



**POVERTY &  
ECONOMIC POLICY**  
RESEARCH NETWORK

**MPIA WORKING PAPER**

**2011-11**

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Security Reform on  
labor markets and poverty.**

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**June 2011**

# Effects of Argentina's Social Security Reform on labor markets and poverty.

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June 8, 2011

## Abstract

In 1994, Argentina introduced Pension Reform and Unemployment Benefits as a major reform component to its social security system. This paper analyzes the effects of introducing new individual accounts in the pension system -which was under effect between 1994 and 2008- over wages, employment and poverty. While the macroeconomic effects of a change in the pension system is an issue that is relatively well addressed by the literature, its microeconomic effects are often neglected in the analysis.

We use a CGE model to evaluate the effects of the reform on labor market and poverty. Our results indicate that if private pension funds are allocated to physical investment, labor demand and wages increase and poverty goes down. However, these effects fade out if funds of private accounts are used to buy government debt.

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‡This research has been possible through PEP Network Support. The authors would like to thank Martin Cicowiez for his useful suggestions.

# 1 Introduction

In the early nineties Argentina launched a major program aiming at modernizing its economy. It included, among other things, a stabilization plan (“Convertibility Plan”<sup>1</sup>), trade and financial liberalization, privatization of public firms and services, and deregulation. These reforms were an attempt to break the long history of huge fiscal deficits financed by money printing, which caused high inflation and required subsequent devaluations in order to avoid a real appreciation of the exchange rate.

In many aspects, this plan was a huge success. The country registered a period of large capital inflows, low inflation, high rates of growth fueled by productivity gains, and high investment.

The Social Security System was also reformed in 1994. During the eighties, social security was characterized by large deficits and high payroll taxes, strong regulations in labor markets with centralized bargaining processes and other inefficiencies.

Prior to 1994, the pension system was financed as PAY-GO, and presented some serious weaknesses. On one hand, some pensioners had not contributed to the pension system during their working years, and became beneficiaries because of a “moratoria”<sup>2</sup>. On the other hand, the old system was not sustainable due to other political aspects. For example, some provinces gave high retirement benefits to their former public servants. These issues explained part of the high deficit generated by the old system, which imposed a high payroll tax burden on the working population. Furthermore, Argentina has one of the most aging population in Latin America, which progressively increases the dependency burden and the country’s long-run deficit.

A major overhaul to the social security system was needed in order to reduce the impact of the increase in the dependency rate, improve efficiency, reduce the

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<sup>1</sup>The “Convertibility plan” included a strict currency board, which pegged the local currency to the US dollar. This strict rule aimed at giving predictability to the monetary authority, reducing expectations of high inflation.

<sup>2</sup>A massive “pardon” which allowed people without enough working history to obtain a pension.

already high non-wage labor costs, and increase coverage of displaced workers due to adjustments (privatization, public sector employment layoffs and openness) in the labor markets. The Social Security Reform included the following aspects:

- Introduction of Unemployment Insurance in 1991.
- Implementation of a pension reform system: All workers could choose between continuing in PAY-GO state-administered system or joining personal account systems (previous contributions to PAY-GO system were recognized in the definition of benefits) run by private companies known as AFJP or *Administradoras de Fondos de Jubilaciones y Pensiones*, (Pension Fund Companies).
- Increase of family allowances on a progressive basis.
- Some degree of competition was introduced in the health insurance system.
- Constitution of a “work risk” insurance system through a law that defined the amount of automatic compensation for all accidents and professional illnesses. Private companies known as *Administradoras de Riesgos del Trabajo* or ART provided insurance service, collecting a fixed amount per worker in each firm and covering compensation costs.

From all these reforms, the pension system reform was by far the most important, both in terms of social security and because of its macroeconomic implications. Huge amounts of transfers were devoted to private pension administrators. The deficit generated by the introduction of such a system was covered with an increase in both public debt and VAT over the period, while payroll taxes were reduced.

This paper represents a contribution to the literature, since it sheds light on the effects of the Pension Reform on labor market outcomes and poverty. It supports the view that Pension Reform has a significant effect on growth only to the extent that pension funds are allocated towards increasing physical capital. If funds are used to

finance public debt instead, the effect on growth is negligible. From a policy point of view, the study is highly relevant since the Argentine government has just undone some of the major changes introduced in 1994, without a comprehensive analysis of the previous reform program's consequences. It is also relevant for developing countries in general, since many of the PAY-GO systems are facing increasing challenges as a result of an aging population across the board.

This paper is organized as follows: section 2 presents the research objectives, section 3 summarizes the main changes introduced by the reform and section 4 describes the methodology utilized. Section 5 shows the results and finally, section 6 concludes.

## **2 Research objectives**

The main objective of the paper is to measure the effect of the Pension Reform (henceforth PR) on labor markets and poverty. This is a question of extreme policy relevance since the transfer of resources from the public to the private sector as implied by the pension reform has significant macroeconomic impacts for the economy. The social security system redistributes an amount equivalent to 10% of GDP, while the pension system alone represents 75% of that total. Pension reform amounted to around 1.5% of GDP, diverting these amounts toward private accounts and increasing the social security deficit, thus inducing a general increase in taxes.

Moreover, as it has been mentioned in the introduction, empirical evidence about the microeconomic effects of social security reform is not very well known for the case of Argentina.

## **3 Social security Reform in Argentina**

From 1994 onwards, several reforms were implemented in social security taxes. The main reform was changing the PAY-GO system to an individual account system,

which allowed each worker to choose between systems. Thus, the relevance of the reform depended on the workers' preferences. While most workers would be better-off after the reform, older workers would not benefit. Thus, younger workers decided to join the new system in great numbers.

