both groups, improvements in the replacement rate are observed. However, the

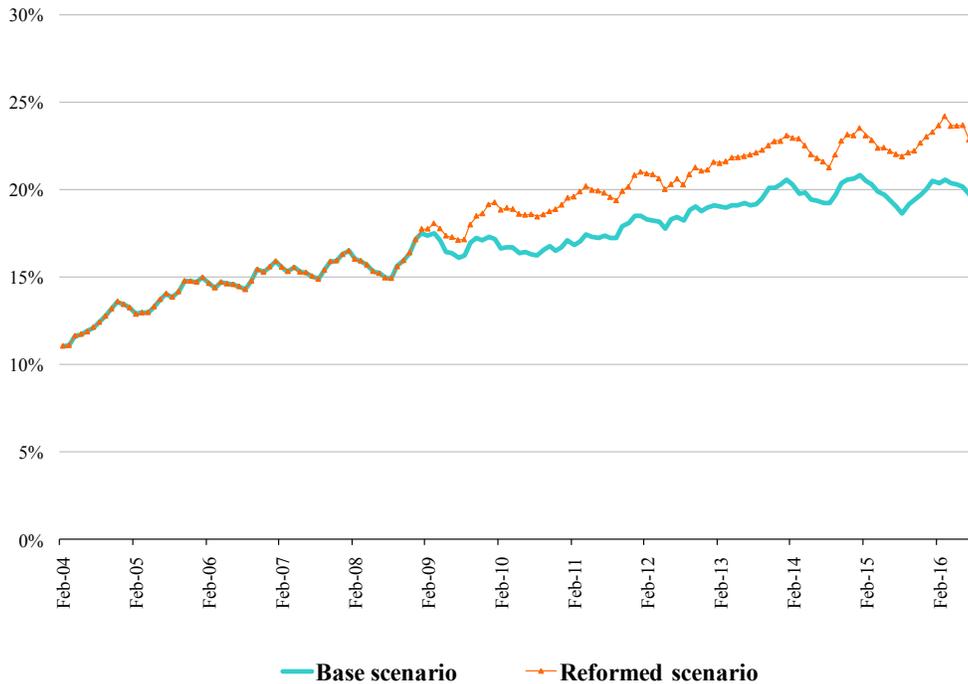
improvement is greater in the case of fixed-term contracts, as this group would access benefits provided by the SF for the first time. Their replacement rates would be maintained, however, at a lower level than those with open-ended contracts, as fixed-term workers tend to present lower rates of density of contributions and, as such, less propensity to have access to the benefits of the SF. Additionally, replacement rates defined by law are lower for workers with fixed-term contracts.

**Figure 18 – Average Replacement Rate in the Event of Unemployment
Open-ended contract workers**



Source: Author’s calculations based on micro-simulation model.

