A Cost Frontier For Pension Funds in Argentina

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Abstract: During the last decade, Argentina has faced an extended process of reform of the Pension System. It had been implemented a mixed system with a private funds scheme (PFS) and a new public pay-as-you-go system. The main advantage of the reform was the introduction of incentives for efficiency and horizontal equity. The PFS was based on personal contributions; it addressed the effect of demographic changes improving age of retirement, and determined a defined contribution scheme plus a universal minimum public benefit. However, the experience shows that the PFS has high social costs, especially in wasteful marketing, and that the pension fund administrators (PFA) do not share the pressure of a competitive environment because regulations tend to generate similar portfolios.

The first aim of this paper is to estimate efficiency levels among PFA, using information from the actual management of PFA, and to argue that a new reform, if is it such the case, should be focused in the regulatory body. In this sense, a social planner concerned with the goal of maximizing the value of future pensions has to work in diminishing the commercial costs of the system, in inducing a better portfolio management, and in forcing less artificial product differentiation related to “client service”. Besides these aspects, in 2001 Argentina has suffered a strong macroeconomic crisis, with severe social impact, that ended with a huge devaluation at the beginning of 2002. This crisis has affected mainly the pension funds, and consequently the income of future retirees, because public bonds were (and still are) the most important part of the portfolio. Public debt was defaulted, and the former securities were replaced for new ones in a swap operation with a 40% “haircut”. Then, a second objective is to evaluate the relative efficiency taking into account the effect of the crisis.

We found that there is not a significant change in efficiency since the initial reform. This is probably related with the lack of competition of this industry. Moreover, we show that the macroeconomic crisis could not be considered a reason for this result, because its effects were transient.

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I. Introduction

In Argentina, between 1967 and 1994, there was a public, defined benefits pay-as-you-go system. An explanation of its characteristics and problems could be found in Delgado (1994) and Ferro (2003), among others. During the last decade, Argentina has faced a reform of the Pension System. In particular, it had been implemented a mixed system with a private funds scheme (PFS) and a new public pay-as-you-go system. One of the objectives of the reform was to deal with the problem of ageing that would make the old pay-as-you-go scheme under-financed. The main advantage of the reform was the introduction of incentives for efficiency and horizontal equity. It is not sure that these objectives have been achieved at present.

The PFS was based on personal contributions; it addressed the effect of demographic changes improving age of retirement, and determined a defined contribution scheme plus a universal minimum public benefit. However, the experience shows that the PFS has high social costs, especially in wasteful marketing, and that the pension fund administrators (PFA) do not share the pressure of a competitive environment because regulations tend to generate similar portfolios (Ferro, 2003). Consequently, firms do not have incentives to decrease costs in order to offer less commissions to contributors. In this context, some voices are claiming for new changes that, in some cases, imply a full restoration of some pay-as-you-go system.

The first aim of this paper is to estimate efficiency levels among PFA, using information from the actual management of PFA, and to argue that a new reform, if is it such the case, should be focused in the regulatory body. In this sense, a social planner concerned with the goal of maximizing the value of future pensions has to work in diminishing the commercial costs of the system, in inducing a better portfolio management, and in forcing less artificial product differentiation related to “client service”. Besides these aspects, in 2001 Argentina has suffered a strong macroeconomic crisis, with severe social impact, that ended with a huge devaluation at the beginning of 2002. This crisis has affected mainly the pension funds, and consequently the income of future retirees, because public bonds were (and still are) the most important part of the portfolio. Public debt was defaulted, and the former securities were replaced for new ones in a swap operation suffering a 40% “haircut”. Then, a second objective is to evaluate the relative efficiency taking into account the effect of the crisis.

Efficiency levels were estimated using econometric techniques and considering a stochastic frontier. A by-product of this paper is to help authorities to improve the regulatory system using information from the actual management of private pension funds. We found that there is not a significant change in efficiency since the initial reform. This is probably related with the lack of competition of this industry. Moreover, we show that the macroeconomic crisis could not be considered a reason for this result, because its effects were transient.

The paper is organized as follows. Section II presents a comparison between the public and private schemes in Argentina, and discusses different views and proposals to modify the regulation of the pension system. Section III describes the main aspects of the macroeconomic crises and its impact on the PFS. Section IV shows the main results of relative efficiency. Finally, Section V draws some conclusions.

II. A Description of the Argentine Pension System

Since July 15 on 1994 the new system (knowing as SIJP) has come into force in Argentina, has replaced the precedent one (whose acronym is SNPS). In order to simplify the exposition, previous pensions were called ex-SNPS. Since that moment on, SIJP comprises two
subsystems: individual fully-funded that is based on accumulation on pension funds managed by PFA, to obtain in the future a benefit called Ordinary Pension (JO), or pay-as-you-go, which provide a right to a benefit called Additional Benefit by Permanence (PAP). Both will receive a Universal Basic Benefit (PBU).

If the new affiliated of SIJP –in both subsystems- had contributed to SNPS; they will receive a Compensatory Benefit (PC). The Table 1 shows the structure of sources and applications of the present system.

The old system, new Universal Basic Benefit and the new pay-as-you-go, rises funds from a 12% employers contribution, plus a 11% employees (affiliated to pay-as-you-go), plus some general taxes. At the same time, fully-funded scheme is financed by a (currently) 7% contribution from employees (affiliated to fully-funded).

### Table 1: Resources and their use

<table>
<thead>
<tr>
<th>Sources</th>
<th>SIJP (fully-funded)</th>
<th>SIJP (pay-as-you-go) and Ex-SNPS Sources</th>
<th>Uses (*), SIJP (fully-funded)</th>
<th>Uses (*), SIJP (pay-as-you-go) and Ex-SNPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal contributions of dependent and autonomous that choice PFS (7% transitory, 11% legal).</td>
<td>Commissions PFA</td>
<td>Employers’ contributions of dependent and autonomous (12%)</td>
<td>JO</td>
<td>Survivors/invalidity pensions collective insurance (SIJP-Fully funded)</td>
</tr>
<tr>
<td>Others tributary resources</td>
<td>JO</td>
<td>Personal contributions of dependent and autonomous that choice SIJP (11%)</td>
<td>Survivors/invalidity pensions (Ex SNPS)</td>
<td>Other tributary resources</td>
</tr>
<tr>
<td></td>
<td>PBU</td>
<td></td>
<td>PAP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PC (if corresponds)</td>
<td></td>
<td>Pensions (Ex SNPS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Survivors/invalidity pensions (Ex SNPS)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own elaboration.

