The private pension system’s contribution to Latin American economic development

Experiences of Colombia, Mexico, Chile and Peru

A study carried out by SURA Asset Management
This publication is a contribution from SURA Asset Management towards the analysis and knowledge of pension management systems in Latin America.

With this aim in view, distinguished economists from Colombia, Mexico, Chile and Peru have worked for over six months on a quantitative assessment of the macroeconomic effects of the pension reform in each country, estimating the impact of the creation of the individually-funded systems on the growth rate and the level of the GDP through four main channels: saving and investment; employment structure and labour productivity; capital market development and efficiency; and the evolution of total factor productivity.
The private pension system’s contribution to Latin American economic development

Experiences of Colombia, Mexico, Chile and Peru

Coordinator
Rodrigo Acuña, Chile

Heads of Research
Leonardo Villar, Colombia
Alejandro Villagómez, Mexico
Rodrigo Fuentes, Chile
Pablo Secada, Peru

Study carried out by SURA Asset Management
The private pension system’s contribution to Latin American economic development. Experiences of Colombia, Mexico, Chile and Peru.

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The favourable economic conditions that exist in the countries of Latin America provide the opportunity to construct a solid foundation that will make their growth sustainable. That is how the International Monetary Fund puts it, in the economic prospects report that it published in May 2013. As priorities for economic policy, it proposes strengthening the margins of fiscal manoeuvring and advancing in structural reforms aimed at increasing productivity and potential growth.

In the same way, at the 5th International Economic Forum of Latin America and the Caribbean, which was held in that same month in France, representatives of the IDB and OECD underlined the fact that, although the 3.5% growth forecast for this year is higher than that estimated for the United States and Europe, it is not sufficient for the region’s needs in terms of development and job creation. They emphasised that it is necessary to implement structural reforms to offset the fall in economic growth forecasts caused by external factors.

We know that, of these reforms, the one concerning the pension system is extremely important and we need to make a thorough analysis of its
implications in order to carry it out. Having high-quality information is essential in this process and, for that reason, accepting the corporate accountability involved in our regional leadership in pension fund management, we have called upon distinguished economists from Colombia, Mexico, Chile and Peru to present, in this book, a quantitative evaluation of the impacts of the individually-funded system in the economic development of their respective countries.

We hope that this study will constitute a valuable contribution for those involved in this analysis and debate, in all spheres, because economic growth is related directly with the promise that we make to our clients in Latin America, over 15 million of them: namely, that we will help them achieve their great dreams, accompanying them throughout their lives with high-quality advice and products.

Executive President
SURÁ Asset Management
Coordinator
Rodrigo Acuña

Mr Acuña’s degree is in Business Administration from the Catholic University of Chile, with specialisation in Economics, and he has postgraduate studies in applied macroeconomics from this same university. He is a partner and director of PrimAmérica Consultores, external advisor to the International Federation of Pension Fund Administrators, FIAP, and lecturer at the Management Development Centre of the Catholic University of Chile, in the Diploma Course on Investments for the Long Term and Retirement.

He has been an executive of pension and financial institutions and an international consultant for governments, multinational bodies and private-sector investors on matters of social security and savings programs.
Colombia
Leonardo Villar

Mr Villar has an M.Sc. in Economics from the London School of Economics and is an Economist cum Laude and Magister, Universidad de los Andes, Colombia. He is Executive Director of the Foundation for Higher Education and Development, FEDESARROLLO.

He was Chief Economist and Vice-President of Development and Public Policy Strategies of CAF–Latin American Development Bank; member of the Board of Directors of the Banco de la República de Colombia; Technical Deputy-Minister at the Ministry of Finance and Advisor to the Executive Council for Foreign Trade. He has been on the board of public and private institutions in the financial system; was Vice-president of the Banco de Comercio Exterior and Technical Vice-president of the Colombian Banking Association.

Mexico
Alejandro Villagómez

Mr Villagómez has a Licentiate in Economics from the National Autonomous University of Mexico, UNAM, and a Ph.D. and M.A. in Economics, from Washington University in St. Louis. He is Research Professor of the Economics Division of the CIDE, Centre of Economic Research and Teaching; member of the Latin American and Caribbean Economics Association, of the Technical Advisory Council of the Centre of Economic Studies of the Private Sector and the Academic Advisory Council of the FIAP, and writes a column in El Universal.

He was advisor to the National Commission of Savings for Retirement (CONSAR), consultant to the Mexican Association of Retirement Fund Administrators (AMAFORE) and Academic Secretary of the CIDE. He was involved in the reform of the pension system corresponding to the Mexican Social Security Institute, IMSS, and has also been external advisor of the IDB and the CEPAL.
Chile

J. Rodrigo Fuentes

Mr Fuentes has a Ph.D. and Master of Arts in Economics, University of California, Los Angeles (UCLA), with a first degree in Business Administration and Magister in Finance from the University of Chile. He lectures at the Catholic University of Chile. He was a senior economist at the Central Bank of Chile, Director of the Postgraduate School in Economics and Business, and lecturer at the University of Chile.

He has been a visiting lecturer at the University of California Los Angeles (UCLA), AB Freeman School of Business at Tulane University and the Universidad Nacional de Tucumán. He has also worked as a consultant for private companies, government offices, the IDB and the World Bank.

Peru

Pablo Secada

Mr Secada has a Bachelor’s Degree in Economics from the Universidad del Pacífico; Master’s in Public Policies (MPP) from Harris School of Public Policy Studies, University of Chicago. He is Chief Economist at the Peruvian Institute of Economics (IPE), Councillor of the Municipality of Metropolitan Lima and partner of Opportunity Investments, a company that specialises in corporate finance. He collaborates with The Economist Intelligence Unit in preparing reports on Peru.

He was advisor to the Ministry of Economics and Finance (MEF), Executive Director of Public Debt for the MEF, Advisor to Congress and Impact Assessment Analyst at the Budgets Department of the Chilean Ministry of Finance. He has taught undergraduate courses at the Universidad del Pacífico and the Universidad San Martín de Porres, and at the postgraduate schools of the Centrum Católica and Universidad Peruana de Ciencias Aplicadas.
3. Executive Summary

Macroeconomic impacts of the creation of individually-funded systems in Latin America: the cases of Colombia, Mexico, Chile and Peru

Rodrigo Acuña
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1. Introduction

The main objective of a pension system is to provide members with a replacement rate that is adequate, stable over time and financially sustainable. The pay-as-you-go systems that were implemented in Latin America and many other parts of the world are suffering from structural problems that make it difficult for them to meet that objective and keep their promise of defined benefits, so producing uncertainty among members and pensioners, both present and future, about the amount and the timing of the benefits that they will actually be able to receive. Their funding scheme, the way in which the benefits are calculated, the centralised administration under the responsibility of the public sector, and the incentives that they offer members, employers and the State, all call into question the viability of these schemes in the long term.

The demographic trends of increased life expectancies and a lower birth rate reduce the ratio between active workers who pay contributions and passive workers who receive pensions. This causes the financial position of these schemes to deteriorate and produces growing operating deficits, which consume any reserves that may exist and demand greater financial support from the State. The current situation in Europe and in many Latin American countries, among them those included in the studies presented in this book, provides evidence of these structural problems that confront the pay-as-you-go pension schemes.

In response to this situation, numerous countries in Latin America, Eastern Europe and Asia have introduced structural changes to their mandatory pension systems during the last three decades, introducing
programs of individual funding with defined contributions and competitive administration, which complemented or replaced the pay-as-you-go systems, bringing about profound changes in the pension situation of members and their beneficiaries.

The new systems of individual funding also face challenges in order to meet the target of providing their members with adequate replacement rates, as a consequence of the increase in life expectancies, the reduction in market interest rates and the shortcomings of the labour market, all of these affecting their coverage and contribution densities, which have been lower than expected.

The creation of individual funding programs has had a significant impact on the growth of countries, the working conditions of the labour force, the public budget and the funding opportunities for companies, and has been the driving force behind the development and improvement of closely related markets, especially the savings and investment market, the capital market, the labour market and the life insurance industry.

In fact, in the case of various countries, building up national savings and developing and deepening the financial system and capital markets were among the main motivations for enacting the reforms that brought in the individual funding programs. The aim was to generate permanent sources of funding for domestic investment and stimulate the growth of the Product, in addition to correcting the structural problems evident in the pension systems and halting or mitigating the growing financial imbalances shown by the pay-as-you-go systems.

The experience and results of the creation and development of the individually-funded systems, which will be discussed further on, show the existence of a virtuous circle linking pension system reform with economic growth. In fact, the increased dynamism of the GDP and the advances made in the development and efficiency of the capital, labour and life insurance markets as a result of the pension reforms, have had favourable repercussions in their turn on the functioning of the individually-funded programs, expanding investment and diversification opportunities for the pension funds’ investments and stepping up contributions to the individual accounts with the growth of employment and wages and greater formalisation and flexibility in the labour market.

During the year 2003, economists Vittorio Corbo and Klaus Schmidt-Hebbel presented a study on the macroeconomic effects of the creation in 1981 of a new system of individual funding in Chile, which is gradually
replacing the pay-as-you-go system with defined benefits that existed prior to the reform.

Corbo and Schmidt-Hebbel analysed the effects of the pension reform on the level of the Product and on economic growth during the first twenty years after the reform, finding that the individually-funded system produced a greater annual increase in the Product of 0.49 percentage points between 1981 and 2001, a period in which the Chilean economy experienced an average annual growth of 4.6%. [Graph 1].

The purpose of this publication is to present the results of a new, updated study on the macroeconomic effects of the creation of the individually-funded system in Chile, which has already accumulated over three decades of operation, and extend the analysis to a further three countries that also created pension programs of this type: Colombia, Mexico and Peru.

All these reforms have a common “backbone”, but also important differences in the design of the pension system and in the macroeconomic environment existing before and during the development of the pension funds. The results of these studies represent an important contribution to the understanding of the macroeconomic effects of the creation of the new, individually-funded systems and to improvement in the application of public policies of pension reform.

Analysing the fulfilment of the main objective of a pension system is not within the purview of these studies. This, as was mentioned above, is to provide members with an adequate replacement rate that is stable in time and financially sustainable. However, the studies include experi-
ences and recommendations that contribute to the design of public policies in pension systems and in labour, capital and insurance markets, which may accentuate the positive macroeconomic outcomes of the reforms and so boost the development and efficiency of the individually-funded programs and the provision of better pensions for members.
2. Estimation of the multi-dimensional macroeconomic effects

The impact of pension system reform on the economy is multi-dimensional and long-term. The studies carried out for Chile, Colombia, Mexico and Peru, the results of which are presented in this publication, evaluate the macroeconomic effects of the creation of the individually-funded systems on the growth rate and the level of the GDP quantitatively and in toto.

These macroeconomic effects occur basically via four main routes: the level and structure of employment and its formality; saving and investment; the development and efficiency of the capital market; and the development of total factor productivity [capital and labour] [Graph 2].
Although the analysis made by the various economists responsible for the studies in each country is complete and multidimensional, there are certain effects caused by the creation of the individually-funded systems that are difficult to capture using quantitative techniques. These have therefore fallen outside the scope of the studies, or their full inclusion has not been possible. This has led to an underestimation of the macroeconomic impact of the creation of systems of this type.

Examples of these effects that have not been captured fully are the contribution of the creation and development of the pension funds to the improved legislation and institutional framework of the financial and capital markets, to the quality of information and the corporate governance of companies, the protection of minority shareholders and greater financial integration in international markets, all of which have certainly had a bearing on volumes of savings and investment, on financial efficiency and finally, on the growth of the GDP.
On the other hand, it is estimated that the development of the pension funds, in addition to their effect on the level and growth of the GDP, may also have contributed to a lower volatility of economic cycles, due to the greater stability implied by the investment of the flow of mandatory pension savings in the supply of funds to the financial system and to companies, the expansion of funding alternatives, the creation of new instruments and the availability of financial resources for longer-term investments, which should be associated with projects with higher yield.

For example, in Chile the flow of mandatory pension savings amounted to an average of 4.86% of the GDP between 1981 and 2012, and the reform involved an increase in total savings of 2.72% of GDP [see Table 3 of letter B in section 5]. Furthermore, it can be seen that there was a steep increase in national savings following the creation of the individually-funded system, explained mainly by private savings, which reached percentages of the GDP that were much higher than those recorded historically [20% -25% of GDP]. There was also a reduction in the volatility of the level of private savings1.

The public sector has also benefited from the larger supply of financial resources implied by the existence of the pension funds, which give the market for state securities greater depth and expand the possibilities for structuring public debt at various different terms and currencies. In this sense, the Colombian experience is an illustration of how capital market development, driven by the growth and investment of the pension funds, has benefited the funding of the public sector by the purchase of treasury bonds that achieve high liquidity in the market, with terms of up to 30 years and with interest-rates that are lower than the historic ones. The investment of the funds has also contributed to the process of changing from external to internal debt in Colombia, mitigating the exchange risk and making the country less vulnerable to possible external shocks. It may well have helped to make the economic cycles less intense.

It was also impossible, in the models used, to capture the full implications of an individually-funded system on the flexibility of the labour market, due to the creation of a single pension program for all workers; the portability of the balances accumulated in the individual accounts, regardless of the member’s job, because those balances are his/her own property; and the incentives for workers to participate to a greater extent in the labour market.

1 The annual standard deviation of the percentage of private savings over GDP falls from 3.5% in the decades 1960-1980 to 2.1% in the period 1986-2010.
Finally, the studies exclude from the analysis other dimensions that are affected by the pension reforms, such as income distribution, for example.
3. Differences between countries that influenced the macroeconomic impacts of the reforms

There are multiple reasons why the macroeconomic impacts of the creation of individually-funded systems differ between countries. Of fundamental importance among these are: the design of the pension system, the individual funding program, and the transition from the old pension scheme to the new; the macroeconomic context existing before and during the implementation of the individually-funded system and the implementation of other structural reforms, that may have had positive or negative synergies with the pension reform; the improvement of the regulations and institutional framework of the pension system and the labour, life-insurance and capital markets, as the individually-funded program develops and the pension funds grow; the characteristics of the labour market, particularly the degree of informality; the conditions and evolution of contributory and non-contributory social protection programs, their contribution rates and incentives; and the effects of the reform on the financial deficit of the old pension scheme and the public budget, and the way this increased deficit will be funded.

The four countries studied incorporated individually-funded programs into their pension systems with characteristics that are common to all, but also with important differences in design and in the transition from the old scheme to the new reformed one [Table 1]. Furthermore, pension systems mature in the long term, and the operation period of the individually-funded programs in the four countries studied is still limited [between 16 and 32 years], meaning that the results obtained must be taken as preliminary.
### Table 1

Characteristics of the new individually-funded programs with defined contributions

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Chile</th>
<th>Colombia</th>
<th>Mexico</th>
<th>Peru</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relation with the PAYG scheme</td>
<td>Replacement</td>
<td>Competition</td>
<td>Replacement</td>
<td>Competition</td>
</tr>
<tr>
<td>Compulsory transfer to individually-funded program</td>
<td>New workers [1]</td>
<td>No</td>
<td>IMSS workers; later ISSSTE [2]</td>
<td>No</td>
</tr>
<tr>
<td>Recognition of contributions to old scheme</td>
<td>Recognition Bond</td>
<td>Pension Bonds</td>
<td>Option to receive pension from old scheme or new</td>
<td>Recognition Bond</td>
</tr>
<tr>
<td>Contribution rate individual account</td>
<td>10.0%</td>
<td>11.5%</td>
<td>6.5% [5]</td>
<td>10.0%</td>
</tr>
<tr>
<td>Disability and survivorship insurance</td>
<td>1.26%</td>
<td>3.0%</td>
<td>2.5% [6]</td>
<td>1.29% [8]</td>
</tr>
<tr>
<td>Administration fee</td>
<td>1.48% [3]</td>
<td></td>
<td>1.29% [3][7]</td>
<td>1.33% [3][8]</td>
</tr>
<tr>
<td>Minimum Pension Guarantee Fund</td>
<td>-</td>
<td>1.5%</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

[2] IMSS when Afores system was created; ISSSTE in 2008.
[4] Members with incomes higher than 4 minimum wages must pay additional contributions to finance the Solidarity Pension Fund.
[5] Includes sub-accounts for retirement, severance at an advanced age, and old age, and the premium of the disability and survivorship insurance. It excludes the social quota and fee of the Afores.
[6] The coverage of this insurance is provided by the Mexican Social Security Institute (IMSS).
[8] Fee on flow in the mixed fee system.

The most important aspects of the design of the pension system in terms of their macroeconomic impact are: the complementarity, replacement or competition defined between the pay-as-you-go system and the individually-funded program; the groups of workers who are covered mandatorily by the new system, those who are free to choose, and those who are obliged to remain in the old system; the contribution
rates and the maximum wages on which contributions are levied; the investment possibilities of the pension funds in the financial and capital markets at both local and international level; the way of recognising the rights acquired as a result of contributions paid in the old scheme by those who transfer to the new system; and the incentives that exist to enrol and contribute in the new system.

Chile and Mexico replaced the old pay-as-you-go scheme with a new, individually-funded program with competitive administration, with different transitions and groups of workers who were obliged to transfer to the new system.

In Chile, all new workers had to enrol in the AFP system as from January 1983 and those who were already enrolled had the option of doing so, but there was a strong incentive to transfer because of the reduction in the contribution rate. Members can choose between different pension options offered by entities in the private sector: life annuities among them. This is not a minor consideration, because the life insurance companies build up vast volumes of reserves due to their obligations to pay the life annuities, which they have to back up with investments that match those obligations. This makes them into major suppliers of long-term funds for private companies and the public sector in the local market.

In Mexico, all the members of the IMSS [workers in the private sector] had to change to the Afores, while employees in the public sector remained in the pay-as-you-go scheme until the year 2008 when they were also brought into the individually-funded program. The coverage of the disability and survivorship insurance remained the responsibility of the IMSS in Mexico, as also the payment of pensions to the transition generation, in other words, the members who had contributed into the pay-as-you-go scheme and had to transfer to the Afores system. The workers affected by the transition have the possibility of choosing between the pension that can be funded with the balance accumulated in their individual accounts in the Afores and the pension that they would have received in the pay-as-you-go scheme. This design of benefits and recognition of acquired rights, the capital requirements and the regulation of prices has made it difficult to develop the pension life-annuity market, unlike what happened in Chile.

Colombia, on the other hand, created an individually-funded system that competes with the pay-as-you-go program and workers can choose between them. Certain special pension schemes were retained [which
were almost entirely eliminated later) and a transition stage was put in place that allowed older workers, with more years contributed, to qualify for an old-age pension under the conditions of the previous scheme. Another aspect of the pension system in Colombia that has important macroeconomic effects is that it was decided to fund part of the financial resources used for helping members of the pension system with lower incomes\textsuperscript{2}, by demanding a higher contribution rate. This definitely constitutes a tax on work. Furthermore, by law, pensions cannot be less than the minimum wage, which has been a crucial element in discouraging the development of the life-annuity market and the supply of long-term funds implied by the investment of reserves by life insurance companies that offer this product.

In Peru, workers were not obliged to enrol in the new system of individual funding, but they were allowed to choose between it and the pay-as-you-go scheme, with certain incentives to remain in or enter the public program, because its contributions were not made any higher, and there were no minimum pensions available to members of the private system. The individually-funded system has seen important changes in its 20 years of operation, one of the most significant being the reform carried out in the year 2012, which, among other measures, included tendering for the administration of the individual accounts of new workers who enrol, the compulsory enrolment of the self-employed and the definition of a scheme of mixed fees, moving towards one in which there will only be a fee on balance. However, the parallel operation of the public pay-as-you-go scheme and the individually-funded system has been maintained.

A regulatory change common in all the individually-funded systems in the countries studied has been the introduction of multiple pension funds, a measure that not only makes it possible to achieve a better match between the investment structure of the pension savings and the preferences, characteristics and conditions of the members, but also to open up new investment options for the pension resources, which are admissible for the higher-risk pension funds aimed primarily at younger members.

\textsuperscript{2} Minimum Pension Guarantee Fund and Pension Solidarity Fund.
4. Effects estimated for the transition period versus the long term

The pension system reforms and the operation of the individual funding programs are still in a transition stage in the four countries being studied. In Chile, which is the country where the reform has been in operation for longest [32 years], the first members to fund their old-age benefits entirely with the balances accumulated in the individual funding accounts are only recently retiring. The study of the Chilean case estimates the effects produced by the pension reform when moving from an unreformed steady-state to a reformed one. The transition may take some 60 years. In the other three countries, the new system has been operating for a shorter time, between 16 and 20 years, and the macroeconomic effects are estimated for this transition period.

However, the development of the individual funding system will continue to contribute macroeconomic effects in the long term, especially through its impact on the financial market and on the public sector. The application of appropriate public policies may potentiate these effects.

With regard to the public sector, the different studies carried out estimate the increase produced by the pension reform in the financial deficit of the pay-as-you-go scheme and in the public budget during the first stage of the transition between the old scheme and the new system. Opposing effects occur during this transition stage. On the one hand, the financial deficit of the public sector is increased due to the diverting of contributions to the individual funding program and the recognition of
the acquired rights of workers who transfer to the new system, which produces a reduction of public savings, but on the other hand, the flow of mandatory pension savings increases over time. Both the greater public deficit and the generation of mandatory pension savings that are channelled into the capital market also produce responses in voluntary private saving. In net terms, the studies show growth in national savings, which produces a positive effect on investment.

In the longer term, the reform of the pension system will allow the fiscal deficit gradually to be reduced and the mandatory pension savings that are channelled into the financial market gradually to increase, until the new pension system is fully functional. This longer-term effect on the public budget is not measured in the studies, and should be of greater magnitude, especially if it is compared with what would have happened if the pension reforms that created the individual funding systems had never been enacted.

Although it is impossible to know how the pension schemes, the public deficit and the macro-economy would have evolved without the reform, the experience and results recorded in pay-as-you-go schemes in other countries leads one to predict that the financial deficits of the old scheme would have got worse over time, due to the demographic trends and the inefficiencies and structural problems of schemes of this type. It is highly likely that the authorities would have reacted to this situation by reducing and delaying the benefits for the members of the pension system, increasing the requirements for obtaining them and increasing the contribution rates, as has happened in many European countries that are facing crises in their pay-as-you-go pension schemes. Such measures would not only have harmed the members and beneficiaries of the system, but would also have had significant effects on the labour market, increasing the incentives to transfer to the informal sector.

For example, in the case of Mexico, it is estimated that the fiscal cost of the pension system without the reform could have meant an annual expenditure oscillating between 6.3% and 14.0% of GDP, depending on the economic assumptions, by the year 2047. On the other hand, according to the Mexican Social Security Institute [IMSS] itself, the contribution rate would have had to be increased to 23.3% of wage in 2020 to avoid a deficit in the flow of the program in that year.

Chile’s experience is an example of the longer-term benefits brought about by replacing the loss-making pay-as-you-go scheme with an individually-funded system. An example of this is to be found in the mes-
sage that accompanied the 2008 pension reform, which strengthened the “pillar zero” by creating a solidarity pension system instead of minimum and welfare pensions. This states that one of the basic sources of funding for that reform was from resources freed up by the reduction of the State’s commitments with the old pension scheme. That freeing up was possible thanks to the replacement of the pay-as-you-go scheme by the individually-funded system.
5. Results of the macroeconomic impacts produced by the creation of individually-funded systems

The most profound, long-term changes with macroeconomic impact that occurred as a result of the introduction of the individually-funded system in the countries where it was implemented, and which were not present in the operation of the pay-as-you-go scheme, were the following:

i. The existence of individual accounts, with the workers having ownership rights of the accumulated balances;

ii. The direct relationship between the contributions paid and the pension benefits received by the members;

iii. The variation in the contribution rates in the period pre and post reform;

iv. The birth of new institutional investors with great influence on the market, whose main objective is to achieve adequate yield and security for the pension funds that they manage;

v. The investment of the flows of mandatory pension savings in the financial markets;

vi. The creation of a variety of pension options in the individually-funded system, including life annuities provided by life insurance companies, which need to make long-term investments in order to back up the obligations they have acquired;

vii. The impact of the pension reform on the financial deficit of the administrators of the old scheme and on the budget of the public sector.
These changes caused significant macroeconomic effects, via the four main routes that were identified earlier; i.e. the level and structure of employment and its formality; savings and investment; the development and efficiency of the capital market; and the development of total factor productivity [capital and labour]. The magnitude of these effects differed between countries for the reasons explained in section 3.

As far as the labour market is concerned, the studies provide evidence indicating that the workers’ ownership rights over the accumulated balances and the direct relationship between contributions and benefits meant that workers who enrolled in the system placed a greater value on their pension contributions, compared with what happened with contributions to the pay-as-you-go scheme. This in turn reduced the perception of those contributions as tax, providing an incentive for more employment in the formal sector and greater productivity. In Chile’s case, there was, in addition, a significant reduction in contribution rates. By contrast, in Colombia the reform coincided with increases in contributions to the pension system, unrelated with the reform that created the individually-funded system, and to other social security programs, with increases in the non-wage costs in the labour market.

On the other hand, in the financial field, the rise of new institutional investors, the pension fund administrators, that have to invest large flows of mandatory pension savings in the capital market in order to ensure adequate yield and security for the pension resources, gave a significant boost to financial development, to the modernization, efficiency and depth of the capital market, to improving the institutional framework, creating new instruments and reducing trading costs. Furthermore, it meant that a supply of long-term funds came into being, which was added in some countries to the supply generated by the life insurance companies that offer life annuities to pensioners in the individually-funded system and need to invest at long terms, in order to match the result of those investments with their pension payment obligations.

In the saving and investment market, the pension reform led to an increase in the fiscal deficit and a reduction of savings in the public sector, due to the diverting of contributions from the pay-as-you-go scheme to the pension fund administrators, and recognition of contributions paid into the old scheme by members who transferred to the new system. This was more than offset by the new flow of mandatory pension savings that had to be invested in the financial market, increasing total savings and therefore investment.
When evaluating the effects of the reforms that created the individually-funded systems, it is important to bear in mind that these were enacted in different years in the four countries studied, so the period of operation of the new system is also different, and this in turn has a bearing on the macroeconomic effects produced so far.

The studies made and presented in this book conclude that, in the evaluation period, the creation of the individually-funded system contributed to a greater annual growth in GDP of between 0.31% [Mexico] and 0.58% [Colombia] [Table 2 and Graph 3].

The higher growth rates brought about by the birth of the individually-funded system were equivalent to between 6.2% [Peru] and 12.9% [Mexico] of the annual growth of GDP during the evaluation period.

The authors of the studies suggest a variety of scenarios and ranges of macroeconomic impact of the reforms, depending on variables such as the way of funding the transitional fiscal deficit caused by the reform, the response of voluntary private saving to greater mandatory pension savings and the lower public sector savings, and the change in the workers’ perception of the value of their contributions to the pension system. The figures given correspond to the average scenario.
**Table 2**
Macroeconomic impact of the creation of the individually-funded system

<table>
<thead>
<tr>
<th>Impact of the Reform</th>
<th>Chile</th>
<th>Colombia</th>
<th>Mexico</th>
<th>Peru</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year new system started</td>
<td>1981</td>
<td>1994</td>
<td>1997</td>
<td>1993</td>
</tr>
<tr>
<td>Annual GDP growth in period</td>
<td>4.58%</td>
<td>4.55%</td>
<td>2.40%</td>
<td>5.3541%</td>
</tr>
<tr>
<td>Effect of reform on GDP</td>
<td>0.37%</td>
<td>0.58%</td>
<td>0.31%</td>
<td>0.3331%</td>
</tr>
<tr>
<td>– Savings – Investment</td>
<td>0.09%</td>
<td>0.22%</td>
<td>0.16%</td>
<td>0.0167%</td>
</tr>
<tr>
<td>– Labour market</td>
<td>0.08%</td>
<td>0.00%</td>
<td>0.02%</td>
<td>0.0129%</td>
</tr>
<tr>
<td>– Financial development and TFP(3)</td>
<td>0.20%</td>
<td>0.36%</td>
<td>0.13%</td>
<td>0.3037%</td>
</tr>
<tr>
<td>% growth of GDP explained by reform</td>
<td>8.08%</td>
<td>12.75%</td>
<td>12.92%</td>
<td>6.22%</td>
</tr>
<tr>
<td>Range of effect of reform on GDP</td>
<td>0.27% - 0.45%</td>
<td>0.37% - 0.80%</td>
<td>0.18% - 0.52%</td>
<td>0.1501% - 0.5161%</td>
</tr>
<tr>
<td>– Savings – Investment</td>
<td>0.09%</td>
<td>0.13% - 0.30%</td>
<td>0.05% - 0.27%</td>
<td>0.0096% - 0.0237%</td>
</tr>
<tr>
<td>– Labour market</td>
<td>0.04% - 0.12%</td>
<td>0.00%</td>
<td>0.00% - 0.10%</td>
<td>0.0094% - 0.0163%</td>
</tr>
<tr>
<td>– Financial development and TFP(3)</td>
<td>0.14% - 0.25%</td>
<td>0.24% - 0.50%</td>
<td>0.12% - 0.15%</td>
<td>0.1311% - 0.4762%</td>
</tr>
<tr>
<td>% growth of GDP explained by reform</td>
<td>5.90% - 9.83%</td>
<td>8.13% - 17.58%</td>
<td>7.50% - 21.67%</td>
<td>2.80% - 9.64%</td>
</tr>
</tbody>
</table>

(1) Increased annual growth produced by the reform.
(2) In the case of Chile and Peru this corresponds to the average of the two scenarios considered. The study on Chile calculates the increase of the GDP in steady-state. The figure given is the estimated effect in 30 years, which assumes that half the gap between one steady-state and the other will have been closed in this period.
(3) Total factor productivity.
The greatest impact of the pension reform on the growth of the GDP occurred through its effect on financial development, this impact varying between 0.13% per year for Mexico and 0.36% per year for Colombia [Graph 4].
A. Effect on the capital market

The pension funds have turned into one of the main institutional investors in the various countries where they operate.

Quantitative estimates of the macroeconomic effects captured the contribution of the reform to the greater growth of the GDP through this channel by the increased financial depth generated by the growth of the pension funds and the positive effect produced by that deepening on factor productivity. This method included the results of other previous empirical studies, which had tended to demonstrate that a greater financial depth has a positive effect on economic development.

For the Chilean case, it is estimated that financial depth, defined as the sum of bank deposits, mortgage liabilities, internal public debt, corporate bonds and market capitalisation, increased from 46% in 1981 to 276% in 2011.

In Colombia, financial depth —measured as the sum of M3, the balance of the government’s public debt securities [TES] and market capitalisation—, was equivalent to 45% of GDP in the mid-1990s, increasing to 137% of GDP in 2010 [Graph 5]; in other words, a growth of 92 percentage points of the GDP. The increase of the pension funds contributed almost 20% of that growth directly and was a key factor in the multiple processes of improvement to the capital market that were observed in Colombia as from the mid-1990s, including the significant growth of the public debt market, which has led to a position in which almost 70% of the financial assets correspond to the TES; the start of securitization for mortgage funding; and the creation of a market of private debt bonds. The greater depth of the public debt market also allowed the government to reconstruct its debt in the direction of greater internal debt.
In the case of Mexico, fifteen years after the reform was carried out there is clear evidence of the positive effect that the pension funds have had on financial depth. Financial savings, measured as M4 minus the notes and coins held by the public, grew from 42.6% to 64.8% of GDP between 2001 and 2012 in other words, an increase of 22.2 percentage points. Approximately 38% of this increase is explained by the resources produced directly by the Afores.

The creation of the individually-funded system in Peru also meant a significant boost to financial depth. If this is measured as the sum of the liquid liabilities of the system, the capitalisation of the share and bond market and the loans of non-residents, financial savings rose from 26% of the GDP at the point of the reform [1993] to approximately 99% of the GDP in the year 2009.

In addition to the impact that the reform produced on financial depth and by this route, on growth, there are other recognizable contributions from the creation of the individually-funded system and the pension funds to the development and efficiency of the financial market. However, we warned earlier that they cannot be fully captured in the studies, due to the complexity that this would have entailed. A few examples of these...
are: the improvement in the quality of the institutions and in the public information that exists about issuers and suppliers of financial instruments; the lower cost and greater control of the information supplied by these issuers and on the companies in which the pension funds invest; improvements in regulation, which have opened up new options for funding and investment; improvements in the institutional framework of the capital market; protection of minority shareholders; the creation of new financial instruments with different term, liquidity and risk characteristics; increased specialization of financial institutions; technological improvements in custody, clearing-house and trading processes, which reduce trading and information costs and increase investors’ security; the increased stability of the supply of available funds in the local market; and the access of financial institutions and companies to financial resources for long-term investments.

The availability of the supply of long-term funds has probably meant an increase in the marginal productivity of capital by reducing the cost of capital for companies, and making it possible to carry out projects with higher expected yield, which previously lacked the necessary financial resources. The case of the CKDs\(^3\) in Mexico is an example of how the pension funds can contribute to the implementation of long-term projects. These are structured instruments, the object of which is to finance the development of productive projects, mainly in infrastructure, private capital and real estate. The project developers seek to raise capital and, to do so they issue CKDs which are acquired by institutional investors. It is still a small market, but one with enormous potential. At present, 91% of the investors in CKDs are Afores.

Additionally, it is estimated that in some countries the growth of the pension funds and their supply of funds has also helped to diminish the size of economic cycles and reduce the impact of external shocks on growth. The rise of the pension funds meant the entry of a new supplier of funds to the market; one that was specialized, professional, with a clear target [that of obtaining adequate yield and security for the pension resources], and with a considerable flow of savings entering the market systematically [annual average of between 1.1% and 4.9% of GDP in the countries studied].

Another indicator that shows the importance that the pension funds represent for the financial markets of the various countries analysed is

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\(^3\) Certificates of Development Kapital
the accumulated value, both in absolute terms and as a percentage of the GDP [Graph 6]. The sum of the pension funds in the four countries as of December 2012 was USD 422,612 million. On the other hand, the studies show that the percentage of GDP that they had achieved fluctuated at the end of 2012 between 12% for Mexico and 57% for Chile. This percentage is influenced by the time that the individually-funded systems have been operating [ranging from 16 years in Mexico to 32 years in Chile], though this is not the only explanatory factor.

The increase of the pension funds as the individually-funded system develops produces a gradually growing demand for financial instruments in which to invest the funds with adequate yield and security. In order to meet this target, it is necessary to broaden investment opportunities, create new instruments and improve the regulation and institutional framework of the capital market. Experience shows that the pension fund administrators themselves press for changes that will allow them access to appropriate investment and diversification options for the pension resources.

In addition, their responsibility for the administration of a considerable volume of funds requires them to develop new know-how, to promote the modernisation of the market and to defend constantly the interests
of the pension funds in the issuers where they have investments. This helps to improve corporate governance, legislation to protect minority shareholders and the transparency of these issuers’ operations.

It is therefore necessary to pass through a process of making the funds’ investment rules more flexible, as the administrators and supervisory bodies acquire the necessary experience and as the changes in the regulations and institutional framework are carried out to enable the security of the workers’ savings to be safeguarded. The agreement of the authorities to this process and the timeliness and efficiency with which it is carried out are key factors in the impact that the pension funds can have on financial development.

Graph 7 shows how the investment portfolio of the pension funds in Chile changed as new investment opportunities were authorised and the financial market and institutional framework gradually developed and improved, one of the main objectives being to safeguard the security of the pension resources.

On the other hand, Graph 8 shows an example of the importance acquired by the pension funds as purchasers of financial securities and as a source of funding for longer-term investment projects, together with the life insurance companies. According to the latest available figures in
each country, the pension funds had between 32% and 48% of the total stock of bonds issued by companies and placed on the market. To these figures one must add the funding that reaches those companies and others requiring funds through the financial system and which originates in the investments made by the pension funds.

**GRAPH 8**

Pension Fund Investment in Corporate Bonds

% of the total stock of bonds

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>37.3%</td>
</tr>
<tr>
<td>Mexico</td>
<td>47.9%</td>
</tr>
<tr>
<td>Peru</td>
<td>32.3%</td>
</tr>
</tbody>
</table>

[1] Percentages calculated with latest available figures. Chile and Peru: 2012; Mexico: 2011. In Colombia there is no information about this indicator.
B. Effect on savings and investment

The effect of the creation of the individually-funded systems on savings and investment and, through this channel, on the annual growth of the GDP, fluctuated between 0.02% in Peru and 0.22% in Colombia, according to the studies carried out [Table 2].

The key factors that influenced these results were as follows: [i] the effect of the reform on the transition deficit from the old pay-as-you-go scheme [letter a, in Table 3], produced by the reduction in the flow of contributions from workers who transferred to the new individually-funded system and by the recognition of the contributions paid by them in the pay-as-you-go scheme; [ii] the way this increased deficit was financed: in particular the percentage that came from adjustments in other public sector expenditure [letter b in Table 3] and not from increases in taxation and/or increased borrowing; [iii] the generation of new mandatory pension savings as a result of the creation of the individually-funded system [letter e in Table 3]; [iv] the reaction of voluntary private saving to the increased dissaving in the public sector [letter d in Table 3] and the increase in mandatory pension saving [letter f in Table 3]; and [v] the effect of the greater net savings on investment [letter h in Table 3].