Other instruments were also important to promote the preference for an individual account system:

- The government implemented a fixed contribution that was relevant only for distributional reasons and for inducing workers to opt for the new system.
- The government also granted a minimum amount of pension for workers in the new system.
- By default, every new worker was assigned to the new system, except those who chose otherwise.
- Once in the individual account system, the worker could not go back to the PAY-GO system. However, the reverse was possible.

On the whole, after two years, 70% of the workers were contributing to individual accounts, and after four years, this proportion reached 80%.

This change had several impacts on the economy, which we will include in our analysis.

First of all, there was a very significant transfer from government accounts to the private financial system, increasing government deficit. The gap in the PAY-GO social security system, the transition cost, was not only relevant for its amount but mostly for its irreversibility: the transition cost would fade out only in the long run.

After implementing this reform, Argentina suffered the impact of the "Tequila" crisis, that reduced activity level and labor demand. Moreover, labor informality, jumped from around 29% to 35% within two years. Formal labor demand was crucial

to limit the social security deficit. To stimulate labor demand, and particularly formal labor demand, **Social Security taxes were significantly reduced** in 1995 and in 1996. While the impact of this reduction over informality is still considered controversial, the Social Security deficit incidence was significant, since such social security taxes constitute an important part of total revenues for social security.

The government implemented two measures to counter this impact on the public accounts. Firstly, it raised the VAT rate from 18% to 21% in 1995. This increase was introduced in order to improve government income without affecting formal labor demand. Nevertheless, the VAT increase affected formal labor demand negatively, through an increment of the hidden economy and, thus, informal workers' demand.

Secondly, **government captured pension funds through public debt**. As AFJP portfolio decisions were regulated, these institutions had to buy periodically significant amounts of public debt. This was a way of financing social security transition costs.

From the point of view of the capital market, the reform also had a significant impact. The proportion that was not captured by public debt was invested in financial assets, such as bank deposits (16% of the aggregate portfolio) and equities (almost 30%). On the whole, and to simplify, 50% of the individual accounts were invested in public debt and the remaining 50% in the capital market or the private sector through financial intermediation.

Nevertheless, from the whole amount deposited in individual accounts, a relevant proportion (initially around 30%, then declining to 20-25%) was retained by these financial institutions as a fee. This can be seen both as an economic impact over a specific sector of activity (financial intermediation services) and as a reduction in the total amount that was channeled into the private sector. Such a fee was high, but it was compensated by the funds' financial returns (returns to financial investment increased total funds at a 10% cumulative rate).

In any case, this financial stock oriented towards financing investment increased the pace of capital stock accumulation. In particular, the capital stock was raised by almost 60 billion dollars/pesos between 1994 and 1999. The portfolio of AFJP accumulated at the end of the period was around 8 billions pesos, which was channeled into the private sector.

The above-mentioned issues are the main ones we focus on in this paper. Nevertheless, several other impacts (which we summarize below) can also be relevant, but are beyond the scope of this work.

First, labor supply can increase significantly due to the reform. Those in favor of the social security reform noted that the PAY-GO system was not highly valued by workers because historically, government tended to use social security amounts in order to finance current deficits. Instead, individual accounts would be regarded as private savings. It was expected that this effect would boost labor supply in the formal sector because of the increase in the valuation of the social security benefits. This effect would contribute to formalization, reducing transition costs.

While the valuation aspect is important in analyzing social security reform, it was not implemented in our model. However, it should be said that by 2000 or 2001 this valuation became at risk due to the high proportion of AFJPs' financial assets which were on the verge of default. Thus, the evolution of valuation is still a matter under discussion.

Secondly, households' expectations about future pensions improve their estimated wealth, thus increasing consumption. In other words, the increase in savings through the social security system would be compensated by a reduction of households' current savings.

Again, this aspect is not included in the model, because so far, there has not been evidence to prove that private savings had diminished due to social security reform.

Thirdly, the other aspect that is not accounted for in the model is the long-term



impact of social security reform on the social security deficit. In fact, transition costs would eventually vanish in the future, thus revealing the fiscal benefits of the reform. The analysis that we implemented in the model implicitly assumes that the new deficit is constant. In any case, this assumption is not entirely misleading, given that the computed transition costs would be practically constant (between 1.5% to 2% of GDP) for 25 years, i.e. up to 2020.

Finally, social security reform implies a swap in the public debt between implicit debt (the present value of the future payments of the PAY-GO system) and explicit debt. The difference is not rhetorical. A default on implicit debt can exist without any punishment in financial markets, thus reducing pension payments (through inflation, for example). On the other hand, the burden of implicit debt is reduced, rather than increased, by an increase in the real interest rate. Furthermore, rollover of implicit debt only includes annual expenses and not the total stock of debt. Thus, if the probability of default arises, explicit debt is significantly riskier than the implicit one. This aspect is not included in our model either.

## 4 Methodology

The kind of reform we are going to analyze has two important dynamic aspects: one is its effects on capital accumulation and the other is the long-run viability of such reform. In this sense, we are aware that pension reform effects will be better appraised by using a dynamic model. However, as a first attempt to start exploring the reform's effects on labor markets and poverty, we will use a static model.

### 4.1 The Model

In order to analyze the effects of the pension reform on the labor market we built a static Computable General Equilibrium (CGE) model for the economy of Argentina,

based on Decaluwé, Martens and Savard (2001). Since one of the most important issues to address when evaluating a social security reform program is its effects on the labor market, we modified the basic model in order to allow for departures from perfect competition in such markets by assuming efficiency wages and an endogenized labor supply, and allowing for the existence of formal and informal labor.