The reform improves the old system because of more restrictive benefit definition criteria, higher pension age and, in general, a more balanced relationship between benefits and contributions. Simultaneously, it took out resources from the government to PFA funds. The resulting deficit is associated with a reduction of contingent public debt, that is, a saving of pensions, which would correspond to whose elected fully funded system. In fact, the falling of implicit future debt was substituted with accumulation of present explicit debt, by means of purchasing of public bonds by PFAs.

When the reform was done, people could choose between the private and the public scheme. Initially, the reform was intended to absorb younger contributors into fully funded. In practice, the younger had chosen fully funded. There, the average age of contributors is around 40 years old. Instead, the majority of the elder workers chose to remain in the new pay-as-you-go system.

Benefits in the ex-SNPS are now over 3 million (the figure is lowering slowly), and 0.3 million in the SIJP (with majority of disabilities’ and survivors’ benefits). Benefits are higher in the SIJP, but some of the difference is devoted to the new Universal Basic Benefit.

The history of this system is one of an increasing dependence ratio (passive population/active population) and decreasing replacement ratio (average pension/average wage). That was a result of five facts: (i) adverse demography, given that Argentina has a low population growth rate and a relative high life expectancy (these impact increasing the dependence ratio); (ii) inflation and sub-indexation of benefits (decreasing replacement ratio); (iii) generosity of the benefits conceded in past years (a higher dependence ratio); (iv) privileged treatment for groups of the population (a greater dependence ratio); and (v) increasing informality in the
economy and difficulties in the system administration (implying a higher dependence ratio and a lower replacement ratio).

The new system was created emulating the Chilean experience. The underlying objectives were to avoid the incentive problems –little individual appropriateness of contributions, since the existence of implicit cross subsidies in the system- and to align the incentives of the participants (in order to participate and to contribute). Externalities in capital markets, in capital accumulation and in economic growth, were expected as by-products.

At the time of the reform, a fiscal gap was expected to last for several years, since the former system was mature (almost 10% of the Argentine population were pensioned). The old system was under-financed but it has to pay the awarded benefits. To address in part the deficit, the new legislation allowed that 50% of the pension funds’ portfolio could be constituted by public debt.

The process of the reform had had a very complicated political process that explains, partially, the complex structure of the system (Isuani, Rofman and San Martino, 1995).

**II.1. The Recent Debate in Argentina**

After one decade, many voices criticized the reform. Goldberg and Lo Vuolo (2002 and 2005) are representative of the more negative view, while FIEL (2005) gives a more optimistic vision, and Ferro (2004b) could be intended as a mixed vision.

Goldberg and Lo Vuolo (2005) consider that the more remarkable results of the reform - where 90% of contributors are in the PFS-, were:

1) Greater financial imbalance. In 1994, 66% of the benefit payments came from contributions to the social security, while in 2002 only 38% of the benefits were paid from the resources of the system. Almost the entire imbalance is currently financed with tax resources.

2) Poor coverage. The number of benefits paid by the system reached a maximum in 1997, and had fallen since then. The no-contributory benefits grew pari passu.

3) The new system did not stimulate participation. The level of regular contributors had been falling: in the public regime, from 69.91% in 1995, regular contributors passed over to 33.41% in 2003, and in the private scheme, from 53.36%, they dropped to 40.46% in the same period.

4) The real business was for the Pension Fund Administrators (PFA)⁴.

5) There was no positive impact neither in the development of capital markets, nor in the growth rate or in aggregate saving.

6) The new regime has created more fragmentation and unfairness.

In order to deal with each of the former arguments, some assertions are drawn below.

With respect to a greater financial imbalance, it was expected that this would happened, still with the levels of contributions at the moment of the reform (27% of the salaries). It was much more expected, when those levels were lowered to a current approximate 18% in average⁵. The salaries’ based contributions have been in part replaced with fiscal resources.

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⁴ In Argentina, they are known as AFJP (Administradoras de Fondos de Jubilaciones y Pensiones).

⁵ The 27% figure came from 11% contributed by employees and 16% by employers. The current 18% (roughly, because it varies in the territory) is formed by 7% contributed by employees and 11-12% by employers.
The coverage has fallen because the system is more demanding in the contributory system, and the age of retirement has risen. However, the coverage of the no-contributory system improved. Given the previous liberality to grant benefits (adopting forms like recognition of years of contributions by sworn declaration, and/or generous moratoriums and/or many special beneficiaries), it can be argued that the previous situation had many implicit no-contributory benefits between the contributory ones. Although is not possible to adjudge stigma effects associated to no-contributory benefits, having made the situation more transparent has a positive effect on the horizontal equity of the pension system.

The assertion that the new system did not stimulate the participation is too strong and it is contradicted by the very authors’ data. The fall in regular contributions in the new public pay-as-you-go system is 52%, whereas in PFS it was 24%. From another view, the ratio of regular contributors between fully-funded/pay-as-you-go was 76% in 1995 and grew to 121%. In this way, the evidence proves the opposite Goldberg and Lo Vuolo (2005) pointed out. In order to understand the global fall of regular contributions, unemployment increased from 9% at the beginning of the 1990s, to more than 20% at the beginning of 2000s. The path of underemployment followed similar results, and even today when the crisis is over, with unemployment between 10 and 12%, it is estimated that a half of the employment is immersed in black economy.

By the side of the PFA, it is arguable if it is true that they earn a lot of money\(^6\). In fact, they spent a lot of money. Capital markets did not expand, but the question is if the real problem was or not the crowding out of all other securities that exerted public bonds. The fiscal dominance in the 1990s and the 2002 public debt default, did not contribute with the by-product of a robust capital market like it was the case in Chile.

To conclude on the macroeconomic benefits of the reform exceed the aim of this work. In any case, given the repeated crises, to attribute responsibilities is quite difficult.

Finally, regarding a greater fragmentation and inequity, is possible to attribute responsibilities, to the growth of unemployment and informality. Those were consequence of combining appreciated real exchange rate with inflexible labour market, increasing public debt, confidence crisis, capitals flights, devaluation and default, that increase the poverty (measured by income).

How is the debate now, when the economy recovered from the severe crisis? It could be characterised as “frozen”. The more recent official proposal is MTSS (2003) (The so called “White Book of Social Security”), which is focused to reduce the uncertainty from future benefits. This scheme is oriented to reach closer relationships between contributions and benefits, through a new benefit computation method for public component. The proposed regime has two tiers. First, no contributory component that will be created, considering lower benefits and higher age of retirement than in contributory scheme. The second one is a multi-pillar contributory based and mandatory scheme, which will be public-defined benefits, private-defined contribution and have voluntary savings with fiscal advantages. Levels of contributions would be restored to 1994 figures. But administration changed and no news was heard.