### TABLE 3

<table>
<thead>
<tr>
<th>Heading</th>
<th>Chile</th>
<th>Colombia</th>
<th>Mexico</th>
<th>Peru</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Déficit de transición</td>
<td>-3.18%</td>
<td>-1.01%</td>
<td>-0.98%</td>
<td>-0.73%</td>
</tr>
<tr>
<td>b. Fiscal adjustment to greater deficit</td>
<td>2.38%</td>
<td>0.63%</td>
<td>0.61%</td>
<td>0.44% ; 0.58%</td>
</tr>
<tr>
<td>c. Variation in public sector savings</td>
<td>-0.80%</td>
<td>-0.38%</td>
<td>-0.37%</td>
<td>-0.15% ; -0.29%</td>
</tr>
<tr>
<td>d. Response of private saving</td>
<td>0.41%</td>
<td>0.00%</td>
<td>0.18%</td>
<td>0.08% ; 0.15%</td>
</tr>
<tr>
<td>e. New mandatory pension savings</td>
<td>4.86%</td>
<td>2.52%</td>
<td>1.70%</td>
<td>1.08%</td>
</tr>
<tr>
<td>f. Response of voluntary domestic saving</td>
<td>-1.75%</td>
<td>-0.61%</td>
<td>-0.53%</td>
<td>-0.76% ; -0.54%</td>
</tr>
<tr>
<td>g. Final impact on total savings</td>
<td>2.72%</td>
<td>1.53%</td>
<td>0.99%</td>
<td>0.19% ; 0.47%</td>
</tr>
<tr>
<td>h. Effect of savings on investment</td>
<td>0.43%</td>
<td>0.81%</td>
<td>0.73%</td>
<td>0.527</td>
</tr>
<tr>
<td>i. Final impact on investment</td>
<td>1.19%</td>
<td>1.25%</td>
<td>0.72%</td>
<td>0.10% ; 0.25%</td>
</tr>
</tbody>
</table>

(1) Average of the evaluation period. Average or base scenario.
(2) This figure is not expressed as a percentage of GDP.
As may be seen in Table 3, the greatest fiscal transition deficit produced by the reform fluctuated between 0.73% and 1.01% of GDP in Colombia, Mexico and Peru, whereas in Chile it reached 3.2% of the GDP. One of the reasons why Chile’s indicator is far higher than that found in the other countries is the number and percentage of workers who transferred from the old scheme to the new system. All new workers had to enrol in the new AFP system, while those already working were able to choose to remain or change. However, there was a strong incentive to change to the individually-funded system, due to the increase in take-home pay. In Peru and Colombia the workers can choose to be enrolled in the old scheme or in the individually-funded system, because the two programs compete with one another, while in Mexico only those enrolled in the IMSS had to enrol in the Afores system at the beginning.

This same explanation may be behind the larger volume of mandatory pension savings that arose with the creation of the individually-funded system in Chile, which reached on average 4.8% of the GDP in the evaluation period, compared with figures between 1.08% and 2.52% of the GDP in the other countries. In any case, mandatory pension savings have been growing strongly over time in all cases [Graph 9]. In Colombia they rose from USD 253 million, or 0.2% of the GDP, in 1995 to USD 10,012 million, or 3.5% of the GDP in the year 2010. In Mexico they rose from USD 5,343 million, or 1.1% of GDP, in the year 1998, to USD 24,378 million, or 2.1% of GDP in 2012. In Chile they increased from USD 300 million, or 0.91% of GDP, in 1981 to USD 20,903 million, or 12.13% of GDP in 2009, then falling to USD 11,676 million, or 4.35% of GDP in 2012. Finally, in Peru they rose from USD 212 million, or 0.47% of GDP, in 1994 to USD 2,797 million, or 1.58% of GDP in 2011. This flow of mandatory pension savings has to be invested by the pension fund administrators in the capital markets, producing a substantial demand for securities from financial institutions, companies and the public sector.
In general, the impact of the pension reform on total savings and on investment is significant, except in Peru. The lower impact caused in the Peruvian case is due to the smaller generation of mandatory pension savings in the individually-funded system, the greater response that is believed to have occurred in voluntary saving to compensate for this growth in mandatory savings and the lower estimated impact of saving on investment [see Table 3].

The mandatory pension savings have come to represent significant percentages of national savings, fluctuating at levels that range from 6.7% to 19.4%, depending on the country [Graph 10]. The lowest percentages correspond to Mexico and Peru. In Mexico the contribution rates of the pension system are lower in relative terms than in the other countries, while in Peru the flows of mandatory pension savings are divided between the pay-as-you-go scheme and the individually-funded system, since the two are in competition [as in Colombia, but in this latter country the contribution rates are higher]. The importance of mandatory pension savings increases when they are compared with household savings, representing in this case 52.3% in Colombia and 20.3% in Mexico4 [Graph 11].

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4 Figures were only available for these countries.
**GRAPH 10**
Mandatory Pension Savings (1)
% of National Savings

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>19.4%</td>
</tr>
<tr>
<td>Colombia</td>
<td>17.8%</td>
</tr>
<tr>
<td>Mexico</td>
<td>8.4%</td>
</tr>
<tr>
<td>Peru</td>
<td>6.7%</td>
</tr>
</tbody>
</table>

(1) Percentages calculated with the latest available figures. Colombia 2010; Peru 2011; Chile and Mexico 2012.

**GRAPH 11**
Mandatory Pension Savings (1)
% of Household Savings

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombia</td>
<td>52.3%</td>
</tr>
<tr>
<td>Mexico</td>
<td>20.3%</td>
</tr>
</tbody>
</table>

(1) Colombia 2010; Mexico 2012.
As has been said, the figures for the impacts on savings and investment presented in the studies capture the net effect produced by the new mandatory pension savings, the dissaving of the public sector, due to the increased fiscal deficit caused by the reform, and the reaction of private voluntary saving to these two components of national savings. However, they do not capture the effect on the amount of national savings that has certainly occurred as a result of the greater efficiency, modernization and development of the financial market caused by the pension reform. Furthermore, the studies establish correlations between domestic saving and investment to estimate the impact of the net increase in savings produced by the individually-funded system on this latter, but the results do not incorporate the effect that the existence of greater financing options has had on the volume and quality of investment, in particular the supply of long-term financial resources originating from the pension fund administrators and life insurance companies, new types of financial instruments and the role of the administrators in the corporate governance of companies.

**C. Effect on employment and labour productivity**

The effect of the pension reform and the creation of the individually-funded system on total employment, formal occupation and labour productivity occurs as a result of changes in the rates of contribution to the pension program; differences in the value placed by members on the contributions and benefits that they will receive from the old scheme compared with the new system [as an extreme case, the mandatory contributions can be considered as 100% tax]; variation in the incentives to work and retire; and changes in potential subsidies granted by the State to members of the system, such as the introduction of the social quota in Mexico, and to non-members [Table 4].
### TABLE 4
Impact of the creation of the individually-funded system on employment and productivity

<table>
<thead>
<tr>
<th>Heading</th>
<th>Chile</th>
<th>Colombia</th>
<th>Mexico</th>
<th>Peru</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variation in contribution rate for capitalisation [% wage][1]</td>
<td>26% (\rightarrow) 10.5%</td>
<td>6.5% (\rightarrow) 16%</td>
<td>No change</td>
<td>9% (\rightarrow) 8%</td>
</tr>
<tr>
<td>Variation in government subsidy on contribution [% wage]</td>
<td>-</td>
<td>-</td>
<td>3% (\rightarrow) 10%[2]</td>
<td>-</td>
</tr>
<tr>
<td>Tax pre and post reform [% wage or variation in %]</td>
<td>15.3% (\rightarrow) 5.6%[3]</td>
<td>-[3]</td>
<td>No change</td>
<td>9.0% (\rightarrow) 3.66%[4]</td>
</tr>
<tr>
<td>Scenario 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 2</td>
<td>Average</td>
<td>-[3]</td>
<td>No change</td>
<td>2.78% (\rightarrow) 1.13%[4]</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>22.1% (\rightarrow) 5.6%[3]</td>
<td>-[3]</td>
<td>D(-) 43%</td>
<td>-</td>
</tr>
<tr>
<td>Variation in employment</td>
<td>1.3%</td>
<td>-[3]</td>
<td>0.00%</td>
<td>0.54%</td>
</tr>
<tr>
<td>Scenario 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 2</td>
<td>3.7%</td>
<td>-[3]</td>
<td>0.20%</td>
<td>0.31%</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>-</td>
<td>-[3]</td>
<td>1.30%</td>
<td>-</td>
</tr>
<tr>
<td>Effect of variation in productivity on GDP</td>
<td>0.11%</td>
<td>-[3]</td>
<td>0.09%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Scenario 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 2</td>
<td>0.32%</td>
<td>-[3]</td>
<td>0.13%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>-</td>
<td>-[3]</td>
<td>1.00%</td>
<td>-</td>
</tr>
</tbody>
</table>

[1] Between the pay-as-you-go scheme and the new individually-funded system.
[3] Although it is estimated that the creation of the individually-funded must have had positive effects on employment and productivity, these are not included because they are only hypothetical. This is due to the fact that there were other changes in contribution rates and non-wage costs that implied reductions in employment at the same time as the pension reform.
[4] The post-reform taxation rate is a weighted average between the private pension system and the old pay-as-you-go scheme.

The changes in contribution rates were very different in the four countries studied. In Chile the contribution rate to the individually-funded system was fixed at 10.5% of wage at the beginning of the AFPs’ operations, while it was 26% on average in the pay-as-you-go scheme, meaning that workers had a strong incentive, in terms of increased take-home pay, to transfer to the formal sector of the economy and the new pension system. It is also estimated that there was a positive effect on the labour market as a result of the increased valuation of the contributions to the individually-funded system, compared with the pay-as-you-go scheme, or, in other words, a reduction in the tax on contribution. Estimates show that this latter fell from between 15.3% and 22.1% to 5.6% of wage; in other words, a reduction of 63% and
75%, respectively. The reform also may influence incentives to continue working and to retire, particularly because in an individually-funded system, the postponement of retiring age and continuance in formal work have a direct bearing on improvements in pension amounts, due to the greater balance accumulated in the account, which means capitalisation of the pension resources for longer, new contributions without withdrawals for pensions, and reduction in life expectancies. By contrast, in the pay-as-you-go scheme, postponing retiring age is very expensive, because it implies sacrificing the pension. This effect on the incentives to work or retire is not estimated for the Chilean case, or for the remaining countries.

The situation in Colombia was completely different, because together with the reform of the pension system and the creation of the individually-funded program, there were increases in contribution rates. This increase in contributions is not attributable to the change of system, but to a delay in increasing contributions that was planned for long before the reform and was intended to improve the financial position of the pay-as-you-go scheme. During the period included in the study there were also significant increases in contributions to other social security programs and other non-wage costs. All this produced an important negative effect on the employment, informality and average wages of the economy. If bringing contribution rates up-to-date had been carried out at the appropriate time, it is estimated that the reform would have meant a reduction in contributions from 22% to 16% of the wage, with the resulting positive effects on the labour market and productivity. However, those are hypothetical impacts that did not occur, so they were not included in the study on Colombia.

In Mexico there were no changes in the contribution rates of workers and employers with the pension system reform, but there was an increase in state subsidies from 3% to 10% of wage, with the introduction of the social quota. This, added to a higher valuation of the contributions which is thought to have been produced by the creation of the individually-funded system, equivalent to a reduction of 43% in the perception of tax, would have brought about an increase in employment of 1.3% in the most optimistic scenario. In the other two scenarios which assume that there is no increase in the valuation of contributions, the increase in employment fluctuates between 0.0% and 0.2%. In the three scenarios, positive effects are estimated in mean labour productivity, which vary between 0.09% and 1.00% of the GDP.
In the case of Peru, the contribution rate fell slightly, from 9% to 8% of wage. In addition, it is estimated that the valuation of the contributions increased substantially, which led to a reduction in the perceived tax of approximately 60% in the two scenarios considered. The two factors produced an estimated increase in employment that varies between 0.31% and 0.54%. On the other hand, there seem to have been no important changes recorded in labour productivity.
6. Final remarks

The studies carried out constitute a valuable contribution for evaluating the macroeconomic impacts produced by the creation of individually-funded systems and contain important lessons of public policy for authorities who are evaluating the introduction of programs of this type, or who wish to strengthen them and potentiate the virtuous circle that exists, by linking the growth of the pension funds and macroeconomic development.

The experiences analysed and the results obtained also contribute important elements that should be taken into account when designing and promoting a new individually-funded pension system.

One of the ways in which the macroeconomic effects of a reform that creates an individually-funded system are transmitted is the change in the worker’s valuation of his/her contributions. To the extent that the individual ownership rights of the balances in the individual accounts and the direct relationship between contributions and benefits increases that valuation and reduces the perception of a tax, there will be a greater impact on employment, on the transfer of workers from the informal to the formal sector and on productivity. Hence the vital importance of ensuring that the information and education campaigns about the characteristics of the new system and the benefits that the workers can obtain, are timely, well-structured, simple and systematic, so that members feel themselves to be the full owners of their accumulated funds, and value them, contributing regularly and checking on the payment of contributions by their employers. This in turn is vital for the defence and
consolidation of the system and for achieving high contribution densities throughout the active life, so enabling adequate replacement rates to be financed. This last point currently represents one of the major challenges for pension systems, especially in the Latin American countries that have the highest levels of informality.

The pension funds have become institutional investors of great importance and influence in the market in the various countries that have introduced individually-funded systems. The investment of the funds produces great pressure on the demand for financial instruments in the local market, which must be resolved appropriately in order to achieve adequate diversification and long-term yield for the pension resources and avoid their being exposed to risks that might compromise their results and the members’ pensions. In order to meet this target, the regulatory design established by the authorities for the new system is very important, particularly with regard to the investment of the funds, and the supervisory bodies should adopt an active policy to make the adjustments in regulations and institutional framework that become necessary over time, as the administrators and supervisory bodies acquire experience. The application of correct policies in this field will not only bring benefits to the pension funds and the members of the pension system, but also potentiate the effects of the reform on the development of the financial system and the growth of the GDP.

The evidence analysed for the four countries makes it clear that there are various aspects of the labour market, the financial market and the pension system that are capable of potentiating the macroeconomic impact in the future if appropriate reforms are carried out.

One of the most significant is the coexistence and competition between the pay-as-you-go scheme and the individually-funded system, which jeopardises the development of this latter system and reduces the potential for the macroeconomic effects that are produced by the reform. This is because it reduces the volume of mandatory pension savings being channelled into the capital market and the growth of the pension funds, thereby reducing the positive effect that such growth produces on financial depth and, through it, on the GDP.

Another outstanding aspect of the studies is the potential impact that the individually-funded system and the growth of the pension funds can have on the size of economic cycles and the degree of a country’s exposure to external shocks. The flow of mandatory pension savings that regularly enters the financial market becomes a new and impor-
tant funding alternative for companies and the public sector, one that is less volatile and is long-term. This new supply of savings opens up the possibility of companies having funding available for investing in the long term, which they did not have before, so increasing the marginal productivity of capital.

The evidence presented in the studies carried out shows us that the deeper the reform that replaces the pay-as-you-go scheme with the individually-funded system, and the more workers that enrol and transfer to the new system, the greater will be the macroeconomic effects of the reform. However, these also depend on many additional factors: among them, the application of other structural reforms before or during the period when the pension funds are developing and growing, the coherence between the different reforms, and the determination and timeliness with which the authorities make changes in regulations and encourage advances in the institutional framework that create an adequate environment for pension fund investment.

Finally, the different studies show the increase in the public deficit caused during the transition period by the structural reforms that introduced the individually-funded systems. On the other hand, they also show that the public sector may benefit from the investment of the pension funds, because these allow a deeper market to develop for the financial securities issued by the State, meaning that there are greater opportunities to structure or restructure public debt by term, currency and rates and so achieve a better match between the flows of that debt and committed expenditure, which reduces the risks involved. In the long term, the reform will make it possible to improve the financial situation of the public sector and free up resources for other purposes, as has happened in the Chilean case.
4. Pension system reform and economic growth
4.1 Colombia’s experience

Leonardo Villar, Jonathan Malagón, Julio César Vaca y Carlos Ruiz*

* Executive Director, Director of Macroeconomic and Sectoral Analysis and analysts at FEDESARROLLO, respectively.
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1. Background

1.1 The pension system prior to Law 100

The first great landmark in the history of the Colombian pension system occurred in 1945: the creation of the Colombian Social Security Institute (ISS). With this institution in place, the system concentrated initially on providing health insurance and paying pensions to workers linked with the public sector [Rodríguez et al. 2002]. It was not until 1967 that pensions were organised for disability, old age and death; coverage was provided for industrial accidents; and rules were introduced to make enrolment in the ISS compulsory for workers in the private sector.

The pension model adopted by Colombia was the so-called ‘Regimen de Prima Media’ RPM, a Pay-as-you-go or defined-benefit scheme. Under this scheme, people of working age who are enrolled in the system pay contributions regularly into a common fund, which is used to make monthly payments to people who have retired. This is a model of inter-generational solidarity in which the contribution of the younger generations constitutes a liability to be settled using the contributions of future generations. This system is considered to be ‘un-funded’, because the money paid by the current members is used to cover the pension of the beneficiaries and not that of the contributor. It is also described as being actuarially unfair, because the monthly pension amount to be received does not correspond in any exact way to the amount contributed by each individual, and this produces inappropriate incentives for contributor.
That design never balanced properly. In fact, only three decades after its creation, there were evident signs that it was financially unsustainable. The imbalance of the system was related mainly with five factors: [i] the failure to implement the rise in the contribution rate that had been scheduled when the system was first set up [Graph 1]; [ii] the failure on the part of the State to pay contributions; [iii] the imbalance between the contributions paid by the members and the pension benefits received; [iv] the existence of a large number of extra costs associated with special schemes; and [v] the demographic shift, which meant fewer contributions [increasingly few young people] and more expenses [greater life expectancy]. These elements affected the financial health of the system to a major extent, a phenomenon that would become increasingly acute as the population of retiring age began to increase1.

In terms of the size of contributions, for example, these were meant to represent 6% of the wages of all workers. These contributions were to be shared between the employee [1.5%], the employer [3%] and the State [1.5%], with a programmed increase of 3 percentage points [pps from this point on] every five years until they reached 22% of wages in 1993. Nevertheless, the initial failure to comply on the part of the Government reduced the size of the contribution from 6 to 4.5%. Furthermore, the contribution, far from being raised every five years as originally envisaged, remained constant until 1985, at which point it was timidly increased to 6.5%. The difference between the real and programmed rate meant that the scheme administered by the ISS was branded as unsustainable from the outset, with the possibility of an explosion in pension liability.

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1 Until well into the 1980s, the financial imbalances of social security remained hidden, not only because of the high proportion of active workers compared with pensioners, but also because of the rapid rise in inflation that occurred in Colombia as from the first half of the 1970s. While wages, and consequently contributions, were fully indexed in their annual adjustments, this did not happen with the monthly pension payments of the ISS, which increased partially [50%] with the absolute increase in the minimum wage and partially [a further 50%] with the percentage inflation of the previous year.
Moreover, the system worked differently for public and private employees. While the contribution of the private workers was actually what they were meant to pay, the contribution of the public workers was lower and was financed mainly by the State. In addition, there was a substantial difference in the benefits to which the two classes of workers were entitled. According to Tellez et al. [2009], the benefits granted to public employees might be 66% higher than those provided by the ISS, and there were funds [“cajas”] that provided pensions even 350% higher than those of the ISS. In this way, the existence of multiple special schemes was producing an escalating fiscal burden. There were numerous extraordinary benefits in entities such as the teaching profession, and in some public companies such as Ecopetrol or the now defunct Telecom. Teachers in the public sector, for example, were entitled to receive a “concurrency” pension\(^2\) in addition to the old-age pension. Meanwhile, employees at Ecopetrol did not pay contributions or have to meet the minimum age requirement, but received a pension equivalent to 75% of their final wage. By 1992, these imbalances had led to a situation in which the estimated pension liability was equivalent to 200% of the GDP.

Finally, the demographic change experienced by Colombia in the past few years has also, in the end, had a serious effect on the system. This has happened because of the increase in life expectancy and the reduction in birth and fertility rates. This combination of phenomena has

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\(^2\) This refers to the fact that these people receive their wage plus an additional income for pension until they reach retiring age.
caused a substantial increase in the population of retiring age [which, in addition, receives a pension for more time on average] and a reduction in the number of contributors [Graph 2]. Santa María et al. [2010] estimate that in 1980 there were about 30 contributors for each pensioner. This figure gradually fell, reaching 13 to 1 in 1990 and 5 to 1 in 2013.

**GRAPH 2**
Population distribution by age cohorts

By 1992 it was evident that the problems of financial stability, unfairness and low coverage were making the system non-viable. Coverage, measured as the number of members over the economically-active population, was slightly over 21%, while the average for the region was between 40 and 50%. In terms of fairness, Vélez [1996] estimated that 50% of the individuals enrolled in the ISS belonged to the first three income deciles, while 5% belonged to the last two deciles, making the system highly unfair. In order to solve these problems, it was necessary to put forward a structural reform to modify the scheme then in force. To do that, it was necessary to introduce a self-funding mechanism that would prevent un-funded liabilities occurring with the new members.

### 1.2 A dual pension system: RPM and RAIS

Law 100 [1993] reformed the system in an attempt to correct serious faults. Its main aims were: [i] to achieve fiscal balance; [ii] to increase coverage and improve fairness; and [iii] to improve efficiency in the management of
the resources. So a system was put in place composed of two mutually exclusive schemes: the RPM with defined benefits, which combined all the existing public systems, and the Individual Saving with Solidarity Scheme ['Régimen de Ahorro Individual con Solidaridad', RAIS].

In the RPM it is necessary to meet the requirements provided in the Law [age and weeks contributed] in order to qualify for a pension. Once those requirements are met, a monthly payment is granted, this being calculated on the basis of the average wage during the last 10 years in which contributions are paid, with a replacement rate of between 65% and 80%, depending on the number of weeks contributed3. At present, the minimum age for retirement is 57 years for women and 62 for men; at the same time it is necessary to have contributed for 1,250 weeks, which will be increased by 25 weeks per year until 1,300 weeks is reached in 2015.

The RAIS, meanwhile, can be described as a scheme in which there are individual savings accounts for each of the members. Those accounts are managed by the private Pension Fund Administrators [AFPs] and their only beneficiary is the owner of the account. In order to qualify for a pension in this scheme, it is not necessary to meet requirements of age or weeks contributed, but to have accumulated sufficient capital in the savings account to finance a pension equivalent to 110% of the legal minimum monthly wage currently in force. If the member does not manage to accumulate sufficient capital to obtain a pension equivalent to a minimum wage, it is verified whether he/she contributed at least 1,150 weeks, in which case he/she may become a beneficiary of the minimum pension guarantee fund4. If he/she does not meet that requirement, the balances are reimbursed. This is also known as a defined-contribution system, because unlike the defined-benefit scheme, the value of the contribution is known, but the benefit/pension depends on the capital and the yields obtained during the contribution period. As there is no type of inter-generational solidarity, this is considered to be a funded model, since each individual accumulates a personal capital which is independent of that of the other members of the system.

However, what was achieved by Law 100 in 1993 was not sufficient to solve the problems occurring in the system at that time and it was necessary in the year 2003 to enact laws 860 and 797, which brought in a new reform for the Colombian pension system. Specifically, Law 797 [2003] increased

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3 Coefficient between the monthly pension payment and the reference contribution wage.
4 The Minimum Pension Guarantee Fund is funded with 1.5% of the contributions paid by all the people who contribute in the RAIS.
contribution rates, reduced the maximum replacement rate in the RPM and gradually increased the number of weeks required to qualify for a pension. The changes introduced by this Law sought to improve the fairness of the system, by sending the new resources collected to the Pension Solidarity Fund and creating a subsistence sub-account\(^5\) in that fund [Asofondos, 2002]. Law 860 [2003] meanwhile concentrated on issues related with disability pensions and pensions for high-risk occupations. In 2005 a new modification of the Constitution was carried out by Legislative Act on 1\(^{st}\) July of that year. This sought to include elements that would improve the fairness and sustainability of the system. With the aim of reaching that target, the 14\(^{th}\) monthly payment was eliminated for all those people earning more than three minimum wages and all new pensioners as from the year 2011\(^6\). All special schemes were likewise eliminated, except the President of the Republic and the Armed Forces; a limit of 25 minimum wages was imposed as the maximum for pension in the RPM and the period of the transition scheme established by Law 100 in 1993 was reduced\(^7\).

These changes implemented over the last two decades have reduced the pension deficit considerably. The work of Osorio, J. \textit{et al} [2005], estimated that with Law 100 the pension debt of the SGP amounted to almost 200 points of the GDP [Graph 3], a figure that has been reduced by almost 60 points of GDP. Nevertheless, this deficit still remains very high if one bears in mind that in 2102 this liability benefited only 30.1\% of the population of pensionable age, which is equivalent to almost 1.5 million people. Today, the system has managed, partially, to correct some of the problems that it was suffering from two decades ago [reduction of the pension deficit], but other problems persist and the prospects are somewhat discouraging. This is particularly true in the case of the pension system’s coverage, which, as we shall see further on, is so low that, if current conditions continue, it will generate pensions for less than 10\% of the workers.

\(^5\) The Subsistence Sub-Account of the Pension Solidarity Fund helps to finance the granting of subsidies to destitute elderly people with no type of protection.

\(^6\) The 14\(^{th}\) monthly payment was created by Law 100 as compensation for those people who had lost purchasing power as a result of a system of pension readjustment that did not fully include inflation. This benefit had been extended later to all pensioners by decision of the Constitutional Court, with a limit of 15 minimum wages.

\(^7\) The transition scheme set up by Law 100 [1993] stipulated that women over 35 years old, men over 40 years old and people who had 15 years or more of service with contributions paid as of 1\(^{st}\) April 1994, could qualify for an old-age pension under the terms of the old scheme until 1\(^{st}\) January 2014. Legislative Act 01 of 2005 brought that limit forward to 31\(^{st}\) July 2010, maintaining the original date only for those people who had contributed 750 weeks at the point when the Act was passed.
GRAPH 3
Pension debt of the General Pension System [SGP]

Source: Results of DNP Pension Model, 2005 [CC: Constitutional Court]
Note: The graph shows the estimate of the present net value of the debt of the General Pension System as a percentage of the GDP.
There is a variety of literature in existence related with the effects of pension systems on the economy. The spectrum of papers covers issues such as the impact of these systems on fiscal sustainability, their influence on economic growth, distributive aspects and the evaluation of the microeconomic efficiency of various different pension designs.

In Colombia, the line of research into the macroeconomic effects has not been a priority. Although there are papers on the impact of the different pension reforms, the main concern has been related with the fiscal and labour areas. In this respect, Clavijo [2003] evaluates the fiscal impact of laws 100 [1993] and 797 [2002] and their effect on the labour market. On the other hand, Fedesarrollo published a study headed by Santa María et al. [2010], which identifies the fact that most of Colombia’s pension problems are a reflection of the unstable development of the labour market. The study also proposes a series of policies designed to increase levels of coverage without putting fiscal sustainability at risk. In particular, that study shows that the minimum wage in Colombia is high compared with the mean productivity of the economy. On the same lines as the above, Schutt [2011] concludes that a minimum pension guarantee index-linked to the minimum wage produces low coverage; in particular, he estimates that an increase of 1% in the real minimum wage is associated with a reduction of 3.64% in the number of members in the pension system and supports the hypothesis that increases in the minimum wage have a negative effect on the probability of receiving a pension. In the same direction, López and Lasso [2008] show the existence
of a close relationship between a high minimum wage and a low rate of contribution to the pension system. The above is intimately linked with the close relationship between informality in the labour market and under-development of the pension system. In this respect, Merchán [2002] finds that the high rates of informality typical of the Colombian labour market affect the system’s coverage to a significant extent.

A series of documents has been produced recently that seek to estimate the likelihood of a person’s being able to retire with a pension under the current parameters [in terms of weeks contributed and minimum age]. López and Lasso [2012] calculated the annual probability of transition between labour categories [wage-earner, non-wage-earner, unemployed and non-active]. They also calculated the annual contributions and base contribution income for each cohort, so making it possible to estimate the probabilities of obtaining a pension. The results of these calculations are not very encouraging, especially for the population without higher education. Under the parameters that will be in force as from 2015, only 1.6% of the population without higher education that contributes in the RPM would receive a pension, while 35.7% of those who do have higher education would qualify for one, making a total of 8.7% of the population. A similar situation would occur in the RAIS, where 1.4% of people without higher education would achieve a pension, while 47.9% of those with higher education would qualify for one, making a total of 11.1%. Vaca [2012], meanwhile, used the total membership base of the association of pension fund administrators – Asofondos – to calculate the average contribution paths throughout individuals’ working lives\(^8\) and, using the Great Integrated Household Survey [GEIH], calculated the paths of probability in terms of weeks contributed. With these elements, he estimated the probability of receiving a pension, finding results slightly higher than those of Lasso [2012], but equally worrying [Table 1]. Under the parameters that will be in force as from 2015, only 13% of the population that contributes in the RPM would obtain a pension, while 35% of those contributing in the RAIS would manage to retire with a pension. Given that only 30% of the working population is in formal employment and contributes towards pensions, these percentages mean that the workers with a probability of obtaining a pension are less than 10% of the total. This scenario makes it clear that there is a need to carry out a series of specific reforms to correct this problem.

\(^8\) Calculated by decile, age and gender.
### TABLE 1
Probability of obtaining a pension for workers contributing to RPM and RAIS (percentages)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAiS</td>
<td>10.5</td>
<td>9.6</td>
<td>10.8</td>
</tr>
<tr>
<td>RPM</td>
<td>3.9</td>
<td>3</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Source: Vaca (2012).

In terms of fairness, the studies of Lasso [2006] and Núñez [2009] are worthy of special attention. Both agree that the system is strikingly regressive from the fiscal point of view. Lasso finds that 80.8% of subsidies are directed to the wealthiest quintile of the population, whilst only 0.22% of them are received by the poorest quintile of the population. Núñez, meanwhile, finds that 86.3% of subsidies are granted to the wealthiest quintile, contrasted with the 0.1% of subsidies reaching the poorest quintile.

The first approximations enabling one to see the effect on economic growth are in the study made by Tellez et al. [2009], which shows the impact on the financial markets and, through them, on economic growth. For Colombia he concludes that, thanks to the AFPs, considerable progress has been made in the development of the capital market, with special emphasis on the evolution of the debt market. At Latin American level, the work of Corbo et al. [2003] on the Chilean case is outstanding, tackling the macroeconomic effects of the change in pension scheme in a cross-sectional manner. The purpose of the following sections in this present study is to replicate the method used by Corbo et al. [2003] for the Colombian case.
In the last two decades, Colombia has achieved an important advance in its main basic macroeconomic indicators, enabling the Colombian economy to perform steadily better so far in this century. Nevertheless, in this period there were two boom periods, interrupted by one of the deepest crises to occur in Colombia’s history.

During the first half of the 1990s, the Colombian economy experienced a first expansive cycle, beginning in 1991 and lasting until 1997. Its highest point was around 1994, when the economy was growing at annual rates of over 5.5%. As from that moment, the downward phase of the economic cycle began. That phase accelerated due to the Asian financial crisis in 1997 and the Russian financial crisis in 1998, which affected Latin America, bringing with them serious consequences that were reflected in Colombia by a 4.2% contraction of the GDP in 1999. During the four years that the crisis lasted (1998-2002) the economy expanded at an average rate of 1.2% per year [Graph 4], a figure far lower than the average for the other two periods (4 and 4.5%, respectively). A second period of expansion began around 2002, which has continued to the present. This has been achieved to a large extent by the reforms and policies adopted during this period, in addition to very good external conditions, foremost among which are the boom in mining and energy exports and the favourable terms of exchange. These factors helped the Colombian economy to ride out the financial crisis of 2008-2009 successfully.
In the period that concerns us, a process of gradual liberalization of the exchange-rate took place, allowing restricted floatation within a band between 1992 and 1999, and later the adoption of a free floatation scheme in the context of a target inflation scheme, which enabled inflation to be stabilised at the desired long-term levels. On average, during the decade of the 90s, inflation was at 22%, over 10 times higher than the figure registered at the end of 2012 [Graph 5]. This has led to renewed credibility in the Central Bank.9

9 Inflation expectations have been comfortably anchored since April 2010 within the target range of 2 to 4% established by the Central Bank.
The behaviour of investment in the past two decades has also had a definite cycle. For 1990, investment as a percentage of the GDP was at 19.2% when measured in constant pesos of 2005, increasing considerably during the next five years until it reached a local maximum of 25.7% in 1995. As from that moment, investment fell to levels of around 20% of GDP for 1998, plummeting a year later to levels of 13% as a result of the international crisis. Since then, investment has been gradually recovering. Thus, 2012 saw the highest investment rate recorded in the whole period analysed [27.7% of the GDP] and it is expected that this upward trend will continue.

Meanwhile, since the early 90s there has been a strong advance in financial deepening. Total credit as a percentage of GDP rose from 36.5% in 1997 to 43.4% in 2011, situating itself at the Latin American average. However, this percentage is far lower than that reported by Brazil [56%], the United States [200%] or the countries belonging to the OECD [166%].

Towards the beginning of the 1990s, Colombia had one of the least-developed stock markets in the region, representing only 11% of the GDP [Graph 6]. This percentage of market capitalisation was slightly greater than that of Peru [7.2% of GDP], but far below that of Mexico or Chile [38 and 66% of GDP, respectively] and continued to be relatively stable until 2001. With the fusion of the stock exchanges of Bogotá, Medellín and Occidente to create the Colombian Stock Exchange [BVC] in July 2001, a steady growth began which has lifted the Colombian stock market to a level where it is one of those with the highest market capitalisation indicators in the region. In this period of time, it has overtaken, in relative terms, such important markets as Brazil [49% of GDP] and Mexico [35% of the GDP], reaching a capitalisation of over 60% of GDP, surpassed only by Chile, where capitalisation in 2011 was over 100% of its GDP. In May 2011, operational integration with the stock exchanges of Lima and Santiago de Chile was achieved, which would enable it in the future to compete in terms of absolute size with those of Mexico and Brazil, increasing the quantity of companies listed, the number of people actively trading and the total market capitalisation. Even so, Colombia has extraordinarily low levels of liquidity in terms of its shares.
The progress achieved in macroeconomic fundamentals has thus allowed the Colombian economy to achieve a better performance following the deep crisis of 1998-2002. In the nineties, excluding the three years of crisis, the average growth was 4%, while in the past 10 years this has been situated at 4.5%.
4. Macroeconomic effects

Following Corbo et al. [2003], the macroeconomic effect of the pension reform introduced in Colombia in 1993 was to manifest itself through three transmission mechanisms: [i] the increase in savings and investment rates and its effect on the rhythm of growth of the capital stock; [ii] the deepening of the capital markets and its impact on Total Factor Productivity [TFP]; and [iii] the effect on the labour market.

4.1 Effect on savings and investment

4.1.1 National savings

The first of the impacts of a pension reform on the macroeconomic performance of a country is the change in savings and investment rates. In the Colombian case, it is worthwhile to assess whether there was an increase in the rate of saving between 1993 and 2010 in Colombia as a consequence of the pension reform, and whether that increase has contributed towards producing a higher rate of investment in the country.

In answering this question we proceeded to estimate the national savings rate for the period 1970-2010, which required dealing with different historic data sets, due to the multiplicity of methodological changes that
occurred throughout this period. National income and consumption at current prices were used to estimate savings, according to DANE’s most recent methodology. The national savings rate, expressed as a proportion of GDP is shown in Graph 7 for the period 1970-2010.

As can be seen, the savings rate has had significant fluctuations following the pension reform. After having maintained levels of over 21% of GDP in the second half of the 1980s and the early 1990s, it fluctuated around 19% between 1992 and 1994 and then began a steep fall that took it to 13% in 2001. From then on it began a strong recovery, exceeding 20% again between 2006 and 2008. However, as from that year there was a reduction once again. For 2010, the last year for which we have available information, the savings rate was 18%.

Of course, the large fluctuations in the savings rate observed in the past two decades may be attributed to multiple factors. The transition between pension schemes is just one of them. The big question is whether this factor had a positive or negative effect. Later on we shall attempt a reply, using the breakdown methodology of Corbo et al. [2003], but before doing so it is useful to differentiate the behaviour of savings, comparing those corresponding to the Government, to households and to companies, as shown in Graph 8. It is clear that the fall in the savings rate throughout the 1990s is attributable fundamentally

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10 The national accounts have used four methodologies: those of 1970, 1994, 2000 and 2005. Between methodologies there were years in which two different sets of data were published for the same period, which made it difficult of construct a unified data set.
to the downward trend in public savings. In fact, public savings represented over 5% of the GDP until 1995 and plummeted to negative values between 1998 and 2002. In the more recent period, public savings became positive once again, but the component that marked the recovery of total savings most clearly was corporate savings. Meanwhile, household savings have shown less dramatic fluctuations, remaining in general at levels of around 5% to 7% in most years since 1994. Although there has been a slight upward trend in the past decade, those levels are clearly lower than those that existed in Colombia in the seventies or even in the eighties.

Given that the behaviour of savings depends on so many macro and microeconomic factors, the best approximation for estimating the impact of the 1993 pension reform on such savings is to identify the different channels by which that reform could act, both on public savings and on household savings. To do that we followed the methodology developed in Corbo et al. [2003], identifying four main channels: [i] the negative effect of the public transition deficit caused by the reform and the Government’s compensatory response; [ii] the positive impact on household savings of the mandatory savings introduced by the reform; [iii] the response of the private sector to the larger Government deficit [a possible Ricardian neutrality effect]; and [iv] the compensatory response in voluntary household saving due to the increase in mandatory savings.
Once these effects have been estimated, we deduce the total impact on national savings and, on that basis we estimate the impact of the reform on investment and, through it, on economic growth.

### 4.1.2. Transition deficit caused by the reform and the Government’s response

The change in the pension scheme from a pay-as-you-go system to one based on individual saving produces a transitional imbalance in public finances. This deficit is a result of less public sector revenue as the contributions go to private individual accounts, plus the recognition of the debt acquired with those contributors who change to the individual saving scheme [the so-called pension bonds]\(^{11}\). It is important to clarify the fact that the Government is not acquiring new debt as a result of the change of scheme; it is making explicit a debt that was previously implicit, and that is the only reason why it appears as a fiscal deficit. The magnitude of the transitional fiscal deficit under the two items mentioned above [transfers to individual accounts and recognition of bonds] has been estimated in Colombia by the National Department of Planning [DNP] using the model known as DNPensiones\(^{12}\), the details of which have kindly been made available to us for purposes of this study.

The evolution of the transition deficit is shown in Graph 9. At the beginning, due to the small size of the RAIS, that deficit was only 0.13% of GDP in 1995. As more people switched schemes, this gradually increased, reaching a maximum of 1.2% of GDP in 2007 [Graph 9]. Nevertheless, during the latest five-year period there has been a reversal of transfers and therefore a reduction in the transition deficit. On average, in the period 2006-2010 it was situated at 1.01% of the GDP. The average value of the Colombian transition deficit is considerably lower than that calculated by Corbo et al. [2003] for Chile [3.4% of GDP]. This is a consequence of

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11 In the Colombian case only those pension bonds that have been entailed are accounted for, and not those that have been issued. Otherwise there would be problems in the accounting in the case of bonds corresponding to members who transferred originally to the RAIS and have subsequently migrated back to the public pension system.