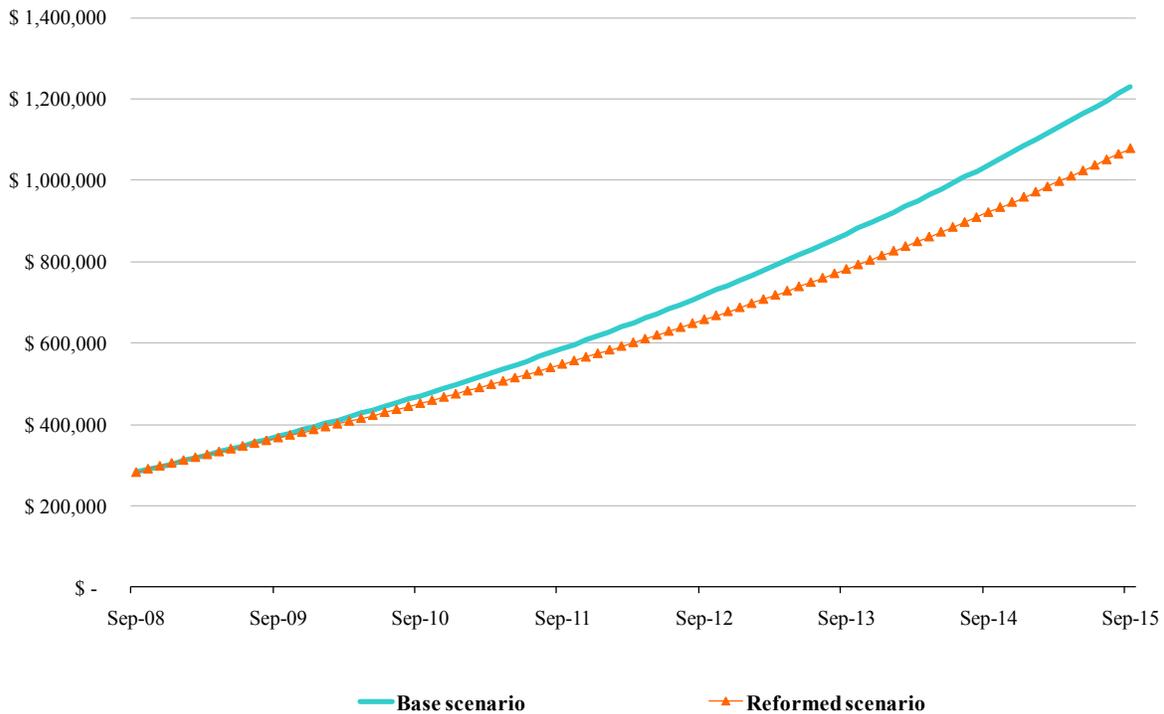
**Figure 19 – Average Replacement Rate in the Event of Unemployment
Fixed-term contract workers**



Source: Author’s calculations based on micro-simulation model.

As was shown in the previous section, under SC rules prior to the reform, the SF was projected to continue along a path of accumulation of funds. The establishment of more flexible access requirements and the incorporation of fixed-term workers to the SF could add a degree of vulnerability to the sustainability of the fund, especially in the transitional stage of the System and in crisis scenarios where unemployment increases. The following figure shows the value of the SF in pre- and post-reform scenarios (intermediate).

Figure 20 – Projected Value of the SF in the Base scenario and Intermediate Post-Reform scenario (Millions of pesos, as of October 2008)



Source: Author’s calculations based on actuarial model.

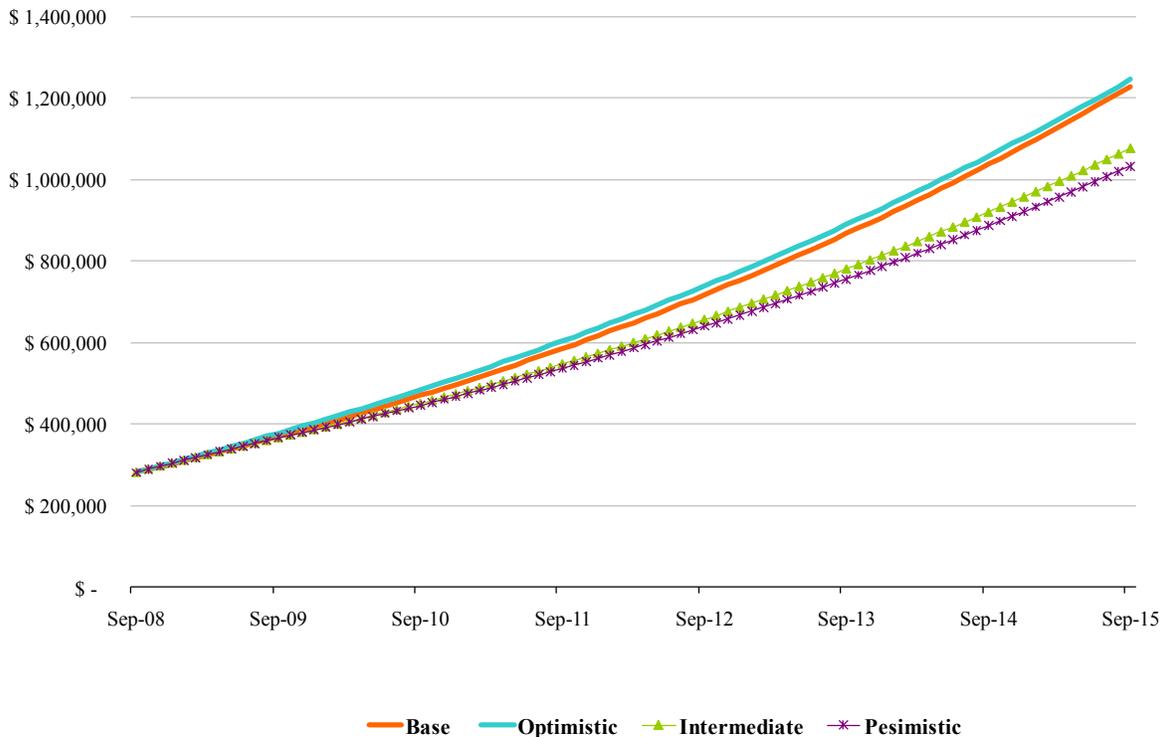
It is appreciated that despite the incorporation of workers with fixed-term contracts to the SF, awarding two months of benefit, and the flexibilization of access for workers with open-ended contracts (and maintaining the total contribution rate), the SF is sustainable in the post-reform scenario, although at a growth rate inferior to that in the base scenario.