The main features of the model are:

- It is a multi-sector small open economy model with 11 sectors<sup>3</sup>
- We assumed Argentina has seven trading partners: Brazil, Mexico, Canada, USA, European Union, Rest of Latin America and Rest of the world.
- Perfect competition is assumed in all sectors.
- We assumed there are four representative households, according to the amount of formal/informal labor they supply to the market: Formal households (HH1), Semi-formal households (HH2), Semi-informal households (HH3) and Informal households (HH4).<sup>4</sup>
- Government collects tariffs and taxes on commodities and on labor. Government revenues are used to buy good and services and to make transfers to the households (pensions, unemployment insurance, etc.). We assumed fixed public savings.
- On the production side, we used a nested production function. At the top level, firms combine intermediate inputs with value-added using Leontieff technology. Value-added is obtained with a Cobb Douglas function which combines formal labor, informal labor and capital.

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<sup>3</sup>Agriculture and food industry, Extractive, Textile, Clothing and footwear, Wood paper and furniture, Oil and refining, Non-metal manufacturing, Utilities, Construction, Government and Other services.

<sup>4</sup>We divided the households between semi-formal and semi-informal according to whether the main source of household income comes from the formal or the informal market, respectively.

- Total demand for each sector is composed of domestic demand and exports.
- Domestic consumption is a composite (Armington) of domestic and imported goods.
- Current Account is fixed.
- There are three factors of production: capital, formal and informal labor.
- We use a non-competitive framework for modeling labor markets. Following Annabi (2003), Harris and Todaro (1970) and Shapiro and Stiglitz (1984) we introduce efficiency wages and a modified Harris Todaro condition in order to generate involuntary unemployment in the formal sector and a wage differential for formal and informal jobs.<sup>5</sup>
- Capital supply is exogenous, but, after the reform program's introduction, a given proportion of funds coming from pension funds is invested in physical capital.<sup>6</sup>

The model was run using GAMS.

## 4.2 Calibration of the model

### 4.2.1 Argentine SAM

The model was calibrated using a Social Accounting Matrix (SAM) which uses Input Output tables for 1997, updated to 2000, adapted from Petri and Mendez Parra (2005). The Argentine SAM is based on the disaggregation of the sectors of the 1997 Input-Output Tables (MIPA-97) built by INDEC (Argentine Institute of Statistics and Census). We modify the SAM built by the Secretariat of Agriculture, Livestock, Farming, Fisheries and Food (henceforth SALF-SAM) which updates the 1997 data

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<sup>5</sup>See the appendix for a detailed description of the labor market modeling.

<sup>6</sup>See the appendix for a detailed description.

up to year 2000. The SAM is based on an Input- Output table which had a detailed breakdown of the agricultural sector (47 categories) and a total of 64 sectors. We proceed to a brief description of the basic structure of the SALF-SAM.

The production factors included in the SALF-SAM are labor, land and capital. All factors are considered homogeneous. Labor demand was estimated using the MIPA 97, the Permanent Household Survey (EPH-INDEC) and the cost product structures. Average wages are obtained from the MIPA 97.

Household consumption is drawn from the National Expenditure Survey (1996-1997).

It is assumed that firms are homogeneous and they receive all the capital payments, i.e. there are no payments between factors. Households receive payment from labor and firms receive payments from capital and in turn make payments to households. Capital payments are computed as the residual part from the value added after payments to labor (gross production surplus).

Government consists of the national, provincial and city governments. Data from government investment were provided by DNIP<sup>7</sup> and expenditures from DNGC<sup>8</sup>.

In order to compute national taxes, tariffs and social security payments, information from the AFIP<sup>9</sup> was used. At the provincial and city level, data from DNGC were used.

For the savings-investments account, data from the DNCN<sup>10</sup> and DNCPM<sup>11</sup> were used.

As far as the rest of the world is concerned, countries were grouped into seven: Brazil, Mexico, Canada, United States, European Union, Rest of Latin America and Rest of the World. All the trade data were provided by the Argentine Customs Office.

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<sup>7</sup>Dirección Nacional de Inversión Pública (National Direction of Public Expenditure)

<sup>8</sup>Dirección Nacional de Gasto Consolidado (National Direction of Consolidated Spending)

<sup>9</sup>Administración Federal de Ingresos Públicos (National Revenue Agency)

<sup>10</sup>Dirección Nacional de Cuentas Nacionales (National Accounts Office)

<sup>11</sup>Dirección Nacional de Programación Macroeconómica (Macroeconomic Programming Office)

Table 1: GDP structure

	% of Output
Agriculture + Food Manufacturing	24.2%
Oil, Mining and Extractive Activities	4.7%
Textile, Clothes and Footwear	5.7%
Wood, Paper and Printing	4.9%
Oil and Refining	5.5%
Non Metal Manufacturing	4.1%
Metal Manufacturing	7.1%
Utilities	7.9%
Construction	8.2%
Government	9.1%
Other services	18.6%

Table 2: Demand

	% Demand
Private Consumption	61.1%
Government Consumption	11.5%
Investment	18.5%
Export	8.9%

The SAM was not properly balanced because the differences in the valuation of magnitudes from supply and demand. The approach used to balance the matrix is the one developed by Robinson, Cattaneo and El-Said (2001), known as the cross entropy method.<sup>12</sup>

The SAM was built on data from 1997, but an update for 2000 was made. This year was the last of “normal” economic activity for Argentina before the crisis of 2001. In order to do this update, gross value of production and supply and demand by sector data was obtained from the DNCN.