12 DNPensiones is the actuarial model prepared by the National Department of Planning [DNP], which estimates the pension deficit. This has been constructed and improved over the past 15 years.
the fact that in Colombia the reform left the RPM open, allowing people to switch freely between schemes, whereas in Chile the transition was a complete one\textsuperscript{13}.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{graph9.png}
\caption{Public deficit caused by the transition between the RPM and RAIS [Percentages of GDP]}
\end{figure}

Fuente: DANE, DNP y cálculo de los autores.

In order to find the impact of the transition deficit on the fiscal deficit, it would be necessary to estimate the degree to which that transition deficit was offset by higher taxes or expenditure cuts in other areas, or with more debt. In the first two cases, there would be a compensatory element of fiscal adjustment, which would not exist in the last. For Colombia, it is virtually impossible to establish a correspondence between the transition deficit and its compensatory mechanisms on the fiscal balance, due to the multiple reforms that have been passed over the past 20 years. For this reason, following the procedure used by Corbo et al. [2003], we shall be using three alternative scenarios. The first of these assumes that 100\% of the transition deficit is fully financed by fiscal adjustments. The second is an intermediate scenario that assumes a fiscal adjustment of 62.5\% and, finally, a low scenario with an adjustment of 25\%. Given the above scenarios, the adjustment of the non-pension balance as a consequence of the reform oscillated between 1.01 and 0.25\% of the GDP, with a mid-point of 0.63\%. This means in practice an increase in the Government’s deficit due to the reform, varying between 0\% and 0.76\% of the GDP, with a mid-point of 0.38\%.

\textsuperscript{13} These alternatives correspond to compensation parameters of 15.3 and 31.3\% respectively, which in turn are equal to the central estimate of 24.15\% mentioned in the text, plus or minus a standard deviation.
4.1.3. New mandatory household savings

The new mandatory savings arise from the contributions that workers pay into the pension funds. To estimate them, we took the difference in the value of the pension funds from one period to another. In that way, the sum of the interest, capital gains and contributions is reckoned up, and pension payments deducted. The mandatory savings grew steadily as from the year of the reform, due to a large extent to the small number of people who were retired under this scheme\textsuperscript{14}. In 1995 the mandatory savings were only 0.23% of GDP, while in 2010 they were at 3.49% of GDP [Graph 10]. The highest point in the period studied was in 2009 with a record of 4.26%. An evaluation of the average from 2006 to 2010 shows that the average ratio of mandatory savings to GDP was 2.52%.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{graph10.png}
\caption{New mandatory private savings}
\label{graph10}
\end{figure}

\textbf{Source: DANE and authors’ calculation.}

4.1.4. Response of the private sector to the increased Government deficit

Does the private sector modify its saving in response to an increase in the Government’s deficit? To find out the response of the private sector to the public deficit, an attempt was made to estimate an error-correction model, following the methodology of Bennett \textit{et al.} [2001]. However, no significant result was obtained to support the existence of some type of Ricardian neutrality. These results are consistent with the findings of Carrasquilla and Rincón [1990] for Colombia, according to which there is no systematic occurrence of Ricardian neutrality. This may be due to the asymmetrical responses of the private sector

\textsuperscript{14} The people who were close to retirement chose to remain in the RPM.
to different time horizons or, alternatively, to the presence of liquidity restrictions in credit markets. This leads us to assume that the response of the private sector to the Government’s increased deficit is statistically irrelevant.

4.1.5. Response of households to the new mandatory pension savings

The response of voluntary household saving to the new mandatory savings was estimated using an ARDL\textsuperscript{15} model, as suggested by Bennett et al. [2001]. The results suggest a compensation coefficient of 24.15% [in other words, for each peso of increased mandatory savings, voluntary savings fall by 24.15 cents]. Therefore, as the mandatory savings in the period 2006-2010 amounted to 2.52% of the GDP, the compensation in voluntary savings would be 0.61%. Given the uncertainty about the compensation parameters, we included in our calculations an alternative with less compensation, in which the compensation in voluntary savings would be 0.4% of GDP, and another with more compensation in which it would be 0.82% of GDP\textsuperscript{16}.

4.1.6. Effect on National Savings

Adding together the above mentioned effects, the increase in savings produced by the pension reform was 1.53% of the GDP in the intermediate scenario. It would be the result of a public deficit of 0.38%, new mandatory savings of 2.52% and compensation in voluntary savings of 0.61%. This scenario, as described before, assumes that the Government is financing 62.5% of the transition deficit through cuts in other expenditure or increased taxes [see Table 2]. These calculations would reflect the change in savings between the situation prior to the pension reform and the situation observed in the period 2006-2010, when the reform was already fully in force.

Against this background scenario, we considered two alternative scenarios, the terms of which are summarised below [Table 2]. For a high-saving scenario, we took the case in which the transition deficit is funded entirely by fiscal adjustment and also the lower compensation

\textsuperscript{15} This is a model in which the dependent variable is a function of its own lags, the independent variables and their lags.

\textsuperscript{16} These alternatives correspond to compensation parameters of 15.3% and 31.3%, respectively, which in turn are equal to the central estimate of 24.15% mentioned in the text, plus or minus a standard deviation.
coefficient in voluntary private saving [0.4% of GDP instead of 0.61% of GDP]. In this scenario the increase in savings as a result of the pension reform would have been 2.12% of GDP.

Finally, in a third low-saving scenario, we considered a compensation coefficient for the transition deficit with only 25% fiscal adjustment, as a result of which the increase in the public deficit would have been 0.76% of GDP. For this scenario, we also assumed that the compensatory adjustment in voluntary savings would have been 0.82% of GDP and, with that, the total increase in national savings would have amounted to 0.94% of GDP.

4.1.7. Investment

After calculating the impact of the new pension scheme on savings, it is necessary to see how investment is affected, in order to determine the impact of those savings on growth. In a closed economy, savings are equal to investment, so alterations in the rate of saving affect the investment rate by the same amount. In an economy that is open to external funding, where it is viable to have deficits or surpluses in the current account of the balance of payments, it might be thought that any excess of investment over saving would be financed externally and therefore that greater internal savings would have no impact on either investment or growth. At the other extreme, it might be argued that the need to maintain a sustainable current account in the balance of payments means that external savings [i.e. the deficit in the current account] do not change with internal savings, and therefore an increase in savings produces an equal increase in investment. The real position is surely located somewhere between these two extreme readings.

In fact, in the Colombian economy, investment behaviour has been linked to a significant extent with external factors that are additional to savings performance. In particular, the current account deficit in the balance of payments, or external savings, has been an important source of investment funding. Graph 11 shows that such external savings represented 1.3% of GDP on average for the period 1990-2011, and fluctuated considerably between periods of negative value\(^\text{17}\) and periods when they rose to represent over 3% of the GDP, such as the period between 1994

\[^{17}\text{ Those periods of negative external savings include [i] the early 1990s, when Colombia had a surplus in current account and acted as lender to the rest of the world, and [ii] the years 1998-2001, when external savings were practically zero because there was no foreign financing available for the country.}\]
and 1998 or the most recent period, which began in the year 2009 and still continues today.

In addition to internal and external savings, the behaviour of real investment—which is what affects economic growth at the end of the day—is influenced to a remarkable extent in a country like Colombia by what happens with the terms of trade. Given the high imported component of investment, the ability to invest increases considerably when there is an improvement in the relative prices of exports, compared with the prices of imports. This can be appreciated clearly in Graph 12. The total investment rate of the economy, measured at constant 2005 prices, has had a notable cycle in the past two decades. After exceeding 25.7% of GDP towards the mid-nineties, investment fell dramatically to reach a minimum of 12% for 1999 as a consequence of the crisis that affected Colombia during that period. As from that point on, it began to recover, reaching levels of 27% once again in 2011 and 2012.

The question that arises is how it has been possible to achieve such a high rate of investment with much lower coefficients of national saving. Unfortunately, we only have figures for savings [in current pesos] up to the year 2010, but that year can serve as an illustration of what continues to happen nowadays. In fact, the investment rate in 2010, in constant 2005 pesos, was 24.1%, while the national savings rate was only 18%. Part of the difference was funded with a deficit in the current account.
[external savings] of 4.1% and the rest came from the benefit obtained by the Colombian economy as a result of an increase in the relative price of its exports [terms-of-trade effect] after 2005, the year which serves as the basis for measuring GDP and investment in real terms.

In these conditions, in an open economy such as Colombia’s, the impact of national savings on investment cannot be seen as something mechanical. After calculating in earlier sections the increase in national savings that occurred as a consequence of the pension reform, the question now is what impact this may have had on investment. A simple procedure for this, following the methodology of Corbo et al. [2003], is to estimate econometrically the impact of national savings on investment by means of a simple regression between the two variables, a regression that has traditionally been used to estimate the degree of integration in international markets [Feldstein et al., 1980]:

$$\frac{\text{Investment}}{\text{GDP}} = \alpha_0 + \alpha_1 \frac{\text{Savings}}{\text{GDP}}$$

The equation estimated was from 1990 to 2010. The results are robust to different estimation periods. The results of the regression between savings and investment were the following:

$$\frac{\text{Investment}}{\text{GDP}} = 0.047 + 0.8144 \frac{\text{Savings}}{\text{GDP}}$$

If we use the three scenarios described above for the increase in the rate of national saving produced by the pension reform, this equation takes
us to three scenarios corresponding to the increase in the investment rate, which are summarised in Table 2. In the intermediate scenario, the increase in investment brought about by the pension reform would have been 1.25\% of GDP; in the high scenario, 1.73\% of GDP and in the low scenario, 0.76\% of GDP\textsuperscript{18}.

4.1.8. Effect on growth via saving and investment

Once the effects of the pension reform on the savings and investment rates have been obtained, it is important to determine their effect on GDP growth. To do this the methodology suggested by Corbo at al. [2001] was used. For this purpose we use estimates of the capital-labour breakdown of a Cobb-Douglas type of production function, according to which the weight of capital in GDP growth is 42\% and that of labour is 58\% [Greco, 2002]:

\[
\hat{Y} = \hat{A} + 0.42\hat{K} + 0.58\hat{L}
\]  

(2)

The effect of the investment rate \([i = \text{Investment}/Y]\) on the growth rate of the stock of capital can be calculated on the basis of the following breakdown, in which the depreciation rate of the capital is represented by \(\delta\)

\[
K = i \frac{\hat{Y}}{K} - \delta
\]  

(3)

The equations for the investment rate and its effects on the growth of GDP are estimated for the three scenarios. This gives us an effect of the increase in the investment rate on the annual GDP growth rate that oscillates in a range between 0.13 and 0.30\%, with a mean value of 0.22\% [Table 2].

\textsuperscript{18} As was mentioned earlier, the intermediate scenario assumes a coefficient of adjustment of 62.5\% and a coefficient of compensation from mandatory savings of 24.1\%. The high-savings scenario assumes complete compensation of the fiscal transition deficit and compensation from voluntary private saving of 0.4\% of GDP. Finally, the low-savings scenario assumes a compensatory fiscal adjustment to the transition deficit of only 25\% and a compensatory adjustment of voluntary savings of 0.8\% of GDP.
The contributions to the private pension funds implied an important financial deepening and a huge increase in the volume of trading in capital markets. Hence, since the pension reform those financial and capital markets have shown an outstanding development, which encourages better corporate governance and transparency in private companies.

In fact, the Colombian stock market has grown steadily during the past 20 years. A large part of that growth can be attributed to the creation of the pension funds. The pension reform set up the pension fund administrators [AFPs], which have been gradually building up their resources over time, with the resulting growth in demand for investments that would be able to provide the highest yield compatible with the legal framework established for institutional investors. This growth can be observed in the increase in the value of the funds. For 2000, this value was around 8 billion pesos [3.8% of the GDP], whereas by 2012 it amounted to 125 billion [19.1% of the GDP], showing a growth equivalent to over 15 percentage points of GDP in only 12 years [Graph 13, panel A].

### Table 2
Estimate of effects of the pension reform on GDP growth, through savings and investment (%)

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Base</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Savings</td>
<td>0.94</td>
<td>1.53</td>
<td>2.12</td>
</tr>
<tr>
<td>Transition deficit</td>
<td>-1.01</td>
<td>-1.01</td>
<td>-1.01</td>
</tr>
<tr>
<td>Non-pension adjustment</td>
<td>0.25</td>
<td>0.63</td>
<td>1.01</td>
</tr>
<tr>
<td>Response of private saving</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>New Mandatory Savings</td>
<td>2.52</td>
<td>2.52</td>
<td>2.52</td>
</tr>
<tr>
<td>Response of Voluntary Saving</td>
<td>-0.82</td>
<td>-0.61</td>
<td>-0.40</td>
</tr>
<tr>
<td>Investment</td>
<td>0.76</td>
<td>1.25</td>
<td>1.73</td>
</tr>
<tr>
<td>Effects on growth</td>
<td>0.13</td>
<td>0.22</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Source: Authors’ calculation.
In order to measure financial depth we use an amplified financial depth indicator (PFA), which include broad money supply (M3), the total supply of Treasury bonds (TES) and the full value of shares traded in the stock exchange (market capitalisation). This amplified measure of financial depth (PFA) represented 45% of GDP by the mid-nineties [Graph 13, panel B]. During the second half of the nineties the PFA rose to 57% of GDP, mainly as a result of the development of the TES market [which represented 4.2% of GDP in 1995 and five years later already represented 12% of the GDP]. During that period, neither market capitalisation nor the banking system [which is reflected in M3] contributed to increasing financial depth, since their shares in the GDP remained at around 12 and 30%, respectively. As from 2002, the PFA was much more dynamic. It rose from representing 57% of GDP in 2002 to 137% of GDP in 2010. This outstanding development was mainly explained by the extraordinary performance of market capitalisation and the expansion of the TES market, which currently represents almost 70% of GDP.
GRAPH 13
Evolution of financial depth and evolution of the pension funds
(Percentages of GDP)

Panel A:
Value of private pension funds

Panel B:
Amplified Financial Depth Indicator

Source: Financial Superintendence, Banco de la República and authors’ calculations.
The increase in the size of the institutional investors caused by the creation and growth of the pension funds was a key factor for the improvement in the capital markets that became evident as from the mid-nineties in Colombia. Outstanding among these are the enormous growth of the internal public debt market, which allowed the government to redirect its traditionally external financing sources towards internal debt; the appearance of securitization for mortgage funding; the creation of a private debt bond market; the consolidation of the stock exchanges with significant effects on shares liquidity and the development of stock markets; a multiplicity of regulatory innovations that opened up space for funding infrastructure through the capital market; and technological improvements of market platforms that reduce trading costs and improve security. It must be said, however, that despite all these improvements, the Colombian capital markets still lag far behind the developed countries, and even other countries in the region. Most important is the lag shown by the capital markets, and the pension funds in particular, in financing infrastructure. This lag may be partly explained by problems in financial regulations [see Gómez, Jara and Pardo, 2005, and Suz et al., 2012] but, to a far greater extent, it may be blamed on the regulations that existed until very recently to promote concessions and public-private projects [see Infrastructure Commission, 2012].

The Colombian Stock Exchange [BVC] has become stronger during the past decade as a result of the fusion on 3rd July 2001 of the stock exchanges of Bogotá, Medellín and Occidente. In addition, May 2011 saw the operational integration of the BVC with the Lima Stock Exchange and the Santiago Stock Exchange, so creating the Integrated Latin American Market [MILA].
4.2.1. The size of the market

The performance of the Colombian stock exchange has been remarkable in the last few years in terms of capitalisation indicators, especially after Ecopetrol entered the market. For 2004 the market capitalisation of the BVC represented 21.5% of GDP. Eight years later, the market capitalisation of the BVC is around 60% of GDP, far higher than the stock exchange of Peru [44.8% of GDP] or Argentina [9.8% of GDP]. However, as a share of GDP, Colombia’s market capitalisation is still below that of Chile [Graph 14]. Furthermore, the indicators on the number of listed companies and on the liquidity of the shares listed on the stock exchange are far lower than those of other countries in the region.

![Graph 14: Market capitalisation]

In fact, a comparison of the BVC with the rest of the stock exchanges in the region shows that while there are 364 companies registered in Brazil and 277 in Peru, in Colombia only 82 companies are listed [Graph 15], and only a few of them are considered liquid. So, despite the good levels of capitalisation of the BVC, the number of companies listed shows evidence that the Colombian market continues to lack depth, even though it has great development potential.
Meanwhile, the value of transactions on the stock market, which indicates liquidity, was approximately 8% of GDP for the year 2011, a figure that has remained relatively constant since 2005 [Graph 16]. Although the pension funds (AFPs) demand a considerable number of assets, it is also true that they keep those assets for long periods, making the market less liquid.
On the other hand, the development of the capital market associated with the AFPs has benefited the funding of the public sector through very liquid Treasury bonds (TES), with maturities of up to 30 years and with far lower interest rates than in the past. Shifting from external towards domestic public debt during the past few years has helped to mitigate the foreign currency exchange rate risk and to make Colombian public finances less vulnerable to possible external shocks [Graph 17]. In that sense, by absorbing a substantial part of public debt issues, the AFPs have contributed towards making economic cycles less intense.

**GRAPH 17**

Evolution of Treasury bonds (TES) holdings and share of external and internal debt within the total public debt

Panel A:

% of internal and external debt in total public debt

<table>
<thead>
<tr>
<th>Year</th>
<th>Internal</th>
<th>External</th>
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</thead>
<tbody>
<tr>
<td>1994</td>
<td>72.1</td>
<td>27.8</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
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<tr>
<td>1996</td>
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<td>2006</td>
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<td>2007</td>
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<td></td>
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<tr>
<td>2008</td>
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<td>2009</td>
<td></td>
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<tr>
<td>2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel B:

TES holdings as % of GDP

Source: Banco de la República and authors’ calculation.
4.2.2 Effect of the RAIS on financial savings

The impact of the private pension funds on financial savings can be quantified in various ways. One of these involves estimating the impact of the mandatory savings in the funds by quantifying their direct effect on the size of the amplified financial depth indicator \(\text{PFA}\) that we described earlier. This procedure, however, does not recognize that the creation of the funds had a series of positive spill-over effects on the capital market.

In order to find a better approximation of the impact of the RAIS pension savings on the amplified financial depth index \(\text{PFA}\), a model was constructed taking the \(\text{PFA}\) as the dependent variable, and the mandatory savings as percentage of GDP \(\text{ms}\), the domestic-foreign interest rate differential \(\text{dif}\), a dummy variable for years with inflation levels of over 10\% \(\text{D1}\), the national savings rate \(\text{ns}\), a financial liberalization measure \(\text{Lib}\), a dummy variable that embodies the privatization processes \(\text{D2}\), the EMBI\(^{19}\) and the logarithm of the value of the pension funds \(\text{Fun}\) as independent variables.

\[
pfa = \alpha_0 + \alpha_1 \text{ms} + \alpha_2 \text{Dif} + \alpha_3 \text{D1} + \alpha_4 \text{ns} + \alpha_5 \text{Lib} + \alpha_6 \text{D2} + \alpha_7 \text{EMBI} + \alpha_8 \text{Fun}
\]

The coefficient of regression of mandatory savings was 7.9, which would indicate that for each additional point of average mandatory savings, the financial depth would increase 7.9\%. This result is similar to that obtained in other studies. In the study of Corbo [2003], for example, this value oscillated between 6.5 and 20.5.

The average mandatory savings of the past 5 years was 2.52\%, which, multiplied by the coefficient of regression, would mean that the indirect effect of the RAIS on the amplified financial depth index \(\text{PFA}\) was 19.9 percentage points of GDP.

4.2.3 Effect of financial savings on growth

The greater development of the capital market, thanks to the reform of the pension system, allowed greater expansion of productive activity.

In order to measure this effect we used alternatively [i] the elasticity levels constructed by Levine et al. [2000], which indicate that GDP growth accel-

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\(^{19}\) The Emerging Markets Bond Index [EMBI] is the main indicator for measuring the country risk of emerging countries. It is calculated on the basis of the difference in interest rate paid by bonds expressed in dollars that are issued by developing countries, and United States Treasury Bonds.
erates by 0.12 percentage points for every 100 additional pps of financial deepening; and [ii] the elasticity levels calculated by Rioja et al. [2003], according to which 10 pps of PFA accelerate GDP growth by 0.25 pps. These parameters are compatible with those used in other studies; for example the elasticity used in the article by Corbo et al. [2003] was 0.2%.

Starting from the results of the previous subsection, according to which the amplified financial deepening indicator should have increased 19.9% of GDP as a result of the RAIS, on using the elasticity levels of Levine and Rioja the result would be an acceleration of the GDP, via productivity, of between 0.24 and 0.50% [Table 3], with a mid-point of 0.36.

### TABLE 3
Effects of the reform on the acceleration of the GDP through the development of the capital market

<table>
<thead>
<tr>
<th>Increase in PFA</th>
<th>Elasticity Levels</th>
<th>Effects on Growth of TFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.9%</td>
<td>0.012</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>0.025</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations.

### 4.3 Effect on the labour market

The third macroeconomic effect of the pension reform has to do with its impact on the labour market. How has total employment behaved? Has there been redistribution among formal and informal workers? What have the effects of that redistribution been on workers’ wages and productivity? These are some of the main questions that will be tackled in this section.

In Colombia, unlike other countries, the real rate of contribution to the system rose with the pension reform. This rise was not an inherent part of the change from the RPM to the RAIS, but the response given by the authorities in 1993 when confronted by the difference between the current rate and what was needed in order to make the system sustainable. To a large extent, that difference corresponded to the distance that
existed at that moment between the real rate and what had been programmed under the RPM. This was a substantial difference, as we saw in an earlier section of this study. In fact, in 1993 the contributions paid into the system by workers and employers were only 6.5% of the wage while, according to the Law, the contribution rate by that date should have been 22%. In order to make the system viable, it was essential to increase the contribution rates. Law 100 (in its article 20) stipulated that the contribution should rise to 8% in 1994, to 9% in 1995 and to 10% from 1996 onwards [Table 4]. An additional 3.5% was also fixed for paying survivorship and disability pensions and the system’s administration expenses. These costs were to be assumed mainly by employers20.

**TABLE 4**

Developments in the contribution rate for pensions resulting from Law 100 [1993] and Law 797 [2003] [% of wage]

<table>
<thead>
<tr>
<th>Year</th>
<th>Contribution Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>6.5</td>
</tr>
<tr>
<td>1994</td>
<td>11.5</td>
</tr>
<tr>
<td>1995</td>
<td>12.5</td>
</tr>
<tr>
<td>1996-2002</td>
<td>13.5</td>
</tr>
<tr>
<td>2003</td>
<td>13.5</td>
</tr>
<tr>
<td>2004</td>
<td>14.5</td>
</tr>
<tr>
<td>2005</td>
<td>15.0</td>
</tr>
<tr>
<td>2006</td>
<td>15.5</td>
</tr>
<tr>
<td>2007</td>
<td>15.5</td>
</tr>
<tr>
<td>2008 onwards</td>
<td>16.0</td>
</tr>
</tbody>
</table>

Source: Law 100 [1993] and Law 797 [2003] and authors’ calculation.

However, these increases in the contribution rates were not sufficient to provide fiscal sustainability to the system and it was necessary to increase them further at the beginning of the 21st century. Law 797 [2003] stipulated in article 7 that the contribution rate would remain steady in 2003 at 13.5%; however, it changed its composition: 10.5% would be dedicated to financing the old-age pension and the contribution for fees and insurance would be reduced to 3%. In 2004 the rate would be increased

20 Employers have to pay 75% of the total contribution and the workers, the remaining 25%.
by 1pp and as from 2005 there would be increments of 0.5pps per year, arriving to 16% in 2008.

It is important to highlight the fact that pension contributions were not the only non-wage labour costs that rose during the period studied. The contribution rate for health rose from 7 to 12.5% and total non-wage labour costs rose from 45% in 1993 to over 58% in 2010 [Graph 18]. Non-wage costs were made up of 12 pps in contributions to the health system and 16 pps to the pension system, 20.5 pps corresponding to severance payments, legal bonuses and holiday allowances and 9 pps contribution to para-fiscal services [2 pps to SENA; 3 pps to ICBF and 4 pps to the compensation funds]. The increase in those costs had a negative impact on the labour market. As shown by Santa María et al. [2008], it increased labour informality by making it too burdensome for companies to hire workers with a formal contract. For 2013 these non-wage costs fell 13.5% as a result of the tax reform [Law 1607, 2012].

Although it was not a consequence of the change from the RPM to the RAIS, the pension reform in Colombia coincided in 1993 with a drastic increase in extra labour costs payable by the companies, which had an important negative effect on employment and labour formality. Albrecht et al. [2008] study this question and find that an increase in non-wage costs leads to

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21 The National Apprenticeship Service, SENA, is responsible for investing in the social and technical development of Colombian workers in productive activities that contribute to the country’s social, economic and technological development.
an increase in informality and self-employment [typically informal], which in turn leads to a reduction in productivity and in the average wages of the economy. This result is consistent with Santa María et al. [2008], who show that the increase in non-wage payroll costs caused an increase, not only in unemployment, but also in the number of informal workers who register on surveys as self-employed, as opposed to wage-earners. In fact, as can be seen in Graph 19, the coefficient of self-employed workers as a share of total employees was relatively stable until the mid-nineties, and then showed a steep increase which coincided with the increase in non-wage payroll costs. The same happened with the unemployment rate (for the main seven cities of Colombia), which rose as the non-wage costs were increased [Graph 20]. The main increase occurred during the period 1996-2000, when the unemployment rate rose from 11 to 20%. Although these two indicators have fallen in the most recent period, they are still above the levels observed in the early nineties.

GRAPH 19
Evolution of employment relative to non-wage costs
To sum up, the pension reform brought with it a considerable increase in the contributions to the system [from 6.5 to 16%], as a result of the lack of earlier updating of the real contribution rates. Meanwhile, there was an increase in health contributions, which increased non-wage payroll costs by around 14 pps. This had a negative effect on the labour market, increasing unemployment and informality and reducing the average wage of self-employed workers. The reduction in formal employment involved a loss in the collection of pension contributions, due to the smaller proportion of people contributing into the system. Although the effect was negative, it is incorrect to attribute those consequences to the reform, because they were simply a result of the system’s being updated to the parameters originally planned, something that would have been necessary, quite apart from whether or not the individually-funded system was introduced. If this updating process had taken place at the correct time, in the way stipulated before Law 100, the effective contribution rate would have been 22% for 1993 and, with the reform, there would have been a reduction to the current level of 16%. This reduction would have had a positive effect on the labour market, reducing unemployment and informality and increasing workers’ productivity. The hypothetical nature of that situation, however, means that in the process of quantifying the impacts of the pension reform and the creation of the RAIS on economic growth, we cannot include the effects that might have occurred through the labour market, but did not.
5. Conclusions

In this study, an evaluation was made of the macroeconomic effects of the pension reform carried out in Colombia in 1993. To do this, various models were developed in order to estimate the impact that the reform has had on macroeconomic flows, capital markets and economic growth, by comparing the period prior to the reform with the situation existing in the five-year period 2006-2010, when the individually-funded system was already fully functional.

According to the classic literature on growth, the impact on GDP comes from three channels: an increase in the labour factor, an increase in the capital factor or an increase in total multi-factor productivity. In Colombia’s case, the exercise on the labour market turned out to be deceptive, because the updating of the real contribution rates to the pension system and other programs distorts the effect that the reform might have had. Therefore the econometric modelling concentrated on the capital and productivity effects, without including effects on the labour market.

In terms of capital, it is estimated that investment as a percentage of GDP increased between 0.8% and 1.7% as a result of the reform, with a mid-point estimate of 1.25%. The above is levered on increments of the savings rate of between 1 and 2.1 points of GDP. In consequence, and bearing in mind the incremental capital-product relationship estimated for Colombia, a boost in GDP growth of between 13 and 30 bps appears to have occurred through this channel.
On the other hand, the creation of the individual saving with solidarity scheme (RAIS) made an important contribution towards increasing the financial depth of the Colombian economy, and this had an impact on productivity. That impact occurs, not only through the improved allocation of savings and investment resources associated with the development of credit and the capital markets; it is also related with the fact that a deep public debt market, such as the one developed in Colombia thanks to the existence of the pension funds, contributed towards reducing Government dependence on external credit, so generating greater macroeconomic stability. Depending on the elasticity figures used to measure the impact of the greater financial depth on economic growth, we estimate that that growth accelerated between 24 and 50 bps through this channel.

To summarise, when the situation in force in the five-year period 2006-2010 is compared with the one that existed before the pension reform, we find that the introduction of the individually-funded pension system produced more savings and greater financial depth, which together produced an impact between 37 and 80 basic points of annual economic growth, with a mid-point of 58 bps. [Table 5].

Of course, the specific numbers are subject to assumptions and methods of estimation that may be open to multiple questionings. However, they constitute a good indication of orders of magnitude and clearly illustrate what we consider may be the main channels through which the Colombian economy has benefited from the 1993 pension reform. As was mentioned, in the Colombian case, we did not include in our estimates the potential impact of the pension reform on labour markets. It is clear that the steep increase in payroll contributions that occurred in the context of the pension reform had a negative impact on employment and labour formalisation. However, that was not a result of the introduction of the individually-funded system, but the unavoidable need to adjust contribution parameters to make the system sustainable.

The benefits associated with the introduction of the individually-funded system 20 years ago should not hide the enormous challenges and difficulties that persist in the Colombian pension system. In particular, coverage is unacceptably low, due fundamentally to the enormous levels of informality characteristic of the Colombian labour market. In the next few years it will be necessary to advance with new reforms in order to improve coverage and guarantee greater fairness. The great challenge
is to achieve this without going back on the aspects through which the scheme introduced in 1993 has helped to boost the country’s financial development and economic growth.

**TABLE 5**

Estimate of the total effects of the pension reform on growth and on the level of the GDP [%]

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Base</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Savings/GDP</td>
<td>0.94</td>
<td>1.53</td>
<td>2.12</td>
</tr>
<tr>
<td>Investment/GDP</td>
<td>0.78</td>
<td>1.25</td>
<td>1.73</td>
</tr>
<tr>
<td>Labour Market</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Capital Market Development [PFA/GDP]</td>
<td>19.9</td>
<td>19.9</td>
<td>19.9</td>
</tr>
<tr>
<td>Growth in Gross Domestic Product</td>
<td>0.37</td>
<td>0.58</td>
<td>0.80</td>
</tr>
<tr>
<td>Saving-Investment Channel</td>
<td>0.13</td>
<td>0.22</td>
<td>0.30</td>
</tr>
<tr>
<td>Financial Deepening Channel</td>
<td>0.24</td>
<td>0.36</td>
<td>0.50</td>
</tr>
<tr>
<td>Labour Market Channel</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations.
The Ricardian neutrality coefficient should be negative, which implies compensation in private savings when there are variations in public savings, so when the relevant coefficient turns out to be positive, the Ricardian neutrality hypothesis is ruled out and no compensatory effect is taken into consideration.

### Notation used in the model

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Ps$</td>
<td>Private savings</td>
</tr>
<tr>
<td>$Pus$</td>
<td>Public savings</td>
</tr>
<tr>
<td>$Gic$</td>
<td>Growth of industrial countries</td>
</tr>
<tr>
<td>$Flib$</td>
<td>Financial liberalisation</td>
</tr>
<tr>
<td>$Find$</td>
<td>Financial deepening</td>
</tr>
<tr>
<td>$Pcin$</td>
<td>Per capita income</td>
</tr>
<tr>
<td>$R$</td>
<td>Real interest rate</td>
</tr>
<tr>
<td>$Cgdp$</td>
<td>Current GDP</td>
</tr>
</tbody>
</table>

### Specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification 1</td>
<td>$ps\ (t-1),\ pus\ (t,\ t-1)$</td>
</tr>
<tr>
<td>Specification 2</td>
<td>$pus\ (t,\ t-1),\ gic\ (t,\ t-1),\ flib\ (t,\ t-1),\ find\ (t,\ t-1),\ pcin\ (t,\ t-1),\ r\ (t,\ t-1),\ cgdp\ (t,\ t-1)$</td>
</tr>
<tr>
<td>Specification 3</td>
<td>$ps\ (t-1),\ pus\ (t,\ t-1),\ gic\ (t,\ t-1),\ flib\ (t,\ t-1),\ find\ (t,\ t-1),\ pcin\ (t,\ t-1),\ r\ (t,\ t-1),\ cgdp\ (t,\ t-1)$</td>
</tr>
</tbody>
</table>

### Relevant coefficients and p-values

<table>
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<tr>
<th>Specification</th>
<th>Relevant coefficient</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification 1</td>
<td>0.6651342</td>
<td>0.0001</td>
</tr>
<tr>
<td>Specification 2</td>
<td>1.150774</td>
<td>0.008</td>
</tr>
<tr>
<td>Specification 3</td>
<td>1.0747</td>
<td>0.012</td>
</tr>
</tbody>
</table>
APPENDIX 2

The specification used in the model was the following:

\[ y_t = \mu + \gamma y_{t-1} + \beta_0 x_t + \beta_1 x_{t-1} + \epsilon_t. \]

Where \( y_t \) is the voluntary savings in the period \( t \), \( x_t \) is the mandatory savings. The results of the model were:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Statistic t</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voluntary savings (t-1)</td>
<td>0.7600456</td>
<td>0.1443068</td>
<td>4.39</td>
<td>0.0001</td>
</tr>
<tr>
<td>Mandatory savings</td>
<td>-0.9090007</td>
<td>0.2862614</td>
<td>-2.87</td>
<td>0.008</td>
</tr>
<tr>
<td>Mandatory savings (t-1)</td>
<td>0.8510398</td>
<td>0.330223</td>
<td>1.32</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Making \( \gamma = \alpha \) the long-term ratio would be:

\[ y_t = \frac{\alpha_0}{1-\alpha_j} + \left( \frac{\beta_0 + \beta_1}{1-\alpha_j} \right) x_t + \frac{\epsilon_t}{1-\alpha_j}. \]

| \( R^2 \)                  | 0.7651      |
| \( P-value \ F \)          | 0.000001    |

Replacing the parameters produces the long term response of voluntary savings to the new mandatory savings.
APPENDIX 3

The specification of the equation was the one used by Corbo et al. (2003):

\[
\frac{investment}{GDP} = \alpha_0 + \alpha_1 \frac{savings}{GDP}
\]

The results were as follows:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Statistic t</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inversión/PIB</td>
<td>0.814419</td>
<td>0.232422</td>
<td>3.50375</td>
<td>0.002375</td>
</tr>
</tbody>
</table>


4.2 The Mexican Case

Alejandro Villagómez and Arturo Antón*

* Professors at the Economic Research and Teaching Centre [CIDE]
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2. Reform of the pension program
   2.1. The IMSS pension program
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   4.1. Impact on saving and domestic investment
       4.1.1. National saving
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5. Conclusions

Appendices
1. Methodological note on the series
2. Estimate of the response of voluntary saving to compulsory saving
3. Model for estimating the effects on the labour market
1. Introduction

There has been a wave of reforms to public pension systems in Latin America in the past three decades, Chile being the pioneer country in 1981. In most cases, pay-as-you-go systems with defined benefits have been replaced by models that include full funding, individual accounts and private administration as their central elements, though the scheme finally adopted varies in each experience. In some cases, the old pay-as-you-go system coexists with the new funded scheme, while in others the former is replaced either gradually or immediately. Mexico approved the reform to its main pension program, provided by the Mexican Social Security Institute [IMSS], in 1995 and the new program began operating on 1st July 1997.

These programs have sought not only to solve the problems of financial imbalance in the existing pay-as-you-go programs and the fiscal pressures that they cause, but have also established important structural reforms whose effects are very much wider. Both theoretical and empirical literature exists, discussing the various macroeconomic effects that these reforms produce on the economy. Corbo and Schmidt-Hebbel [2003] offered the first complete analysis of these effects for the Chilean case, 22 years after the reform. In this study, emphasis is given to four main channels by which these effects manifest themselves: national saving and domestic investment; aggregate employment and its degree of formality; the development of the capital market, and the growth of total factor productivity and GDP.
In the Mexican case, the reform is much newer: only 15 years old. Various studies have been made in this period to analyse its macroeconomic effects, but they are generally partial analyses. For example, Villagómez and Hernández [2010] and Águila [2008] discuss the issue of private savings, while Cazorla and Madero [2007] analyse its impact on the labour market. However, there has so far been no study that analyses the macroeconomic effects over a wider spectrum, with a view to determining their final impact on the GDP. In that sense, this present study constitutes a first attempt to weigh up those effects as a whole, considering the channels proposed by Corbo and Schmidt-Hebbel [2003].
2. Reform of the pension program

2.1 The IMSS pension program

The program offered by the IMSS –the most important in terms of its size– covers wage-earners in the formal private sector. It was set up in 1944 with the passing of the Social Security Law [LSS] in 1943, which granted a variety of benefits, such as protection for orphans and widows, and sickness, unemployment and old-age benefits for these workers and their families. It was originally set up as a partially-funded scheme, though it functioned on the basis of pay-as-you-go and defined benefits practically from the start. The resources obtained in contributions were used to finance infrastructure or to subsidise other types of insurance that traditionally ran at a deficit, such as maternity or health. Given below are the main features of this program prior to the reform known as Law 73.

Contributions. The program was funded in three parts: with contributions from the employer [70%], the worker [25%] and the Government [5%]. In 1996, the total of these contributions represented 8.5% of the wage on which contribution was based [SBC]: 3% for disability and life; 3% for old age and severance late in life; 1.5% for medical services, 0.6% for administrative expenses and 0.4% for social assistance. The contributions were limited to 10 times the minimum wage [SM]; the payments made by the employers were tax-deductible, but the worker had to pay income tax on withdrawal, though only on the amount in excess of the SM.
**Benefits.** In order to obtain the old-age pension it was necessary to be 65 years of age [60 in the case of severance late in life] and have contributed for at least 500 weeks [10 years]. The amount of the pension depends on the period of contribution over and above the 500 weeks and is calculated on the basis of the average SBC of the last five years, divided by the SM, adjusted by the changes in this latter figure. As an example, in 1995 the replacement rate would be 50% for a worker with an average wage-earning career who has contributed for 20 years, and 100% after 45 years of contribution. There is a guaranteed minimum pension equivalent to 1 SM.