The more critical view deserves a paragraph to summarise its proposal. The objective of Goldberg and Lo Vuolo (2005) is to modify the historical regressive tendency that has characterized the successive pension systems. If a basic pension payment is guaranteed to all people that reach a certain age and independently of each contributing record, a more

\(^6\) See SAFJP (2003) for an analysis of consolidated balance sheets.
progressive distribution path could be achieved (universal, uniform and unconditional), without consequences on labour effort incentives. In addition, a contributory pillar that considers the whole life cycle would be created in a NDC shape. The suggested floor for universal benefit is the level of poverty for passive population. No estimation of the cost of the proposal is given.

II.2. The Underlying Discussion at the World Bank

The World Bank had had a remarkable influence in the Chilean shape reforms in the Latin American region. Goldberg and Lo Vuolo (2005) denominate New Social Security Orthodoxy to the body of ideas arisen and spread from World Bank (1994). Such authors argue that one decade later, in the update of the original document, made in World Bank (2004), many ideas have been smoothed or reformulated in the light of the experience.

In World Bank (1994), the pay-as-you-go systems are characterized as unfair—in terms of horizontal, vertical and generational equity-, inefficiently managed, because its high cost and low returns, distortive—because of increasing imbalances, unsustainable labour taxes, free riding, moral hazard and benefit formulas that not stimulate savings and labour effort-, and politically problematic given populism and political risks involved.

The reform tries to separate saving of redistribution, to diminish the first function, and to maximize the second one. It is pleaded for a multi-pillar design (or multi-tier, as points Barr, 2000): the first pillar, public and no contributory (anti-poverty pillar); a second pillar of private mandatory fully funded, and the third pillar of voluntary savings.

As Goldberg and Lo Vuolo (2005) suggested, World Bank (2004) critically analyses some points of their former contribution (World Bank, 1994). The principal conclusions, between others, are that: (i) the new systems could not extend the coverage, which grew at the beginning but then flatted, (ii) there were improvements in income distribution in the decade and (iii) the reforms have contributed to create a new financial sector.

The document ties the low coverage to growth problems, and emphasizes that, in some places; the access to the anti-poverty pillar is very restrictive. The problems of the Argentine regime are attributed to a deficient regulation. Moreover, it highlights that the new systems have been expensive since the very beginning, although they are expected to cheaper since the launching costs became diluted. Thus, it recommends some reforms:

1) More attention is paid to the public pillar of poverty reduction and to the effort to lower costs of the private pillar administration, by adding greater competition and a better regulation.

2) The income replacement should rest mainly in individual savings.

3) The optimal size of the mandatory pillar depends on the level of development of the countries. Is not efficient to promote savings forever.

When the debt of pay-as-you-go system is too high, the “notional accounts”7 are accepted as alternative, and the pillar of mandatory savings is conceived as transitory. The news in the design is to made a distinction set between Pillar 0 and Pillar1. Pillar 0 is related to universal coverage, with independence of the contributing record.

There are three possible designs of the pillar of poverty reduction.

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7 Notional accounts refer to the new Swedish model, introduced in later 1990s, and known as NDC (Notional Defined Contributions).
1) A guaranteed minimum for those who have contributed for a determined time (Pillar 1).

2) Focused benefit for the elder poor that not fulfil the access requirements to the contributory system (Pillar 0).

3) Universal benefit for all the elder reaching a certain age (Pillar 1 + Pillar 0).

II.3. Chile

During the recent 2005 electoral campaign in Chile, which is the precursor of the reforms to private systems, the future of the paradigm regime was being discussed. Since the coalition in office won the elections and the new administration is established, there are expected changes in the system. The main definitions of the program of Michelle Bachelet’s government can be summarizing as:

“The protection of the elder’s income is the most elementary component of a social protection system... Unlike what happens with unemployment or diseases, aging is a certain risk... The success of the new system depends on its ability to generate fair and decent benefits”. The reform of 1980 has had three goals: to lift low value pensions, to address little coverage of independent workers and to cut deficits. “The first and second ones have not been achieved”. With respect to the third, rights to the precedent system were credited by a Recognition Bond, issued by the state and added to affiliates personal accounts. That fiscal obligation and the state warranty to minimum benefits had been bigger than the original estimates.

The coverage did not rise because, in the labour market, most of the workers do not follow the traditional path of formal employment over all adult life. Therefore, many workers have gaps in their contributions. Nowadays in Chile, open unemployment is relatively low (less than 10%), whereas 40% of workers do not contribute. It happens, partially, because labour market structure admits much different type of works, as well as the traditional work of complete journey. Many workers are affiliated, but because of the irregular character of its contributions –temporary, informal workers, young people with high turnover, or women who leave the market after giving birth-, and they could only obtain a minimum pension. They have not raised the required years of contributions. In Chile, a public guarantee for minimum pension exists, applying to those who do not get the right to acquire a floor value (officially set) of an annuity with their pension savings.

Although the current system in Bachelet’s program is criticized, it is affirmed in that programme that in order to correct failures is not necessary to replace it; instead of that, the need of some parametric reforms is recognised.

Furthermore, the new government will create a Reform’s Commission that will receive antecedents, testimonies and proposals from diverse actors. This Commission emphasizes the commitment of the government to consider all related agent, including the industry, experts and civil society. This Commission will have to present a report, including its proposal to ameliorate the quality and the equity of pension system. It has been promised that a law project will be presented in National Congress during second semester of 2006, which will consider the work of the Committee.

It must propose measures that increase the regularity and density of the contributions; the main obstacle is the scarcity of independent contributors (that have freedom to contribute

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8 Named “Concertación”, it comprises the Socialist Party, Christian Democrats, PPD (formerly a fraction of Socialist Party) and Radical-Social Democrats.
voluntarily). The other related problem is to reduce drastically the gaps of dependent worker’s contributions, especially women and young people. Also, it is wanted to elevate the ratio of replacement of women’s income and of workers of lower levels of income.

In order to elevate the yield of the contributions in the Pension Fund Administrators (PFA), it is fundamental to identify measures that allow reducing administrative costs and the commissions that those receive, and also, that allow increasing competition in the system and to generate better returns to the funds without putting in stress its risk levels.