The updating process consisted on using the technical coefficient from the 1997 SAM and applying the 2000 total values to its rows and columns. In this way, a SAM with final values for 2000 was obtained, keeping the relatives price structure and technology of 1997.

<sup>12</sup>For a more detailed analysis see Petri et al. (2005)

Table 3: Household's Consumption and Income

	HH Consumption	HH Income
HH1	35.3%	40.7%
HH2	33.8%	31.4%
HH3	20.2%	18.1%
HH4	10.7%	9.8%

#### 4.2.2 Modifying the SAM

Here, we aggregate back all agricultural breakdowns and make specific modification to the household income-expenditure structure which we will note below.

We used the Household Survey for May 2000 (Encuesta Permanente de Hogares) in order to calculate the income sources and the structure of the four representative households.<sup>13</sup>

We also used the information available in the household survey in order to characterize the household supply of labor.

We used the Expenditure Survey in order to build the consumption of each representative household. Expenditure information available for Argentina is relatively poor compared to that of income. The last expenditure survey is available for 1996-1997. We updated this information for year 2000 using the consumer price index for each item we describe in appendix D. In order to update the ENGH up to 2000, disaggregated consumer price indexes were used.<sup>14</sup>

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<sup>13</sup>The following income sources appear in the Household Survey: a) monthly labor income (wages): salaried workers ordinary wage, salaried workers benefits, self employed, company owner, retrieved production for home consumption, other non monetary payments (vouchers, etc.), b) non labor income: pensions, rents/Interests, benefits/dividends, unemployment benefits, severance payments, scholarships, alimony, transfers from people outside the household, others.

<sup>14</sup>See disaggregation in the appendix

Table 4: GDP structure

	% of Output
Agriculture + Food Manufacturing	24.2%
Oil, Mining and Extractive Activities	4.7%
Textile, Clothes and Footwear	5.7%
Wood, Paper and Printing	4.9%
Oil and Refining	5.5%
Non Metal Manufacturing	4.1%
Metal Manufacturing	7.1%
Utilities	7.9%
Construction	8.2%
Government	9.1%
Other services	18.6%

Table 5: Demand

	% Demand
Private Consumption	61.1%
Government Consumption	11.5%
Investment	18.5%
Export	8.9%

Table 6: Household's Consumption and Income

	HH Consumption	HH Income
HH1	35.3%	40.7%
HH2	33.8%	31.4%
HH3	20.2%	18.1%
HH4	10.7%	9.8%

## 5 Social Security Reform - Simulation results

The model allowed us to simulate alternative shocks, mainly in the social security system, taxes, labor supply and capital stock.

We conducted several simulations with the objective of decomposing the impact of each shock on the labor market. We first present the most relevant simulations, their quantitative implications in the model and their main results. Then we analyze the results and compare them to actual changes registered by the economy after the reform. Then, we will estimate the impact of the changes in the labor market on poverty. Finally, we conclude by analyzing the limits of the exercises and plan future improvements of the model.

The following shocks were estimated:

1. **Pension Reform (PR)** - Individual accounts system: Individual accounts were simulated as a change in social security taxes: a proportion of these taxes (80%) are oriented to none other but government income.
2. **Physical capital accumulation:** Here, we estimated the total physical capital accumulation that PR permits to implement. This amount is calculated as a perpetuity at a 20% annual return. Sensitivity analysis is implemented through the relevant coefficient, that is to say the proportion of individual accounts that finance capital accumulation.
3. **Funds captured by the government:** the government closure implies that its savings are held constant by an increase in the VAT rate. In other words, PR implies VAT increment. Nevertheless, this raise is tempered by the proportion of pension funds captured by the government. This issue is explored through a sensitivity analysis of the relevant coefficient, that is to say, the proportion of funds that government captures.<sup>15</sup>

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<sup>15</sup>Other experiments analyzed were: cut in social security taxes, an exogenous increase in labor



We built three scenarios:

- **Scenario A:** Introduction of individual accounts with 75% of the funds directed towards increasing physical capital and the rest captured by the government in the form of higher debt.
- **Scenario B:** Introduction of individual accounts, but lowering the percentage invested in physical capital to 20%.
- **Scenario C:** Introduction of individual accounts, as in Scenario A, but for some reason individual accounts will not be financing physical capital.

## 5.1 Results

Table 4 summarizes the simulation results according to the different scenarios. These scenarios are constructed according to the previous shocks. Specifically, scenario A differs from the base case in the implementation of PR, from PAY-GO to individual accounts. This shock is simulated using the corresponding parameters. Parameter  $c_{prop}$  indicates the proportion of the social security tax that is reoriented towards individual accounts. Of that amount, 25% is captured by public debt ( $\tau_o$ ) and the remaining 75% is invested in physical capital ( $\tau_{ap}$ ).

This exercise does not include any other shock. Nevertheless, it should be noted that government adjusts VAT rate in order to finance the same level of consumption and transfers, and that the proportion ( $\tau_o$ ) of individual accounts is considered a way of financing expenses. In other words, tax rate increases when social security tax receipts are reduced.

According to the model and its calibration, the social security reform program generates good results without any fiscal costs.

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supply, an increase in labor supply in the formal sector-analytically equivalent to an increase in Social Security Valuation- and, finally, a reduction of household savings.

Individual accounts, simulated in this way, generate an increase in both formal and informal wages of 5% and 7% respectively, while capital returns drop by 7%. Value-added goes up by 8%, generating an increase in labor demand of 1%, substituting formal jobs for informal ones.

This impact depends crucially on capital accumulation effect: all these positive changes are owed to an increase in capital supply of 15%, based on pension funds. If the government captures a higher proportion of individual accounts, say 80%, then the effects would fade out (see scenario B).