The program is administered by the IMSS, the body responsible for collecting contributions and paying pensions. It was stipulated in the law that the reserves must be invested in Federal Government bonds and in other highly-rated instruments approved by the National Banking and Securities Commission. It was also stipulated that the income and expenditure of each type of insurance should be kept separate, though in fact this did not happen.

### 2.2 Causes of the reform

Reforming contributory pay-as-you-go pension programs is a phenomenon that has been present in many countries for several decades. There are reasons common to all, such as the demographic structure of the population and the growing financial problems that they face, but there are also other causes that are specific to each case. In Mexico, when the discussion that eventually led to the reform of the IMSS program first began, there were two main reasons behind this action: the growing financial problems that the IMSS program and the institute itself had been facing, and the need to encourage higher rates of private saving in the country, as mentioned in Sales, Solís and Villagómez [1998]. We shall explain these aspects in greater detail below.

**Demographic change.** This has been a relevant factor all over the world, and although it is much more worrying in the case of the developed countries, it is still an aspect that has to be taken into account in the developing economies. In Mexico the population grew at an average annual rate of 3.7% between 1970 and 1990, with the result that the total population in 1994 had reached 90 million. At the point of discussing the possibility of a reform, it was estimated that the population would
reach 142 million by 2030 and that people aged 65 years or over would represent 10% of the total. These trends would mean that the percentage of pensioners compared with active workers [the dependency ratio] would rise from 7% in 1995 to 14.8% in 2030. This phenomenon means a growing cost for the program and financial pressures in the future. The IMSS [1995] stated that the expected annual growth rate of pensioners would be 5.7% during the next 20 years, while that of contributors would be only 2.6%. This problem is compounded if we consider the increase in life expectancy, which was 49.6 years in 1950 and in 1995 had reached 70.8 years, added to a reduction in the birth rate which had fallen from 6.4 children per woman at the end of her fertile period, to 2.8 children in that same period. These demographic forecasts are being reinforced today. For 2010 the total population of 114.3 million is growing at an annual rate of 1.2%, while the population aged 65 years or over [7.1 million] is doing so at a rate of 3.1% per year, meaning that this latter segment of the population represents 6.2% of the total and is expected to reach 16.8% in 2050.

**Low contributions and lack of relation to benefits.** This is another of the program’s main problems, which predicted an explosive scenario for the future. When the system was set up, the contributions represented 6% of the SBC and the benefits were restricted: in fact they did not include dependents. In the run-up to the reform, contributions increased to 7% in 1991, 7.5% in 1993 and 8.5% in 1996. Of this percentage, 3 points corresponded to the disability and life insurance and 3% to the insurance for retirement and severance late in life. The benefits, meanwhile, also underwent changes. As summarised by Turner [2011], the increases in benefits included pension payments for disabled widowers, pensions for parents or grandparents, a reduction from 700 to 500 in the number of contribution weeks required to qualify for the old-age pension, medical expenses for pensioners and their dependents, welfare assistance, family allowances, bonuses, an increase in the age limit for an orphan’s pension, an increase in the minimum pension from 35% of the SM to 100% in 1995, and an increase in the widow’s pension from 20% to 90% [of the disability pension]. Obviously, this led to there being no relation at all between the benefits received and the contributions paid during the active life. According to the IMSS [1996], the contribution needed to be raised to 23.3% of the SBC by 2020 to avoid a deficit in the program’s flow in that year.

In addition to the elements described above, there was the fact that the resources in the reserve funds were used in part to finance the building
of the institute’s own infrastructure and in part to fund other insurance such as health and maternity. Taken as a whole, this situation led to a significant financial imbalance, since the actuarial reserves would not be sufficient to finance the expected outgoings at current net value. In Cerda and Grandolini [1998] a report was given of the actuarial deficit estimated at that time by the authorities [considering 75 years], which amounted to 141% of the 1994 GDP.

Promoting saving. However, there are other factors that also had a bearing on justifying the reform of the IMSS program. The most important has to do with the savings issue. It must be remembered that in 1995 Mexico was facing a major economic and financial crisis that had blown up in December 1994 with the so-called “peso problem”. That year the external debt reached one of its highest historic levels, representing almost 7% of GDP [Villagómez 2008]. But these resources are typically extremely volatile, with the result that towards the end of 1993 there was a heavy outflow of capital and a speculative attack that culminated in the devaluation of the peso, at a point when President Zedillo’s administration was just beginning. That is why he made the promoting of internal saving, especially private saving, a central point in his economic program, in order to reduce the dependence on external flows of capital. In 1994, private savings were at less than 12% of the GDP, one of the lowest levels in recent decades. As a result, the reform of the IMSS pension program was seen as an opportunity to encourage the generation of such savings. It is worth mentioning that this is a matter of debate in economic theory, even though a considerable increase in financial savings could definitely be guaranteed, and that would certainly have a significant impact on the development of the country’s capital market and the securement of funding sources in the economy.

Finally, it can also be said that the IMSS program showed significant problems of design that were leading to inequalities and regressive effects in terms of social policy. Generally speaking, the workers with lowest incomes, those in highly unstable activities, and women could not manage to contribute for the number of weeks required to qualify for a minimum pension, but in addition, they lost their contributions. Neither did this program allow portability of benefits, which accentuated the aforementioned problem. [Solís and Villagómez, 1999].
2.3 The reformed Program

The problems facing the IMSS had been under discussion since the end of the 1980s. One of the proposals for tackling the problem that was gaining ground, pointed towards the solution adopted in Chile at the beginning of that decade, which was to introduce a scheme of total funding and individual accounts. President Salinas decided to take the first step with the creation in 1992 of a scheme that was mandatory and complementary to the IMSS pension program [and that of the ISSSTE], called the “Saving for Retirement” Program [SAR], with total funding, individual accounts and private administration. The contributions paid by employers consisted of 2% of the SBC for retirement and 5% for housing, and these were deposited in commercial banks, which entered them in the accounts and, after a maximum period of four days, sent the resources corresponding to retirement to the Banco de México and those for housing to the INFONAVIT. For this service they charged an annual fee of 0.8% on the balance in the retirement sub-account. The funds in this sub-account were invested in public debt bonds and had a real guaranteed annual minimum yield of 2%, while the housing funds channelled into INFONAVIT offered yields according to the annual operating surpluses of the institute.

Though this decision was moving in the right direction, the program came up against a number of problems and did not solve the financial difficulties of the IMSS. As Cerda and Grandolini [1998] remark, the SAR presented problems due to lack of adequate supervision of the accounts in the banks and of the program itself. The National Commission of Saving for Retirement Systems [CONSAR] was only set up in 1994. There were also administrative problems and a lack of adequate coordination, plus a serious problem of duplication of records and accounts. In a short time, the accounts were concentrated in only three banks [75%]. Finally the members had no say in the investment of their resources, or in the choice of bank to administer their account. However, it is important to recognise the fact that this experience served as a reference for the reform of the IMSS program that would come a few years later. In December 1995, in the context of one of the worst economic and financial crises to hit the country in recent decades, the Congress passed the new Social Security Law, which reformed the IMSS pension program. In April 1996 the Law of Saving for Retirement Systems was passed, and the new program started operations on 1st July 1997 in the case of voluntary contributions, and in September in that of mandatory contributions. The reform consisted in
replacing the pay-as-you-go, defined-benefit program [Law 73] with a new fully-funded scheme with individual accounts and private administration, which was mandatory for all workers enrolled in the IMSS.

2.3.1 Original features of the program

In the new scheme, each member has an account in his/her name, made up of three sub-accounts: retirement, housing and voluntary contributions. The contributions are collected by the IMSS, transferring the retirement resources to private financial institutions created exclusively to manage these funds and called Retirement Fund Administrators [AFOREs], while the housing resources are transferred to INFONAVIT. Given below are a few of the main features.

Contributions. The three-part contribution remains [employer, worker and Government]. The total amount of the contribution includes: the 8.5% of the SBC that was contributed in the previous program, divided into 4.5% that is deposited in the worker’s retirement sub-account and 4% paid to the IMSS for disability and life insurance [2.5%], and pensioners’ medical expenses [1.5%]. Added to these are the SAR contributions: 2% for retirement and 5% for housing, and a new government contribution, known as the “social quota”, fixed initially at 5.5% of the SM in January 1997 and then adjusted quarterly according to the National Consumer Price Index [INPC]. This social quota was reformed in May 2009, its amount being increased by 21% for the case of a minimum wage and 16% for higher wages.

Benefits. These depend, in the case of old age, on the capitalised contributions accumulated in the worker’s individual account, net of fees. The main variables affecting the amount of the pension are: the rate of yield, the amount of the contributions, the wage level and its growth and the actual contribution period [contribution density]. It is also important to include variables that affect the pay-out period, such as the pensioner’s family structure, the number of his/her financial dependents and their ages, since these factors determine the cost of the survivorship insurance. In order to obtain the old-age pension, the worker must be 65 years old, or 60 in the case of severance late in life. A minimum contribution of 1,250 weeks is required, and at the point of retirement the worker will be able to choose between: a] programmed withdrawals from his/her AFORE or b] purchasing a life annuity from a private insurance company. There is a minimum guaranteed pension [PMG] which is granted if the
the person is entitled is less than this PMG, and he/she has paid contributions for the 1,250 weeks. This pension is equal to the SM at the point of the reform and is adjusted by the NCPI. If the contribution period is less than 1,250 weeks, the worker shall be able to withdraw all his/her resources in a lump sum. Workers who were paying contributions before the reform have the choice of taking the benefits provided by the earlier law [see section 2.3.2].

**Partial withdrawals.** There is the possibility of partial withdrawals in the case of marriage, if contributions have been paid for at least 150 weeks. The amount of the withdrawal is equivalent to one month’s wage and will be possible once only. In case of unemployment lasting at least 45 days, it is possible to withdraw, as a maximum, 10% of the resources accumulated, provided that contributions have been paid for at least 250 weeks and this facility has not been used in the last five years. In May 2009, in the context of the worldwide crisis, the amounts of these partial unemployment withdrawals were increased and a clause was included in the law, making it possible for workers who make use of this benefit, to pay back the resources withdrawn and recover contribution weeks.

**Administration.** The resources are administered by the AFOREs, which enter them in the individual accounts but only invest the resources in the subaccounts corresponding to retirement and voluntary contributions. Each worker is free to choose the administrator that suits him/her best and switching is limited to once a year. The AFOREs have minimum capital and fixed capital requirements and rules governing the investment of their reserves which are issued by the regulatory authority. But, and this is important, there is a limit to their share in the market which was fixed at 17% when the system began and for the first four years, and later at 20%. Initially there was a lack of clarity as to the criterion for fixing this limit, though it was suggested that it was the number of workers enrolled in these administrators.

**Fees.** The AFOREs charge a fee for their services in any of the following three ways: a] on the flow of contributions; b] on the accumulated balance; c] on the yields obtained; or a combination of these. As from 2008, the only fees charged are those on the accumulated balance.

**Investments.** The resources are invested in funds called Specialised Retirement Fund Investment Companies, SIEFOREs. The structure of these funds is dictated by the regulatory authority by setting up an investment scheme that stipulates limits per type of instrument and for each SIEFORE. The system began with a single SIEFORE. One very important
point was that investment of resources in foreign instruments was not authorised. Neither was a guaranteed minimum return stipulated.

**Regulation.** The regulatory and supervisory authority is the National Commission of Saving for Retirement Systems [CONSAR]. It establishes the criteria and procedures to ensure that the system runs as it should; it can authorise the creation of an AFORE or annul its licence; and it lays down the principles that govern the investment of resources and their yield.

### 2.3.2 Transition and cost of the reform

The reform stipulated that the change to the new program should be compulsory for all workers enrolled in the IMSS. However, it was necessary to recognise the rights of the pensioners and workers who were already contributing in the previous program. In the case of the former, the payment of their pensions was respected. This was done by using the reserves from the previous program plus federal fiscal resources, because the pay-as-you-go scheme had been eliminated. In the case of the second group, known as the Transition Population, they were obliged to move to the new scheme, but on arriving at the point when they would receive the pension benefit, the worker could choose between the benefit that he/she would have received under Law 73, or the one that would result from the new law on the basis of the resources accumulated and capitalised in his/her individual account. In the case of choosing Law 73, the resources accumulated in the account are taken by the Government and topped-up in order to pay the amounts stipulated in the former program. This scheme is different from those followed by other countries, such as Chile, where the decision was to issue recognition bonds when the reform came in, to be credited to the workers’ accounts when they retired.

The transition scheme chosen affects the fiscal costs incurred by the State when the reform is enacted. These are made up of: a] payments to current pensioners, since these benefits are no longer covered by contributions from active workers; b] the recognition of the rights of active workers “in transition”, and c] payments made by the Government in the new system, which are the PMG and the contributions that correspond to it, including the new social quota. The first two components are transitory costs, because they will disappear with the death of the last person retired under Law 73, while the third component is a permanent cost. In this document we report the estimates of these costs that were made in the years when this reform was being discussed and approved, with the information that
was available at that time and served for reference on the subject. Cerda and Grandolini [1998] report on the estimates made by the Government in a conservative scenario, assuming a real interest rate of 3.5% and a 2% growth in the real wage. The total cost is made up of the payment to existing pensioners and the cost of the workers in transition, since they are allowed to opt for the benefits of the previous law, in which case the Government tops up the resources accumulated in their individual accounts. These first two components are transitory. It also includes the payment of quotas by the State, the new social quota and the guaranteed minimum pension. The flow of the total cost estimated for 1997 [excluding INFONAVIT] was 0.93% of the GDP of that year, increasing to 1.04% in 2015 and 1.19% in 2025. In present value, the total cost was estimated at 141.5% of the GDP. Sales et al. [1998] also presented estimates for various scenarios. In the case of a scenario with moderate GDP growth [3% per year in real terms], a real interest rate of 3.5% and wage growth of 0.8% per year, the flow of this transition cost [without including the quotas of the new scheme] would be 0.48% in 1997, reaching a maximum of 2.29% in the year 2035 and falling to 1.79% in 2047. The values of the total cost [with the State quotas including the guaranteed minimum pension] would be 0.77%, 3.05% and 2.62%, respectively. By way of comparison, in a recent estimate made by Vásquez Colmenares [2012] the cost of the reformed IMSS program for 2012, including the payment of current pensions, quotas payable by the Government and PMG, would be put at 155.9 thousand million pesos, equivalent to 1% of the GDP for that year.

An important point to be emphasised is that the fiscal cost would have been much higher if the reform had not taken place. In Sales et al. [1998] it is estimated that this cost might have meant an annual expenditure by 2047 that would have oscillated between 6.29% and 14% of GDP, depending on the assumptions of economic growth used in the forecast.

Once the fiscal cost of the reform has been estimated, the related issue is how to pay for it, because this has important economic effects. This deficit can be funded by higher taxes, by reducing other Government expenditure, by issuing debt or by some combination of these. According to the theory, if this deficit is funded entirely by new debt, there is only a marginal effect in the short term on national saving, capital stock and the intergenerational redistribution of welfare, the magnitude of which depends on the net gains in efficiency from the reform. If, on the other hand, this deficit is funded via reduction in expenditure and/or increased taxation, the effect would be equivalent to that of a restrictive fiscal policy, giving rise to a transfer of resources from present to future genera-
tions, so encouraging higher rates of saving, formation of capital and an increase in future levels of per capita income and wages. The case involving a combination of these options leads to effects that depend on the relative weighting of each of these elements.¹

2.3.3 The first 15 years

In this section we make a review of the developments, advances and main problems that the individually-funded system has had to deal with during this period, putting emphasis on its main variables and the changes that have occurred.

Membership. This variable, measured in accounts administered by the AFOREs, has shown a significant change during these 15 years. In December 1997, 11.2 million accounts were entered as registered in the system and by December 2012 this figure had reached 48.5 million. However, it is important to mention that this total includes assigned and inactive accounts. The first are accounts that originated with the SAR system and were in the Banco de México. During these years, not all workers chose an administrator, so the regulator put a mechanism in place to assign them to the existing AFOREs. At the close of 2012, 11.38 million accounts had been assigned and their resources deposited in the Siefores. But there are still 5.2 million accounts with resources deposited in the Banco de México, though these are administered by an AFORE. This means that only 31.9 million workers have enrolled voluntarily in an AFORE. Of this total, approximately one million are workers who belong to the program of the State Workers’ Security and Social Services Institute [ISSSTE] and who, following its reform in 2008, opted voluntarily to move to the new program, being registered in an AFORE that was created especially for them [PensionISSSTE].² On the other hand, not all the accounts registered in the system are active, because there is considerable mobility between the formal and informal markets in Mexico. When a worker moves from the first to the second, he/she stops paying contributions into his/her account. An approximate comparison of how many accounts are active can be obtained by considering the number of active workers reported by

¹ These options are analysed in detail in Arrau [1990], Arrau and Schmidt-Hebbel [1993], Arrau, Valdés-Prieto and Schmidt-Hebbel [1993] and Corsetti and Schmidt-Hebbel [1996].

² It is worth mentioning that as from the fourth year following the ISSSTE reform, these workers were able to opt to transfer their resources to any other existing AFORE, which happened as from 2011.
the IMSS each month and adding the accounts of the workers in the ISSSTE. **Graph 1** shows this variable as the solid line, representing 17.1 million for December 2012.

**GRAPH 1**
Enrolled and Active Workers in the AFOREs

Source: Authors’ own work with information from the IMSS and CONSAR

**Resources under management.** A significant accumulation of resources has occurred in the system and these have been channelled into the formal financial system. We will discuss their effects further on. A first item refers to the resources registered in the AFOREs, which include not only what is invested in the Siefores, but also the resources for housing [INFONAVIT and FOVISSSTE], the social insurance funds of public and private institutions, the pension bonds granted with the ISSSTE reform, and the resources that are still deposited in the Banco de México. As may be seen in **Table 1**, these resources represented 17.8% of the GDP in December 2012.
### TABLE 1
Resources Registered in the AFOREs (December 2012)

<table>
<thead>
<tr>
<th>Item</th>
<th>Value [millions of pesos]</th>
<th>Percentage structure</th>
<th>As % of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources registered in the Afores</td>
<td>2,795,239</td>
<td>100.0%</td>
<td>17.8%</td>
</tr>
<tr>
<td>Resources administered by the Afores</td>
<td>1,911,818</td>
<td>68.4%</td>
<td>12.2%</td>
</tr>
<tr>
<td>Resources of the workers</td>
<td>1,868,265</td>
<td>66.8%</td>
<td>11.9%</td>
</tr>
<tr>
<td>RCV-IMSS1</td>
<td>1,701,253</td>
<td>60.9%</td>
<td>10.8%</td>
</tr>
<tr>
<td>RCV-ISSSTE2</td>
<td>153,969</td>
<td>5.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Voluntary savings3</td>
<td>13,042</td>
<td>0.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Social Insurance Funds4</td>
<td>22,972</td>
<td>0.8%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Capital of the Afores5</td>
<td>20,581</td>
<td>0.7%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Pension bond of the ISSSTE6</td>
<td>148,755</td>
<td>5.3%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Housing7</td>
<td>717,840</td>
<td>25.7%</td>
<td>4.6%</td>
</tr>
<tr>
<td>INFONAVIT</td>
<td>606,115</td>
<td>21.7%</td>
<td>3.9%</td>
</tr>
<tr>
<td>FOVISSSTE</td>
<td>111,725</td>
<td>4.0%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Resources deposited in the Banco de México8</td>
<td>16,827</td>
<td>0.6%</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

Notes: [1] Retirement, Severance late in life and Old-age for workers contributing in the IMSS. This includes the Retirement funds of those workers in SAR 92. [2] Retirement, Severance late in life and Old-age for workers contributing in the ISSSTE, including the resources of the SAR ISSSTE. [3] Includes Voluntary Contributions and Complementary Contributions for Retirement, Long-term Savings and Solidarity Savings. [4] Social Insurance Resources from public and private institutions administered by the AFOREs. [5] Resources of the AFOREs that have to be invested in the Siefores, in accordance with the capitalisation rules. [6] According to the Law of the ISSSTE, the AFOREs keep the record of the updated value of the ISSSTE Pension Bond in the workers’ individual accounts. [7] The housing resources are recorded by the AFOREs and managed by INFONAVIT and FOVISSSTE. [8] Corresponds to resources of the accounts managed by the Service Providers that are recorded by the AFOREs and invested in the Banco de México, according to the rules currently in force.

Source: Authors’ own work based on data from CONSAR and INEGI.

However, the funds administered by the AFOREs correspond only to the resources in the subaccounts of retirement [IMSS and ISSSTE], voluntary savings and social insurance funds, plus the corporate equity of these institutions themselves. This amount represents 12.2% of the GDP, as may be seen in Graph 2. Finally, if we consider the accumulation of resources in the system by subaccount: retirement, housing and voluntary savings, we find that these resources currently represent almost 16.5% of the GDP, as is shown in Graph 3.
**Market and fees.** During these years, the AFOREs market has shown changes in its structure. In 1997 there were 17 administrators and in 2012, just 13. However, as can be seen in Graph 4, this structure has been modified systematically over the period, with a minimum of 11 AFOREs being registered in 2002, while in 2006 this number reached a maximum of 21. It is important to remember that there is an upper limit on each AFORE’s share quota, fixed at 20% of the total number of accounts registered, with the aim of avoiding excessive concentration. This dy-
Dynamic can be estimated using the Herfindahl Index which captures market concentration, in this case by considering the number of workers in each AFORE and the accumulated assets or resources. Graph 5 shows this Index and it is possible to see that the increase in the number of AFOREs towards the middle of the past decade was reflected in a reduction in the concentration of the two indicators. However, in 2012 the index calculated on the basis of the number of members rose, reflecting the effect of recent mergers in the market. However, the index calculated on the basis of the resources remained practically unchanged. A possible interpretation is that this difference reflects the considerable proportion of inactive accounts among the total accounts in the system, meaning that it does not represent an accumulation of resources.

GRAPH 4
Number of AFOREs

Source: National Commission of Saving for Retirement Systems (CONSAR)

GRAPH 5
Herfindahl Index of concentration in the AFOREs’ market

Note: The dark bars correspond to the index calculated on the basis of the number of workers, while the light bars correspond to the calculation on the basis of resources.
Source: Authors’ own work based on data from CONSAR.
Meanwhile, in the course of these years, the level of the AFOREs’ fee has been a variable involved in continual debates and controversies. When the system began, fees could be charged on flow, on balance or on a combination. However, this made it very difficult to compare prices between one administrator and another, so, as from February 2004, the CONSAR has published an indicator of “equivalent fees on balance” [CE], in order to facilitate members’ decisions when selecting their AFORE or deciding to switch, complementing this with a decree in December of that year to reform and add to the SAR Law, allowing workers to change AFORE whenever they wished if the AFORE was charging a lower fee. This decision, together with other actions designed to encourage competition, seems to have had a positive impact on the market by reducing fees, as may be seen in Graph 6. In June 2007 the SAR Law [LSAR] was reformed again so that from March 2008 fees were charged only on balance. Finally in January 2009 the LSAR was reformed yet again, giving the CONSAR powers to authorise the fee to be charged by the AFOREs on a yearly basis and issue policies and criteria in this area. Specifically, the authority sets a maximum reference fee per year, defines an application horizon for 5 years and sets a maximum permitted scatter of 0.55%. Table 2 shows the level of fees in December 2012.

GRAPH 6
Evolution of the equivalent fee on balance [%]

Note: In order to obtain the equivalent fees, an annual rate of yield of 5%, in real terms, is assumed, contribution periods of 1, 2, 3, 4, 5, 10, 15, 20 and 25 years; an initial balance of $22,000; bimonthly contribution of $723.57; social quota of $2,750.07 per day contributed; permanence of 5 years and wage growth of 0%.

Source: National Commission of Saving for Retirement Systems [CONSAR] and BBVA [2007].
### TABLE 2
Current Fees
(December 2012)

<table>
<thead>
<tr>
<th>AFORE</th>
<th>Annual fee on balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afirme Bajío</td>
<td>1.50%</td>
</tr>
<tr>
<td>Azteca</td>
<td>1.52%</td>
</tr>
<tr>
<td>Banamex</td>
<td>1.28%</td>
</tr>
<tr>
<td>Bancomer</td>
<td>1.28%</td>
</tr>
<tr>
<td>Coppel</td>
<td>1.59%</td>
</tr>
<tr>
<td>Inbursa</td>
<td>1.17%</td>
</tr>
<tr>
<td>Invercap</td>
<td>1.59%</td>
</tr>
<tr>
<td>Metlife</td>
<td>1.54%</td>
</tr>
<tr>
<td>PensionISSSTE</td>
<td>0.99%</td>
</tr>
<tr>
<td>Principal</td>
<td>1.48%</td>
</tr>
<tr>
<td>Profuturo GNP</td>
<td>1.39%</td>
</tr>
<tr>
<td>SURA</td>
<td>1.31%</td>
</tr>
<tr>
<td>XXI Banorte</td>
<td>1.33%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>1.38%</strong></td>
</tr>
</tbody>
</table>

Source: CONSAR

**Investment and yields.** One of the crucial functions of the system is concerned with the process of investing the resources, since the yield obtained is one of the determining factors in the final accumulated balance that will define the worker’s pension when he/she retires. The investment scheme when the system began was very circumscribed, largely as a consequence of the complicated political environment in which the reform took place resulting from the country’s financial crisis, as well as the need to show new members that there was a serious commitment to protect the system’s resources. This was the reason why the investment scheme offered only one Siefore at the beginning, and for the first five years, in which investments were limited to public debt instruments in local currency or dollars, concentrating on respecting maximum limits of investments’ responsiveness to the interest rate by means of an average weighted term that was not allowed to exceed 900 days [see Graph 7].
However, in the course of time this investment scheme became more flexible, incorporating new classes of assets and financial instruments.\textsuperscript{3} Between 2002 and 2003 the approach was changed to measure, control and limit both idiosyncratic risks and global or aggregate risks. Investment was permitted in debt that was expressed in yens and euros, and new underlying financial instruments were included by the use of basic derivatives. Between 2004 and 2007 permission was given to invest in foreign markets, and in equities, both local and foreign. In 2007 it became possible to include securitised instruments [traded on the stock exchange] and structured instruments, as also investment securities listed on recognised stock exchanges with intra-day trading. Additionally, another great advance was enabling members’ pension fund options to be expanded by authorising two Siefores and in 2008 this was increased to five Siefores, which follow a logical sequence according to life-cycle. The basic idea is that younger members are in a better position to take more risk with their investment portfolio, while for those close to retirement the approach is to maintain the purchasing value of the resources. As may be seen in Graph 8, SB1 is the one that offers the most conservative investment scheme, and is the only option open to workers over the age of 60. SB2 is applicable for workers between 46 and 59 years of age, while SB3 is for those between 37 and 45 years. Finally, SB4, with a larger share of equities, is open to members between

\textsuperscript{3} In Ordorica [2013] it is possible to find a summary of the modifications to the investment scheme during the first 15 years of the system’s existence.
27 and 36 years, while SB5 is for those under 26 years of age. During the most recent years, the investment scheme has continued to become more flexible, by allowing assets such as commodities or widening the group of countries that are eligible for investment purposes.

Despite these changes, the investment of the pension funds in Mexico still shows a significant concentration in Government bonds, if one compares it with the rest of the region. In 2000 it represented about 90%, whereas Chile had only slightly over a third [35.8%] of its funds placed in government bonds and a similar proportion in the financial sector [35.7%]. For 2012, something over 57% of the Siefores investment was placed in public instruments and 29% used to purchase assets issued by companies.

**GRAPH 8**

Composition of the SIEFORES portfolio [2012]

<table>
<thead>
<tr>
<th>SB1</th>
<th>SB2</th>
<th>SB3</th>
<th>SB4</th>
</tr>
</thead>
<tbody>
<tr>
<td>68.2</td>
<td>60.9</td>
<td>56.0</td>
<td>51.3</td>
</tr>
<tr>
<td>14.8</td>
<td>10.2</td>
<td>14.5</td>
<td>18.4</td>
</tr>
<tr>
<td>9.3</td>
<td>11.9</td>
<td>10.3</td>
<td>8.8</td>
</tr>
<tr>
<td>7.2</td>
<td>8.3</td>
<td>10.3</td>
<td>13.3</td>
</tr>
</tbody>
</table>

**Note:** “Quasi-governmental” instruments refers to those issued by government-controlled institutions.

**Source:** CONSAR

During these first 15 years, the evolution of the returns has been favourable. There are various indicators concerning the yield of the system’s investments. Below we refer to the so-called Historic Return, corresponding to SB2 for the period 1998-2012, and reported by the CONSAR. This return represents the yield registered on the accumulated resources, and the report includes real and nominal values and averages since
As can be seen in Graph 9, the average annual nominal value has been 18.6% while the real value has been 7.7%.

**GRAPH 9**
Basic SIEFORE II
[Historic Return in %]

It is worth mentioning that some of the behaviour of the returns is explained by the heavy investment in public bonds and their high interest rates at the time of the reform. The nominal mean return of the basic Siefores was over 20% in 1998 and 1999, compared with a relatively lower return of 12.25% in 2012. It should also be pointed out that the return of the Siefores at medium term [5 years] had a better performance than that of the Siefores with shorter-term investment in the first half of the last decade [2000-2005]. Nonetheless, the market conditions changed and the results of the Siefores in medium-term investment have been outstripped by the returns of the Siefores with investments at 36 and 12 months in the course of 2012.

**Benefits and replacement rates.** As we mentioned, in the new program the workers who are “in transition” have the possibility of opting for the benefits provided by the previous program [Law 73] if it suits them. Due to the relatively short time that the new program has been in place and the low balances accumulated in the accounts, it is natural that the vast majority of workers who are retiring have made use of this option, since

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Data on the historic returns of the basic Siefores existing in each year at prices of the Mexican Stock Exchange [BMV], with data from CONSAR.
their pension corresponds to a defined benefit. However, the greatest cause for concern at present is the matter of low replacement rates and contribution densities. This situation could lead to low pension amounts for many workers, or to a situation in which a greater number have to resort to the PMG. What is even worse, many are not entitled even to that. A large part of the origin of this problem lies in the enormous, growing informal labour sector in the Mexican economy and the great mobility between it and the formal market, as described by Levy [2008] and Antón et al. [2012], which we shall discuss further on. In the case of the workers who opt for Law 73, they need only pay contributions for 10 years to qualify for the PMG. But in the case of the new law, the problem is greater, because this minimum benefit is obtainable only after contributing for 25 years. Furthermore, the contributions to this system are low, compared with other countries. According to various studies, the contribution density of an average worker may vary between 45% and 65%, depending on the assumptions used in the calculations.

After 15 years, the reformed program of the IMSS in Mexico has shown considerable advances and has allowed a significant accumulation of resources in the formal financial system that are available for funding productive investment. However, there are still various problems that constitute challenges for the system, particularly on matters such as coverage and replacement rates. In the fourth section of this paper we shall analyse in greater detail the impact that this reform has had on economic growth via its effects on savings, capital markets, the labour market and productivity.
3. The macroeconomic climate and the pension reform

Following a period lasting for most of the 1980s in which the Mexican economy saw practically no growth at all, due to the severe debt crisis it was facing, when President Salinas’s administration began in December 1988 the door was opened for an ambitious program of structural reforms, seeking to recover the path of growth. Among the main aspects of this program it is possible to highlight the following: a] the redefinition of the State’s role in the economy, reducing its direct intervention in economic processes and strengthening its role as promoter of investment and as regulator; b] an important reduction in the number of state-run companies and de-centralised bodies through mergers, privatisations and liquidations; c] liberalisation of the financial sector, including the re-privatisation of the banking sector and the granting of autonomous status to the Banco de México [Banxico]; d] liberalisation of other markets of goods and services; e] openness to private capital in key sectors such as telecommunications, telephones, transport, etc.; f] the creation and development of a public debt market; and g] the deepening of open trading, including the signing of the Free Trade Agreement with North America. Within this wide range of structural reforms is the start of the process that was to lead to the reform of the IMSS pension system, but in the first stage, this included only the creation of a program complementary to the existing contributory programs, called the SAR, with the scheme of total capitalisation, individual accounts and private administration. However, this process of structural reforms came to an abrupt halt in
1994 when the so-called “December error” or “peso crisis” occurred, culminating in a severe economic and financial crisis in 1995.

In this process of public sector readjustment, the aim of restructuring public finance is paramount. It must be remembered that in the period 1983-1988, public spending represented 39% of GDP, on average; the public deficit, 10%; internal debt, 21%; and external debt, 64%. The reprivatisation of public institutions made it possible to generate resources to amortise part of the debt, while the autonomy of Banxico cut off a source of inflationary funding from the expenditure. The expansion of the public debt market created the instruments needed for the new mechanisms to fund this expenditure. For the period 1989-1994, average public expenditure had fallen to 25% of GDP, the deficit to 1%, the internal debt to 10.9% and the external debt to 25.7%. On the other hand, the reprivatisation of the banking sector and financial liberalisation sought to produce an expansion of the money and capital markets to provide funding for private investment. However, the economy’s total savings showed no important increases. In fact, private savings fell from about 28% of the GDP in 1988 to 11.3% in 1994. On the other hand, external savings increased considerably, reaching levels of 10% of GDP in 1993. This variable played an important role during the 1994 crisis, since this is highly volatile capital, a fact which became evident that year with its rapid outflow from the country, which ended in a speculative attack and the devaluation of the peso.5

President Zedillo’s administration began with a severe economic and financial crisis. The nominal exchange rate rose from a little over three pesos per dollar at the beginning of 1994 to over eight pesos per dollar in 1995. External savings practically disappeared and this, coupled with the low level of internal savings, constituted a serious restriction to economic recovery. During that year restrictive fiscal and monetary policies were adopted once again, concentrating efforts on the fight against inflation and the instability of the exchange rate. Rescue programs were put in place for the banking sector and to support debtors. For 1995 the real GDP fell by over 6% and inflation had exceeded 50%. This was also reflected in a considerable rise in interest rates. This is the environment in which the discussion took place regarding the reform of the IMSS pension system, which explains some of the main targets that it was trying to reach. On the one hand, it sought to halt or mitigate the financial pressures produced by the financial imbalance shown by the IMSS

5 For a more detailed discussion of how savings and their components evolved during those years, consult Villagómez [2008].
program [and the Institute in general], which threatened to explode at any moment and would have caused serious problems for the efforts to correct public finances. Furthermore, it sought to encourage internal saving and the development and deepening of the financial system in order to produce permanent sources of funding for investment. The reform of the pension system was meant to contribute towards achieving these targets by generating a large accumulation of resources. In fact, the financial sector is precisely the one that became the central focus of reforms in the following years, and to some extent this is closely linked with the development of the reformed pension system itself.

### TABLE 3
Macroeconomic environment

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP(^1)</td>
<td>3.5</td>
<td>2.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Inflation</td>
<td>22.5</td>
<td>4.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Public Income</td>
<td>21.9</td>
<td>22.2</td>
<td>22.9</td>
</tr>
<tr>
<td>Public Expenditure</td>
<td>22.6</td>
<td>22.7</td>
<td>24.4</td>
</tr>
<tr>
<td>Public Deficit</td>
<td>0.7</td>
<td>0.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Internal Debt</td>
<td>3.9</td>
<td>9.7</td>
<td>16.0</td>
</tr>
<tr>
<td>External Debt</td>
<td>27.2</td>
<td>23.1</td>
<td>19.0</td>
</tr>
<tr>
<td>Exchange Rate(^2)</td>
<td>8.3</td>
<td>10.5</td>
<td>12.3</td>
</tr>
</tbody>
</table>

Source: Banxico, INEGI, SHCP.

1: The GDP variable is expressed in real growth rate.
2: The Exchange Rate is expressed in current or “new” pesos and is the average of the period given.

Note: The remaining variables are averages of the percentages relative to GDP, except for inflation, which is expressed as a percentage.

As from 1996, the Mexican economy regained its growth path, though the average rate during the period 1995-2000 was low: 3.5% in real terms. Efforts were kept up to correct the fiscal imbalances, with the result that average public expenditure was at 22.6% of GDP and income at 21.9%, which made it possible to reduce the public deficit to 0.7% of GDP for this period and maintain manageable levels of public debt. However, the issue of low growth became the Government’s major concern from that time on. During the decade of the 50s, Mexico grew at an annual rate of 5.6%, increasing to 7.1% in the 60s and 6.2% in the 70s. However the economy has not managed to recover similar growth rates following the crisis of the 80s. In this context, an important element is the low productivity seen
since the 80s. Moreover, in spite of the structural reforms carried out in the first half of the 90s, the recovery of growth and productivity was very slow. Some of the factors that go to explain this problem, and appear in various diagnoses of those years, are the underdevelopment of the financial sector and the distortions that exist in the labour market. In relation to this latter point, a World Bank report [1998] states that the Mexican labour market appeared to be reasonably integrated, with the possible exception of the market for less-qualified workers in the primary sector. However, there were problems resulting from the institutional framework in which this market operates, which provides an incentive for informality. This began to grow considerably as from the 80s. In particular it has to do with a rapid increase in non-wage costs and high severance costs. The new pension system began operations in July 1997 and that same report states that this would help to correct some of these disincentives for workers in the formal sector. It would reduce the general tax burden of companies by about 2 percentage points of the base wage, but, above all, by being a system based on individual accounts, would create a more direct link between the individual contributions and the pension received, in addition to relating the coverage of the workers’ compensation [or industrial risk] insurance with the company’s accident record.