The reform sets out to structure a "Solidarity Pillar", which represents "...the minimum security and standards that the society guarantees to its less lucky members...” The government has set as an objective granting the right to receive automatically a no contributory pension to adults elder than 65 years, and to handicapped persons without income.

In parallel, in recent presentations, the Superintendent of Pensions has shown a first draft of the reform designed in the Superintendency of PFA (SAFP, see www.safp.cl). Its main purpose is “the combination of protection with incentives”. It comprises three issues: coverage, competition and investments.

Regarding coverage, it could be emphasized a universal right to basic pension, a minimum pension -graduated according to the contribution years-, genre equity and contribution by independent workers by means of their annual income tax statement.

With respect to competition, the project support the suppression of fixed commissions (as it was done in Argentina); promotion of the supply of new substitutes (In Chile, unlike in Argentina, banks are excluded from the pension administration business, and a public PFA does not exist either); bidding of “undecided” contributors as a form to increase demand elasticity. It was proposed a global bidding of the disability and survival insurance (giving more incentives to cover people with low income). Temporary downgrade of embroiders requirements for new entrants (in order to improve the competition) and temporary extension of minimum and maximum returns for newcomers were proposed.

And finally, about investments, to allow a greater flexibility of the investments regime and risk based supervision.

III. The (More) Recent Macroeconomic Crises and Its Impact on the PFS

Since its creation on 1994, the regime has suffered many regulatory changes. Between 2000 and 2001, there were some changes in the operation and the contribution rate was temporally diminished. By the ending of year 2001, Argentine economy fell into an acute financial crisis that causes the default of public debt, which included assets in PFA’s portfolio. At the begging of 2002, a lot of economic changes have occurred, such as: a devaluation; public bonds in PFA’s portfolios, originally denominated in US Dollars were changed by Peso denominated bonds at an arbitrary parity. The public debt was also in default, until a swap

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9 Some people do not choose any PFA at all. The regulation allows the SAFP to transfer them a PFA. By means of some kind of a bid, the PFA could compete by the undecided, lowering the commissions.

10 The process was baptized as “Pesificación”, which refers to the compulsive change of deposits and bonds denominated in Dollars to Pesos, using an exchange rate of AR $ 1.40 plus an adjustment clause based in the CPI, called CER. The exchange rate prior to the devaluation of January 5th, 2001 was AR$ 1 = US$ 1. The exchange rate went to AR$ 4 = US$ 1 in July, but ceded afterwards. Currently is around AR$ 3 = US$ 1. The Dollar denominated deposits and bonds were the rule, not the exception, before the devaluation.
process concluded on June 2005. The new instruments replaced the old ones, currency
denomination changed in the majority of the bonds, and a “haircut” of more than 40% was
applied on bonds held by PFA. A special accountancy treatment allowed the portfolios to
remained in nominal terms with the condition of maintaining the bonds to maturity. So the
portfolios did not reflect the impact of the “haircut”.

The next three subsections are organised as follows. In the first one, macroeconomics
conditions are presented; the second subsection describes the regulatory changes in this sector
since last crisis, and finally, a summary of debt restructuring and its consequences is
presented.

III.1. The Macroeconomic Landscape

This subsection follows Chisari and Ferro (2005). After almost eleven years of currency board
and pegged exchange rate, the economy experienced a huge devaluation and a generalized
default on financial contracts, both domestically and at the international level. Since the end
of 2001, Argentine economy had been experienced a dramatic crisis; the problematic
devaluation was followed by a 12% fall of GDP and a rise of the rate of unemployment to
24% (far from the 6% of the eighties and 15% of the nineties).

Uncontrolled public expenditure, uncontrolled roll over of debt, overvaluation of exchange
rate and incapacity to deal with changing conditions of foreign capital markets have been
advanced as possible explanations.

Economic instability is not news for Argentina. In 1989 and 1990 Argentina suffered two
hyperinflationary episodes (CPI increased 4923% in the first episode, and 1343% in the
second; GDP fell –6.2% in 1989, and grew only 0.1% in 1990), and the rate of unemployment
reached the unusual rate –for the country tradition- of 9%. Between both crises, a new
government was appointed and a liberal economic program was announced. The new program
included elimination of subsidies to state owned enterprises, liberalization of prices,
elimination of barriers to capital account movements and opening to private sector
participation in infrastructure.

From 1991 on, the cornerstone of the program was the “Convertibility Rule”. It attained price
stability by pegging the national currency to US Dollar on a one-to-one basis, and allowing
Dollar denominated contracts.

Appreciation of local currency followed the “Convertibility Rule” due to the simultaneity of
stabilization and capital inflows, in an international environment of low interest rates. In the
following years –with the exception of the Tequila Crisis episode in 1995- the economy grew
at high rates but also did unemployment. Structural change of the economy, increasing wages
in Dollar terms and reductions in technical labour requirements (due to technological change)
were among the reasons that explained the new phenomenon. The low Country risk premium
reflected the growing optimism on the evolution of the economy and fostered investments. By
the late nineties, however, it became clear that new investment projects exhibited low rates of
return (appreciation of Peso and crowding out of private sector of the financial markets were
basic reasons).

By 1996 the country was again showing positive growth rates, and the rate of unemployment
fell. But since 1995 on, it never again went below 12%.

Unemployment and underemployment were followed by poverty growth. A new-
impoverished class emerged: middle urban class people, displaced from the job market and
hardly adapted to the new human capital requirements. Rigidity of labour markets and
employment regulations and costs - heritage of the older organization of the economy-, were also part of the explanation.

Peso appreciation reduced the profitability of projects in the tradable sector, while the expected gains of opening to international trade were becoming a reality but at a slow speed (moreover inflation of non tradable prices was observed, so relative prices were changing in the wrong sense).

The combination of the loss of confidence of markets on the ability of the administration to deal with the crisis, the imminent expiration of a high proportion of public debt, and the growing influence of opposition parties ended in an economic, social and political chaotic crisis.

III.2. Sector Regulatory Changes Before and During the Crisis

Following Ferro (2004b), this section describes the more important developments in the period 2000-2001.

One of the developments was the way to assign undecided affiliates between PFA. In the former arrangement, those who joined the mixed system and did not choose any PFA, after a legal period of time, were assigned to a PFA according to an administrative procedure. In addition, they needed a minimum of contributions to shift from one PFA to another (twice a year the possibility is open). Now, they are assigned to the cheaper PFA with geographic coverage in the place where the contributor lives; and the restriction of a minimum of contributions was eliminated.