On the other hand, if for any case, aggregate amounts of individual accounts would not be invested in physical capital (for example, the investment is oriented to US bonds), then the simulated effect of individual accounts is not positive: wages fall by 1%, labor demand also falls and VAT must increase by 28% to compensate the fiscal deficit. This situation is simulated in scenario C.

Going back to scenario A, pension reform would generate an increase in VAT rate of 7%, which implies a 15% increase in receipts that compensates the fall of social security taxes collected by government. Government income falls by only 1%, which is covered by new debt.

Consumption prices would go down, given the reduction in returns to capital, while this reduction is compensated by the increase in VAT.

On the whole, disposable income rises by 3% in nominal terms and by 4% in real terms. This points out the relevance of pension reform impact over poverty and income distribution, as it increases demand for formal labor, reduces unemployment and slightly increases labor supply.

Table 7: Simulation Results

Variable and parameters		A	B	C
<b>Parameters</b>				
capprop	Weight of individual account system	0.8	0.8	0.8
taop	Proportion invested in private physical capital	0.75	0.2	0
tao	Proportion captured by government (public debt)	0.25	0.8	0.25
<b>Results</b>				
wf	Formal wage	1.000	1.014	0.987
wi	Informal wage	1.000	1.017	0.988
r	Returns to capital	1.000	0.979	0.985
VA	Value Added (GDP)	732,815	748,627	732,352
Ldf	Formal labor demand	236,755	237,511	237,018
Ldi	Informal labor demand	55,154	54,905	54,370
PC	Consumer Prices (average)	1.033	1.028	1.036
PC Agr	Food consumer prices	1.005	0.998	1.002
			-0.7%	-0.3%
			5.4%	-1.3%
			6.7%	-1.2%
			-7.4%	-1.5%
			8.3%	-0.1%
			1.2%	0.1%
			-1.7%	-1.4%
			-1.4%	0.3%
			-2.6%	-0.3%

## 5.2 Poverty calculations

As we saw in the previous sections, the reform program affected labor market outcomes, and hence, it can have effects on poverty. Since our CGE only has representative households, we have to resort to a top-down approach in order to measure its effect on poverty.<sup>16</sup>To calculate the impact of pension reform on households, we implemented a simple micro simulation method.

This method consists of changing Permanent Household Survey database (of May 2000), introducing new levels of employment and wages. Changes in mean wages were implemented, proportionately modifying all wages of each sector (informal and formal). New jobs were calculated through a random imputation of a new job and wage for unemployed labor. In other words, a specific number of observations of unemployed workers were changed to employed. A wage was imputed to these observations, according to the mean wage of the group, that is, for the workers of a specific industry, sector (formal/informal) and educational level.

Before analyzing the results of poverty calculations for PR scenarios, we present the method by changing different relevant variables. We calculate a new poverty headcount and severity measures after introducing changes in labor demand, wages and poverty lines, which can be observed in table 9.

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<sup>16</sup>This approach is widely used in the literature. (Bourgignon et al, 2008).

Table 8: Changes in poverty

Scenario	Poverty	Extreme poverty	Poverty Gap	Squared Poverty Gap
Base case	0.316	0.082	0.131	0.076
Formal Labor Demand: 5%	0.300	0.077	0.124	0.071
Difference	-0.016	-0.004	-0.007	-0.005
Informal Labor Demand: 5%	0.302	0.076	0.123	0.071
Difference	-0.014	-0.006	-0.008	-0.005
Formal wages: 5%	0.307	0.080	0.128	0.075
Difference	-0.009	-0.002	-0.003	-0.001
Informal wages: 5%	0.309	0.079	0.126	0.073
Difference	-0.007	-0.003	-0.005	-0.003
Poverty line: -5%				
Extreme poverty line: -5%	0.296	0.075	0.122	0.071
Difference	-0.020	-0.007	-0.009	-0.005

Table 9: Simulation results

Scenario	A	B	C
Formal wage	5.4%	1.4%	-1.3%
Informal wage	6.7%	1.7%	-1.2%
Formal labor demand	1.2%	0.3%	0.1%
Informal labor demand	-1.7%	-0.5%	-1.4%
Poverty line	-1.4%	-0.4%	0.3%
Extreme poverty line	-2.6%	-0.7%	-0.3%
Poverty change	-0.023	-0.006	0.009
Extreme poverty change	-0.009	-0.002	0.003

An increase in formal demand of 5% would reduce the poverty headcount by 1.6 points and extreme poverty by 0.4 points. The poverty gap would also drop significantly by about 0.7 points, while severity would fall by 0.5 points.

Similar results are attained when informal labor demand is increased by 5%. The informal sector is related to low wages and higher probability of poverty or even extreme poverty. Thus, the impact in poverty reduction is lower, because every new worker receives a lower level of new income. However, the impact over extreme poverty is higher, because the new workers are more concentrated in those households.

Changes in wages would reduce poverty less than an increase in labor demand. With an unemployment rate of almost 18%, the impact of new employment over income distribution is greater than the proportional increase in wages. Furthermore, households with occupied members have a lower probability of being poor, thus an increase in those households' income does not change poverty conditions. Hence, changes in poverty would be less than 1 point and 0.3 points in the case of extreme poverty this time around. Again, informal sector improvement has a lower impact over poverty and a higher one over extreme poverty.