The other important aspect that the reform of the pension system aimed to deal with was the need to produce more development in the national financial system. It was during these years that a new wave of changes occurred in the institutional and regulatory environment affecting this sector. Probably the most important change had to do with its opening up to foreign capital, especially in the banking sector. In 1995, as a result of the severe banking and financial crisis, it was decided to modify the rules governing the participation of foreign banking in the market, with the aim of developing the capitalisation of the financial system. Especially noteworthy was an increase in the market share limit for banks controlled by foreigners from 1.5 to 6% individually, and from 6 to 15% in the aggregate for subsidiaries of foreign financial institutions that acquired a Mexican intermediary in operation. These provisions excluded those banks whose net capital exceeded 6% of the sum of the net capital of the system. On the other hand, the general limit on shareholding by foreigners in the ordinary capital stock of local banks was increased from 30 to 49%, while the restrictions were eased on shareholding by natural persons and legal entities at individual level, with a move from
10 to 20%. In 1995 the installation of a further 13 subsidiaries was approved, some of the most noteworthy being the Bank of America, Banco Bilbao Vizcaya, ING Bank and Dresdner Bank. Between 1996 and the end of 1998, all restrictions on the participation of foreign capital in the Mexican banking system were eliminated. It is clear that in this period there was a significant change in the ownership and market structure of the Mexican banking sector, in which it is possible to see three groups: those banks with Mexican capital alone; a second group with Mexican and foreign capital; and a third group with capital that is entirely foreign. To give us an idea of this incredibly rapid change, it is necessary to highlight the fact that in 1997 the first group represented 47.4% of the system’s net worth; the second, 37.5%; and the third, the remaining 15.1%. It is also clear that these modifications in legislation opened the way for the largest Mexican banks to be taken over by foreign banks. In August 2000, Banco Bilbao Vizcaya took over Bancomer, and Santander, Serfín, while Citibank took over Banamex the following year. Other important takeovers were that of Inverlat by Bank of Nova Scotia in 2001 and Bital by HSBC in 2002.

But these modifications also affected other markets and traders. In 2001 the Stock Market Law was modified to provide greater transparency, rights to minorities, corporate governance for issuers and traders, stricter penalties, efficient procedures for punishing the improper use of inside information and manipulation of the market, and a new credit security called the “Stock Exchange Certificate” [Certificado Bursátil] was added. In June of that same year, the Law of Finance Companies was passed, containing provisions designed to avoid conflicts of interest; make the investment scheme more flexible; set up corporate governance centred on the composition and duties of the board of directors of the investment companies, and on the regulation of the services that they have to outsource; and establish a process for the transparent valuation of open investment companies, through a price provider. This law introduced the figure of the regulatory auditor as support for the operator’s board of directors, introduced a new type of limited-purpose investment company, and gave additional powers to the National Banking and Securities Commission. It was modified again in 2009.

Certain other important changes affected the Law Regulating Financial Groups [2006]; the Law of Investment Companies [2007]; the General

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6 These modifications were published as a decree amending the Law of Credit Institutions on 15th February 1995, in the Official Gazette of the Federation.
Law of Securities and Credit Operations [2008]; the Stock Market Law [2009]; the Law of Savings and Popular Credit [2009] and the Law of Credit Institutions [2010]. It must be mentioned that we do not list here the modifications to the law of savings for retirement systems, because these were analysed in the previous section.

Despite all these modifications or changes in the financial system’s institutional and regulatory framework, the economy’s performance in terms of economic growth has been rickety in the past decade. Between 2001 and 2006 the real average growth was 2.3% and it fell to 1.6% between 2007 and 2012, though one has to consider the worldwide financial crisis and great recession of 2009, which produced a contraction of 6% in real terms in the country that year. Though it has been possible to reach a macroeconomic stability that is reflected by a balance in public finance and low inflation, productivity has not picked up and informality in the labour market has continued to rise, as described by Levy [2008] and Antón et al. [2012].
4. Macroeconomic effects of the reform

As we have already mentioned, the macroeconomic effects of a pension reform have various channels and affect other markets and sectors, so evaluating them is no trivial matter. It is necessary to add to this the fact that in many cases these reforms form part of a wider agenda of structural reforms, so it is no easy task to isolate the effects, because of the existence of synergies. In this paper the aim is to make a thorough valuation of these macroeconomic effects in the Mexican economy. To do this we are following the strategy suggested by Corbo and Schmidt-Hebbel [2003], which emphasises four main channels: national saving and domestic investment, aggregate employment and its level of formality, the development of the capital market, and the growth of total factor productivity and GDP.

4.1 Impact on saving and domestic investment

4.1.1 National savings

One of the positive effects expected of pension system reform is the generation of more national savings. In the case of Mexico this was one of the main arguments and aims of the reform, as we have said. In order to capture the full effect on national savings, we have considered four channels, as Corbo and Schmidt-Hebbel [2003] suggest: a]impact on public
saving; b) generation of new mandatory saving, c) change in private saving in response to the change in public saving, and d) the response of voluntary saving to higher mandatory saving in households. We quantify each of these effects below, following Villagómez and Hernández [2010] for the period 1998-2012.

a) Public saving, transition deficit and global Government deficit

The impact on public saving comes from the increase in the public deficit that occurs as a result of replacing the pay-as-you-go scheme with one with total funding and individual accounts, as we discussed in section 2.3.2. For our study we took the estimation of the fiscal cost from Cerda and Grandolini [1998], which assigns values to the transition deficit for a period close to our study [1997 and 2015]. The cost estimated by these authors for 1997 was 0.93% of GDP, increasing until it reaches 1.04% in 2015. For purposes of this analysis, the average cost between 1998 and 2012 was taken on the assumption that growth in those years corresponded to the linear combination of the values estimated by Grandolini and Cerda. The result is that the transition deficit represented an average of 0.98% of GDP for the period being studied, which is comparable to the estimation made by Vásquez Colmenares [2013] for the transition deficit of the IMSS in 2012, i.e. 1% of the GDP of that year.

We have pointed out that the Government has the possibility of funding the reform’s transition deficit by converting implicit debt to explicit, raising taxes, reducing expenditure or a combination of these measures. However, it is not possible to identify the specific financing method used completely, due to the fungible nature of the available financial resources and the lack of correspondence with specific items. It is for this reason that assumptions have to be made on the fiscal structure used for funding the transition deficit. In this study it was decided to take three scenarios, which follow the lines of Corbo and Schmidt-Hebbel [2003], but are also plausible for the Mexican case. The first is the extreme case in which the deficit is covered entirely by fiscal adjustment, by reducing expenditure in other areas of public investment to pay for the costs of the reform. The second is the case in which the Government decides to contract debt on the financial markets which covers the cost involved in the reform almost completely [75%]. The final scenario presents an intermediate point in which the State decides on combined funding, while relying mostly on a fiscal adjustment amounting to 62.5% of this deficit.
Starting from an average cost of 0.98 per cent of GDP for the study period and under the three funding scenarios, our results show that the change in the total public deficit ranges from zero [when there is total fiscal adjustment] to 0.74 per cent when the funding consists primarily of debt. The intermediate value is 0.37 per cent.

b) The new mandatory savings

The second channel to be considered is the effect derived from the generation of new savings that are mandatory or contractual. A series of these savings was constructed on the basis of monthly data on contributions paid into the retirement savings funds, fees charged, returns on the value of the Sefores’ shares at month end, transfers from the system to pay pensions and retirement benefits, and variation in the housing savings funds. The details are explained in Appendix 1.

These estimates show that the annualised quarterly flows of all compulsory savings represent an average of 1.70 per cent of GDP between 1998 and 2012.

c) Response of the private sector to the change in the Government’s total savings

In Mexico there are some empirical studies that attempt to identify the response of private saving to changes in the public deficit. However, the conclusions obtained are varied. Studies such as that of Burnside [1998] and, more recently, Swiston and Bulir [2006] find that in our country private saving responds negatively to an increase in public saving, with a compensation coefficient between -0.8 and -1 [and significantly no different from -1]. These results support the idea that the Theory of Ricardian Neutrality is being borne out [partially at least]. This means, therefore, that in the case of an increase in public deficit, private saving increases to compensate.

The study carried out by Cermeño, Roth and Villagómez [2008], based on an analysis of structural autoregressive vectors with traditional savings series, corroborate the partial fulfilment of the TRN. However, that study proves that by using savings series adjusted for the inflationary tax, the loss of value of the debt and the capital outflow [which represent more faithfully the dynamics of saving in Mexico, when facing the crisis of the mid-nineties], the response of private saving to changes in public saving [or deficit] is nil.
In order to quantify the estimated size of the impact produced by the reform on private saving due to the change in public saving, three possible values were taken for the coefficient of private-saving response: the maximum, -0.9, was taken from the estimates of Swiston and Bulir [2006], the minimum is zero and corresponds to the findings of Cermeño et al. [2008] on adjusting the series of private savings. An intermediate value of -0.5 was also used, allowing for partial fulfilment of the TRN.

The results when using these response coefficients range from a null increase in private savings when there is no change in public deficit [due to total fiscal adjustment], to an increase of 0.66 per cent of GDP when the coefficient closest to -1 is taken, with a mean estimate of 0.18 per cent.

d) The response of voluntary saving to higher mandatory saving in households

The fourth channel refers to the relationship between voluntary and compulsory saving. There is plenty of literature that analyses this aspect, and it suggests that, according to the implications of the Life Cycle Model [Modigliani and Brumberg, 1954], an increase in personal wealth [resulting from the accumulation of compulsory savings], produces a shift in voluntary savings. In other words, mandatory savings appear to replace the individual’s voluntary savings. In Águila [2008], reference is made to this literature over the past three decades and results are shown in that same study that validate this implication in the case of the reform to the IMSS program in Mexico. However, in Sales et al. [1998] arguments are given that suggest that in certain circumstances the net effect on saving is positive. Villagómez and Hernández [2010] show evidence in the same direction, though the impact is very small.

To measure the effect of compulsory saving on voluntary saving, two different estimates were used in this study. In the first, the effect of contractual saving on households’ voluntary saving was estimated with data from the composition of total sectorial saving reported by the National Institute of Statistics, Geography and Information Technology [INEGI]. In the second estimate an approximation was given of the effect of mandatory saving on the voluntary component of household saving, estimated on the basis of data from the National Survey of Household Income and Expenditure [ENIGH].

In order to evaluate the response of private entities to contractual saving, the work carried out by Bennet, Loayza and Schmidt-Hebbel [2000]
for Chile’s case was closely followed. For this reason, the estimate includes the effects that other variables may have on household saving: for example, saving in companies, saving in the public sector and external saving, plus rates of interest, unemployment and population dependency. These variables coincide with those used in other estimates of determinants in saving [including that of households], both in Chile [Butelmann and Gallego, 2001] and in developing countries [Loayza, Schmidt-Hebbel and Servén, 2000a] and at worldwide level [Loayza, Schmidt-Hebbel and Servén, 2000b].

The estimate seeks to observe the effect on voluntary household saving directly, and corresponds to the following specification:

\[ VHS = \beta_0 + \beta_1 CS + \beta_2 PFS + \beta_3 PS + \beta_4 ES + \beta_5 DEP + \beta_6 R + \beta_7 RR + \beta_8 U + \beta_9 D_{\Delta Y < 0} \]

Where:

- AVH Voluntary household saving [as proportion of GDP].
- CS Compulsory saving [as proportion of GDP].
- PFS Private firms’ savings [as proportion of GDP].
- PS Public saving [as proportion of GDP].
- ES External Saving [as proportion of GDP].
- DEP Dependency rate.
- R\textsuperscript{7} Risk-free real interest rate: Cetes 91 [quarterly average].
- RM\textsuperscript{8} Real rate of return on the money [no interest]: inflation [quarterly average].
- U Unemployment rate [quarterly average].
- \(D_{\Delta Y < 0}\) Dummy to check for recessions. 1 when the moving average of the growth of the GDP for the past year is less than zero. [past year = 4 periods].

Given that the variables included are all integrated of order one \([I[1]]\), it is possible to estimate an error correction model [ECM] without any major difficulty. However, if this were not so, it is possible to use the method

\[ R = i - \pi \]

\(i\): nominal rate of inflation.
\(\pi\): annual inflation.

\[ RM = \frac{(1 + i)}{(1 + \pi)} - 1 \]

\(\pi\): annual inflation.
\(i\): nominal rate of inflation.

---

\textsuperscript{7} R = i - \pi

\textsuperscript{8} RM = \frac{(1 + i)}{(1 + \pi)} - 1
suggested by Pesaran, who proposes estimating the long-term relationships between variables of different orders of integration, by constructing autoregressive dynamic specifications with distributed lags [ARDL] and the corresponding ECM [Pesaran, 1997; Pesaran and Shin, 1999]. On carrying out co-integration tests, sufficient evidence was found to justify the application of the error correction model. In this way, the estimates proposed for the long-term relationship are extremely consistent. The co-integration is confirmed on finding that in both cases the error correction term [ECT [-1]] is negative and statistically significant.

In the initial estimate for both dependent variables [two alternative measurements], the estimator for households’ response to compulsory saving is negative and not significantly different from zero [-0.31 and -0.34, respectively]. Furthermore, specifications with a smaller number of variables were included [of these, the case where the population dependency variable was eliminated from the estimate is particularly important]. That adjustment produces a relevant change when the dependent variable is households’ saving measured with data from the composition of total saving by sector reported by INEGI. In this case, a statistically significant coefficient, equal to -0.596, is found.

On looking at the “short-term” response coefficient, estimated via the ECM, a consistent result is found under the different specifications used. It is worth mentioning that the value R2 [adjusted and non-adjusted] is also low in all the estimates.

These results lead one to the conclusion that there was no trade-off or perhaps only a partial trade-off, within the period analysed, between voluntary household saving and the compulsory saving generated for retirement and housing. The results obtained are consistent with the estimates presented in Villagómez and Hernández [2010].

In order to make an approximation of the final trade-off effect in our three scenarios, a value 0 was taken to represent the absence of response [optimistic scenario] and the value obtained in estimate II, -0.59, was taken as the maximum response value. For the intermediate scenario we use an intermediate value, let us say -0.3, within the range derived from our estimates, which runs from 0 to -0.59.

As a result, it can be seen that the variation in voluntary private saving in response to compulsory saving varies from zero [where there is no trade-off] to a reduction of 1 per cent of the GDP in household saving [if it is assumed that there is a partial trade-off].
e) Total effect on national saving

In order to obtain the final impact on national saving, it is necessary to add together the four effects present in the different components of domestic saving. Table 4 summarises these results. In the most optimistic scenario, compulsory saving produces an increase of 1.70% of GDP in national saving. This happens when a fiscal adjustment of 100% is achieved; in other words, the cost of the reform is paid on the basis of adjustments in expenditure and taxes and voluntary household saving does not respond to the increase in compulsory saving.

The opposite case occurs when, in response to the greater deficit caused by the reform, the adjustment of other fiscal expenditure and/or increased taxes amounts to only 25% of the total, meaning that public saving falls. At the same time, private entities do not react to changes in the public deficit and they compensate for the existence of compulsory savings, unit by unit. In this way, the final effect on national saving is an average reduction of 0.04% of the GDP in the period.

The estimated intermediate effect is that the compulsory saving derived from the pension system reform has a positive effect on national saving of approximately 1% of the GDP. In this case, there is an intermediate adjustment in public finances to pay the costs of the reform and Ricardian Neutrality occurs only partially. In other words, households reduce their voluntary saving partially due to the presence of compulsory savings, with a trade-off coefficient approaching 0.3.
### TABLE 4
Total effect of the pension system reform on National Saving [% GDP]

<table>
<thead>
<tr>
<th>Fiscal Adjustment</th>
<th>100%</th>
<th>63%</th>
<th>25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Increase in the public deficit [Fiscal cost of the reform]</td>
<td>0</td>
<td>-0.37</td>
<td>-0.74</td>
</tr>
<tr>
<td>ii) Contractual household saving</td>
<td>1.70</td>
<td>1.70</td>
<td>1.70</td>
</tr>
<tr>
<td>iii) Increase in private saving in:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Response to public deficit</td>
<td>Maximum</td>
<td>0</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>Intermediate</td>
<td>0</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>II. Response to contractual saving</td>
<td>Maximum</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Intermediate</td>
<td>-0.53</td>
<td>-0.53</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>-1.00</td>
<td>-1.00</td>
</tr>
<tr>
<td>Change in National Saving</td>
<td>Maximum</td>
<td>1.70</td>
<td>1.66</td>
</tr>
<tr>
<td></td>
<td>Intermediate</td>
<td>1.17</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>0.70</td>
<td>0.33</td>
</tr>
</tbody>
</table>

### 4.1.2 Domestic investment

In order to estimate the relationship that exists between saving and investment, we start from the fact that even though there is a high level of integration in international financial markets, the empirical evidence has shown that there is still a correlation between national saving and domestic investment, as has been stated in a wide range of literature that began with Feldstein and Horioka [1980]. This is why we are using a simple equation based on the design created by those authors. It is important to make clear that we are dealing only with an approximation of a correlation coefficient, in which we assume *a priori* the relationship of cause and effect, because it is complicated to set up a rule of exact cause and effect. In the past decade, the analysis of the savings-investment correlation has become more sophisticated, mainly because there is evidence of co-integration between these variables.

It was decided to estimate the correlation using the simple formula:

\[ IR = \alpha + \beta SR + \varepsilon \]
Where IR is the domestic investment rate [gross formation of capital assets] and SR is the internal savings rate, both as a percentage of the GDP. The resulting estimate produces a coefficient of correlation ($\beta$) equal to 0.73, with a standard error of 0.026, reflecting a high statistical significance.

On the basis of the above considerations, and bearing in mind the effect of the increase in fiscal deficit on the transition, and of compulsory saving on national saving as estimated above, it is possible to see that the potential effect of the pension system reform on investment lies in a range between 1.24 and -0.03 per cent of the GDP.

The point estimation of the pension reform’s contribution and its funding is positive, with a value of 0.99 per cent of the GDP on the rate of national saving and 0.72 per cent of the GDP on the investment rate in the period analysed.

**TABLE 5**
Effect of the pension system reform on Domestic Investment [% GDP]

<table>
<thead>
<tr>
<th>Fiscal Adjustment</th>
<th>100%</th>
<th>62.5%</th>
<th>25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in National Saving</td>
<td>Maximum</td>
<td>1.70</td>
<td>1.66</td>
</tr>
<tr>
<td></td>
<td>Intermediate</td>
<td>1.17</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>0.70</td>
<td>0.33</td>
</tr>
<tr>
<td>Change in Domestic Investment</td>
<td>Maximum</td>
<td>1.24</td>
<td>1.21</td>
</tr>
<tr>
<td></td>
<td>Intermediate</td>
<td>0.86</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>0.51</td>
<td>0.24</td>
</tr>
</tbody>
</table>

9 It is worth pointing out that the DW statistic is low, due to a problem of specification. In this sense, the result cannot be used to assume cause and effect. For purposes of this study, this coefficient is informative in terms of the correlation that exists, so we do use it in the final estimate.
4.2 Effect on the capital market

Another of the central issues derived from the reforms to pension systems is the one that concerns their effect on the capital market and the financial system as a whole. To the extent that total capitalisation programs of this type imply the accumulation of a considerable amount of long-term resources, which are channelled into the formal financial system and there invested, it is hoped that they will have a significant impact, contributing to greater diversification and depth in these markets. In Mexico’s case, this target is enshrined in article 43 of the SAR Law, which states that “...the investment scheme shall aim to increase internal saving and the development of a market of long-term instruments suitable for the pension system.” However, this process needs to be accompanied by modifications in the institutional framework, and appropriate regulation.

15 years after the reform, its positive effect on the country’s financial savings is indisputable. This includes those resources derived from savings in the economy that are channelled into the formal financial system. As may be seen in Graph 10, the financial savings in the Mexican economy represented 64.8% of the GDP in 2012, 22.2 percentage points more than in 2001. In their turn, the resources linked with the SAR represented 17.9% of the GDP, which meant an increase of 10.2 percentage points compared with 2001. As a result, approximately 46% of the increase in the country’s financial savings between 2001 and 2012 corresponds to resources generated by the new pension system. This indicator offers us a first approximation of the important contribution in the deepening of the financial system, measured as money aggregate M₄, minus the notes and coins in the hands of the public, as a proportion of the GDP. What is even more important, this amount will continue to increase considerably in the coming years and may accelerate its growth rate as the size of the informal labour market decreases and more workers can reactivate their contributions to the system or can enrol in it. It is clear that there are various aspects of the labour market and the pension system in Mexico that are capable of reinforcing the macroeconomic impact in the future if the appropriate reforms are carried out.
The contribution of the pension reform to the development of the financial system can also be seen in terms of helping to achieve greater diversification of instruments in the market. Though it is true that in the early years of the system the resources were dedicated almost entirely to public sector financing, with the result that government debt represented over 95% of the investment portfolio, as time went on the investment scheme became gradually more flexible, as explained in section 2.3.3. By 2012, the share of government debt had been reduced to 57%, local private debt represented 17% and investment in local and international equities represented 8% and 12.8% respectively. This diversification has made it possible to include local and foreign corporate equities; local and foreign indexes and shares; currencies, derivatives, commodities, and structured instruments such as CKDs and FIBRAS.10

The case of the CKDs is an example of how the effects of the accumulation of pension funds on the development of the capital market can be potentiated, by expanding the funding alternatives for investment. They

10 These are instruments for funding real estate. They offer periodic payments [income] and at the same time, the possibility of capital gains [appreciation]. They are trusts dedicated to purchasing or building properties designed for rental, or the acquisition of the right to receive income from renting such properties. They also provide financing for such purposes.
are structured instruments, the aim of which is to fund the development of productive projects, mainly infrastructure, private capital and real estate. They are long-term instruments. The AFOREs, as institutional investors, provide financing for the productive development of project designers and individual companies. Project developers seek to raise capital, so they issue CKDs which are acquired by these institutional investors. Although this is still a small market, it has immense potential. Currently, 91% of CKD investors are AFOREs.

Finally, it is important to mention that this process of making the investment scheme more flexible has been accompanied by modifications in the legal, institutional and regulatory framework as we explain in the third section of this chapter. But the effects of these changes go beyond the pension system and have positive effects on the development of the financial system to the extent that they provide the incentive to create new instruments and players in the market.

Below we offer a quantification of the pension reform’s impact on the Mexican financial system in terms of depth. The strategy followed is to estimate the effect produced by the flow of compulsory savings on a measure of financial depth, as suggested by Corbo and Schmidt-Hebbel [2003] for the Chilean case. It is worth mentioning that this variable is not equivalent to traditional financial savings, because it includes other elements, such as the value of the shares circulating on the Mexican Stock Exchange, for example. In order to capture the desired effect, an error correction model [ECM] was estimated to explain the financial development [FIR] on the basis of the flow of mandatory savings, controlling by the use of variables that influence the relative demands of the various financial assets, and variables that capture possible cyclical effects in the financial markets. As is explained further on, two alternative definitions for FIR were used.

The specification used takes the form:

\[
FIR = \beta_0 + \beta_1 CS + \beta_2 DS + \beta_3 (tcr - \bar{tcr}) + \beta_4 Priv + \beta_5 RRB + \beta_6 RRM + \beta_7 RRQ + \beta_8 RRE + \beta_9 RRX + \beta_{10} D_{\Delta Y<0} + \beta_{11} D_{\pi<10\%} + \beta_{12} D_{\pi<5\%} + \beta_{13} ACS
\]

where:

FIR     Financial Intermediation Ratio [percentage of GDP, considering 2 alternative measurements:

FIR-I  Deposits in banking and savings institutions + internal public debt in residents’ hands + private securities in the possession of pri-
vate and specific companies\textsuperscript{11} + value of shares outstanding [quarterly average].

**FIR-II**  
M\textsubscript{3} = Monetary Base + value of shares outstanding [quarterly average].

**CS**  
Compulsory savings [pensions + housing] as percentage of GDP

**DS**  
Total internal savings as percentage of GDP.

\(tcr - \overline{tcr}\)  
Gap between real exchange-rate index and its trend [quarterly average].

**Priv**  
Private securities outstanding, including shares as proportion of GDP.

**RRB\textsuperscript{12}**  
Real return on bonds: cetes 91 [quarterly average].

**RRM\textsuperscript{12}**  
Real return on money [not interest]: inflation [quarterly average].

**RRQ\textsuperscript{12}**  
Real return on deposits [quasi money]. TIIE 91 [quarterly average].

**RRE\textsuperscript{12}**  
Real return on equities: index of prices and quotations [quarterly average].

**RRX**  
Real return on external assets: Libor 3m [quarterly average].

\(D_{\Delta Y<0}\)  
Dummy to check for recessions. 1 when the moving average of growth in the GDP of the previous year is less than zero.

\(D_{\pi<10%}\)  
Dummy with value 1 when the inflation of the period is less than 10\% [benefits of controlled inflation]

\(D_{\pi<5%}\)  
Dummy of price stability with value 1 when the inflation of the period and those adjacent to it is less than 5\%.

**ACS**  
Accumulated compulsory savings as a percentage of GDP.

It is worth pointing out that, unlike the study presented by Bennet, Loayza and Schmidt-Hebbel [2000] for the case of Chile, for the Mexican case it was decided not to include the variables of financial liberalisation and structural reforms. This is due to the fact that these variables show no significant variations in Mexico during the period included in the study [as may be seen in the Chinn-Itto index of financial openness and Lora, 2001].

\textsuperscript{11} Includes mortgage debts, unsecured loans, commercial paper, ordinary share certificates, medium and short-term promissory notes, and share certificates issued by resident private entities.

\textsuperscript{12}  
\[ RR = \frac{(1 + i)}{(1 + \pi)} - 1 \]

\(\pi\): annual inflation
\(i\): nominal interest rate.
The unit root tests in each of the variables, in both levels and differences, indicate that the series are integrated of order 1. Furthermore, the tests applied suggest the existence of co-integration. As a result, we proceeded to estimate the long-term relationship for the different versions of dependent variable given by the equation presented at the beginning, and in a reduced version by eliminating some regressors, such as those of the ECM. In this latter case the error correction term [ECT[-1]] is negative and highly significant in all cases, close to 1 in absolute value. The estimate was carried out with two specification versions: the first includes all the variables and the second excludes the flow of compulsory savings, leaving only the accumulated resources.

The results show that there is a statistically-significant long-term relationship between the financial development and the compulsory savings [flow and accumulated resources] derived from the reformed pension system. Most of the control variables also show a significant relationship, especially the proportion of private assets in the market, the return on external assets and inflations, measured through the real return on money [when the dummies for inflation are eliminated].

**GRAPH 11**
Variables of financial depth [% GDP]

---

**FIR-I**  Deposits in banking and savings institutions + internal public debt in residents’ hands + private securities in the possession of private and specific companies + value of the shares outstanding [quarterly average].

**FIR-II**  M3 – Money Base + value of shares outstanding [quarterly average].

Source: Authors’ own work using information from CNBV, CONSAR and INEGI.
As can be seen in Graph 11, the measurements of financial depth that were used grow at different rates, meaning that the parameters estimated under the alternatives estimated differ in size. The coefficient that represents the effect of compulsory saving on financial development is growing in the estimates in the same way as its variance. In addition, the estimators obtained from the modified specification [from which certain regressors were eliminated after carrying out redundancy tests] show greater efficiency [less variance].

In order to measure the impact of the reform on the development of the capital markets, two channels are observed: the effect of the flow of compulsory savings and the accumulated amount of savings resulting from the reform of the pension system. These channels are incorporated in the regression described earlier and the corresponding estimate is to be found in Appendix 2. As may be observed, the FIR’s coefficient of response to the flow of savings takes the value 0.63 as a minimum [with the FIR II as dependent variable] and 0.75 as the maximum value [with variable FIR I as dependent]. Meanwhile, the coefficient of response to the accumulated compulsory savings takes a minimum value of 0.81 [using FIR I to measure the financial development] and a maximum of 1.89 [when FIR II is used as the dependent variable].

In order to estimate the impact of the pension system reform on financial deepening, we used the coefficients related with the accumulated compulsory savings reported in Appendix 2. This is because we consider this to be the variable that best reflects the impact of the pension reform on the development of the capital markets. In other words, it is the accumulation of the resources and not the flows which should have the greatest impact in these markets.

The estimate of that impact is shown on Table 6. In the period analysed, the figures show a change in accumulated compulsory savings of 81 per cent as a proportion of the GDP. At the same time there is an increase in the financial depth variable as a proportion of the GDP which varies between 52 and 72 per cent, depending on whether FIR I or FIR II is used, respectively. Basing ourselves on that, it is estimated that the effect on financial depth that can be attributed to compulsory saving ranges from a minimum of 16.9% [with FIR I] to a maximum of 25.7%, with FIR II.
4.3 Labour markets

In this section we evaluate the effects of the pension system reform on labour markets. To do this, a version of the dynamic general equilibrium model with occupational decision found in Antón and Leal [2012] is used, calibrated for the Mexican economy. Among other things, the model makes it possible to capture the effects of changes in the contributory social security scheme [and the pension system in particular] on employment, equilibrium wages and average productivity of labour. In order to explain the reasons behind the model’s structure, there is first a brief discussion of the social security system in Mexico, and the changes that the reform of the pension system could have produced on the valuation of contributory social security. Then the structure of the Antón and Leal [2012] model is presented and finally an analysis made of the effects of the reform on labour markets.

The social security scheme in Mexico has a dual nature. Within it there is a contributory system, funded by contributions based on wages, coexisting with a non-contributory scheme based on government transfers funded out of general taxation. Basically, the contributory system offers health and life insurance; pensions for retirement, disability and work-
risk; housing loans; and day-care services. These services are offered as a package and the individual does not have the option of choosing only part of them. This may encourage certain workers to decide to belong to the non-contributory system, especially if their assessment of the social security services provided by the contributory system is low [Levy, 2008].

Prior to the reform of the pension system in 1997, Cerda and Grandolini [1998] estimate that contributions to social security in Mexico were about 31.5 per cent of the wage. The Government financed only 3 per cent of this rate. The 1997 reform increased government subsidies to the pension system described, through the contributions to the social quota. At the same time, the contribution rate paid into the system by workers and employers remained unchanged.13 By doing this, the Government increased the percentage of subsidy to social security from 3 to 10 per cent of the average wage. This higher subsidy to the employed worker was meant to provide an incentive for formal employment and even for some informal workers to move into the contributory system.14 If the formal worker is more productive on average that the informal one, then that transition could at the same time have increased the average productivity of labour. On the other hand, the transition from a pay-as-you-go scheme to an individualised scheme should make the link between present contributions and expected pension benefits closer. In this way the reform could have meant a reduction in the “pure” labour tax, due to the higher value placed on the pension services of the contributory scheme, and this should mean an increase in formal wage-earning employment and even wage-earning employment as a whole, as a result.

In this respect, the empirical evidence for Mexico is mixed. In particular, the Report on Social Security in America [2003] provides different estimates of how much social security benefits are valued and how this changed as a result of the 1997 reform. One estimate suggests that the

---

13 From 1997 to the present, the contribution rate on wage-earning work in areas other than pensions has risen. These areas include contributions to sickness and maternity insurance and state payroll taxes. Specifically, the contributions rate on wage-earning employment has increased from approximately 32.5 per cent in 2008 [including state payroll taxes] in 1997 to 38 per cent in 2008 [Antón et al. 2012]. Due to the fact that contributory social security services are offered as a package, this increase in contributions has made formal wage-earning work very expensive. Since this section concentrates on analysing the effects of the reform to the pension system, the simulations of the model do not include the increases in the contribution rate mentioned here.

14 In this document, a formal worker is defined as one who pays into the contributory social security system. Otherwise the worker is classed as informal.
assessment has remained at levels of around 35 per cent, even after the reform. An alternative estimate in the same Report suggests that the assessment of the benefits as a percentage of the contribution rate increased from 46.9 to 69.7 per cent as a result of the 1997 reform.

On the other hand, Cazorla and Madero [2007] use data emerging from household surveys to estimate an equation of wages by the three-stage least squares technique. The regressions are made with two samples: before the reform [1987-1996] and after the reform [1997-2004]. For the first case, the authors report that workers placed no value at all on the contributions paid into social security, meaning that it was viewed as 100 per cent tax. However, for the sample 1997-2004, the results suggest that about 58% of the contributions are valued by the workers.15 In this way, the increase in perceived value as a result of the 1997 reform implied a fall in the “pure” labour tax.

The model used is based on Antón and Leal [2012], which is explained in some detail in Appendix 3. In that model, production takes place in two sectors: “full-time” entrepreneurs and the self-employed. Full-time entrepreneurs demand wage-earning labour to produce goods and can hire workers formally [paying their social security contributions according to the law, net of subsidy] at a net wage \( w_F \), or informally [evading such contributions] at a wage \( w_I \). \( T_F \) is taken as the contribution to the contributory system as a percentage of the wage and \( \theta \) the rate of government subsidy. Thus the worker’s gross wage paid by the employer is \( w_F [1+(1–\theta)T_F] \).

Due to monitoring problems and laxity in enforcing the law on the part of the authorities, smaller companies tend to hire a larger percentage of their workforce informally. In the extreme case, the self-employed are not detected by the authorities and may therefore decide not to pay into contributory social security [in other words, they are informal].16 Informal workers, [both informal wage-earners and the self-employed] benefit from government subsidies to non-contributory social security, the amount of which, per worker, is represented by \( T_I \).

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15 In order to estimate this percentage, Cazorla and Madero [2007] estimate an equation of standard wages, with controls by individual characteristics, such as level of schooling, work experience, gender and membership of the contributory social security system, among others. If the social security contributions are valued by the individual, it is expected that the coefficient of the regression associated with that variable will be negative and have an absolute value of less than the contribution rate.

16 The self-employed are not legally obliged to contribute in the contributory social security system.
Due to the labour mobility in the model, belonging to the contributory system will be immaterial to the worker if the wage plus the valuation of the social security services ["valued wage"] is identical to the valued wage in the non-contributory system. Let $\beta_F$ and $\beta_I$ denote the parameters that capture the valuations of contributory and non-contributory social security, respectively. Thus, choosing between the two social security systems will be immaterial to the worker if $w_F (1+\beta_F T_F) = w_I + \beta_I T_I$. The model makes it possible to calculate the equilibrium wages $w_F$ and $w_I$, as also the levels of the different types of employment in the face of changes in the parameters of the model, including those related with social security.

The model is calibrated using data from the Mexican economy [see Appendix 3]. Once calibrated, the model is used to evaluate the effects of the changes in the pension system on labour markets. As was mentioned earlier, these changes include: [a] an increase in the government subsidy from 3 to 10 per cent of the average wage; and [b] a possible increase in the valuation of pension services and therefore in contributory social security. In the simulations, no changes in the contribution rate of the private sector [workers and employers] to the pension system are included, since the 1997 reform did not modify those rates.

The effects of the changes in social security on the labour market in three alternative scenarios are shown in Table 7. The first column of results ["scenario 1"] assumes a value of 0.30 for the valuation of contributory social security, while the second assumes a value of 0.47. In both cases the only effect included is the increase in the rate of government subsidy. The third scenario assumes that in addition to the increase in the subsidy, the 1997 reform increased the valuation of contributory social security from 0.47 to 0.70. The values of 0.30, 0.47, and 0.70 are close to those reported by the Report on Social Security in America [2003], as mentioned earlier.

In scenarios 1 and 2, the changes in the pension system imply an increase in equilibrium wage-earning employment of between 0.6 and 0.7 per cent, compared with the base scenario. If that valuation increases to 0.70, wage-earning employment increases by 5 per cent. On the other side of the scale, the number of self-employed workers decreases between 1.5 and 2.1 per cent in the first case, and 12.1 per cent in the second. In net terms, the total number of informal workers falls by 0.4 per cent when valuation parameter $\beta_F$ remains constant and by 4.8 per cent if it increases.
TABLE 7
Effect of changes in the social security system on labour markets
[percentage changes compared with the base scenario]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total wage-earning employment</td>
<td>0.6</td>
<td>0.7</td>
<td>5.0</td>
</tr>
<tr>
<td>Formal</td>
<td>1.4</td>
<td>2.6</td>
<td>25.7</td>
</tr>
<tr>
<td>Informal</td>
<td>0.3</td>
<td>0.1</td>
<td>-2.1</td>
</tr>
<tr>
<td>Self-employed [informal]</td>
<td>-2.1</td>
<td>-1.5</td>
<td>-12.1</td>
</tr>
<tr>
<td>Informal wage-earners and self-employed</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-4.8</td>
</tr>
<tr>
<td>Wage-earners and self-employed</td>
<td>0.0</td>
<td>0.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Gross wage</td>
<td>-0.3</td>
<td>-0.5</td>
<td>-3.2</td>
</tr>
<tr>
<td>Valued wage</td>
<td>0.5</td>
<td>0.6</td>
<td>4.5</td>
</tr>
<tr>
<td>Take-home wage</td>
<td>-0.1</td>
<td>-0.3</td>
<td>-3.1</td>
</tr>
</tbody>
</table>

Source: produced by the authors.

\( \beta_F \) is the valuation parameter of contributory social security. Scenarios 1 and 2 assume \( \beta_F = 0.30 \) and \( \beta_F = 0.47 \), respectively. Scenario 3 assumes an increase in \( \beta_F \) of 0.47 to 0.70. The gross wage and the valued wage are defined respectively as \( w_F (1 + (1 - \theta) T_F) \) and \( w_F (1 + \beta_F T_F) \). while the take-home wage is simply \( w_F \). See the text for further details.

Even though in each case the fall in self-employment is greater than the increase in wage-earning employment, in scenarios 2 and 3 the total employment [measured as the total number of wage-earners plus the self-employed] increases between 0.2 and 1.3 per cent. This is due to the lower proportion of the self-employed in the total workforce. The effects on total employment reported here are used later to evaluate the pension reform’s contribution to growth, via its effect on total employment.

The model also makes it possible to estimate the changes in the average productivity of labour and their effects on production. In the model’s base scenario, the average productivity of labour in the sector of full-time entrepreneurs is 2.2 times greater than that of the self-employed. Therefore, reassignment of work from one sector to another may have effects on aggregate productivity of labour, and so, on production. However, those effects are small in each of the three scenarios included. In scenario 1, the effect of the change in labour productivity on production is 0.09 per cent of GDP, while in scenario 3 that effect is 1 per cent. In the intermediate case, the effect is 0.13 per cent of GDP. The information from these three cases is used later to quantify the contribution of the pension reform to growth, through its effects on the average productivity of labour.
Finally, it is worth saying that Corbo and Schmidt-Hebbel [2003] also include the effects that the change in the pension system in Chile might have had on retirement incentives. For that purpose, the authors consider a regression in which the participation of people aged between 55 and 64 years in the labour market is a linear function of the pension system reform. Unfortunately, a regression of this type cannot be carried out for Mexico because there are too few observations. Specifically, the information about the rate of participation in the labour market broken down by age is available only from 2005 onwards. On the other hand, the data on life expectancy is brought out annually. This means that there are only eight observations, which is clearly insufficient for performing a satisfactory quantitative analysis.