Besides, fixed commissions were eliminated. Nowadays, when the commissions corresponding to the insurance cost can be paid from funds’ balance even in the absence of a regular contribution, and a new commission in line with better performance in profitability of the funds was opened, but it remains suspended by decree.

In order to reduce insurance costs, general conditions of collective insurance policy of survivors and invalidity was also modified, and so the base of coverage, is now defined as a function of the claims by PFA.

Within the portfolios, trusts of financial derivates, private equity funds and mortgage funds have been admitted. In addition, the Fluctuation Fund\textsuperscript{11} was changed. By using the Fluctuation Fund, excess or failures of maximum or minimum in the band were punished and the band kept profitability of all administrators around an average (Inducing “Herd Behaviour”).

Reserve requirements to PFA were reduced from 2% to 1% of the fund, or AR $ 1.5 million (US$ 0.5), the greater. If the PFA is paying benefits in advance (because of a delay in the bureaucratic process of awarding the pension), those payments could be computed as part of the reserve requirements.

With respect to personal contributions, they were transitorily reduced from 11% of salaries to 5% at the end of 2001. In March 2003, they were elevated to 7%, and in an indefinite future are expected to return to the legal level of 11%.

During the crisis, required grades of PFA instruments to qualify for the portfolio were reduced.

\textsuperscript{11} It was made with excess return over the 130% of the average profitability. One of its uses was to cover underperformance in profitability, when it yields below 70% the average profitability. The superior bound of the profitability band was eliminated in the 2000’s reforms.
The contracting of Dollar denominated Annuities (which were the rule) was also suspended. In addition, awarded annuities were converted to Argentine Pesos. This operation affected also, the contracts of Programmed Retirement.


The title of the section is complex in itself; the real process was more than complex, it was Kafkian.

Government securities passed from 55% in portfolio in June 2001 to over 75% in June 2002. When the definitive swap process finished, in June 2005, they represented 58% of the portfolio. The way to reach these values is shown in Box 1.

Box 1: The impact of the macroeconomic crisis on PFAs’ regulation: A chronology

- November 30, 2001. First swap of public debt bonds into “Guaranteed Lending”. The “playpen” (“corralito”): a regulation intended to avoid a bank crash was introduced forbidding the bank deposits refunding.
- December 5, 2001. Forced subscription of Treasury Bonds with certificates of deposits at their maturity.
- February 3, 2002. “Pesificación” of banking deposits locked in the “playpen” at an exchange rate of AR $ 1.40 per dollar. At the same time, Dollar denominated banking lends were converted to Pesos at an AR $ 1 = US $ 1 rate.
- March 8, 2002. “Pesificación” of Dollar denominated government securities (national, provincial and municipal) at an exchange rate of AR $ 1.40 per dollar plus CPI indexation by the clause known as CER.
- April 15, 2002. Accountant revaluation (in Pesos) of public debt part of the portfolios -“Guaranteed Lending”-, to reflect the 40% devaluation of the local currency.
- August 7, 2003. As a response to a claim from the PFAs –in the sense of maintaining the Dollar value of the portfolios, in a context of continuous devaluation of the Peso-, the old defaulted public securities, denominated in Dollar, replaced the newer “Guaranteed Lends”. The accounting value was unchanged until the conclusion of the swap of the entire defaulted debt.
- June 6, 2005. Restructuring of public debt. The PFA received new issued securities in exchange of the older defaulted ones.

After the swap, National Government Securities represented 58% of portfolio. Of them, 60.13% corresponded to Government Securities to Maturity, which are nominally valued with the commitment of maintaining them in the portfolio; 21.45% were Non Guaranteed Negotiable Securities, with market valuation; and the remaining 10.08% were Guaranteed Lending to National Government.

The swap involved old securities, denominated in Dollar (mainly), Euros and Pesos for US $ 17,330 millions; and in exchange the PFA received new securities –mainly in Pesos- valued in US $10,126 millions. Therefore, the nominal “haircut” was 41.56%. But the loss was not recorded because a 70% of new instruments are accounted at book values until maturity. The remaining 30% of the new bonds will be gradually negotiable, and the market value will be the reference. See Table 2 for a summary.
Table 2: The Swap of Public Debt on June 2005 and PFA’s Portfolios
(in millions, except indication in contrary)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Old bonds</th>
<th>New bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Securities in US$</td>
<td>US$ 15400</td>
<td></td>
</tr>
<tr>
<td>Securities in Euros</td>
<td>€ 1400</td>
<td></td>
</tr>
<tr>
<td>Securities in Pesos</td>
<td>AR $ 700</td>
<td></td>
</tr>
<tr>
<td>Quasi Par in Pesos</td>
<td>AR $ 23010</td>
<td></td>
</tr>
<tr>
<td>Boden 2014 in Pesos</td>
<td>AR $ 3540</td>
<td></td>
</tr>
<tr>
<td>Discount in Pesos</td>
<td>AR $ 2655</td>
<td></td>
</tr>
<tr>
<td>Discount in US$</td>
<td>US$ 295</td>
<td></td>
</tr>
<tr>
<td>Value in Pesos</td>
<td>AR $ 51464</td>
<td>AR $ 30075</td>
</tr>
<tr>
<td>Value in US$</td>
<td>US$ 17330</td>
<td>US$ 10126</td>
</tr>
<tr>
<td>Value in Euros</td>
<td>€ 14322</td>
<td>€ 8378</td>
</tr>
<tr>
<td>Percentage of “haircut”</td>
<td></td>
<td>41.56%</td>
</tr>
</tbody>
</table>

Note: Exchange Rate AR $ 2.97 = US$ 1, AR $ 3.59 = € 1, US$ 1.21 = € 1
Source: Own elaboration.

IV. PFAs’ Relative Efficiency

Efficiency measures are an important tool for regulators in infrastructure industries (utilities), showing how much a firm can rise its output without using more inputs. The estimates of efficiency measures could be indicative tools to improve regulation.

IV.1. Methodological Aspects

Technological frontier studies can be classified according to the specification and estimation methodologies. Focusing on specification, the problem can be approached from two different views: the production function and the cost function. The production function shows the output as a function of inputs, while the cost function shows the total cost of production as a function of output and input’s prices.