A change in the poverty line would move real income proportionately higher than an increase in payroll of one sector. In fact, a decrease of 5% in the poverty line would move poverty headcount 2 points lower while a reduction of extreme poverty

Table 10: Actual changes

	1994	1996	1998	1994-1996	1996-1998	1994-1998
Occupied Workers	7799	7539	8298	-3.3%	10.1%	6.4%
Formal Workers	3836	3534	3949	-7.9%	11.7%	2.9%
Informal Workers	1594	1787	2246	12.1%	25.7%	40.9%
Formal Wages	722	693	754	-4.0%	8.8%	4.4%
Informal Wages	453	410	406	-9.5%	-1.0%	-10.4%
Unemployment Rate	13.9	19.9	15.8	43.2%	-20.6%	13.7%
Capital Stock	564,938	593,887	636,592	5.1%	7.2%	12.7%
Value added	250,308	256,626	288,123	2.5%	12.3%	15.1%

line would change the extreme poverty headcount by 0.7 points.

These changes in poverty calculations can be used to construct “marginal” impacts of each variable over poverty. For small changes, these calculations are relatively accurate.

The previous table shows the impact of different scenarios on poverty and extreme poverty, calculated using “marginal” impacts. In particular, a pension reform program would result in a reduction of poverty headcount by 2.3 points and extreme poverty by almost 1 point.

### 5.3 Observed evolution

Are these results comparable to the evolution of the economy after the Social Security reform? This question is difficult to appraise, because the reform was implemented at the time of the “Tequila” effect. Nevertheless, it would be illustrative to split the data into two periods, from 1994 to 1996, and from 1996 to 1998.

The previous table summarizes the evolution of some variables in the relevant period. First of all, employed workers increased by 6 percent in the whole period and by 10 percent between 1996 and 1998. Over the later years, formal labor demand improved by 12 percent, while informal workers increased by 26 percent. Wages also

account for the difference in labor demand between both segments: while formal wages increased by 9 percent, informal wages declined by 1 percent. Capital stock increased by 7 percent while value-added increased by 12 percent.

In these terms, the model can adequately account for some of the main facts. However, according to the observations, labor demand clearly shows a preference for informal workers, jointly with a reduction in informal wages. The simulation results clearly show the contrary.

#### **5.4 Limits of simulation exercises**

Our simulations show positive aspects of pension reform such as the accumulation of physical capital, the increase in labor demand and the changes in social security valuation. Nevertheless, the results are not in strict accordance with observed results. Particularly, labor market segmentation deepened after the reform, through the increase in informality and the wage gap.

Several reasons may explain this difference between simulated results and observed data. On the first place, labor market was negatively shocked by the “Tequila” effect in late 1994. Secondly, individual social security valuation may have well been negative.

In order to allow for such discrepancies, we construct a new scenario trying to account for actual changes: an extreme reduction of valuation, a significant increase in labor supply, and an increase in consumption.

The results are shown in table 11.



Table 11: Simulation results

Variables and parameters		Base case	Near Actual
Parameters			
capprop	Weight of individual account system	0	0.4
taop	Proportion invested in private physical capital	0	0.5
tao	Proportion captured by government (public debt)	0	0.5
tssf	SS Tax rate change	0	0.5
zeta	Labor supply coefficient	zeta	zeta*0.2
htpar	Labor supply relationship between formal and informal labor	htpar	htpar*0.6
psi	Household savings	psi	psi*1.8
Results			
wf	Formal wage	1.000	1.037
wi	Informal wage	1.000	0.889
r	Returns to capital	1.000	0.959
VA	Value Added (GDP)	732,815	789,736
Ldf	Formal labor demand	236,755	244,307
Ldi	Informal labor demand	55,154	63,714
LD	Total Labor Demand	291,909	308,021
LS	Total Labor Supply	324,343	340,355
UN	Unemployment Rate	10.0%	9.5%
KD	Physical Capital	404,066	443,493
YDH	Disposable Income	579,454	595,252
SSTF	Social Security Tax	18,420	5,914
SSTFC	Individual Accounts	0	7,885
SST	Total Social Security	18,420	13,799
txa	Adjustment of VAT	1	0.989
VAT	Value Added Tax rate	41,964	45,024
YG	Government Income	178,823	174,685
SG	Government Savings	86,131	86,131
PC	Consumer Prices (average)	1.033	1.005
PC Agr	Food consumer prices	1.005	0.972
			4%
			-11%
			-4%
			8%
			3%
			16%
			6%
			5%
			-5%
			10%
			3%
			-68%
			-
			-25%
			-1%
			7%
			-2%
			0%
			-3%
			-3%

We can account for some of the changes observed, but our simulations clearly underestimate the substitution between formal and informal labor which took place. Also, it is probable that, besides calibration, some limitations may be influencing these results, since several aspects cannot be included in our model such as:

- Substitution between formal and informal activities within each sector: The increase in VAT, for example, does not change the proportion of formal and informal production activity and labor demand. This is a crucial point in the simulations presented. This will be taken into account in the next versions of this model, introducing two sectors (formal and informal) for each private sector of the SAM.
- Substitution between skills and complementarity of skilled workers with physical capital: This is a relevant issue, as the capital accumulation effect is the PR's main positive shock. If the renewal of equipment requires human capital improvements, then the skill biased impact of labor demand would affect income distribution through returns to education and through the wage gap between formal and informal wages. We plan to introduce this aspect in the model's future versions.
- Substitution between implicit and explicit debt: This issue is not negligible, but the model is not capable to account for this factor.

## 6 Conclusions

On the whole, simulations show positive outcomes in terms of growth, labor market and poverty improvement. These results heavily depend on the capital accumulation that pension funds permit.

The main positive effect obtained from pension reform is a “growth effect”. Financial capital available in the private funds is transformed into physical capital. This

increase is translated into a decrease in capital returns, an increase in both formal and informal wages, and an increase in labor demand.