To sum up: it is estimated that the various modifications in social security in Mexico have had an effect of between 0 and 1.3 per cent on employment and it is calculated that the effects on average productivity of labour are between 0.1 and 1 per cent of GDP.

4.4 Impact on economic growth

This section offers an evaluation of the contribution of the 1997 pension system reform to the growth of GDP. For that purpose, a growth accounting exercise was carried out which isolated the effects of the 1997 reform on each of the variables of the growth equation: total factor productivity [TFP], capital and labour. In the first part we quantify the effect that the increase in financial depth resulting from the reform could have had on TFP. In the second part, we quantify each variable’s effects on economic growth.

4.4.1 Effects on TFP

As was mentioned earlier, the 1997 reform of the pension system has had a significant effect on financial deepening in Mexico. In principle, the availability of more resources and the efficient allocation of them would make it possible for productivity of capital and labour to increase. For that reason, and in a way similar to that used by Corbo and Schmidt-Hebbel [2003], we estimate in this section the effects of the 1997 reform
on the TFP as a consequence of increased financial depth. To achieve this, a series of regressions is produced where the dependent variable is [the logarithm of] the TFP and the independent variables include, among others, the measurement of financial depth FIR II, described in Section 4.2. Since in that same section there is an estimate of the effects of compulsory saving on FIR as a consequence of the 1997 reform, the results of that regression enable the effects of compulsory saving on TFP to be quantified.

In order to construct the TFP series, a Cobb-Douglas production function is assumed:

\[ Y_t = TFP_t (K_t)^\alpha (L_t)^{1-\alpha} \]  

where the parameter \( \alpha \in (0,1) \) is the elasticity of production \( Y_t \) in relation to capital \( K_t \). Given the time series for \( Y_t, K_t \) and labour \( L_t \), equation [1] makes it possible to construct the TFP series for a given value of \( \alpha \).

In Mexico there is no information about the capital stock. However, this is constructed by the perpetual inventory method. In that estimate, the investment includes gross capital formation plus the variation of inventories. In order to maintain consistency with the assumptions of section 4.3, a capital depreciation rate of 10 per cent is set [see Appendix 3]. As in Corbo and Schmidt-Hebbel [2003], the capital stock is adjusted by its utilisation rate, where the proxy for that rate is equal to 1, less the unemployment rate of the workforce. Meanwhile, labour is defined as the working population times the average hours worked per week per worker. In order to remain consistent with what was seen in section 4.3, the value of \( \alpha \) is fixed at 0.4 [see Appendix 3]. The series used are quarterly for the period 1993 Q1 – 2012 Q3, and are seasonally adjusted.

The estimated TFP series is shown in Graph 12. It can be seen that the TFP fluctuates considerably in the course of the period: it falls during the so-called Tequila crisis in late 1994 and early 1995; it shows a further slide during the recession in the year 2000; and falls yet again as a result of the Great Recession of 2008. Due to this series of deep, recurrent recessions, Mexico’s TFP has been unable to rise steadily for the past 20 years.
Once the TFP series has been estimated, a calculation is made of the effects on TFP of the financial deepening measure. For that purpose, the following general specification is taken into account\(^\text{17}\):

\[
\ln TFP_t = \alpha_0 + \alpha_1 FIR_t + \alpha_2 TI_t + \alpha_3 Openness_t + \alpha_4 \left( \frac{\pi_t}{1 + \pi_t} \right) + \alpha_5 \left( \frac{G}{GDP} \right) + \alpha_6 T_t
\]

In the above expression, \(TI\) denotes the terms of trade; \(Openness\) is the variable that captures trade openness, defined as the ratio between the sum of exports and imports and the GDP; \(\left( \frac{\pi_t}{1 + \pi_t} \right)\) is a standardised function of the inflation rate, defined in terms of the GDP deflator; \(\left( \frac{G}{GDP} \right)\) is the ratio of Government consumption to the GDP and \(T\) is a linear trend. This term is included due to the fact that, in theory, TFP should grow at a constant rate in the long run.

\(^\text{17}\) For a detailed justification of the explanatory variables in the TFP regression, see Corbo and Schmidt-Hebbel [2003].
The measurement of financial deepening used in this specification is FIR II, since this offers a broader definition than FIR I. Both the standardised inflation rate and the ratio of Government consumption/GDP are included as proxies of macroeconomic stability measurements. Unlike Corbo and Schmidt-Hebbel [2003], an index of structural reforms was not included, for the reasons mentioned above. Neither was an index of labour quality included, since no similar series has been estimated for Mexico, as far as we know.

The estimates of this equation under different specifications are shown in Table 8. The first estimate includes all the variables. The following three regressions eliminate the standardised inflation rate and only include the Government consumption/GDP ratio. By contrast, estimates 5 to 7 only include the standardised inflation rate as a measurement of macroeconomic stability. The last two regressions eliminate both variables, since they are not significantly different from zero in either of the previous estimates. It is possible to see in each of the estimates that the coefficient of the variable that concerns us, FIR II, is significant and robust, even when the openness and terms of trade variable is eliminated. The value of this coefficient is between 0.27 and 0.31.
TABLE 8
Estimated equations for Total Factor Productivity (1998Q1-2012Q3)

<table>
<thead>
<tr>
<th></th>
<th>Ec 1</th>
<th>Ec 2</th>
<th>Ec 3</th>
<th>Ec 4</th>
<th>Ec 5</th>
<th>Ec 6</th>
<th>Ec 7</th>
<th>Ec 8</th>
<th>Ec 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>4.58</td>
<td>4.57</td>
<td>4.55</td>
<td>4.56</td>
<td>4.47</td>
<td>4.47</td>
<td>4.49</td>
<td>4.47</td>
<td>4.48</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.06)</td>
<td>(0.09)</td>
<td>(0.04)</td>
<td>(0.03)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>FIR II</td>
<td>0.29</td>
<td>0.29</td>
<td>0.29</td>
<td>0.31</td>
<td>0.27</td>
<td>0.27</td>
<td>0.31</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Ti</td>
<td>-0.08</td>
<td>-0.06</td>
<td>0.33</td>
<td>0.02</td>
<td>0.38</td>
<td>0.04</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.12)</td>
<td>(0.10)</td>
<td>(0.11)</td>
<td>(0.07)</td>
<td>(0.10)</td>
<td></td>
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</tr>
<tr>
<td>Openness</td>
<td>0.48</td>
<td>0.46</td>
<td>0.43</td>
<td>0.46</td>
<td>0.48</td>
<td>0.44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.10)</td>
<td>(0.07)</td>
<td>(0.11)</td>
<td>(0.07)</td>
<td>(0.10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INF/(1+INF)</td>
<td>0.51</td>
<td></td>
<td>0.35</td>
<td>0.41</td>
<td>-0.71</td>
<td></td>
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<tr>
<td></td>
<td>(0.81)</td>
<td></td>
<td>(0.81)</td>
<td>(0.77)</td>
<td>(0.89)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>G/Y</td>
<td>-0.59</td>
<td>-0.56</td>
<td>-0.46</td>
<td>-0.33</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(0.38)</td>
<td>(0.38)</td>
<td>(0.31)</td>
<td>(0.44)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trend</td>
<td>-0.004</td>
<td>-0.004</td>
<td>-0.004</td>
<td>-0.003</td>
<td>-0.004</td>
<td>-0.003</td>
<td>-0.004</td>
<td>-0.004</td>
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</tr>
<tr>
<td></td>
<td>(0.0)</td>
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<td>(0.0)</td>
<td>(0.0)</td>
<td>(0.0)</td>
<td>(0.0)</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.71</td>
<td>0.72</td>
<td>0.72</td>
<td>0.61</td>
<td>0.70</td>
<td>0.71</td>
<td>0.61</td>
<td>0.71</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Source: authors’ work. Standard errors in brackets.

Based on the information given in the above table and on the estimates in section 2.2, it is possible to quantify the contribution of the pension system reform to the growth rate of TFP. To do this, three scenarios are assumed. The first of these takes the lowest value of the coefficient of accumulated compulsory savings [ACS] in the regression for FIR II: i.e. a value of 1.76. At the same time, the lowest value is taken for the coefficient of FIR II in the regression for TFP: i.e. a value of 0.27. The second scenario takes the intermediate value between 1.76 and 1.89, which are the coefficients of ACS in the regression of FIR II and in the same way, adopts the intermediate value between 0.27 and 0.31 according to the results of the above table. Finally, the third scenario takes the highest coefficients into account in each case: i.e. 1.893 and 0.31.

On the basis of these assumptions, it is estimated that, on average, a growth of 0.12, 0.13 and 0.15 per cent of TFP can be attributed to the pension reform for the period 1998 Q1 – 2012 Q3, corresponding to scenarios 1, 2 and 3, respectively.
4.4.2 Total effect on economic growth

In this part, the results obtained in the previous sections are used to quantify the total effect of the 1997 reform on economic growth. To do this, an exercise of growth accounting is carried out, taking the production function [1] for reference. Expressing the variables of equation [1] in terms of rates of change, the following expression is obtained for the growth rate of the GDP:

\[ \Delta Y = \alpha \frac{\Delta K}{K} + (1- \alpha) \frac{\Delta L}{L} + \Delta TFP \]  

Due to the fact that the pension reform affects each of the variables of the production function, the total effect of the reform can be broken down into its effects on the accumulation of capital, on labour, and on total factor productivity. For this purpose, the information in the previous sections is used, where the effects of the pension reform on saving and investment, labour markets and total productivity are quantified. In order to remain consistent in the values of the parameters used, in each of the exercises in this section the fixed value of \( \alpha = 0.4 \) is used.

Given below is a separate explanation of each of the effects, on the basis of the method used by Corbo and Schmidt-Hebbel [2003]. Specifically, we offer estimates of the effects of the reform on average growth in the period 1998Q1 -2012Q3. For reference purposes, the average growth of the GDP in that period was 2.4 per cent per year.

**Saving and investment.** In order to estimate the effect of the reform on capital accumulation, the following version of the law of motion for capital was taken for reference, according to Solow’s model:

\[ \frac{\Delta K}{K} = i \left( \frac{Y}{K} \right) - \delta, \]  

Where \( i \in (0.1) \) is the investment/GDP ratio and \( \delta \in (0.1) \) is the depreciation rate of capital. For purposes of this section, \( Y/K \) is the average of the GDP/capital stock ratio for the period 1998Q1- 2012Q3. Meanwhile, the depreciation rate is 10 per cent per year, in order to be consistent with the assumptions in section 2.3.

As was mentioned in section 1.1, the effects of the reform on domestic investment occur in a range between -0.03 and 1.24 per cent of GDP, depending on the percentage of fiscal adjustment. In this case, we assume...
that the adjustment is 62.5 per cent, and as a result the effects on the investment rate are situated in a range between 0.24 and 1.21 per cent of GDP, with an intermediate value of 0.72 per cent.

On the basis of this information and the values of $Y/K$ and $\delta$, equation [3] is used to calculate the changes in the capital stock in each scenario. Then equation [2] is used to quantify the effects on the growth of the GDP. The results are shown in Table 9. It is possible to see that the effect of the reform through the increase in the domestic investment rate lies in a range between 0.05 and 0.27 percentage points, with an intermediate estimation of 0.16 percentage points.

### TABLE 9

*Estimate of the effects of the pension reform on GDP growth [%]*

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real average growth of GDP, 1998Q1-2012Q3</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Effects of the reform on growth of GDP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saving-investment</td>
<td>0.05</td>
<td>0.16</td>
<td>0.27</td>
</tr>
<tr>
<td>Labour markets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change in employment</td>
<td>0.0</td>
<td>0.01</td>
<td>0.06</td>
</tr>
<tr>
<td>Change in labour productivity</td>
<td>0.0</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Financial development and TFP</td>
<td>0.12</td>
<td>0.13</td>
<td>0.15</td>
</tr>
<tr>
<td>Total</td>
<td>0.18</td>
<td>0.31</td>
<td>0.52</td>
</tr>
</tbody>
</table>

Source: authors’ own work.

**Labour markets.** As was commented in section 3.3, there is evidence that the 1997 pension reform could have reduced the “pure” labour tax component from the contributions of wage-earning workers. In that section, three scenarios were estimated to quantify the effects of the reform on total labour and average productivity of labour. Those estimates are included in equation [2] to capture at the same time its effects on the growth of the GDP. For purposes of this section, it is assumed that those changes had an effect throughout the period 1998Q1-2012Q3.

The results are shown in Table 9. It is estimated that the pension reform’s contribution to growth, through its effect on employment, lies in the range between 0 and 0.06 percentage points, with an intermediate value of 0.01. For the case of the effects through changes in the average productivity of labour, that contribution is found between 0 and 0.04 percentage points, with an intermediate estimate of 0.01.
**Total Factor Productivity.** As has already been argued, the pension reform has contributed significantly to increased development of the financial system, due to the increase in pension savings. This in turn may have favourable effects on productivity as a consequence of an increase in the availability of resources and their appropriate allocation.

These effects have been quantified in section 4.4.1 and it is only necessary to include them in equation [2] in order to estimate their effects on growth. In that equation, it may be seen that the percentage changes in TFP result, one by one, in percentage changes in production. In this way, it is estimated that the pension reform, through its effect on TFP, has contributed between 0.12 and 0.15 percentage points to the average growth of the GDP, with an intermediate value of 0.13.

**Total effect of the reform.** Once the effects of the reform on each of the variables in equation [2] are known separately, we proceed to estimate the total effect on the growth of the GDP. To do this, \( g_{PR}^T \) is defined as the average rate of total growth attributable to the pension reform. This rate can in turn be written as the product of the growth rates attributable to each of the variables, as follows:

\[
1 + g_{PR}^T = (1 + g_{PR}^K) (1 + g_{PR}^L) (1 + g_{PR}^{TFP})
\]

where \( g_{PR}^i \) is the average growth rate attributable to the pension reform through its effect on the variable \( i = K, L, TFP \).

The results are shown in the final line of Table 9. The estimates suggest that the pension reform has contributed between 0.18 and 0.52 percentage points of the average growth of the GDP during the period 1998Q1-2012Q3, with an intermediate value of 0.31 percentage points.
5. Conclusions

Mexico implemented an important reform of the IMSS pension program in 1995 by replacing the defined-benefit pay-as-you-go scheme with one whose central axis is total capitalisation with individual accounts and private administration, which began operations on 1st July 1997. This was undoubtedly a reform of enormous importance, because its effects reach far more widely than the social security sphere, affecting other key aspects of the economy such as public finance, saving, investment, the development of the financial system, the labour market, productivity and economic growth as a whole. 15 years after this reform, it is important to make a first comprehensive evaluation of those effects, to value the contribution that it has made to economic growth. In this study, we have attempted to perform this exercise, though it is important to emphasise that many of the expected effects occur in the long term, so our results must be considered as a first, preliminary exercise.

It must be made clear that the reform was necessary and could not be postponed. The matter of counterfactuals in economics is not a minor one, but the studies that existed at the point when the reform was discussed showed quite clearly that the financial position of the IMSS [and the program itself] was unsustainable in the medium and long term. As we mentioned in this study, the contingent liability that was being produced as a result of the pay-as-you-go program and its defined benefits showed an explosive trend that would end up seriously affecting public finance.

In this context, it would have been impossible for the authorities to
continue with a policy of reorganising public accounts with a view to balancing public finance, as happened during the previous decade. The need to validate pensioners’ rights would have meant an increase in the public deficit and/or less expenditure on other items, a growing level of debt and a negative impact on economic growth. But in addition there would have been no generation of long-term financial resources available for investment on the same time-horizon. It is likely that the development of the financial system and capital markets would have been less and, consequently, there would have been less economic growth.

After 15 years, the reformed program has shown significant progress. In 2012 there were 48 million registered accounts with resources representing 17.8% of the GDP. Of these, the resources managed by the 12 AFOROrs in the market represented 12.2% of the GDP, while the housing funds (including FOVISSSTE) represented 4.6% of the GDP. The fees charged for services have fallen considerably, representing 1.38% per year on the balance, as an average for the system [December 2012]. The investment of the resources has been diversified, and there are currently four basic Sioforees under the life-cycle concept. In the year 2000, Government bonds represented around 90% of the assets in the investment portfolio, whereas by 2012 this share had fallen to 57% and the assets issued by companies had increased to approximately 30%. The yield recorded during this period has also been good. According to CONSAR, on average the historic annual yield of SB2 has been 18.6% in nominal terms and 7.7% in real terms.

Our study closely follows the strategy proposed by Corbo and Schmidt-Hebbel [2003], where the total effect of the reform is analysed on the basis of four main channels: national saving and domestic investment, aggregate employment and its level of formality, the development of the capital market and the growth of total factor productivity and GDP.

Our estimates of the impact of the reform on national saving suggest a range that runs from -0.04% to 1.7% of GDP. The estimated intermediate effect is positive, 0.99% of GDP, one of the outstanding points being that, although households reduce their voluntary saving in the presence of mandatory saving, the trade-off is only partial, with a coefficient of around 0.3. As regards the investment rate, the effect lies in the range between 1.24 and -0.03 per cent of GDP. The intermediate estimate of the contribution of the pension reform to the investment rate is 0.72% of GDP in the period analysed.
One of the greatest effects resulting from the reform of the pension system has undoubtedly been the boost given to the financial system and capital market. The accumulated financial savings in the economy grew 22.2 percentage points of GDP between 2001 and 2012, of which 17.9 represent the accumulation of the pension funds. According to our estimates, which use the constructed variables of financial depth, FIR I and FIR II, the effect that can be attributed to compulsory pension savings in the increase of financial depth ranges from a minimum of 16.9% [with FIR I] to a maximum of 25.7% with FIR II.

The results related with employment, formality and labour productivity were more modest, relatively speaking. We estimate that the reform has had an effect on employment of between 0 and 1.3 per cent, while the effects on average labour productivity are between 0.1 and 1% of the GDP. In this sense, it is worth mentioning that the lack of an appropriate reform of the labour market means that various distortions have not been resolved, and these have manifested themselves in a low average labour productivity.

The total effect of the reform on the growth of the economy was obtained by using a standard production function for the Mexican economy, in which the impact occurs through its three components: capital, labour and total factor productivity. In the first case, the effect of the reform through the increase in the domestic investment rate is found in a range between 0.05 and 0.27 percentage points with an intermediate estimate of 0.16 percentage points. As regards the second component, the effect of employment is to be found in a range between 0 and 0.06 percentage points, with an intermediate value of 0.01. Finally, it is estimated that the pension reform, through its effect on TFP has contributed between 0.12 and 0.15 percentage points to the average growth of the GDP, with an intermediate value of 0.13.

This information makes it possible to estimate the total effect on economic growth resulting from the pension reform. Our estimates suggest that the reform has contributed between 0.18 and 0.52 percentage points of the average growth of the GDP during the period 1998Q1-2012Q3, with an intermediate value of 0.31 percentage points. Although these results are somewhat lower than those reported for the Chilean case in Corbo and Schmidt-Hebbel [2003] some 22 years after their reform, it has to be recognised that it has represented an important contribution to the Mexican economy in the past 15 years. Our results suggest that the reform of the pension system is respon-
sible for between 7.5% and 21.6% of the average annual growth observed in the past 15 years.

However, it is important to point out that certain additional factors can usefully be included when evaluating these results. In the first place, our model captures only aggregate effects through the four channels mentioned. But there are other effects, both direct and indirect, that are not picked up by the model. For example, the model captures the effect on financial depth resulting from the accumulation of pension resources, but not the fact that these are long-term resources that are available for funding projects with the same time-horizon, nor the effect arising from the creation of new financial instruments suitable for needs of this type; i.e. a growing diversification in financial instruments and greater scope in the market. The same happens in the fact that this reform implies the creation of new financial intermediaries, such as the AFOREs or the insurance companies specialising in life annuities, and potentially positive synergies with other intermediaries. In the document we make a qualitative assessment of these effects, but not a quantitative assessment, since that calls for a different methodological and analytical frame of reference.

Our study analyses the relationship between public and private saving and the effect on national saving, but does not capture the positive effect of encouraging the development of a market for public securities. This same thing happens in the case of private saving, since our analysis deals only with its reaction to the creation of mandatory saving, but not with other potentially positive effects on private saving resulting from having a deeper and more diversified financial sector. In this sense, we think that the impact we are estimating on economic growth may fall short of what has actually happened; in other words, we could be underestimating this impact. In any case, this is a topic for future analyses.

On the other hand, it is also important to recognise the limits and problems faced by this reform, which have meant that its positive effects on economic growth have not been potentiated. As we have already mentioned, the reform appeared in the context of a deep economic and financial crisis, where public perception of private financial intermediaries was not the best. This led to the initial design’s being subject to important limitations. In particular, the initial investment scheme was managed on very narrow limits which restricted participation in equities and foreign paper to a considerable extent. This meant investing
lower risk/yield frontier than was desirable, reducing the possible positive impact on the development of the capital market and economic growth. But the limitations can also be seen throughout these 15 years. In particular, the results for Mexico have to be put in the context of an economy that has shown poor growth in the past decade, together with low productivity, due to a number of obstacles and distortions in various markets. In fact, since the IMSS pension reform in 1997, the only important structural reform to take place is that concerning the ISSSTE [bureaucrats] pension system in 2007. It is only in 2013, with the new administration, that a new impetus has been given to the process of structural reform. Clearly, one of the reforms that should have been implemented long ago is that of the labour market, and our study shows that it is precisely in that aspect that the pension reform has had least impact.

Our study and its results offer important policy implications, which in some cases go beyond the sphere of the pension program itself. As a general reflection, our work suggests that however important a structural reform may be, that of pensions in this case, its effects on growth will be limited if other reforms that eliminate important distortions are not put in place. In this sense, it is important that the Mexican Government should continue with the agenda of reforms, particularly in the labour, fiscal and social security markets. In this case, as Levy and Antón et al. [2008] suggest, the distortions that produce informality incentives could be reduced or eliminated, while at the same time enabling the marginal contribution rate of firms to be reduced. To the extent that this happens, there should be an increase in formality, which in turn would mean more pension savings. These, as we have already seen in this study, have important effects on financial depth and, by this route, on Total Factor Productivity.

In terms of the drive towards financial deepening and capital market development, it is important to continue making the Siefores’ investment scheme more flexible, reducing the share of public debt and making way for other instruments that enable the optimum risk-return frontier to be raised.

One issue that is only captured partially in our study is that referring to low contribution densities and replacement rates. To the extent that a solution is found to the formal-informal duality problem in the labour market, there should be an increase in contribution density and therefore in replacement rates. However, this latter variable should also be
positively affected as fees continue to fall and returns improve; this last by way of a more flexible investment scheme. If the aforementioned reforms can be carried out in the next few years, we can assume that the type of positive macroeconomic effects derived from the pension reform could be reinforced in the future.

In brief: our study shows the importance of the pension reform in terms of its contribution to economic growth in Mexico. However, as reforms extend to other sectors and markets and the design of the pension programs is adjusted, these effects could be augmented.
Methodological note on the series

Compulsory savings

The compulsory saving series was constructed on the basis of monthly data on flows of contributions into the retirement savings funds, the fees charged, the return on the value of the Siefores’ shares at month end, transfers from the system to pay pensions and retirement benefits, and variation in the funds of savings for housing.

In order to calculate the mandatory social security savings, these steps were followed:

1. The fee on balance and on flow in each period was subtracted from the gross retirement contributions reported by CONSAR. The historic data of both fees are reported by CONSAR, in detail, for each AFORE.

2. Subsequently the estimated return was added, according to the type of Siefore in which the resources were placed. The monthly return in pesos was estimated by applying the corresponding monthly value of the return on management for the last 12 months, which CONSAR reports for each Siefore, to the value of each Siefore’s net assets.

3. Then the capital gains that the AFOREs generate by investing their own equity in the investment funds were subtracted, as was the return on the insured members’ voluntary savings. To do this, the in-
formation reported by CONSAR on the registered corporate equity of each AFORE was taken, plus the total voluntary savings registered, and the weighted return of each AFORE was calculated by the net assets of the Siefores that it manages.

4. Finally, it was adjusted by the total value of the withdrawals from the system reported by CONSAR.

In order to estimate the total sum of compulsory savings, the flow of resources set aside for housing was added to the pension savings. The flow is calculated simply, by looking at the variation in the total resources for housing registered and reported by CONSAR.

**Household savings**

INEGI produces an annual series of household saving as a percentage of the total saving. Two series were taken [bases 1993 and 2003] and the repeated data were reconciled using an average. The value for 2012 was projected as the moving average of the past five years, to obtain a forecast that would represent the trend smoothly.

The annual percentage produced was imputed to the total savings series previously calculated, in order to construct the quarterly series.

**Population dependency**

The population dependency series was taken from the World Bank’s database. That series contains annual data from between 1960 and 2011. On the basis of these, the value for 2012 is forecast on the basis of a linear estimate.

Finally, quarterly series were constructed for the period 1998-2012 by the method of temporal disaggregation proposed by Boot, Feibes and Lisman [1967], which minimises the quadratic differences of the sub-periods.
Estimate of the response of voluntary saving to compulsory saving

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compulsory saving [CS]</td>
<td>-0.310</td>
<td>-0.589**</td>
<td>-0.344</td>
<td>-0.154</td>
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<td>(-1.313)</td>
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<td>Corporate savings</td>
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<td>Public savings [GS]</td>
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<td>0.120*</td>
<td>0.176**</td>
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<td></td>
<td>(-1.185)</td>
<td>(-2.312)</td>
<td>(1.731)</td>
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<td>External savings [XS]</td>
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<td>(-0.678)</td>
<td>(-1.737)</td>
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<td>Dependency rate</td>
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<td>Real interest rate</td>
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<td>(0.053)</td>
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<td>Return on money</td>
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<td>0.152***</td>
<td>0.006</td>
<td>0.082**</td>
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<tr>
<td></td>
<td>(4.729)</td>
<td>(3.778)</td>
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<td>(2.16)</td>
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<tr>
<td>Unemployment rate</td>
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<td>-0.247*</td>
<td>-0.288*</td>
<td>-0.033</td>
</tr>
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<td>(-0.248)</td>
<td>(-1.716)</td>
<td>(-2.011)</td>
<td>(-0.258)</td>
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<tr>
<td>D(ΔY&lt;0)</td>
<td>-0.005</td>
<td>-0.006*</td>
<td>0.010***</td>
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<tr>
<td></td>
<td>(-1.529)</td>
<td>(-1.795)</td>
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<td>(3.359)</td>
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<tr>
<td>Constant</td>
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<td>(-3.466)</td>
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<td>Adjusted R²</td>
<td>0.247</td>
<td>0.251</td>
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<td>Durbin- Watson</td>
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<td>1.089</td>
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<td>1.864</td>
<td>1.922</td>
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Period: June 2008 to June 2012.
Frequency of series: quarterly
*, **, *** indicates level of significance at 10%, 5% and 1%, respectively.
Values R² and DW correspond to the SCM.
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<th>Variable</th>
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<td>Internal Saving [DS]</td>
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<td>-0.107</td>
<td>-0.352 **</td>
<td>-0.405 **</td>
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<td>Exchange Rate Gap [DS]</td>
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<td>(-0.419)</td>
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<td>Private Securities /GDP [Priv]</td>
<td>0.993 ***</td>
<td>0.978 ***</td>
<td>1.033 ***</td>
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<td>(21.267)</td>
<td>(20.448)</td>
<td>(16.112)</td>
<td>(15.997)</td>
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<td>Real Return on Deposits [RRQ]</td>
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<td>-0.038 **</td>
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<td>(-3.776)</td>
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<td>Real Return on External Assets [RRX]</td>
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<td>(-1.08)</td>
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<td></td>
<td>(1.139)</td>
<td>(0.973)</td>
<td>(1.597)</td>
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<td>D[ΔY&lt;0]</td>
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<td>0.013 **</td>
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<td></td>
<td>(2.361)</td>
<td>(2.085)</td>
<td>(0.455)</td>
<td>(0.325)</td>
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<tr>
<td>Accumulated Compulsory Savings [ACS]</td>
<td>0.814 ***</td>
<td>0.976 ***</td>
<td>1.756 ***</td>
<td>1.893 ***</td>
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<tr>
<td></td>
<td>(3.396)</td>
<td>(4.152)</td>
<td>(5.333)</td>
<td>(6.035)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.283 ***</td>
<td>0.294 ***</td>
<td>0.327 ***</td>
<td>0.336 ***</td>
</tr>
<tr>
<td></td>
<td>(8.295)</td>
<td>(8.385)</td>
<td>(6.968)</td>
<td>(7.183)</td>
</tr>
<tr>
<td>ECT [-1]</td>
<td>-0.996 ***</td>
<td>-0.934 ***</td>
<td>-0.739 ***</td>
<td>-0.726 ***</td>
</tr>
<tr>
<td></td>
<td>(-7.004)</td>
<td>(-6.963)</td>
<td>(-5.395)</td>
<td>(-5.547)</td>
</tr>
<tr>
<td>Adjusted R^2</td>
<td>0.865</td>
<td>0.863</td>
<td>0.820</td>
<td>0.825</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>1.611</td>
<td>1.528</td>
<td>1.419</td>
<td>1.400</td>
</tr>
</tbody>
</table>
Model for estimating the effects on the labour market

This appendix provides a description of the Antón and Leal [2012] model used to estimate the effects on the labour market in section 4.3. In that model, the production of the single “good” is carried out in two sectors: that of full-time entrepreneurs and that of the self-employed. In each case production takes place using three inputs: capital, labour and entrepreneurial ability. The market structure is one of perfect competition in which the producers of goods are price-takers.

The full-time entrepreneurs demand wage-earning labour to produce goods and must pay social security contributions and other taxes on labour. However, the entrepreneurs have incentives to evade those contributions, and the likelihood of their being detected by the authorities is proportional to the size of their firm. If the firm is found out in evasion activities by the authorities, it has to pay a fine of an amount higher than the sum total of the evaded contributions. Under this structure, small firms have greater incentives to evade the contributions on labour, and vice-versa. In the extreme case, the likelihood of the authorities detecting contribution evasion among the self-employed is practically zero. In this context, workers for whom contributions are paid are rated as formal, and the rest are informal. These workers receive wages denoted by $w_F$ and $w_I$, respectively.

Meanwhile, there is a continuum of identical families that live for ever. Entrepreneurial ability is distributed exogenously among the different
members of each family. Thus, each individual optimally chooses to be a wage-earner, self-employed worker or full-time entrepreneur, depending on his/her ability endowment. The families are owners of capital and they rent it to the firms producing goods. The family income is intended for consumption or for accumulating capital. Finally, the role of the Government consists in collecting the contributions on labour and providing subsidies for contributory and non-contributory social security.

In equilibrium, the full-time entrepreneurs decide to hire both formal and informal workers. Due to the low probability of being detected by the authorities, the small entrepreneurs decide to hire proportionally more informal workers. By contrast, the large entrepreneurs hire proportionally more formal workers. Meanwhile, the self-employed decide to evade 100% of the contributions on labour, meaning that they are all informal. As is discussed in Antón et al. [2012], this specification makes it possible to replicate the distribution of workers by firm size observed in the data.

Meanwhile, there is perfect mobility in the labour market. The members of the household also value the social security services provided by the contributory and non-contributory systems. Those valuations are represented respectively by the parameters $\beta_f$ and $\beta_i$. Let $T_f$ be the contribution rate per formal worker as a percentage of wage and $T_i$ the government subsidy per informal worker. As was discussed in the main text, if $w_f(1 + \beta_f T_f) = w_i + \beta_i T_i$ a worker will be indifferent about belonging to one or other of the two social security systems. On the other hand, it must be true that, in equilibrium, the supply of labour is equal to the demand. These two equations define the equilibrium wages $w_f^*$ and $w_i^*$. So the model makes it possible to evaluate the effects on the labour market [and on the remaining variables] due to changes in parameters $T_f, T_i, \beta_f$ or $\beta_i$, which are related with social security.

The model is calibrated for the Mexican economy. The data comes from various sources, including information from National Accounts [for estimating the investment/production ratio], the Economic Census of 1994 [for data related with the distribution of employment in private and government-owned firms] and the National Employment Survey from the second quarter of 1997 [for estimating formal and informal workers in the private sector prior to the reform]. The values of some parameters are taken from the literature and others are calculated to replicate certain moments observed in the data. Specifically, 9 moments are used to calibrate 9 parameters.
Like Corbo and Schmidt-Hebbel [2003], the share of capital in the production function is fixed at 0.4. This value is consistent with the range reported by García-Verdú [2005] for Mexico. Meanwhile, the depreciation rate of the capital is fixed at 10 per cent. This value makes it possible to obtain a ratio of capital stock/GDP that is closer to the value of 1.88 reported by García-Verdú [2005], and also a ratio of investment/GDP that is closer to the average of 0.22 in the data [see Table A1]. The rates of contribution to social security and the corresponding government subsidy are fixed at 0.325 and 0.03, respectively, these being the values estimated prior to the 1997 reform. The valuation parameter for contributory social security \( (\beta_F) \) is fixed at 0.3, which is close to the value reported in the Report on Social Security in America [2003]. We decided not to fix that initial value at zero as suggested in the estimate of Cazorla and Madero [2007], because we interpreted this as being an extreme case. According to the econometric results of Levy [2008], the ratio of assessments between contributory and non-contributory social security on the part of workers is fixed at 0.35.

The results of the calibration exercise are shown in Table A1. The first column shows the 9 moments used to adjust the 9 remaining parameters. The second column shows the numerical values corresponding to those moments, according to what is recorded in the data. The final column shows the corresponding numerical values produced by the model. As can be observed, the model replicates the moments of the data quite reasonably.
TABLE A1
Comparison of the moments in the data and in the model

<table>
<thead>
<tr>
<th>Moment</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of workers per establishment</td>
<td>6.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Fraction of employment in establishments with over 51 workers</td>
<td>0.31</td>
<td>0.30</td>
</tr>
<tr>
<td>Average number of workers in establishments with over 51 workers</td>
<td>189</td>
<td>190</td>
</tr>
<tr>
<td>Fraction of self-employed</td>
<td>0.19</td>
<td>0.19</td>
</tr>
<tr>
<td>Fraction of informal workers</td>
<td>0.71</td>
<td>0.70</td>
</tr>
<tr>
<td>Capital stock/GDP ratio</td>
<td>1.88</td>
<td>2.37</td>
</tr>
<tr>
<td>Investment/GDP ratio</td>
<td>0.22</td>
<td>0.24</td>
</tr>
<tr>
<td>Rate of return on capital</td>
<td>0.065</td>
<td>0.065</td>
</tr>
<tr>
<td>Ratio of subsidies per worker in non-contributory system versus contributory system</td>
<td>0.80</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Source: authors’ own work based on information from National Accounts, Economic Census (1994), the National Employment Survey from the second quarter of 1997 and Levy [2008].


Ordorica, Pedro [2013]. A quince años de la reforma al sistema de pensiones del IMSS: Principales aspectos de la evolución del sistema 1997-2012, regulación, diseño, evolución y principales cambios, in Oscar Franco y Alejandro Villagómez [coordinators]. A quince años de la reforma al sistema de pensiones. Asociación Mexicana de AFOREs.


4.3 Evidence for Chile

J. Rodrigo Fuentes*

* Associate Professor at the Institute of Economics of the Catholic University of Chile.

I am grateful for Rodrigo Acuña’s comments and for useful conversations with Joaquín Vial and Gert Wagner.

Gonzalo García, research associate at the Institute of Economics of the Catholic University of Chile, collaborated in producing this paper.
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1. Introduction

The 1981 pension reform in Chile constituted essentially a change from the traditional pay-as-you-go system, with no accumulated funds and managed by the State, to an individually-funded system managed by the private sector. The way in which this reform was carried out produced changes in employment and the distribution of labour between the formal and informal sectors of the economy; in the decisions taken by private sector and Government entities on saving and investment, and in the development of a financial market that was necessary for the new institutional framework. This in turn resulted in more efficient allocation of resources and consequently an increase in Total Factor Productivity (TFP).\(^1\)

The sum of these effects has macroeconomic repercussions that are far from insignificant: they involve intergenerational transfers, changes in the level of per capita income and in the corresponding level of welfare. In this paper we analyse just one of them [the macroeconomic effect of the reform], excluding other equally important aspects, such as income distribution, social justice, the struggle against poverty and the regulation and organisation of the industry of pension fund administrators. The conceptual framework of this paper aims to analyse the impact of the reform on the long-term level of GDP per capita.

Although there is an enormous amount of literature on specific aspects of the Chilean reform and its effects, there are few more comprehen-

\(^1\) These effects are the ones mentioned and analysed by Corbo and Schmidt-Hebbel (2003).
sive studies. One of the exceptions is the paper published by Corbo and Schmidt-Hebbel [2003], who analysed each of the dimensions referred to and its effect on the level of per capita GDP and economic growth in the first 20 years after the reform. They found that 0.49 percentage points of the 4.6 per cent which was the growth rate in the period 1981-2001, were due to the reform. In terms of the level, they found that the GDP in 2001 was 4.6 per cent higher as a result of this reform.

One of the difficulties involved in this work lies in identifying the full effect of the pension reform on the level of the Product and economic growth, as opposed to the impact of other reforms that took place at that moment. This is especially important in the case of the 1981 pension reforms, which took place in a context where the Chilean economy was passing through a period of deep structural changes. At the point of the pension reform, Chile was in a process of transition from an economy with high State participation in economic activity to one in which the private sector took the lead, with the State basically playing a subsidiary role. Among the most emblematic reforms of the seventies and eighties were the liberalisation of trade and finance; the guaranteeing of property rights, accompanied by a process of privatisations of companies in State hands; a financial reform resulting from the 1982 crisis; the adoption of policies aimed at fiscal consolidation and careful management of monetary policy and, of course, the pension reform. We must not lose sight of the fact that these reforms and those that followed them in the decades that came afterwards, have been an important part of the series of factors that have determined the Chilean economy’s performance over the past thirty years.