One advantage of the cost function over the production function approach is the flexibility to adopt different specifications, particularly in the cases when the firm produces more than one product. Moreover, estimation of production function allows obtaining a measure of technical efficiency, but ignores allocative efficiency problems. Estimation of cost frontiers, on the other hand, gives information on cost differentials due to technical and allocative inefficiencies.¹²

Both, production and cost functions estimates can be obtained using statistical or mathematical programming methods. Non-statistical methods estimate frontiers (which can be parametric or non-parametric) without assumptions on the form of the distribution of the error term. The estimates, as a result, have no statistical properties, making it impossible to test hypothesis. In the case of estimates using mathematical programming, the frontier can or not be specified as a parametric function of inputs. The main advantage of non-parametric methods (also known as Data Envelopment Analysis or DEA for short), is that no a priori functional form is imposed to the data. The main disadvantage, is that to estimate the frontier it uses only a subset of the available data (those actually determining the frontier), while the rest of the observations are ignored.

¹² To separate these two effects it is necessary to formulate some additional assumptions.
Once a decision is made on which type of frontier -costs or production-, is it going to be estimated, and which technique -statistical or mathematical programming-, is to be used, the following step is to decide on whether a deterministic or stochastic frontier is to be used. If a deterministic approach is chosen, all observed difference between a particular firm and the frontier is attributed to inefficiency. It is ignored the possibility that the performance of a firm might be affected not only by its own efficiency, but also by factors beyond its control (such as adverse climate conditions). An additional disadvantage of deterministic estimates is the high sensibility to outliers. A single outlier observation can have strong effects on the results. Moreover, increasing the size of the sample cannot solve the problems associated with the “outlier problem”.

In traditional cost analysis the problem faced by the firm is to minimize total costs subject to delivering a given level of output. The solution to this problem generates an optimal set of inputs, which depend on output level and input prices. In the same way, it is possible to estimate the cost function of the firm, which depends only on output level and input prices.

The resulting cost model specification is given by: $C = f(Y, Z, P_L, P_K)$


The most common specification is the Cobb-Douglas function where the inefficiency terms ($\varepsilon$) enters the model as a multiplicative factor (which turns into additive in the logarithmic form):

\[ C = A P_L^{\beta_1} P_K^{\beta_2} Y^{\gamma_0} \Pi_i Z_i^{\gamma_i} \exp^\varepsilon \]

Applying logarithms to both sides we obtain:

\[ c = \alpha + \beta_1 \ln P_L + \beta_2 \ln P_K + \gamma_0 \ln Y + \sum_i \gamma_i \ln Z_i + \varepsilon \]

where $\beta_i$ and $\gamma_i$ are parameters to be estimated and small cases represent logarithms of the variables in [1] (levels in capital letters).

The systemic part of the model determines the minimum achievable cost with a given set of outputs and environmental variables, and it is known as the cost frontier. According to the deterministic approach, the stochastic part of the model is completely include in the (in)efficiency term. Given that actual costs cannot, by definition, be lower than the frontier cost, the error term cannot be negative. Conceptually, the cost function defines a frontier, which envelops the technically feasible costs associated to particular sets of inputs and environmental characteristics.

The firm with the min($\varepsilon_i$) will be 100% efficient. For this firm $\varepsilon_i$ is zero and therefore $\exp(\varepsilon_i)$ equals one. The larger the inefficiency of a particular firm $i$ the term $\varepsilon_i$ will be larger and the resulting efficiency measure closer to zero.

Two alternative strategies for estimating stochastic frontiers can be used: Modified Ordinary Least Squares (MOLS) and Maximum Likelihood (ML). Estimates using MOLS require the formulation of an assumption regarding the distribution of the error term. Several distribution forms have been proposed such as half-normal, exponential, beta and gamma. The procedure has two steps. First the slope parameters are estimated with Ordinary Least Squares OLS and then the constant is modified displacing it in a magnitude equal to the average $\varepsilon_i$, which is calculated using the moments of the residuals of the OLS. The OLS residuals are modified in the opposite direction and used to calculate the efficiency measure of each one of the firms in the sample. This strategy does not guarantee that the efficiency measure is in the 0-1 range.
In the case of stochastic frontiers, the cost function is similar to the one presented in (1') only that now the error term \( \varepsilon \) is no longer equal to inefficiency but is decomposed into two terms:

\[
\varepsilon_i = u_i + v_i,
\]

where \( u_i > 0 \) and \( v_i \) is not restricted. The \( v_i \) term captures the effects of statistical noise and are assumed to be independently and identically distributed with an \( \text{N}(0,\sigma_v^2) \). The \( u_i \) error term represents cost inefficiency and is assumed to be distributed independently of the \( v_i \) and the regressors. Several functional forms have been proposed for the inefficiency term: half-normal, truncated normal, Gamma and exponential. The most common distribution used in empirical tests is the half-normal.

### IV.2. The Estimation

About efficiency frontiers in pension funds, the more direct precedent is Barrientos and Bousoffiani (2001), for Chile. There are a lot of good quality research applying efficiency frontiers –both econometric and mathematics programming ones-, related with utilities regulation (See Coelli et al, 2003, for a survey).

The database was created basing on previous works about the cost function of this sector, mainly in Ferro (2003). Some previous work could be found in Braberman \textit{et al} (1998) and Valdés Prieto (1999). The correlation matrix could be seen at Table 3.

**Table 3: Correlation matrix.**

<table>
<thead>
<tr>
<th></th>
<th>APOR</th>
<th>AFIL</th>
<th>PROM</th>
<th>EMPL</th>
<th>SUCU</th>
<th>TPOS</th>
<th>RENT</th>
<th>FOND</th>
<th>SALA</th>
<th>GADM</th>
<th>GCOM</th>
<th>CTOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOR</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFIL</td>
<td>0.98</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROM</td>
<td>0.78</td>
<td>0.67</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMPL</td>
<td>0.78</td>
<td>0.67</td>
<td>0.99</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUCU</td>
<td>0.36</td>
<td>0.31</td>
<td>0.53</td>
<td>0.52</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPOS</td>
<td>0.77</td>
<td>0.68</td>
<td>0.87</td>
<td>0.88</td>
<td>0.36</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>TNEG</td>
<td>0.83</td>
<td>0.77</td>
<td>0.83</td>
<td>0.83</td>
<td>0.28</td>
<td>0.92</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RENT</td>
<td>-0.03</td>
<td>0.02</td>
<td>0.00</td>
<td>0.03</td>
<td>-0.12</td>
<td>0.01</td>
<td>-0.04</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOND</td>
<td>0.79</td>
<td>0.86</td>
<td>0.40</td>
<td>0.41</td>
<td>0.25</td>
<td>0.49</td>
<td>0.56</td>
<td>0.10</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SALA</td>
<td>0.89</td>
<td>0.87</td>
<td>0.79</td>
<td>0.81</td>
<td>0.30</td>
<td>0.82</td>
<td>0.86</td>
<td>0.12</td>
<td>0.73</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GADM</td>
<td>0.89</td>
<td>0.92</td>
<td>0.68</td>
<td>0.68</td>
<td>0.35</td>
<td>0.67</td>
<td>0.73</td>
<td>0.15</td>
<td>0.87</td>
<td>0.91</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>GCOM</td>
<td>0.69</td>
<td>0.57</td>
<td>0.77</td>
<td>0.78</td>
<td>0.22</td>
<td>0.78</td>
<td>0.78</td>
<td>-0.03</td>
<td>0.24</td>
<td>0.67</td>
<td>0.47</td>
<td>1.00</td>
</tr>
<tr>
<td>CTOT</td>
<td>0.92</td>
<td>0.89</td>
<td>0.82</td>
<td>0.83</td>
<td>0.32</td>
<td>0.84</td>
<td>0.88</td>
<td>0.11</td>
<td>0.73</td>
<td>0.99</td>
<td>0.92</td>
<td>0.73</td>
</tr>
</tbody>
</table>