Despite the discrepancy between simulated and observed outcomes, this model shows that a substantial proportion of Argentina's economic evolution during the period 1994-1998 can be explained by the pension reform. Part of the growth, labor demand and capital accumulation was due to this significant reform program.

Nevertheless, it is also true that this reform, including all the effects that increased transition costs (including the reduction in collected social security taxes), had systematically contributed to increase public debt, a phenomenon which contributed to the 2001-2002 crisis.

However, as we mentioned before, our analysis did not take into account the dynamic aspects that are present in this kind of reforms, specifically capital accumulation and viability of reform. Undoubtedly, these matters deserve further attention and will be tackled in further research.

## References

- [1] Annabi, Nabil. *“Modeling Labor Markets in CGE Models: Engogenous Labor Supply, Unions and Efficiency Wages”*, CIRPEE Working Paper. **2003**
- [2] Bassanini Andrea, Jorn Henrik and Stefano Scarpetta. *“The Economic Effects of Employment-Conditional Income Support Schemes for the Low-Paid: An Illustration from a CGE Model Applied to Four OECD countries”*, OECD Economics Department Working Papers, Nr. 224. **1999**
- [3] Bourguignon, François. *“The pace of Economic Growth and Poverty Reduction.”* Paper presented in LACEA 2001, **2001**.

- [4] Bourguignon, François, Anne-Sophie Robilliard and Sherman Robinson. "*Crisis and Income Distribution: A Micro-Macro Model for Indonesia.*" **2001.**
- [5] Bourguignon, François, Anne-Sophie Robilliard and Sherman Robinson. "*Representative versus real households in the macro-economic modeling of inequality*". Paper prepared for the Conference on Frontiers in Applied General Equilibrium Modeling, New Haven, Yale University, **2002.**
- [6] Bourguignon, François, Mauricio Bussolo and Luis A. Pereira da Silva. "*The Impact of Macroeconomic Policies on Poverty and Income Distribution*", Palgrave, MacMillan, **2008.**
- [7] Corbo, Vitorio and Klaus Schmidt-Hebel. "*Efectos macroeconómicos de la reforma de pensiones en Chile.*", *Documento del Banco Central de Chile*, **2003.**
- [8] De Ferranti, David, Guillermo Perry, Indermit Gill and Luis Servén. "*Securing our future in a Global Economy.*" World Bank Latin American and Caribbean Studies, **2000.**
- [9] Decaluwe, B., A. Martens and L. Savard. "*La politique économique du développement et les modèles d'équilibre général calculable. Une introduction à l'application de l'analyse mesoeconomique aux pays en développement.*" Montreal, Presses de l'Université de Montreal, **2001.** ,
- [10] Diamond, Peter A. "*Issues in Privatizing Social Security.*" MIT press, Cambridge Massachusetts, **2000.**
- [11] Edwards, S. and A. Edwards. "*Social security privatization reform and labor markets: The case of Chile.*" NBER Working Paper 8924, **2002.**

- [12] Garro, N., Meléndez, J., and E. Rodríguez Oreggia. “*Un modelo del mercado laboral mexicano con trabajo con o sin seguro social (IMSS)*”. Inter-American Conference on Social Security, **2002**.
- [13] Harris, John and Michael Todaro. “*Migration, Unemployment and Development: A Two-Sector Analysis*”. American Economic Review 60, **1970**.
- [14] Kotlikoff, Smetters and Walliser. “*Finding a way out of America’s demographic dilemma.*”, NBER Working Paper 8258. **2001**.
- [15] Lewis, W. “*Economic Development with Unlimited Supply of Labor.*” Manchester School, 22 : 139-191, **1954**.
- [16] Lofgren, Hans, Rebecca Lee Harris and Sherman Robinson. “*A Standard Computable General Equilibrium Model in GAMS.*” International Food Policy Research Institute, **2002**.
- [17] Petri, Gerardo Luis and Maximiliano Mendez Parra, “*The 2000 Social Accounting Matrix for Argentina*”, mimeo, **2005** .
- [18] Pizzati, Lodovico and Stefano Scapetta. “*Product and Labor Market Reform in an Economy with Rents, Bargaining and Informality.*” unpublished manuscript, **2005**.
- [19] Robinson, Sherman; Cattaneo, Andrea and El-Said, Moataz (2001). Updating and Estimating a Social Accounting Matrix Using Cross Entropy Methods. Economic Systems Research 13 (1): 47-64.
- [20] Terra, Maria Inés and Marisa Bucheli. “*The Effects of Increasing Openness and Integration to the MERCOSUR on the Uruguayan Labor Market: A CGE modeling analysis*”, PEP Working Paper, **2004**.

- [21] Valdés-Prieto. “*Social Security Coverage in Chile, 1990-2001.*” Background paper for regional study on social security reform. World Bank, Latin America and Caribbean Studies, **2002**.

## A Model characteristics: Labor markets

Our model is based on a standard computable general equilibrium model for an open economy, to which several changes were introduced. We will focus on these differences, stressing the importance of some particular equations.

Schematically, the main changes are the following:

- we introduce two different labor markets: **formal and informal labor**. The formal market is covered by social security and pays social security taxes. These taxes are paid both by firms and workers as a payroll tax. Relative demand for each labor varies between sectors.
- Labor supply is endogenous, allowing unemployment to increase. Formal sector equilibrium is determined by efficiency wages, which depend on the unemployment rate.
- Formal and informal relative supply of labor is related to a Harris-Todaro relationship of segmented labor markets. Again, the unemployment rate helps to determine this equilibrium.