The approach of this paper is summarised in Figure 1. The reform of the pension system affects employment, capital formation and total factor productivity (TFP), traditional components used to express growth in accounting terms. The reform affects the labour market in that it reduces the pension contribution and links contributions with retirement benefits, so changing the idea that pension contributions are essentially tax. This naturally reduces the wage paid by the companies and increases the wage received by the worker, in addition to increasing employment (all the effects depend on the elasticity of labour supply and demand). This increase in employment produces a higher level of steady-state product, which generates more growth in the transition. A second effect has to do with

---

2 Many more reforms were carried out involving regulation of public service companies, competition in the markets, a mining code, the independence of the Central Bank and changes in the regulation of the labour market.
the incorporation of new workers into the formal sector of the economy from the informal sector. Generally, workers in the formal sector enjoy higher productivity, which raises the aggregate TFP by changing the composition of production and employment between the two sectors. A third effect, which is hard to quantify, is the ending of the relationship between the type of pension and the job: in the old system, the pension fund corresponding to each worker was dictated by the economic sector in which he/she worked. This ended with the new system.

A pension reform that replaces the pay-as-you-go system with one based on private administration of individual accounts of pension savings has a considerable impact on the development of the capital market, this development being understood as a broad concept that includes more instruments, an expanded term structure, improvements in corporate governance, etc. These effects on the capital market have an influence on the generation of more saving and more investment, and also in increased efficiency in the inter-temporal allocation of resources in the economy, which affects the TFP.

Finally, there is a direct effect on the saving and investment market. This occurs because of the need to finance a fiscal deficit [less savings] caused by the transition between one system and the other, which can be funded partially by private savings. However, this effect of the transition deficit does not affect the steady-state situation. On the other hand, if workers perceive their contributions to the pension fund as compulsory savings, this will have a trade-off effect on families’ voluntary savings. Furthermore, there is a fiscal commitment with the reform that concerns the provision of welfare pensions and minimum pensions. These imply a permanent deficit that has to be funded and affects the steady state.3

3 Similarly, the old system, bearing in mind its benefit structure, financing and the demographic trends, would have generated a growing fiscal deficit that would have meant important adjustments in the parameters that govern pensions, so taking the economy to a different steady state.
This paper is divided into 9 sections. Following this introduction, Section 2 describes the conceptual framework for analysing the relationship between economic reforms and growth, and also takes a look at the process of Chile’s economic growth. Section 3 gives a brief summary of the 1981 pension reform and the main changes that were introduced by the reform in 2008. Following the scheme presented in Figure 1, sections 4 to 6 analyse the impact of the 1981 pension reform and its 2008 modification on the savings and investment market, the capital market and the labour market. Section 7 quantifies the effect of the reform on TFP. Section 8 summarises and calculates the total effect on the level and growth of per capita income in Chile. Section 9 is the conclusion.
2. Economic reforms and growth in Chile

This section explains conceptually the effect of economic reforms on growth and on the level of Product per capita. It is understood that reforms modify long-term per capita income and that, if these reforms are appropriate, they should increase it. This alters what occurs in the short term and the corresponding growth rate. The second part of this section analyses the impact of the reforms on Chilean economic growth overall.

2.1 Economic reforms and growth: conceptual framework

In the context of the neoclassical growth model, economic reforms lead to a change in the level of the product per worker [and also per capita] in steady state, which is reflected in a higher rate of growth in the transition towards this new steady state. For example, a reform that increases the investment rate in the economy leads to a greater accumulation of capital, which produces a greater stock of capital per worker in the long term and therefore a greater product per worker in steady state. Meanwhile, a reform that improves efficiency in the allocation of resources [liberalisation of trade, for example] leads to a displacement of the aggregate function of production by increasing the growth rate in the transition towards a steady state characterised by a higher product per worker [and also, per capita].

Figure 2 shows in graphic form the effect of a reform on the course of the long-term Product. The [natural logarithm] of the per capita Prod-
uct is shown on the vertical axis and the time on the horizontal. An economy grows at a constant rate in steady state represented by the straight line that starts at time zero on Figure 2 [the cyclical component is disregarded]. A reform is carried out at moment T which produces a change in the long-term level of the economy and which may or may not affect the long-term growth rate. In the figure, this change is represented by a change in the long-term path, where the slope may be slightly greater if the reform affects the rate; if not, it will simply be a straight line with the same slope [both drawn on the graph]. In the short term, the economy adjusts gradually towards this new long-term equilibrium, following a course represented by the broken line. This curve has a steeper slope, which represents a greater growth rate as long as it converges towards the long-term trend line, which will occur at some future date.

**FIGURE 2**
Theoretical effects of a reform

The key, therefore, is to find out how the pension reform affects the long-term level of the line and its growth rate. That is the subject-matter of the following sections.

### 2.2 Reforms and growth in Chile

The episodes of growth in the Chilean economy have been studied in Fuentes [2011] for the period 1810-2009, using the neoclassical growth model. When the product per worker is analysed using the simple ver-
sion of the model, the study finds that there are structural changes in the model summarised by the path of the economy in the years 1929 and 1981. Although the pension reform took place precisely in the latter year, it is not possible to attribute the change to it, but it is indeed the reflection of a series of changes that took place at around that date.

The long-term growth rate of labour productivity rose from 2.05 per cent to 2.71 per cent, according to this analysis. That corresponds to the change of slope in the long-term path represented in Figure 2. However, the growth rate of the period 1982-2009 has been different, due to two factors: the first is what is represented in Figure 2 and corresponds to the convergence towards the new balance; in that period of transition the economy grows at a higher rate than the long-term rate. The second is the deep recession of 1982-1983, when the Product per worker fell 16% in those two years, while the Product per worker continued downwards until 1985. From then on, due to the recovery, the growth rate was much higher than the long-term rate, moving towards the new long-term trend in the late nineties.
The 1981 pension reform has a series of dimensions, not all of which will be described in detail here. The emphasis will be placed on those details with macroeconomic impacts. Its main characteristic is the replacement of a pay-as-you-go system managed by the State to a system of individual contribution handled by private managers. The new role of the State in the system involves subsidising, regulating and supervising the system. Naturally, the replacement of the system, as it was conceived, requires a relatively long transition period, because the workers who were contributing in the old system at that time were not obliged to change [those who did change were eligible for a recognition bond for the earlier contributions].

3.1 Characteristics of the reform

The old pension system corresponded to what is known as “pay-as-you-go”. By the beginning of the 1980s this scheme was considered to be financially unsustainable in the long term, if the level of benefits was held constant. In this system the workers paid contributions into one of 32 pension savings banks and were covered by one of over 100 pension schemes. Even though the contributions were high, the system did not manage to stay afloat, due more to the bad management of the resources
collected than to the effect of a demographic transition, and to the use of the pension contributions for providing members with other benefits, apart from retirement pensions\textsuperscript{5}. Acuña and Iglesias [2000] and Chumacero et al. [2006], among others, give a brief account of the facts [political economics] that led the authorities of the time to take a decision on implementing the reform. This section concentrates on describing the chief characteristics of the reform that will be useful for analysing the effect on the level of aggregate income of the economy, following the scheme in Figure 1, and not on the way the reform was conceived\textsuperscript{6}.

The modifications to the Pensions Law in 1981 constituted a radical change in the system. The new pension scheme took the model based on multiple pension schemes apart, transforming it into a single scheme in which both blue and white-collar workers of any sector had access to the same system. The sector containing the Armed Forces and Police Force were left out of this transformation. In the new system, male workers retire at 65 years of age and female workers at 60, the point at which they can decide for a system of programmed withdrawal from their pension funds or can purchase a life annuity. In both cases, the amount of the pension to be received is based on the funds that have been accumulating in the corresponding personal account throughout the working life. These funds are administered by private institutions which are regulated and supervised by the Superintendence of Pensions.

The fact that the pension funds were managed as individual accounts by private administrators had an important impact on the capital market. Previously, the contributions were administered by the State and used to pay pensions, while in the current scheme their destination is the capital market, in search of better yield opportunities and therefore better pensions. Meanwhile, the possibility of purchasing a life annuity has produced a demand for longer-term instruments, indispensible for covering the pensioner’s needs. In addition, the fact that part of the contribution paid by the worker constitutes a premium for a life and disability insurance boosted the demand for services of this type. All this changed the structure of the financial system, producing effects on saving, investment and efficiency and on the allocation of resources, as will be analysed further on.

\textsuperscript{5} Acuña and Iglesias [2000], Godoy and Valdés [1994], Cheyre [1997].

\textsuperscript{6} The reform was originally conceived in the document popularly known as “The Brick” [CEP 1992]. This document was produced by a group of economists in the early seventies with a view to influencing the reforms of the government that would succeed that of Salvador Allende. The reform was also criticised on the grounds that it was unnecessary to change the system completely for a private one [Arellano, 1981].
At the moment of the reform, all workers [except the members of the Armed Forces and Police] were allowed to choose to remain in the old system or enrol in the new one; but for all those entering the workforce, enrolment in the new system was obligatory. In other words, there was a total replacement of the old system by the new, with a transition period that will end when the last member of the old system retires. Those workers enrolled in the old system who moved to the new one receive a recognition bond for the contributions they paid under the old system, and this is added to what they have paid into the new system when the time comes to calculate their retirement benefit. This transition between the systems has an effect on the fiscal coffers, and consequently on public savings and total savings, that is by no means negligible. In addition, the reduction in public savings has effects on private savings because the public deficit has to be funded with taxes [or debt], which influences the decision to save.

Due to the nature of the old pay-as-you-go system, the contributions to the system were seen by the workers mainly as tax and not as savings. A transparent system of individual capitalisation produces a clear perception that these are compulsory savings, but they will be recovered with the corresponding yield when the working life is over. This produces a trade-off effect between private voluntary savings and compulsory savings.

Another important change is the reduction in the percentage of contribution from approximately 26% to 10.5%. This necessarily produces an impact on labour: whether or not the contributions are perceived as savings, this reduction constitutes a fall in the cost of labour for the company and an increase in the worker’s take-home pay, with the consequent effect on the level and composition [formal and informal] of employment.

The role of the State in the new system is subsidiary: it guarantees the right to a minimum old-age, disability and survivorship pension for all those members of the new system [who meet certain requirements] who have not managed to accumulate an amount that allows them access to the minimum pension fixed by Law by the time they reach retiring age. The State takes over only when the funds in the individual accounts are exhausted, and everything has to be funded out of the fiscal budget and not by using contributions from active workers. In addition, the State plays a role in paying the so-called welfare pensions provided for those people with low incomes who are over 65 years old and have no pension of any kind, and those disabled people without resources, including people with incomes lower than 50% of the minimum pension.
3.2 Modifications to the reform in 2008

2008 saw one of the most important reforms to be carried out on the system since its inception. The details of the reform are in the Superintendence of AFPs [2010]; here we mention only those with macroeconomic impact.

The main idea behind the reform was the reinforcement of the pension system’s solidarity pillar. The benefits previously granted through the minimum and welfare pensions were extended, with a different name and with different requirements. The State Minimum Pension Guarantee [GEPM] was replaced by the Solidarity Pension Contribution [APS], a benefit accessible to people with a pension lower than the Maximum Pension with Solidarity Contribution [PMAS]. The welfare pensions are governed by the Basic Solidarity Pension [PBS], an amount available for those people who have no entitlement to a pension. These modifications have fiscal implications, because they produce pressure for greater fiscal spending in the future. This has to be financed and, consequently, produces effects on private savings, due to the potential need to fund that fiscal deficit.

Furthermore, the changes in the conditions for the PBS and APS produce unintended incentives that encourage workers in the formal sector to pass to the informal one, in order to have greater access to these benefits. This has effects on the labour market and labour productivity, and also on compulsory saving. On the other hand, the modification seeks to increase the contributions of independent workers – a very low number at the time of the reform. One of the consequences of this has been an increase in compulsory saving at the expense of voluntary saving on the part of these workers.

---

7 The GEPM and APS will coexist for a transition period of 15 years.
4. Fiscal effects of the reform and its impact on saving and investment

In a system of individual funding, contributions are viewed by the workers as a part of saving which is compulsory and in practice may replace voluntary savings. However, it is difficult to argue that such replacement is perfect. On the other hand, the fiscal impact of the reform produces a change in the Government’s savings, which brings consequences for private and external saving. In the context of an economy that is open to the international market, but with imperfect capital mobility, all this will generate a change in investment through modifying the economy’s real interest rate.

Graph 1 shows the evolution of the various components of savings. Gross national savings show a fairly erratic course in the sixties and seventies, where they amount to 13 per cent of the Product, on average. These fluctuations are due, among other things, to the behaviour of fiscal savings, which rose from -7 per cent at the beginning of the seventies to 7 per cent in the second half of the decade. Following the financial crisis of 1982-83, when the rate of national savings plummeted to levels of 2 per cent –this coinciding with the start of the new pension system–, gross national savings expanded strongly, achieving values far higher than the historic ones: between 20 and 25 per cent. As can be seen in Graph 1, this expansion was headed up by private savings, which achieved hitherto unknown levels.
It is important to underline the fact that the Government’s savings contribute to gross national savings, except in very specific situations. This is in spite of the fact that the new pension system constituted a heavy burden for the Treasury during the early years of the reform, as shown in the analysis of the next section.

**4.1 Fiscal savings and private savings**

As was mentioned in section 3, the replacement of the defined-benefit system with an individually-funded system involves a transition that may be fairly long, in which the Treasury has to finance the workers who remained in the old system and the recognition bonds corresponding to the workers who have transferred to the new system. This increased expenditure disappears with the retirement of the last worker from the old system.

In brief, the public pension deficit is due to the following components:

**Operating deficit.** This occurs due to the change of contributors from the pay-as-you-go system to individual funding, while the Treasury has to continue paying the pensions of those who have already retired and those who retire under the pay-as-you-go system. In this case the Treasury no longer receives income from contributions, but has to continue financing the pensions of the old system.
Recognition Bond. This is the way of recognising the payments made to the old system by contributors who changed to the AFP system. This involves all those workers who decided to change pension system in the year 1981. The Treasury pays this bond into the individual account at the point when the contributor retires.

Welfare Pension [PASIS, or PBS after the 2008 reform]. This corresponds to the pension guaranteed by the State for any person over 65 years of age.

Minimum Pension [GEPM, or APS after the 2008 reform]. GEPM is the State Minimum Pension Guarantee, where the State guarantees a basic pension for any individual who has contributed for over 20 years. The APS came into being after the 2008 reform [and will coexist with GEPM until 2023] and the State’s contribution to the individual’s pension is set on the basis of a formula.

Deficit of the Armed Forces and Police. Public employees of this type still maintain their own pension system payable by the Treasury.

The magnitude of the fiscal effect of the reform can be seen in Graph 2 showing Fiscal Pension Deficit. This series was constructed using a variety of sources. For the period 1981-2001 the data constructed by Bennet and Schmidt-Hebbel [2001] was used and for 2002-2011, data published in the Quarterly Budget Performance Reports each year by the Budgets Department depending on the Ministry of Finance [DIPRES].

In the first place, it can be seen that the transition deficit is quite large and that it remained at around 4 per cent until the year 2000, at which point it began to fall to levels of 2.6 per cent; in other words, the point of maximum transition deficit has already passed and a downward trend has begun that will disappear altogether with the death of the last worker who at one time belonged to the old system. If the transition deficit is compared with the total fiscal deficit, the significance of the former is obvious, as is the effort of the fiscal component that is not related with pensions, in order to be able to balance the fiscal accounts.
Graph 3 shows the transitional pension deficit divided into its two components: operating deficit and recognition bond deficit. As was mentioned, the high point of the pension deficit should already have passed, having occurred at the end of the nineties. This is due to the fact that the operating deficit falls gradually as the number of pensioners enrolled in the old system falls, but it is offset by an increase in the deficit associated with the recognition bond. This latter has grown as a result of the fact that more workers who were formerly members of the old system and moved to the AFP system in the early days of the reform have been retiring.
Although this transition is long, the deficit under this item is transitory and therefore has an important effect on private voluntary savings. In fact, because the deficit is transitory, the Government will have to finance it with higher taxes, less public spending, a mix of the two, or debt. In any case, entities that optimise inter-temporally will adjust private savings, as a result of this need for funding on the part of the Government, which, because it is transitory, should have no effect on consumption. According to Valdés [2002], the transition deficit has been financed by adjustment in the fiscal surplus that is not associated with pensions. In any case, in this paper we suggest three possible scenarios for funding the transition deficit: 100 per cent fiscal adjustment; 75 per cent fiscal adjustment and 25 per cent debt, and 50% fiscal adjustment and 50% debt.

On the other hand, the welfare and minimum pensions mean permanent fiscal expenditure, so the State cannot fund them with debt. In this way, the increase in the fiscal burden must be offset by a redistribution of expenditure or more tax revenue; in other words, 100 per cent fiscal adjustment, which does not affect savings but does affect consumption.

In Bennet, Schmidt-Hebbel and Loayza [2001], the response of voluntary private savings to the transitional fiscal pension deficit for Chile is estimated to be -0.47, while Vergara [2001] finds a coefficient of -0.74. Meanwhile, a study by the OECD [2004] estimates a coefficient of -0.51 of response of voluntary private saving to changes in public savings in countries belonging to that organisation.

Another important factor is private savings, which have a compulsory component given by the mandatory nature of the contributions and another which is voluntary. The latter reacts to changes in the involuntary savings and to changes in fiscal savings. In fact, increased compulsory saving produces a substitution effect and causes a reduction in the voluntary saving that people were doing in the absence of the compulsory kind. The system of individual funding makes workers more aware that their contributions constitute savings for the long term.

The magnitude of compulsory savings is considerable and has constituted 4.88 per cent of the GDP on average for the period 1981-2012. This is represented in Graph 4. The construction of that series was carried out on the basis of the flow of contributions into the AFP system [minus the voluntary pension savings] plus the yield obtained on those funds in the time—which also constitute compulsory savings—, minus the outlay made by the State in recognition bonds. This latter adjustment is made because the Treasury transfers this money into the individual funding
account at the moment when the contributor decides to retire, but this “pension saving” was made years before, so it does not correspond to the compulsory savings of the period. Bennet, Schmidt-Hebbel and Loayza [2001] estimate a coefficient of -0.36 for the response of voluntary private savings to changes in mandatory savings.

Finally, in a closed economy, the consequence of an increase in savings is a reduction in the real interest rate and an increase in investment. In an economy that is completely integrated with the rest of the world and with perfect mobility of capital, saving and investment will not be correlated. However, the well-known jigsaw-puzzle by Feldstein-Horioka suggests that despite worldwide financial integration, there is a high correlation between saving and investment among countries. For that reason it is to be expected that investment will increase in response to a significant change in total saving.

To address this issue, Corbo and Schmidt-Hebbel [2003] estimated a ratio between investment and saving for the period 1960-2001, finding that the coefficient of response of investment to saving is 0.51\(^8\). In addition, they carried out estimates based on rolling windows of 20 years, starting with 1960-1980, and find that the coefficient has decreased from 0.99 to 0.4, which is to be expected, considering the financial liberalisation that occurred in the mid-seventies.

\(^8\) Other estimates, such as Schmidt-Hebbel [2001] find a higher value, 0.728, for the coefficient.
This paper extends the work carried out by Corbo and Schmidt-Hebbel in certain dimensions. The most obvious is the inclusion of 9 extra years of data, 1960-2010; the second has to do with the method of estimation. Estimating an equation with investment on the left and savings on the right presupposes that the former is endogenous and the latter exogenous, which is not theoretically correct in the case where mobility of capital is imperfect or the economy is closed. To overcome this problem of endogeneity, the estimation was made using instrumental variables. In addition, as independent variables, a lag of investment and a dummy variable taking the value 1 for the period 1960-1976, the period prior to the opening of the capital account\(^9\), were included.

The results of the estimate are shown in Table 1. The first column shows the ordinary least square estimates in which the long-term coefficient of the responsiveness of savings to investment is 0.7 for the period 1960-2010. The next column presents the estimates using instrumental variables for savings [savings lagged one or two periods] and the coefficient falls to 0.57. The last two columns repeat the previous exercise, but using a dummy variable to separate the period of financial integration with the rest of the world, 1977-2010. In this case, the coefficient is reduced to 0.5 if it is estimated by ordinary least squares and to 0.44 if estimator IV is used. All these values are within the range of what was estimated by Corbo and Schmidt-Hebbel [2003] and Schmidt-Hebbel [2001].

\[^9\] An attempt was made to estimate with a domestic financial liberalisation index and the results are qualitatively similar.
TABLE 1

Estimate of the relationship between investment and saving

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
</tr>
<tr>
<td>Constant</td>
<td>5,136**</td>
</tr>
<tr>
<td></td>
<td>(3,58)</td>
</tr>
<tr>
<td>National Saving</td>
<td>0,464**</td>
</tr>
<tr>
<td></td>
<td>(6,43)</td>
</tr>
<tr>
<td>Investment in t-1</td>
<td>0,340**</td>
</tr>
<tr>
<td></td>
<td>(3,62)</td>
</tr>
<tr>
<td>Dummy1960-1976</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy1960-1976* National Saving</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-term Effect of Saving on Investment</td>
<td>0,703**</td>
</tr>
<tr>
<td></td>
<td>(7,75)</td>
</tr>
</tbody>
</table>

Note: Significance at 10% [*] and 5% [**] of reliability. Statistics t in brackets.
*Dummy variable takes value 1 for the period 1960-1976.

With the data collected, we are in a position to obtain the effect of the pension reform on saving and investment. The results are shown in Table 2, where three scenarios are assumed for funding the transition deficit: an extreme case in which everything is done by fiscal adjustment, meaning that there is no rise in taxes and private investment is unaffected [this is in the first column]. The other two scenarios correspond to cases in which only 75 and 50 per cent of the pension deficit is funded with fiscal adjustment. This is relevant for the analysis of the transition because, in the long term, this deficit disappears. The response coefficients used for calculating the other effects are:

- Response of Voluntary Saving to Public Deficit = 0.51, estimated by the OECD 2004.
- Response of Voluntary Saving to Compulsory Saving = 0.36, according to Bennet, Schmidt-Hebbel and Loayza [2001].
- Feldstein-Horioka model: 0.439 [corresponds to the estimate in column 4 of Table 1].

As a result of the reform, the investment rate increased between 1 and 1.4 percentage points.
**TABLE 2**

<table>
<thead>
<tr>
<th></th>
<th>Fiscal Adjustment 100%</th>
<th>Fiscal Adjustment 75%</th>
<th>Fiscal Adjustment 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in Public Deficit due to Transitional Pension Deficit</td>
<td>0.00</td>
<td>-0.80</td>
<td>-1.59</td>
</tr>
<tr>
<td>Increase in Mandatory Household Saving</td>
<td>4.86</td>
<td>4.86</td>
<td>4.86</td>
</tr>
<tr>
<td>Increase in Voluntary Private Saving</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Response to Public Deficit</td>
<td>0.00</td>
<td>0.41</td>
<td>0.81</td>
</tr>
<tr>
<td>ii) Response to Compulsory Saving</td>
<td>-1.75</td>
<td>-1.75</td>
<td>-1.75</td>
</tr>
<tr>
<td>Increase in National Saving</td>
<td>3.11</td>
<td>2.72</td>
<td>2.33</td>
</tr>
<tr>
<td>Increase in Domestic Investment</td>
<td>1.37</td>
<td>1.19</td>
<td>1.02</td>
</tr>
</tbody>
</table>

**4.2 Potential effects of the 2008 reform**

One of the most important objectives of the 2008 reform was to strengthen the solidarity pillar of the pension system. This naturally has a fiscal cost, because it aims to provide pensions to people who have none and creates the solidarity pension contribution which replaces the State Guaranteed Minimum Pension system that existed until that point. Arenas et al. [2008] estimate the fiscal impact of this reform, including various additional elements that have a potential fiscal impact, such as the child bonus for women and the family allowance for independent workers. The increase in fiscal expenditure associated with the reform is a permanent one, so it is funded entirely with fiscal adjustment and therefore has no effect on national saving.

Furthermore, the 2008 reform stipulates that, as from 2012, workers who issue fee receipts [independent workers] will have to pay contributions. This obligation is gradual: they must pay a minimum of 40% of the corresponding contributions in 2012, rising to 100% obligation in 2015. This constitutes an increase in mandatory savings and consequently has
an impact on voluntary savings. This is estimated using the assumptions as in Table 2.

In order to estimate the effect of this measure on compulsory saving, it is necessary to estimate the number of independent workers who are subject to the reform, and the corresponding income. Two estimates are made to do this: the first using information from the National Socio-Economic Description Survey [Casen] 2011 and the second, the Micro-Enterprise Survey [EME 2011] carried out by the Micro-data Centre of the University of Chile and published by the Ministry of the Economy. The calculation of the potential increase in contributions associated with bringing independent workers into the system is described in appendix 1. Using the Casen, the estimated increase in compulsory saving is 0.27 per cent of the current GDP, while with the EME survey, the figure is 0.52 per cent.

The aim behind making contribution compulsory for formal independent workers, in other words, those who issue receipts for fees, is to encourage them to move into the formal sector of the economy. On the other hand, the new scheme and the amounts fixed by the system’s parameters produce incentives for wage-earning workers who receive a minimum wage today to move towards the informal sector of the economy [Valdés-Prieto, 2007], reducing compulsory saving and increasing the subsidy received by the State at the point of retirement. This would have a negative effect on compulsory saving, which is partially offset by possible private savings. These two effects mean that the calculation made here to measure the effects on national saving and investment is overestimating the real contribution. In the absence of a better estimate, we shall assume that the effect is negligible.

Table 3 replicates Table 2, but this time for the 2008 reform. The only difference is that this table assumes that the fiscal cost of the reform is met in its totality by fiscal adjustment. In this table, columns [1] and [2] correspond to calculations using the estimates of compulsory savings according to the Casen and EME. The effects are quite small: between 0.08 and 0.14.
### TABLE 3
Effect of the 2008 Pension Reform on National Saving and Domestic Investment [% of current GDP]

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in Public Deficit</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>due to Transitional Pension Deficit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in Mandatory Household Saving</td>
<td>0.27</td>
<td>0.50</td>
</tr>
<tr>
<td>Increase in Voluntary Private Saving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Response to Public Deficit</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>ii) Response to Compulsory Saving</td>
<td>-0.10</td>
<td>-0.18</td>
</tr>
<tr>
<td>Increase in National Saving</td>
<td>0.17</td>
<td>0.32</td>
</tr>
<tr>
<td>Increase in Domestic Investment</td>
<td>0.08</td>
<td>0.14</td>
</tr>
</tbody>
</table>

[1] Own estimate based on the Casen Survey 2011
5. Impact on the capital market

The development of the capital market, through a variety of channels, tends to have a positive influence on growth. In a comprehensive review of the literature, Levine [2005] finds that theoretically the development of the financial market affects growth by reducing the costs of trading and information. The development of appropriate instruments, markets and institutions makes this cost-reduction possible, which affects saving and investment decisions, technological innovation and steady-state growth rates.

Empirical studies have also tended to demonstrate that there is a positive correlation between growth and financial development [for example, King and Levine, 1993, for aggregate data on countries and Rajan and Zingales, 1998, for data at the level of industries]. More specifically, Levine, Loayza and Beck [2000] find that the cause and effect mechanism goes from financial development to growth and not the other way round, a key discovery for analysing the effect of the capital market on growth. In a similar piece of work, Beck, Levine and Loayza [2000] find evidence that the effect on growth occurs through Total Factor Productivity.

As regards elements found in the literature that reinforce the development of financial intermediaries, it is possible to mention those institutional arrangements that ensure the rights of creditors, and legal systems that guarantee respect for contracts [including those with the State] and improve the quality of information provided by companies [La Porta et al., 1997 and 1998; Levine et al. 2000].
This section is divided into three parts. The first analyses the empirical facts of how the pension funds have affected the capital markets. The second deals with qualitative aspects of how the birth of the AFPs has collaborated with the development of the financial market. Finally, the third estimates an equation to discover, formally, the effect of the pension funds on the degree of financial intermediation.

5.1 Pension reform and capital market: empirical regularities

The AFPs manage workers’ assets that represent around 67 per cent of the GDP. Graph 5 shows how the assets managed by the AFPs have evolved as a percentage of the GDP since the system began. This series constitutes a first indicator of how the pension funds have played an increasingly important role in the capital market.

Graph 6 shows the portfolio in which these assets are invested. There are various elements that are worth highlighting. At the beginning of the system, all investment took place in the state sector and in the financial sector in the form of term deposits. Later on, an opening was created for investing in the corporate sector [shares and bonds, although this was practically non-existent at that time], which grew strongly in importance in the late eighties, due to the wave of privatisations in those years. The growth of the assets in the corporate sector grew until about 1994 and then began to decline as the pension funds were authorised to invest abroad. This increased demand for instruments abroad changed the asset mix, reducing the demand for domestic assets in the corporate sector. Investments in the financial sector grew rapidly in the context of the Asian crisis. Due to their confidence in the domestic financial system, the pension funds increased their deposits in it. After that crisis, investments in the corporate sector began to grow again and the growth in overseas investments remained strong [with a parenthesis due to the sub-prime crisis], so reducing the degree of investments in the fiscal sector, which coincides with the gradual reduction of debt in that sector.
5.2 Qualitative aspects of capital market development

The development of the financial markets makes it possible to generate more efficiency by lowering trading and information costs, and in this way affect growth. This section analyses the way in which the privately-managed pension fund system has contributed in these dimensions to improving the functioning of the financial market. There are two major
channels by which this contribution has been made: i) development of a long-term investment market that increases the marginal productivity of capital and therefore growth [Bencivenga and Smith, 1991]; ii) qualitative changes in the way the capital market operates.

Given the long-term nature of their liabilities, the pension funds have incentives to invest in long-term instruments that are less liquid but have higher rates of return, and this translates into greater depth and liquidity in the domestic capital market. Catalán et al. [2000], with a sample of 14 OECD countries and 5 emerging economies, find statistical precedence [Granger causality] from pension funds to capital market development [in stocks and bonds].

On the other hand, Walker and Lefort [2002] argue that the investment horizon of the pension funds is longer than that of the households that are not obliged to save. Therefore, the pension funds generate a transfer of demand for shorter-term financial instruments to those of longer maturity, which reduces the costs of capital for businesses that require long-term funding, due to the lower liquidity and risk premiums required.

The channel of qualitative effects triggered by the pension funds concerns the improvement in corporate governance, the increase in financial innovation, greater specialisation in the financial institutions and reforms to the regulatory framework and market transparency.

As regards corporate governance, Vittas [1996] and Iglesias [2000] prove that the participation of the pension funds in the stock market has had a positive impact. In particular, there has been an increase in the number of independent members on the boards of directors of the businesses that trade on the stock exchange, monitoring costs have fallen as a result of the improved information delivered to the market by businesses, and the companies in which the pension funds are invested are constantly exposed to public scrutiny. Along the same line, Impavido and Musalem [2000] argue that the pension fund administrators monitor the firms in which they invest and exert pressure on them to improve their probity and transparency, to ensure the maximum possible return on investment.

With regard to financial innovation, Vittas [1996] and Impavido and Musalem [2000] maintain that the growth of the pension funds generates incentives to create new financial instruments designed to meet the market’s diversity of needs [maturity, risk and liquidity]. Acuña and Iglesias [2000] highlight the creation of a centralised electronic system of securi-
ties custody, which began to operate in Chile in 1995—the AFPs and life insurance companies are among its shareholders—, and the operation of an electronic trading system. They also mention the introduction in 1989 of the real-estate companies, created with the aim of facilitating pension fund investment in property.

As regard efficiency and specialisation, it may be argued that the existence of a greater volume of funds available in the market requires the institutions responsible for administering them to develop new knowledge, technologies and processes. This development results in a reduction in the costs of information which encourages efficiency in the running of the capital market. Catalán et al. [2000] and Levine and Zervos [1998] maintain that there is no question of pension funds replacing the banking system, but rather a situation in which each institution plays a different, specialised role in the allocation of resources within the capital market, the latter in the short term and the former in the longer term. On the other hand, Walker and Lefort [2002] argue that, thanks to the economies of scale provided by the size of the pension funds, trading costs are reduced, giving long-term instruments more liquidity.

The system of privately-managed pension funds has collaborated in perfecting financial regulation and transparency. Acuña and Iglesias [2000] suggest that the growth of the pension funds made it necessary to improve the regulations of the financial market. For Chile’s case, the setting up of the risk-rating system and the incorporation of new regulations on conflicts of interest in the Securities Law are evidence of this causal relationship, since the reforms were justified by the need to ensure an appropriate framework for the process of pension fund investment and were incorporated into that institutional framework.

Iglesias [2000] maintains that the economies of scale that have been generated allow a company-analysis industry to exist, which reduces the costs of information for small investors. An example of this is the appearance of risk-rating firms.

5.3 Effect of the reform on financial intermediation

This section estimates the importance of the role played by the pension reform in the deepening of the financial market, which makes it necessary to construct a measurement of financial deepening. Corbo and Schmidt-Hebbel work with a ratio of financial intermediation to GDP [FIR]. This measurement is the sum of bank deposits, mortgage liabili-
ties, internal public debt, corporate bonds and market capitalisation. The construction of this series is explained in Appendix 3.

In the years when the pension fund reform came into force, a series of economic reforms were carried out which may be complementary in their effects on financial development, and must therefore be checked in the econometric model. This is done by including an index of structural reforms which summarises the degree of financial and trade liberalisation: domestic financial liberalisation, privatisations and tax reform.

Following Corbo and Schmidt-Hebbel [2003], a dummy variable that takes a value of 1 when inflation is less than 20 per cent, and the deviations of the real exchange rate from its long-term rate, were included as explanatory variables. The first one measures the negative effect of high inflations on the financial system, while the second captures the negative effects of exchange rate imbalances on the financial sector. In the estimate of the original equation, evidence was found that the residuals are not white noise, so the lagged FIR variable was included additionally as an independent variable. The results of the estimated equation are the following:

\[
FIR_t = -0.09 + 3.66 \times CS_t + 0.24 \times IRE_t - 0.048 \times Dinf_{20,t} + 0.920 \times FIR_{t-1} + \epsilon_t
\]

\(t\)-stat in brackets

The long-term coefficient estimated for compulsory savings corresponds to the sum of the coefficients of CS and lagged CS divided by one minus the coefficient of the lag of the FIR. This coefficient is equal to 32.6 which means that a permanent increase of 0.5 percentage points in compulsory saving [in other words, increasing the average of the period 1981-2011 from 5 per cent to 5.5 per cent] increases the FIR by 16.3 percentage points. The estimated FIR for 2011 is 256 per cent, meaning that the rise represents an increase of 6.4 per cent.

10 The estimated coefficient for the gap in the real Exchange rate was not statistically significant.
6. Effects on the labour market

The 1981 pension reform had an impact on the labour market, especially on wages, employment and its composition – the balance between formal and informal. This point was first studied by Edwards and Cox Edwards [2000 and 2002] and the impact of these changes in the growth and level of the GDP by Corbo and Schmidt-Hebbel [2003]. We shall take the figures obtained by these studies for our analysis of the effects of the reform on the labour market.

It is worth pointing out that the effects on employment and its composition are a one-off event, even though this may take some time to come to completion, and therefore affect the long-term level of the Product. First we analyse the effect on employment and then the composition of employment and its impact on productivity.

As was mentioned in the description of the reform, one of the main effects was the reduction in the contribution percentage from 26 per cent to 11 per cent, approximately. If one adds to this the fact that the link between contribution and pension is weak in the pay-as-you-go system, while in the funded system it is direct, the reduction in contribution can be taken as the elimination of a tax on the labour market. The effect on wages and employment will depend on how much of that percentage is taken as tax and how much as savings. In any event, there is a reduction of tax which produces an increase in employment, consisting of unemployed people who find work, people who were outside the workforce and who begin to participate as a result of receiving more take-home pay, and a transfer of workers from the informal to the formal sector.
Corbo and Schmidt-Hebbel [2003] study this effect in a model with two sectors, one formal [which complies with social security laws] and another informal [which evades them]. The model assumes the existence of a minimum wage that produces unemployment of workers seeking work in the formal sector, because the expected wage is higher than in the informal sector. The unemployment rate is what balances these flows. Finally, it assumes that the total supply of labour has some elasticity relative to wage, meaning that an increase in take-home pay will produce a larger number of people prepared to participate in the labour market.

They calibrate the model with three measurements of how much of the reduction in contributions can be considered pure tax, and two alternative scenarios of parameters. Considering those scenarios, they find that the increase in total employment is between 1.3 and 3.7 per cent. This change is broken down into an increase in employment in the formal sector that ranges from 3.2 to 7.6 per cent and a decrease in employment in the informal sector which ranges from 1.1 to 1.7 per cent.

The mean productivity of labour increases when there is a change in the composition of the workforce, between sectors of different productivity. As a result of the reform, there are non-active workers who are now participating in the formal sector. Furthermore, as a result of the increase in take-home pay, there are workers who will move from the informal to the formal sector. On the assumption that the productivity of the formal sector is greater than that of the informal sector, Corbo and Schmidt-Hebbel [2003] estimate that the range for gain in GDP is from 0.11 per cent to 0.32 per cent.

Just as in the case of savings, the 2008 reform may partially reverse these effects, to the extent that the reform generates incentives for workers who have very low incomes, close to the minimum, to move from the formal to the informal sector, so saving their contribution and in this way becoming eligible to receive the Solidarity Pension Contribution. The lower the level of resources saved in the pension funds, the greater the size of this contribution. Although the pension is higher if people contribute more, the subsidy falls with the contribution. This meets the aim of gradual withdrawal of the subsidy; however, the parameters for the Basic Solidarity Pension and for the Maximum Pension with Solidarity Contribution, which are used for determining the subsidy, mean that contribution densities fall [Valdés-Prieto, 2007]. This could reduce marginally the effect on productivity mentioned above.
7. Pension reform and total factor productivity

TFP measures the effect of the technological changes and gains in efficiency that occur in the economy. To summarise, an increase in TFP represents a real reduction in costs [Harberger, 1998].