As has been mentioned, an important part of the recent evolution of the SF originates in the large percentage of affiliates that, either do not apply for benefits in circumstances in which they are able, or opt to receive Insurance payments from their own funds, rejecting the possibility of accessing the Principal Fund. It is possible to quantify these behavior patterns for individuals with open-ended contracts (since they currently are able to access

this kind of benefit). However, the prediction of this behavior for workers with fixed-term contracts is not as direct.

Given that parameter is of great importance in the projection process, it was decided that post-reform scenarios would be made flexible to different behavioral assumptions which were listed earlier, and are denominated as optimistic, intermediate and pessimistic. The following graph presents the value of the SF under these different behavioral assumptions. Once again, the SF presents positive balances in all scenarios analyzed.

**Figure 21 – Projected balance of the SF under alternative behavioral assumptions
(Millions of pesos of October 2008)**



Source: Author’s calculations based on actuarial model.

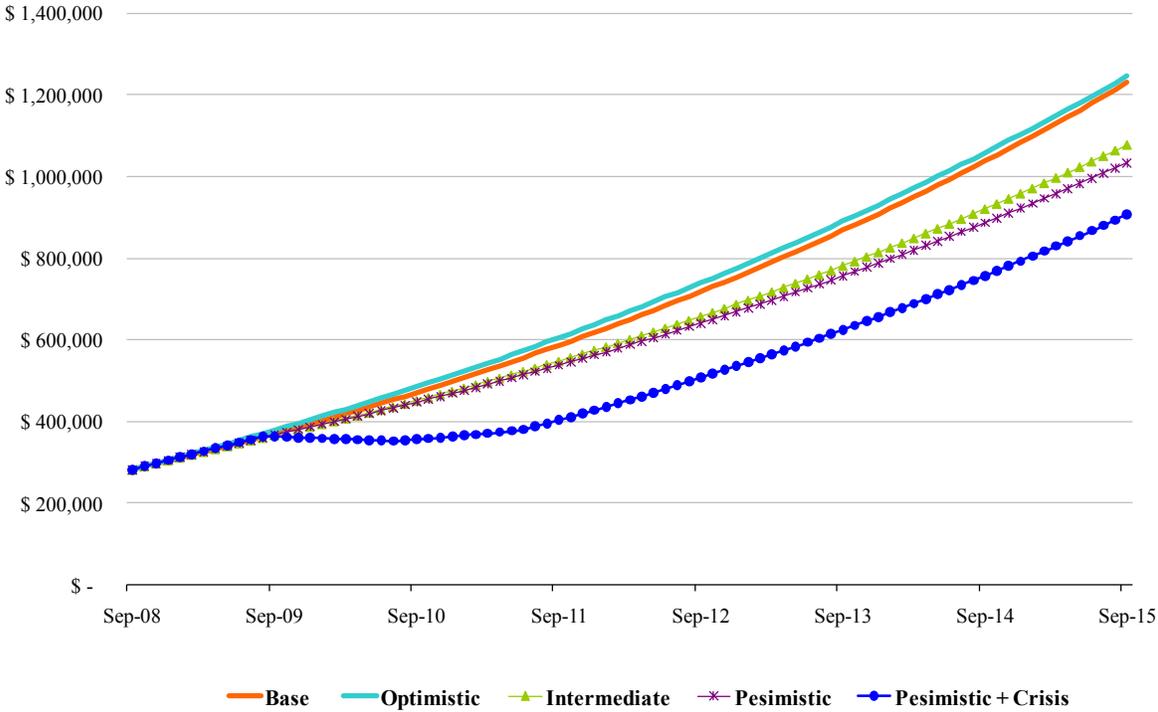
4.3. - Results in Crisis Situations

To further assess the sustainability of the fund, the FC was subject to a stress situation, simulating the scenario of a hypothetical unemployment crisis that would affect the number of contributors to the fund, the number of those who would be unemployed, and the probability of applying for benefits from the fund in this case. The crisis is assumed to start in October 2009 and end in June 2012. It was designed with similar characteristics to those confronted by Chile in 1997. It is also assumed that during the crisis period, two additional payments from the SF are awarded: workers with fixed-term contracts would receive a third

and fourth withdrawal with replacement rates of 25% and workers with open-ended contracts would be eligible for a sixth and seventh withdrawal, equivalent to 25%.³³

The following figure presents the evolution of the SF under the scenarios previously mentioned, including the crisis-pessimistic case. As is observed, the SF always presents positive balances, even under the most benefit-demanding assumption (crisis-pessimistic). Nevertheless, the levels in each year differ substantially, depending on the behavioral assumptions that were made.

**Figure 22 – Projected Value of the SF, Crisis Scenario
(Millions of pesos at October 2008)**



Source: Author’s calculations based on actuarial model.

³³ The increase in the number of payments awarded by the SC in times of crisis is in line with the proposals made by Engel (2005) and by the SC User’s Commission, who proposed the addition of a catastrophic component to the UI scheme.

5. - Conclusions