Source: Own elaboration based on SAFJP data. See <www.safjp.gov.ar>

A dummy took into consideration the regulatory changes from 1997 on, which consisted basically in banning the “address sale” that was practiced by promoters\(^{13}\). Since 1998, the transfer only could be processed in a branch, which –as it was said- has a more flexible -and cheaper- shape. The employment of promoters decreased abruptly in 1998 as a result of the

\(^{13}\) This was the origin, as in Chile some years before, of spurious transfers of affiliates, that increase the system costs. The new regulation tended to avoid those abuses.
new regulation. The regulatory dummy and the total costs have a low correlation, but the dummy was significant and obtained the expected sign in the estimations.

The second dummy seeks to establish whether the 2002 macroeconomic crisis represented a structural change over the system costs. It has a low positive correlation of 0.2 with total costs, but it is significant in the estimations.

In practice, the estimation of cost function is not as simple as the theoretical model implies. The main conceptual problem is to identify within this set of variables which one (or ones) are the output. We discard the possibility of treating PFAs as multi-product firms given that the different possible variables cannot be separately sold and/or priced. For example, once the number of affiliates is identified as the product, the administered funds cannot be sold separately. Given that once a product is chosen, the rest of the variables can be introduced in the model as firm specific characteristics to allow inter firm comparisons.

The estimation of a Cobb-Douglas cost function requires data on input prices, included the price of capital input. However, this information is very difficult to obtain. This problem is very usual in the literature and the usual way is the formulation of an arbitrary cost function, without including the price of the capital input. In our case we prefer to estimate a cost efficiency function, and therefore we eliminate the remaining input price (lnSALA).

There were estimated two different models of cost efficiency.

Model 1  \[ \ln\text{COST} = \alpha + \beta \ln\text{FOND} + \gamma_0 \ln\text{PROM} + \gamma_2 \ln\text{TPOSLAG} + \gamma_3 \text{CRIS} + \gamma_4 \text{REGU} \]

Model 2  \[ \ln\text{COST} = \alpha + \beta \ln\text{FOND} + \gamma_0 \ln\text{PROM} + \gamma_1 \ln\text{SUCU} + \gamma_2 \ln\text{TPOSLAG} + \gamma_3 \text{CRIS} + \gamma_4 \text{REGU} \]

In Table 4 are presented the results of both estimations.

<table>
<thead>
<tr>
<th>Dependent variable: lnCTOT</th>
<th>Model 1 Coefficients</th>
<th>t-stat</th>
<th>Model 2 Coefficients</th>
<th>t-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnFOND</td>
<td>0.430***</td>
<td>10.33</td>
<td>0.436***</td>
<td>10.04</td>
</tr>
<tr>
<td>lnPROM</td>
<td>0.341***</td>
<td>4.88</td>
<td>0.250***</td>
<td>4.94</td>
</tr>
<tr>
<td>lnSUCU</td>
<td>-0.078**</td>
<td>-2.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lnTPOSLAG</td>
<td>0.157***</td>
<td>3.90</td>
<td>0.171***</td>
<td>4.32</td>
</tr>
<tr>
<td>CRIS</td>
<td>-0.464***</td>
<td>-6.78</td>
<td>-0.460***</td>
<td>-6.26</td>
</tr>
<tr>
<td>REGU</td>
<td>-0.467***</td>
<td>-4.71</td>
<td>-0.590***</td>
<td>-7.75</td>
</tr>
<tr>
<td>cons</td>
<td>-2.307***</td>
<td>-11.47</td>
<td>-2.063***</td>
<td></td>
</tr>
</tbody>
</table>

Note: ***: 1% significance, ** 5%, * 10%. Number of firms 142, R²= 0.95, F statistics

Source: Own elaboration.

Efficiency figures are calculated on basis of both models. The slope parameters are all significant at the usual levels of confidence. The annual figures obtained were averaged to obtain the final score (Figure 1).
The impact of the huge macroeconomic crisis can be clearly observed in Figure 1. A very low average efficiency of the system in 2002 and a fast recovery to the average efficiency the following year. This result shows that the fall was not permanent. In order to explain the change of efficiency along the period, that it is very common after reforms in regulated sectors, we found that average efficiency has not changed significantly in this ten-year period.

Table 5 shows average efficiency by PFA. There are not differences in ranking when comparing both models. Model 2 gives lower levels of efficiency for most of the PFAs.