In the following paragraphs, the issues about the labor market are explained in detail.

**Efficiency Wages:** Paying a wage premium in order to avoid shrinking is a widely used framework for non-competitive wage determination. The introduction in our model is based on the work of Annabi (2003), particularly on the Shapiro and

Stiglitz (1984) application. The 'no shrinking' condition on this model implies that efficiency wages in equilibrium satisfy the following equation:

$$w_f = ee + \left(\frac{ee}{qq}\right)\left(\frac{bb}{un} + rr\right) \quad (1)$$

in which  $ee$  is the effort disutility,  $bb$  is the exogenous probability of being laid off,  $qq$  is the probability of monitoring and detecting shrinking,  $un$  is the (endogenous) unemployment rate and  $rr$  is a discount rate.

This equation states that efficiency wages must cover the disutility of effort plus an additional amount. This is higher, the lower is the shrinking detection (when monitoring is difficult, incentives should be stronger), the higher is the probability of being fired (future payments are uncertain), the higher is the discount rate (future payments are less valuable) and the lower is the unemployment rate.

In our model, the only endogenous variable is the unemployment rate, given that all other determinants of efficiency wages are held fixed. It should be noted that efficiency wages are applied only to formal contracts. Several reasons can be given in this regard. Firstly, only in formal contracts can efficiency wages be implemented as a commitment; in informal relationships wages are flexible and future payments are not secured. Secondly, the informal sector, without adjustment costs, is frequently used as a buffer to face *transitory* demand shocks, while formal jobs are adjusted after *permanent* shocks. Thus, formal jobs are related to specific human capital, valuable to the firm, that can be preserved at a relative low cost, given the low firing and the commitment about future wages.

**Formal and informal labor equilibrium:** In the efficiency wage model, formal jobs enjoy high job security, are monitored, and paid efficiency wages. Informal jobs are paid competitive wages and have neither security nor adjustment costs. This situation generates a labor market segmentation in which getting a formal job is preferable than being an informal worker. Thus, unemployment is a characteristic

of the formal sector (which justifies the introduction of unemployment in the formal efficiency wage equation). The Harris-Todaro model of urban-rural labor market segmentation can be adapted to this framework. The HT equation,

$$w_r = w_u \frac{LD_u}{LD_u + UN} \quad (2)$$

shows that rural wages ( $w_r$ ) depend on the expected wage in urban sector, that is determined as the wage rate ( $w_u$ ) times the probability of getting an urban job. This probability is calculated as the proportion of jobs over total urban labor supply, considering that the unemployed are looking for urban jobs. This equation can be adapted to formal and informal sectors/jobs. The equation can be rewritten as:

$$w_i = w_f \frac{LD_f}{LS} \quad (3)$$

that states that informal wages equal the expected formal sector wage, considering that all laborers prefer and seek formal jobs. This equation, considering that labor demand equals labor supply in each segment, is added to our model as:

$$LSF_h = \left( \frac{LSF_h + LSI_h}{1 - un} \right) (1 + htpar_h) \frac{w_i}{w_f} \quad (4)$$

This notation implies that the HT equation must be satisfied by each representative household. Furthermore, given that informality differs among households, a parameter ( $tpar_h$ ) was introduced in order to maintain that difference. This parameter can be considered as a non explicit form of social security valuation: formal-informal wage gap depends on labor market segmentation and on the valuation among workers of the social security benefits. If these benefits are more relevant to workers, informal wages should increase in order to compensate for the disutility of lacking social security.

**Labor supply:** Labor supply was introduced following Annabi (2003). The



model imposes two restrictions on the variables: a maximum level of labor supply (thus, a minimum level of leisure) and a minimum level of consumption. Following Annabi (2003), labor supply is determined by the following equation:

$$\left(\frac{LSF_h + LSI_h}{1 - un}\right) = MAXHOUR_h - \left(\frac{ZETA}{(1 - zeta)w}\right)(CTH_h - \sum_j C_{MIN_{j,h}}PC_j) \quad (5)$$

This equation is defined for each representative household, while  $w$  represents the mean wage rate.

## B Model characteristics: Capital markets and government

The Social security reform simulation required that several closures of the model be changed, particularly in the capital market and in the government accounts. Capital supply is exogenous and is freely mobile across sectors. Nevertheless, the social security reform program collects pension funds that are invested in physical capital in a given proportion. This proportion is determined by two other allocations of these funds: public debt and fund fees. Thus, the proportion that is invested in physical capital is exogenously determined in the model by the parameter  $taop$ . The increase in physical capital is considered to be the perpetuity of annual funds, discounted at a rate  $rrr$ . In other words, long term impact is assessed. Thus, the capital supply equation is:

$$KS_i = KSO + \frac{(taop) \sum_i SSTFC_i}{rrr} \quad (6)$$

Pension reform reallocates a significant proportion of government income that is transferred to private accounts. This introduces a significant deficit in the social secu-

urity system. These transition costs can be financed by higher taxes or by public debt. To introduce these aspects in the model, government closure was changed. In fact, the government increased VAT rate in order to cover financial needs. Additionally, government can make use of a proportion of pension funds to finance transition costs, through public debt. Both sources of financing should maintain current government savings as fixed. In other words, transition costs should not affect the final result of the government accounts. Two special characteristics are relevant to the case of Argentina:

- The increase in tax collection is focused on VAT, coherently with the adjustment in Argentina.
- The proportion of social security taxes that is converted in public debt is an exogenous parameter that reflects government's regulation of pension funds.

This closure of the government has evident drawbacks. Improvements would take into account government debt, financial costs, limits to outstanding debt and an increase in interest rate when debt increases.