Like earlier studies, the present article predicts that the Unemployment Funds should follow the recent tendency of sustained growth. Without changes to the eligibility requirements or benefit structures, the accumulated balance of the SF should have approached one billion pesos in the year 2015. This is fundamentally explained by the low proportion of individuals who fulfill the access requirements and the high proportion of eligible individuals who opt to withdraw accumulated resources from their individual accounts, instead of accessing the defined benefits.

The estimations produced in this study suggest that even in the post-reform scenario, which allows fixed-term workers to access the SF and under the most extreme behavioral assumptions in a crisis scenario, the SF is sufficiently robust to withstand an unemployment crisis of reasonable magnitude. Part of this robustness comes from the gradual incorporation of workers with more stable contracts, with higher incomes, and those who tend to contribute to the SF but do not benefit from it.

Beyond the results obtained, we believe that the present study represents an important advance in the development of projection models for social security, by incorporating a model based on real micro-data for the estimation of the future evolution of the parameters of interest. There remains however a series of challenges which should be confronted in future work.

The macro-economical component of the model should be made more robust, allowing for a combined projection of the main inputs into the actuarial model, which are the evolution

of contributors, the interest rate, and the probability of job loss under normal conditions, and crisis scenarios.³⁴

A central element of the model, especially in the counterfactual situation, lies in the behavior when applying for benefits. In this study this was modeled using logistical models based upon certain demographic and labor variables. In future stages, these probabilities should come from estimations made using behavioral models for workers, as a function of expected benefits, expectations of duration of unemployment, or other determinants of the decision to apply to certain funds. Said estimations should pay particular attention to controlling the strong selection bias which is present in the current data base of affiliates of the SC, due to the affiliation process which tends to initially capture high-rotation individuals.

Finally, it is worth highlighting that the results presented here correspond to point estimates or ranges of results but we do not provide a measure of the distribution of potential results resulting from alternative stochastic patterns of the key variables. Future work should incorporate Monte Carlo simulations in order to capture the variety of alternative events which could occur in the near future.

³⁴ The last actuarial study, Cerda and Coloma (2008) is a step in that direction.

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