<table>
<thead>
<tr>
<th>PFA</th>
<th>Model 1</th>
<th>Ranking</th>
<th>Model 2</th>
<th>Efficiency</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFA_01</td>
<td>0.816</td>
<td>13</td>
<td>0.850</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>PFA_02</td>
<td>0.897</td>
<td>3</td>
<td>0.912</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>PFA_03</td>
<td>0.807</td>
<td>15</td>
<td>0.846</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>PFA_04</td>
<td>0.754</td>
<td>19</td>
<td>0.806</td>
<td>19</td>
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<tr>
<td>PFA_05</td>
<td>0.820</td>
<td>12</td>
<td>0.854</td>
<td>10</td>
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<tr>
<td>PFA_06</td>
<td>0.729</td>
<td>20</td>
<td>0.787</td>
<td>20</td>
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<tr>
<td>PFA_07</td>
<td>n.a.</td>
<td>n.a.</td>
<td>0.617</td>
<td>23</td>
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<tr>
<td>PFA_08</td>
<td>0.906</td>
<td>2</td>
<td>0.918</td>
<td>1</td>
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<tr>
<td>PFA_09</td>
<td>0.794</td>
<td>16</td>
<td>0.847</td>
<td>14</td>
<td></td>
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<tr>
<td>PFA_10</td>
<td>0.808</td>
<td>14</td>
<td>0.844</td>
<td>16</td>
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</tr>
<tr>
<td>PFA_11</td>
<td>0.891</td>
<td>4</td>
<td>0.906</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>PFA_12</td>
<td>0.866</td>
<td>7</td>
<td>0.884</td>
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<tr>
<td>PFA_13</td>
<td>0.866</td>
<td>6</td>
<td>0.910</td>
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<tr>
<td>PFA_14</td>
<td>0.766</td>
<td>17</td>
<td>0.809</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>PFA_15</td>
<td>0.915</td>
<td>1</td>
<td>0.902</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>PFA_16</td>
<td>0.833</td>
<td>9</td>
<td>0.872</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>PFA_17</td>
<td>0.824</td>
<td>11</td>
<td>0.849</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>PFA_18</td>
<td>0.558</td>
<td>21</td>
<td>0.774</td>
<td>21</td>
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</tr>
<tr>
<td>PFA_19</td>
<td>0.829</td>
<td>10</td>
<td>0.851</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>PFA_20</td>
<td>0.862</td>
<td>8</td>
<td>0.883</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>PFA_21</td>
<td>0.762</td>
<td>18</td>
<td>0.807</td>
<td>18</td>
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</tr>
<tr>
<td>PFA_22</td>
<td>0.882</td>
<td>5</td>
<td>0.898</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>PFA_23</td>
<td>0.505</td>
<td>22</td>
<td>0.759</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own elaboration

As can be observed, the efficiency ranking of Model 1 and Model 2 is not very different.
In the following graph (Figure 2) we present efficiency scores by PFA and year for the six bigger (in terms of affiliates and funds) PFAs. All of them have gone down through the crisis. The rest of PFAs have had a similar behaviour in terms of efficiency.

![AFJP Efficiency by year](image)

**V. Conclusions**

The reform of the pension fund system in Argentina in 1994, was aimed to prevent population ageing consequences (which are alike all over the world), and some specific problems of local pay-as-you-go scheme, more or less common in Latin American Countries. The reform improves the old system because of more restrictive benefit definition criteria, higher pension age and, in general, a more balanced relationship between benefits and contributions. But it introduced a serious financial imbalance and the reality of labour market implies that coverage of the contributory system is low and with no traces of improvement.

In 2002 a huge macroeconomic crisis, with a 75% devaluation of local currency, default in public debt, 12% loss in the GDP, and an unemployment rate rising up to 24%, affected the PFS. Public debt was swaped, with a 40% “haircut” on June 2005. Regulation prevented the recognition of the losses in the account records.

Efficiency levels of the more important PFA had until a 25% drop in the year of the crisis. But in 2003 those levels recovered to pre-crisis figures. Before that, a regulatory reform to lower costs and to avoid wasteful affiliates transfers, implied until a 12% drop of efficiency levels of the more important PFA, but its effect was also transient.

Efficiency levels are more or less constant throughout the years (with the exception of the 1998 new transfer regime, and 2002 of macroeconomic crisis). It is also remarkable that the rankings remained more or less the same, and the efficiency differences between PFA also remained.

Regulation of PFA is different from utilities regulation, where price caps are commonly set up. It is not clear that price caps are an alternative to this industry. But the cost frontiers estimation could shed light on the task of regulators, pointing to which problems are to be

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14 Because of lower population growth rate and higher expectancy of life, ageing is a problem in the Southern cone of South America (Uruguay, Chile and Argentina), but not yet in some other Latin American countries. Informality in the labour markets is more extended.
solve, and which reform are to be introducing, having in mind the objective of the system: to replace incomes in the old age.

VI. References


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Appendix I. Productive Efficiency: Basic Concepts

Efficiency measures were originally introduced by Farrell (1957). Let’s assume an industry using 2 inputs $X_1$ and $X_2$ to produce a single output $Y$ with a production frontier $Y = f(X_1, X_2)$. This function shows the maximum amount of output that can be obtained by the given set of inputs. If we also assume that $f(X_1, X_2)$ is homogenous of degree one, the technological frontier can be characterized by the unit isoquant (YY in figure 1). Inputs can be measured in output terms $X/Y$. Assuming inputs are bought in competitive markets, the relative price is represented by the slope of the isocost bb, and the firm minimizes costs for one unit of output in E, where the marginal technical substitution rate equals the relative price of inputs. By definition, no firm can operate under YY.

Let’s consider a firm producing at R. This firm is inefficient on two grounds. Firstly, it is operating in a point over the unit isoquant and secondly, it is not using the optimal input combination. Note that the firm in Q has the same input mix that in R using only a fraction $OQ/OR$ of each input (or in other words produces $OR/OQ$ times more output with the same amount of inputs). The ratio $OQ/OR$ is therefore a measure of the technical efficiency of R.

Nevertheless, E and not Q is the optimum production given that although both points represent a 100% technical efficiency, production costs at E are a fraction $OP/OQ$ of the costs at Q (cost of producing at P is the same than in E). The ratio $OP/OQ$ is a measure of allocative efficiency.

Summing up, productive efficiency is the ability of the firm to produce at minimum cost. To achieve minimum costs the firm must use inputs in the most efficient way (technical efficiency) and choose an input mix for which the marginal rate of technical substitution (i.e. the rate at which inputs can be substituted keeping production constant) equals the relative price of inputs (allocative efficiency):

$$\text{Productive efficiency} = \text{Allocative efficiency} \times \text{Technical efficiency}$$

And in terms of figure A1.1: $OP/OR = (OP/OQ) \times (OQ/OR)$

The measure of productive efficiency adopts values between zero and one with one denoting a firm that is 100% efficient. These measures are defined under the assumption that the production frontier or efficient production function is known. There are basically two possibilities: theoretically defined production function (based on engineering knowledge of the process of the industry) and an empirical function constructed on estimates based on observed data. The usual practice for regulatory purposes is to analyse individual performance in relation with best-observed practice rather than comparing with an ideal practice (which is generally unobtainable). In this work, we will consider that the efficient production function is represented by the best-observed practice among the firms in the sample.