On the side of the capital market, the pension reform has helped to increase financial depth, enabling a long-term market to develop through the impetus of a series of additional reforms that have contributed to reducing the costs of information and trading. In theory, economic growth depends on the difference between the marginal productivity of capital net of depreciation and the subjective inter-temporal discount rate. Bencivenga and Smith [1991] suggest a model in which entities have two types of assets to invest: one short-term, which gives a very low yield, and another long-term, which pays a higher yield. On the other hand, the entities are subject to liquidity shocks and, in the absence of complete markets, tend to invest in the less productive asset, reducing the marginal productivity of the capital in the economy, and growth. In this way, the effect that the pension reform has had on the development of the long-term financial market can be seen as an increase in the marginal productivity of capital or, equivalently, an increase in the parameter that reflects TFP in the production function.

Section 5 discusses how the pension reform has contributed to the reduction in information and trading costs emphasised by Levine [2005].
The way in which this real cost reduction is translated into growth should be through an increase in TFP which reflects the reduction of the real cost and this is exactly what is found by Beck et al. [2000].

Finally, the other effect is through the labour market, which was analysed in section 6. The reform led to a change in the composition of the workforce, from the formal and informal sectors, which increases aggregate productivity, assuming that the formal sector has a higher level of productivity.

This section studies the effect of the pension reform on TFP.

TFP is defined as the ratio between the product and a combined function of capital and labour. To put it simply:

\[ TFP = \frac{Y}{F(K,L)} \]  

where \( F \) has the property of constant returns to scale; \( K \) is a measurement of the services of capital to produce \( Y \) and \( L \) is a measurement of the labour input [which should include correction for human capital]. Equation 1 can be written in rates of variation in the following form:

\[ d \ln TFP = d \ln Y - \alpha d \ln K - (1 - \alpha) d \ln L \]  

Since it is assumed that \( F[.] \) has constant returns to scale, the parameters \( \alpha \) and \( 1-\alpha \) are the product-factor elasticities, and at the same time correspond to the share of the payment to each factor in total income. Notice that equation [2] makes it clear that the changes in TFP correspond to all the variations in output that are not due to variations in the factors of production. Thus, variations in TFP will be capturing three elements: measurement errors, changes in efficiency and technological progress. Fuentes, Schmidt-Hebbel and Larraín [2006] estimate different measures of the TFP using different measures of factors of production. Appendix 4 lists the measurements of capital and labour used in this study, which brings the earlier study up to date. For purposes of the analysis presented here, two measurements are used: i) in which capital and labour are measured without adjusting for utilisation or human capital; ii) in which capital is adjusted by utilisation rate, and labour by hours worked and human capital. In addition, a model is estimated using the TFP calculated by the Chilean Treasury for applying the fiscal rule.
Following Fuentes, Schmidt-Hebbel and Larraín [2006], an equation is described in which the TFP is a function of structural reforms measured by: the reforms index of Morley et al. [1999] and Lora [2012], fiscal expenditure as an approximate measurement of tax distortion, and terms of trade for checking for external shocks. To this set of variables, we add the ratio of compulsory savings to GDP which captures the application of the pension reform. Just as in Fuentes et al. [2006] the estimation is from the general to the particular; in other words, with contemporary and lagged variables, so that the remaining terms will be white noise. Table 4 shows the results of the equations finally estimated. The reference estimate appears in column 1 using the TFP calculated by the Treasury and the other two columns contain the TFP estimated in this paper, which are used for the conclusions, since there are no substantial differences between the two estimates.

All coefficients have the expected signs. The variable that concerns us, compulsory saving, has a short-term coefficient of around 0.2 but the long-term coefficient is 1.9 in the case of the TFP estimated with unadjusted capital and labour and 1.1 in the case where the dependent variable is the TFP estimated with capital adjusted for the utilisation rate and labour adjusted for hours worked and human capital.

The estimated coefficients make it possible to calculate the effect of the 1981 pension reforms on total factor productivity in steady state. These calculations are shown in Table 5. Considering that average compulsory savings represent 4.88 per cent of GDP, multiplying these by the long-term coefficients, we estimate an increase that varies between 9.4 per cent and 5.3 per cent on the level of each of the measurements of the TFP.
### TABLE 4
Equation estimated for TFP

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.322</td>
<td>0.579</td>
</tr>
<tr>
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<td>(1.28)</td>
<td>(1.40)</td>
<td>(1.29)</td>
</tr>
<tr>
<td>Involuntary Saving in t-1</td>
<td>0.202**</td>
<td>0.206**</td>
<td>0.191</td>
</tr>
<tr>
<td></td>
<td>(2.04)</td>
<td>(1.96)</td>
<td>(0.94)</td>
</tr>
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<td>Structural Reform Index</td>
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<td>0.021</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>(0.53)</td>
<td>(0.35)</td>
<td>(0.51)</td>
</tr>
<tr>
<td>Ln Terms of Trade</td>
<td>0.047**</td>
<td>0.051**</td>
<td>0.062**</td>
</tr>
<tr>
<td></td>
<td>(2.16)</td>
<td>(2.27)</td>
<td>(2.54)</td>
</tr>
<tr>
<td>Fiscal Expenditure</td>
<td>-2.296**</td>
<td>-2.190**</td>
<td>-0.908**</td>
</tr>
<tr>
<td></td>
<td>(-3.75)</td>
<td>(-3.91)</td>
<td>(-3.18)</td>
</tr>
<tr>
<td>Fiscal Expenditure in t-1</td>
<td>2.088**</td>
<td>1.865**</td>
<td>0.528</td>
</tr>
<tr>
<td></td>
<td>(3.94)</td>
<td>(4.05)</td>
<td>(1.41)</td>
</tr>
<tr>
<td>Long-term Effect of Compulsory Saving on Ln TFP</td>
<td>1.749</td>
<td>1.92</td>
<td>1.081</td>
</tr>
<tr>
<td></td>
<td>(1.42)</td>
<td>(1.32)</td>
<td>(0.68)</td>
</tr>
</tbody>
</table>

Note: significance at 5% [**] and 10% [*]. Statistics t in brackets.

### TABLE 5
Long-term effects of compulsory savings on TFP

<table>
<thead>
<tr>
<th>Regression Model</th>
<th>Unadjusted TFP</th>
<th>Unadjusted TFP</th>
<th>Adjusted TFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Compulsory Savings 1981-2011 [% current GDP]</td>
<td>4.88%</td>
<td>4.88%</td>
<td>4.88%</td>
</tr>
<tr>
<td>Estimated Coefficient for the Long Term</td>
<td>1.749</td>
<td>1.92</td>
<td>1.081</td>
</tr>
<tr>
<td>Long-Term Effect</td>
<td>8.53%</td>
<td>9.36%</td>
<td>5.27%</td>
</tr>
</tbody>
</table>
8. Pension reform and economic growth

This section provides an answer to the question about the long-term effect of the pension reform on the Product per worker in the economy. In other words, it concentrates on the final rectangle of Figure 1, which summarises the results of all the channels of the reform. The calculation to be made enables us to measure the jump in steady state shown in Figure 2 of section 2.

The analysis is based on the neoclassical growth model in which, on the basis of a Cobb-Douglas function of production, it is possible to determine the steady state of the economy. Calibrating the change in the parameters according to the results obtained in the previous sections, it is possible to determine the change in the steady state of the economy as a result of the pension reform. The aggregate function of production of the economy can be written as:

\[ Y = AK^\alpha L^{1-\alpha} \]

In which \( Y \) represents output; \( K \) stands for capital; \( L \) for labour and \( A \) corresponds to total factor productivity. The parameter \( \alpha \) represents the share of the payment to the capital factor in national income. In terms of output per worker, the function can be written as [lower-case letters represent the same variables, but divided by labour]:

\[ y = Ak^\alpha \]

In an economy with constant investment rate [called \( s \)], the Product per worker in steady state can be written as:
In which $n$ represents the growth rate of the workforce, which is assumed to be constant, and $\delta$ the depreciation rate. Note that $n$ represents the growth rate of employed labour and it does not capture sudden single changes in employment as calculated in section 6.

Equation [3] implies that a percentage growth in the investment rate or in the TFP will in the Product per worker. On the other hand, the percentage increase in employment of an isolated occasion causes a reduction of $\alpha$ times that percentage variation in the Product. For the Chilean economy, a reasonable value for $\alpha$ would be 0.4, making the coefficient $\frac{\alpha}{(1-\alpha)}=2/3$ and the coefficient of TFP $\frac{1}{(1-\alpha)}=5/3$.

Table 6 shows the effects of each of the factors on the Product per worker in the long term. It is assumed that the increase in the investment rate corresponds to the case in which the transition deficit is covered 100 per cent by fiscal adjustment, because the transition effect disappears in the long term. Therefore, the increase in investment rate resulting from the reform is 1.37 percentage points [Table 1]. The gross formation rate of fixed capital in 1980 was 16 per cent; therefore the increase in the investment rate represents 8.56 per cent and an effect of 5.71% on the Product per worker.

In section 7 it was estimated that the increases in the TFP as a result of the reform were between 9.36 and 5.27 per cent. This produces an increase in the per capita Product of 15.6 and 8.78 per cent.

Adding up all the results, it is found that the variation in the per capita output in steady state that can be attributed to the pension reform fluctuates between 21.3 and 14.5 per cent. If we consider that, after 30 years, half the gap to steady state has been closed, the level effect would be from 10.7 to 7.3 per cent, a significant increase if compared with the 70 per cent by which the labour productivity has increased during this period. In terms of the growth rate, the effect calculated is between 0.34 and 0.23 per cent, which represents a considerable percentage of the 1.8 per cent that labour productivity grew during the period.\(^{12}\)

\(^{11}\) Barro and Sala-i-Martin [1995] estimate the closing of the gap towards steady state for a certain combination of parameters at a range of 23 to 42 years.

\(^{12}\) Corbo and Schmidt-Hebbel [2003] estimate that the range for the effect of the reform on the growth rate of the Product—not that of the product per worker—between 1980 and 2001 is from 0.22 to 0.93 per cent. These numbers are small if one considers that the product grew, on average, at 4.6 per cent per year.
Table 6 shows an estimate of the effect on total GDP. For this it is necessary to add the increase in labour productivity and the increase in the workforce as a result of the reform. This increase was calculated in section 6, where there is an estimate of the effect of reducing the tax component of pensions on total employment. With this, it is estimated that the effect of the pension reform on the level of GDP in the period 1981-2011 is within the range of 14.4 and 8.6 per cent.

**TABLE 6**
Long-term effect of the 1981 reform on GDP per capita

<table>
<thead>
<tr>
<th>Saving- Investment [1]</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment rate in 1980</td>
<td>16.00%</td>
<td>16.00%</td>
</tr>
<tr>
<td>Increase in investment rate due to pension reform</td>
<td>1.37%</td>
<td>1.37%</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>8.56%</td>
<td>8.56%</td>
</tr>
<tr>
<td>Effect on y*</td>
<td>5.71%</td>
<td>5.71%</td>
</tr>
</tbody>
</table>

**Financial Market and Productivity [2]**

| Variation in productivity due to pension reform | 9.36% | 5.27% |
| Effect on y* | 15.60% | 8.78% |

**Total Effect [1 + 2]**

| Effect on steady-state level | 21.31% | 14.49% |

**Labour Market [3]**

| Variation in employment due to pension reform | 3.70% | 1.30% |
| Effect on Y* | 3.70% | 1.30% |

**Total Effect = 0.5x[1+2] +3**

| Effect on GDP level 2011 | 14.36% | 8.55% |
This paper makes an evaluation of the effect of the pension reform on the long-term macroeconomic balance of the Chilean economy. Taking as reference the exhaustive work of Corbo and Schmidt-Hebbel [2003] and the models quoted there, it has been possible to estimate the effects of this reform. The main difference of this paper, compared with that of Corbo and Schmidt-Hebbel, is that the analysis concentrates on the impact of the reform on the steady state of the economy, rather than explaining the proportion of the growth attributable to the reform between 1981 and 2001. Other minor differences are the use of a longer sample to estimate certain parameters and the way in which certain effects are estimated, which differs somewhat from the work of Corbo and Schmidt-Hebbel.

As was stated in the introduction, the channels by which the pension reform affects the level of Product per capita or by worker are:
- The saving and investment market, by causing variation in the investment rate.
- The labour market, by increasing employment and causing variation in its composition between formal and informal.
- The capital market and its effects on total factor productivity.

The pension reform has produced a positive effect on private saving by means of the compulsory saving that people have to set aside for their pensions. Since this is an individually-funded system, the compulsory savings are not dedicated to paying the pensions of those already retired, as in the pay-as-you-go system, but are considered as non-liquid.
savings until the moment comes to retire. Counterbalancing this effect, a transitional fiscal deficit occurred which has to be financed with fiscal adjustment or increased taxes. Therefore the compulsory savings plus the reduction in fiscal savings and the effects of these changes on voluntary savings result in a change in the savings rate in the economy. That increase in the savings rate produces an increase in the investment rate that is estimated at between 1 and 1.37 per cent. It must be borne in mind that the fiscal impact has a permanent component and also a transitory one, so for purposes of measuring the long-term impact, it is assumed that the deficit is funded 100 per cent with fiscal adjustment. Some part of these effects may be slightly encouraged or discouraged by the 2008 reform, depending on i] how many independent workers who were not contributing actually enrol in the system, ii] the incentives for low-paid workers to transfer to the informal sector, so reducing their contribution density, and iii] the impact of the reform on long-term fiscal spending, due to the change in the amount of welfare pensions and the way they are paid.

The 1981 pension reform brought about a drastic reduction in the tax-on-labour component included in the old system. This reduction produced a cut in labour costs for the companies and increased workers’ take-home pay in the formal sector of the economy, namely the one in which contributions are paid. This led to an increase in employment in the formal area, due to the transfer of workers from the informal to the formal sector and a rise in labour participation, thanks to the increase in take-home pay. All in all, Corbo and Schmidt-Hebbel estimate that employment increases between 1.3 and 3.7 per cent, figures which are used in this present study. Once again, it is true that the 2008 reform may reverse the composition effect partially, by causing workers from the formal sector to move to the informal sector as a result of the new incentives scheme. In general, both for savings and employment, it is considered that the effects of the 2008 reform were small, since in some ways they tend to cancel out.

The pension reform had an impact on the capital market in two very important dimensions. First, the pension fund administrators have urged forward a series of reforms in the capital market designed to improve transparency and reduce the costs of trading and information. This necessarily results in a real cost reduction equivalent to an increase in the aggregate TFP. Secondly, the deepening of the financial market, measured by the ratio of financial intermediation to GDP, makes it possible to complete markets by generating long-term options that enable in-
vestment projects to be financed with a higher marginal productivity, which can be estimated as an increase in TFP.

An equation was estimated for TFP, using as independent variables those used in the literature, and the variable of compulsory savings to GDP was added as a measure that captures the effect of the reform. It is estimated that the reform increases the steady-state TFP in a range between 5.3 and 9.4 per cent.

Using the neoclassical growth model and a Cobb-Douglas production function, it is estimated that the sum of the increase in productivity and investment have meant that the Product per worker [or Product per capita, there is no difference in the long-term effect] increases between 14.5 and 21.3 per cent due to the reform. Assuming that half the gap is closed as of the year 2011, the Product per worker in the Chilean economy is higher, in a range of 7 to 10 per cent, than in the unreformed case.

For purposes of comparison with the study by Corbo and Schmidt-Hebbel, an estimate was made of the effect on the GDP. This is calculated by adding the effect on labour productivity [increase in productivity plus increase in investment] and the change in the workforce due to the reform. In the thirty years since the reform, it is estimated that the effect on the level of the GDP is between 8.6 and 14.4 per cent, which is comparable with the specific estimates of 2, 4.6 and 9.8 per cent in twenty years, estimated by Corbo and Schmidt-Hebbel.
APPENDIX 1

Calculation of independent workers’ contribution to compulsory savings

Two surveys were used to estimate the input in compulsory savings implied by the contributions of independent workers who would potentially be enrolling in the system: the National Socio-Economic Description Survey [Casen] 2011 and the Micro-Enterprise Survey [EME 2011]. The filters described below were applied to these surveys to estimate the maximum contribution of these workers.

**Casen 2011**

Filters to determine the potential increase of independent workers obliged to pay contributions:

I. **Question o15**: if they answer that they are employers or self-employed workers they are considered to be independent workers.

II. **Question o14**: if they answer that they issue receipts for fees, they are considered to be formal independent workers.

III. **Question o30**: if they answer that they do not pay contributions at present, they are considered to be formal independent workers who could potentially be obliged to pay contributions.

IV. **With these three filters** it is estimated that there are 311,000 formal
independent workers who are not currently contributing and would be obliged to do so as from 2012.

Using the labour income [ytrabaj] of these individuals, a potential increase in Compulsory Savings of 0.27% of the current GDP is estimated.

EME 2011

Filters to determine the potential increase of independent workers obliged to pay contributions:

I. If they answer that they are employers or self-employed workers, they are considered to be independent.

II. If they answer that they have official recognition of their activities with the Inland Revenue, they are considered formal independent workers.

III. If they answer that they are not currently paying contributions, they are considered to be formal independent workers who can potentially be obliged to contribute.

IV. With these three filters, it is estimated that there are 514,000 formal independent workers who are not currently paying contributions and would be obliged to do so as from 2012.

V. The universe of current contributors amounts to 5,000,000 people, so the potential increase of mandatory contributions corresponds to 10.3%.

VI. If compulsory savings were 5.15% of GDP for the period 1981-2011 on average, then the potential increase of the savings is 0.52% of the current GDP.
APPENDIX 2

Development of the investment portfolio of the pension funds by issuer

Investment Portfolio of the Pension Funds in the Corporate Sector

[Current GDP%]

Corporate Sector
Shares
Bonds
Investment Fund Share Units
Investment Portfolio of the Pension Funds in the Foreign Sector
[\% current GDP]

Investment Portfolio of the Pension Funds in the State Sector
[\% current GDP]

Investment Portfolio of the Pension Funds in the Financial Sector
[\% current GDP]
Method used for constructing the financial variables

Financial Intermediation Ratio

The financial intermediation ratio (FIR) series is constructed as the sum of total deposits, mortgage liabilities, internal public debt, corporate bonds, public bonds and market capitalisation. Given below is a description of how the series for each of the components were constructed. For the period 1960-2000 the main source of information is the paper “The Republic in Figures”, 2010, EH Clio Lab. For the period 2001-2011, the series from that work are updated using various sources. All the series are expressed in pesos from the year 1996 and as a percentage of each year’s GDP.

Total deposits. This is equivalent to the sum of bearer deposits and long-term deposits. The series for the period 1960-2000 corresponds to that produced by EH Clio Lab. This series is updated with the Private Money Aggregates series, Central Bank of Chile.

Mortgage Liabilities. This corresponds to the year-end balance on mortgage loans for housing. The series for the period 1960-2000 is obtained from EH Clio Lab, constructed on the basis of information from Braun et al. [2000] and the Superintendence of Banks and Financial Institutions [SBIF] [1996-2000]. For 2001-2011 the series is updated with information published by the SBIF.
Market capitalisation. Data for the period 1960-2000 was obtained from EH Clio Lab, constructed on the basis of information provided by the Central Bank of Chile. For 2001-2011 the series are updated with information from the Annual Statistics 2011 document published by the Santiago Stock Exchange.

Internal Public Debt. For 1960-2000 data from EH Clio Lab is used, constructed on the basis of the studies of Braun et al. 2000 [1960-1989] and Statistics of Public Finance 2003, from the Ministry of Finance [1990-2000]. For 2001-2011 the series are updated with information from Statistics of Public Finance, from the Ministry of Finance, where the series is estimated as total gross liabilities minus external public debt in millions of dollars, expressed in pesos at the average exchange rate of each year.

Corporate bonds. The information used is from the Private Money Aggregates series published by the Central Bank of Chile.

Public bonds. This corresponds to the sum of the documents issued by the Central Bank of Chile, plus those issued by the Treasury. The data is obtained from the series of Private Money Aggregates published by the Central Bank of Chile.

Structural reforms index

This corresponds to the general index of structural reforms constructed by Morley et al. 1999, the data of which is available between 1970 and 1995. The Index is made up of open trade practices, domestic financial liberalisation, tax reform, privatisations and international financial liberalisation. This data is extended for the period 1960-1969 and brought up to date for 1996-2009 with the data of Lora 2012.

Inflation dummy

This discrete variable takes the value 1 if the inflation of a year is less than 20% and 0 in other cases. The series is constructed on the basis of the continuum 1960-2012 published by the Central Bank of Chile.
Estimation of TFP

This section describes briefly the way of measuring the factors of production, capital and labour which will be used in estimating the growth of TFP. This part of the study updates the database of Fuentes, Larraín and Schmidt-Hebbel [2006].

Stock of net capital for Chile 2002-2010

The Central Bank of Chile publishes a series at constant 2008 prices for the period 2002-2010, based on the work of Henríquez [2008]13. In order to update the stock of capital of Fuentes et al. [2006] a calculation is made of the growth rate of the stock of net capital at constant prices in millions of pesos from the year 2008 and that growth rate is applied to the 2001 value of the stock of capital series measured in millions of pesos from the year 2003, so obtaining the estimated values for the period 2002-2010.

Employment

This consists of the simple average of the moving average of employment data at a quarterly rate. The information of the quarterly data is available in the INE14. Updating begins in 1997.

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13  http://www.bcentral.cl/estudios/estudios-economicos-estadisticos/063.htm
**Hours of work**

This variable was updated as from 1997, taking as its source the University of Chile’s Employment and Unemployment Survey. These average hours of work per week were obtained from a simple average of the quarterly information provided by the Microdata Centre of the University of Chile.\(^{15}\) There are 4 databases per year [March, June, September and December] and the average hours of work per quarter were calculated taking into account the expansion factor of the database itself.

**Quality of labour index**

The quality of labour index used here is the same as that of Roldós [1997] for Chile, based on Jorgenson, Gollop and Fraumeni [1987]. This variable is a weighted average of income from work, by level of education. The weightings were constructed on the basis of the participation in employment by educational level, over total employment. There are 8 levels of education in the University of Chile’s Employment and Unemployment Survey: no studies, primary, scientific secondary, technical secondary, higher technical, university, postgraduate and others. On the other hand, income from work was calculated in relation to the income from work of that group of workers with the lowest level of education [in other words, the average wage of workers with no studies at all]. These relative working incomes were re-scaled to become weighting factors, the sum of which is equal to 1 in every month. This was done with the aim of reducing the high volatility found in these relative incomes in the period evaluated. The volatility could be associated with errors of measurement in the wages of workers with high incomes affected by their low share in the sample.

With the data calculated in the previous section, an estimate was made of the growth in TFP for the period 1960-2010, using equation [2]. **Graph 1** presents the estimates of the level of the TFP using four methods of estimating capital and labour:

I. Capital measured as the real value of machines, calculated with investment data and labour measured as the number of employees.

II. Capital, as in the previous point, but multiplying the labour by the average number of hours worked by each individual.

III. Capital, as in the previous point, but measuring labour through the quality of labour index estimated using relative wages.

IV. The capital is corrected by its utilisation rate using the consumption of energy, and labour is measured by the quality of labour index.

On comparing the four measurements, it is observed that the correction for the quality of labour index makes a great difference to the level of TFP, especially in the eighties and nineties. However, the long-term trends do not vary, with the exception of the last period 1998-2010. This is due to the fact that the TFP grows more slowly when it is corrected for quality of labour.

**GRAPH 1**

50 years of TFP in Chile 1960-2010

Source: produced by the author.
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4.4 Effects in Peru

Pablo Secada, Antonio Cusato y Verónica Zapata*

* Chief Economist, Peruvian Institute of Economics; Member of the Economics Department, Rutgers University; and Research Analyst, Peruvian Institute of Economics, respectively.
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1. Introduction

Chile was the first country to bring in a private pension system in the 1980s, setting the old pay-as-you-go system aside. Peru was the second. After these two cases, over thirty countries adopted similar schemes. However, in the context of the recent international crisis, several of these countries [Argentina, Bolivia, Hungary, Poland, Slovakia, Latvia and Kazakhstan] have reversed the reform, either partially or totally. That has produced a need to evaluate the private pension systems and look specifically at what their macroeconomic impact has been.

Among the most important evaluations are the studies by Corsetti and Schmidt-Hebbel [2003], Holzmann [1997] and Corbo and Schmidt-Hebbel [2003] on the Chilean case. The first article is a theoretical one. It presents an endogenous growth model to simulate the effects of the reform. The documents of Holzmann and Corbo and Schmidt-Hebbel are empirical evaluations [this study will follow the methodology of the latter]. In the case of Peru, Apoyo [2010] carried out the first study on the macroeconomic impact of the reform.

This article evaluates the impact of the reform on growth, following the line taken by Corbo and Schmidt-Hebbel [2003]. Thus the exercise breaks down the growth of the Gross Domestic Product [GDP] into three factors: capital, labour and productivity. Corbo and Schmidt-Hebbel argue that the pension reform increased the stock of capital in the economy through increased investment, which in turn resulted from a higher level of savings. In the second place, the authors state that the reform involved a higher level of formal and total employment in the economy, as a result of the
reduction in the implicit labour taxes for the formal sector. Finally, the reform affected productivity, since it encouraged greater financial development.

An analysis will be carried out for each of the three potential impact areas [capital, labour and productivity], and the results obtained will be compared with the findings of Corbo and Schmidt-Hebbel for Chile, and Apoyo, for Peru. Section two describes briefly the historic evolution of growth in Peru and the role played by the structural reforms of the 1990s, discusses the reform of the pension system and compares the results of Corbo and Schmidt-Hebbel with those of Apoyo. Section three presents and explains the results of the study. Finally, section four points out the potential limitations of the analysis, presents the aggregate effects and the conclusions.
2. Economic growth and reforms

2.1 Growth and structural reforms

The past four decades have seen a long cooling period in Peru’s economic growth. While the decade of the eighties was a loss for Latin America as a whole in terms of product per inhabitant, the GDP per capita of Peru corresponding to the year 2005 was similar to that of 1975; in other words, three decades were lost. The contraction of production per inhabitant was 29.4 per cent between 1975 and 1992. The economic collapse, and the recovery that began in 1993, are related with the economic policy. From the 1960s onwards, this policy had been characterized by a high level of protectionism and government intervention which endangered private property and incentives, in addition to excessively pro-active fiscal and monetary policies that culminated in hyperinflation at the end of the 1980s. The paradigm changed as from 1990 with the implementation of free-market policies and less government intervention in the economy.

As can be seen in Figure 1, the three lost decades meant that Peru was left far behind other countries in the region, such as Chile. During the sixties and seventies, the GDP of Chile and Peru were very similar, but from the eighties onwards Chile’s economy took off strongly. In 2011, Peru’s GDP per capita was only half that corresponding to Chile.

How important was this process of high growth in Chile since the eighties, and how does it compare with the recovery in Peru after 1993? The
answer will depend on the year that is taken as baseline. If the years 1981 and 1993 are considered for Chile and Peru respectively, [when the private pension system was implemented in the two countries, in addition to other reforms] the answer would be that the growth processes were not so very different in the post-reform period. Figure 1 also shows the development of the GDP per capita 18 years before and 18 years after the respective reforms were implemented. That, a priori, provides a first sign of the importance of implementing economic reforms and their potentially positive effects on growth.

**FIGURE 1**
GDP per capita
Peru and Chile, 1960-2011
[constant dollars of the year 2000]
There are different studies on economic growth in Peru. In line with the aim of this study, some of these present a formal analysis of the impact of the structural reforms on growth. Two ways have been used to make that calculation: estimating the effect of the reforms on productivity [and later using the ratio of productivity-growth to measure the final impact] or estimating the impact of the reform on economic growth directly. Morón et al. [2004] use the first approach and explain the changes in productivity by using three groups of variables [macroeconomic variables, external factors and institutional factors], plus an index of structural reforms, estimated by Lora [2012]. The authors found that the index of reforms had a negative sign and was not statistically significant.

On the other hand, Jenkner [2007] relates the Peruvian growth directly with the index of structural reforms, controlling by the possible effects of other variables related to macroeconomic stability, civil liberties, levels of education, and public service infrastructure. Jenkner found that the structural reforms boosted growth, though the impact was not always significant for all the robustness analyses that were carried out. The difference in the average growth of GDP between the nineties and the eighties was 5.7 percentage points per year. The structural reforms explained 1.8 percentage points of that difference. Jenkner also confirms the relevance of the structural reforms with the estimation of a dynamic panel, in the same way as Loayza, Fajnzylber and Calderón [2005].

Subsequently, Loayza [2008] brought the work done with his co-authors [Loayza, Fajnzylber and Calderón, 2005], which used data for the period 1960-2000, up to the year 2005. His results prove the importance of the reforms in the increase in Peru’s growth rate during the decade of the nineties. Loayza finds that, of the 5.03 points of increased growth [compared with the previous decade], 3.27 points are explained by macroeconomic stabilization policies and 1.3 points by the reforms. It is worth pointing out that Loayza breaks down the effects of the structural reforms, assigning 0.28 points of the growth to the increase in financial depth. If the first 5 years of the next decade [2000-2005] are compared with the previous decade, the author points out that the contribution of financial depth to growth was somewhat less, amounting to 0.23 percentage points.

These estimates of the extent to which financial depth contributed to growth [between 0.2 and 0.3 percentage points per year] are important,
because they constitute a reference for analyzing the impact of the reform through financial development and productivity. However, it should be borne in mind that they were worked out by using data up to the year 2005 in the best possible case. The period 2006-2011 presented a higher average growth of the economy than occurred in 1993-2005 [7.2 versus 4.6 per cent, respectively], so it is feasible that the contribution has increased slightly in the past few years.

2.2 Pension reform in Peru

The public pension system in Peru was created in 1936, but it was only in 1973 that the government merged the different systems that existed into a single pay-as-you-go system. In 1985, just before the worst economic crisis that Peru has had to face in its recent history, the Peruvian pension system was characterized by its low coverage [only 38 per cent of the Economically Active Population [EAP], compared with the 61 per cent coverage in the case of Latin America], a generalized failure to comply with contributions, significantly negative returns on the savings and an unsatisfactory administration [Mesa Lago, 1985].

Between 1985 and 1990 the system grew even worse in different aspects [Morón and Carranza, 2003]. The public body responsible for administering the system showed an explosive increase in its administration costs [the number of employees rose from 25,000 to 45,000 in five years]. The financial results got worse and worse, with the surplus of 47.3 million dollars in 1986 turning into a deficit of 8.1 million dollars in 1989. This, added to economic mismanagement and hyperinflation at the end of the eighties, reduced the size of the public pension savings to nothing.

In 1987, according to Mesa-Lago [1991], 71.8 per cent of the assets of the pay-as-you-go system were invested in fixed-term deposits. In the second half of the eighties, these were compulsorily converted by the Government into ‘intis’, the Peruvian currency of that period. This diluted the real value of the assets with the hyperinflation at the end of the decade. The World Bank [1994] shows that the Peruvian pension savings amounted to 0.2 per cent of GDP in 1988, the lowest level recorded, together with a further three countries, out of a sample of 46
nations [Figure 2]. Three years later, in 1991, the accumulated savings were only 340 million dollars, when they should have been 10,000 million [Morón and Carranza, 2003].

The critical fiscal situation of Peru at the beginning of the nineties, added to the historically poor administration of the system, explains why the reform was necessary. In December 1991, the Executive made a first attempt at pension reform, which was unsuccessful. As Morón and Carranza [2003] recall, after a series of changes to that project to make it politically viable, the Private Pension System [SPP] was created in December 1992 and began operating a year later.

**FIGURE 2**
Pension system reserves in various countries in the 1980s [as a percentage of GDP]

The modifications incorporated into the initial reform watered down certain key elements of the Chilean model: enrolment in the SPP was not made compulsory; the National Pension System [SNP] was retained, with the argument that it would increase competition inside the system; it was decided not to increase the contribution to the SNP and no minimum pension was written into the SPP [these latter two measures made the public system more attractive]. The pension system in Peru was therefore composed of two main sub-systems: the SNP which acted under a pay-as-you-go system; and the SPP, operated by Private Pension Fund Administrators [AFPs] under a financial scheme of individual accounts. Some later changes were designed to minimize the differences between the two systems [see discussion in section 3.2.3] and to change the way in which resources are managed.
or reduce administration costs\(^1\).

Other recent modifications have been directed towards reducing the low coverage rate. In particular, this is the result of a highly informal labour market. In a World Bank study on informality in Latin America, Fajnzylber et al. [2007] show that Peru has the region’s third highest level of informality in the labour force [approximately 70 per cent at national level], and is also in third place in terms of the size of the informal economy [around 60 per cent of the GDP]. Changes were introduced in 2008 to achieve more formalization of small, medium-sized and micro businesses, creating a scheme of state subsidies to complement workers’ contributions. In 2012 these modifications designed to extend coverage continued, with the introduction of compulsory enrolment of independent workers in one of the two systems.

2.3 Studies on pension reform in Chile and Peru

Corbo and Schmidt-Hebbel [2003] found that the reform contributed 0.49 points to economic growth in Chile between 1981 and 2001. Apoyo [2010] estimated a higher impact, equal to 0.55 points in Peru for the period 1994-2010. As was mentioned earlier, the impact of the reform occurs via three channels: capital [through savings and investment], labour and productivity.

Table 1 shows the effects broken down into percentage points of GDP growth, and the main related indicators. The impact in terms of savings is largely dependent on the new savings generated by the reform and also on secondary effects that will be discussed further on. As can be seen in this Table, the new savings generated in Peru were only a third of those produced in Chile, and the same is true if one looks at the total savings in the two economies. In the same way, the impact calculated by Apoyo is approximately a third of that estimated for Chile.

---

\(^1\) In terms of the administration of resources, the creation of a system of multiple funds in the year 2005 was the most important change. Three funds were created, corresponding to three different levels of risk exposure, allowing a better match between members’ profiles and the distribution of investment by risk. At the same time, with the growth of the fund there has been a gradual increase in the foreign investment limit. In terms of the costs related with administering the resources, Carranza and Morón [2008] questioned the validity of various criticisms, in the sense that there is limited competition between the AFPs and their administration costs are high. In response to this discussion, a reform was introduced in 2012 designed to reduce those costs by introducing a mechanism of competitive bidding for new members.
TABLE 1
Results of previous studies and indicators for Chile and Peru

<table>
<thead>
<tr>
<th>Effects through: [pts of growth]</th>
<th>Indicators [% of GDP or AEP]</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Savings and investment</td>
<td>- New mandatory savings</td>
</tr>
<tr>
<td>0.13</td>
<td>4.6</td>
</tr>
<tr>
<td>- Total increase in savings post-reform</td>
<td>19</td>
</tr>
<tr>
<td>- Employment</td>
<td>- Increase in formal employment</td>
</tr>
<tr>
<td>0.07</td>
<td>15.8</td>
</tr>
<tr>
<td>- Financial depth and productivity</td>
<td>- Increase in financial depth</td>
</tr>
<tr>
<td>0.20</td>
<td>118.6</td>
</tr>
<tr>
<td>- GDP</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
</tr>
</tbody>
</table>

Notes: Mandatory savings for Peru are as reported by Apoyo. The definition of financial depth is in section 3.3. Formal employment in Chile was taken as the proportion of contributors to the AFPs and INP presented by Corbo and Schmidt-Hebbel [2003]. In the case of Peru, the comparison corresponds to the period 1993-2011 for Lima.

The estimated impact for Peru through employment is almost five times greater than the impact calculated for Chile. This result is striking, insofar as the reform could have had effects on employment by encouraging greater formalization, which did indeed happen in Chile’s case [15 percentage points of formalization] but not in Peru’s [the level of formalization changed hardly at all]. As discussed in the section on labour markets, this is the only part of the study where Apoyo uses a method completely different from that proposed by Corbo and Schmidt-Hebbel.

In terms of the productivity channel, the reform affects this variable through depth or financial development. The table shows a greater increase in depth in Chile than in Peru for the period following the reform [118 versus 80 percentage points of GDP]. The comparison presented for Peru in the table contains the impact of the recent global financial crisis [by including the period 2008-2010] and the corresponding temporary contraction of financial development. If the same financial development indicator was used for the pre-crisis period [up to 2007], the increase in financial productivity in Peru would be approximately 80 per cent of the variation in the same indicator for Chile.
To summarize, the result obtained by Apoyo’s study for Peru would seem to be overestimated in terms of employment, if one takes into account only the relevant indicators for Peru and Chile, without considering methodological aspects. As will be seen later on, the methodological analysis made by Apoyo has certain problems. The most recurrent is the omission from his estimates of indicators that reflect the effects of other complementary reforms, plus other relevant explanatory variables.
3. Macroeconomic impact

Presented below is the estimate of the reform’s macroeconomic effects. The first part contains a discussion of the effects on savings and investment [which finally affect the level of capital]; in the second subsection is the analysis of the labour market; and the third part corresponds to the capital market and total factor productivity.

It is worth underlining the fact that this study uses regressions in reduced form, in the same way as Corbo and Schmidt-Hebbel [2003] and the other studies included in this book which estimate the impact of the reforms in Chile, Mexico and Colombia. However, in the last part of the study an exercise of robustness is carried out which allows the main variables used to be modeled endogenously.

3.1 National savings and domestic investment

3.1.1 Transition deficit and overall government deficit

In simple terms, the reform implied a reallocation of the resources collected for pension purposes from the government [pre-reform pay-as-you-go system] to the new pension fund administrators [private AFP system]. At the same time, when the members switched to the new system, the government recognized the contributions that they had made previously [this obligation was given the name Recognition Bonds].
The transition deficit is calculated as the sum of the operating deficit [loss of contributions from members who switched to the new system] and the recognition deficit [recognition bonds]. Corbo and Schmidt-Hebbel find that the transition deficit in Chile was 3.4 per cent of GDP, on average, between 1981 and 2000, while Apoyo estimated a deficit of 0.93 on average between 1993 and 2009 for Peru. In this study the transition deficit calculated for the period 1993-2011 was 0.73 per cent of GDP.

The transition deficit had to be funded in some way [by less spending, higher taxes or more debt]. The authors of the study for Chile made assumptions about the potential savings by the government when this deficit had to be funded. Thus they assumed that government savings fluctuated between 25, 62.5 and 100 per cent of the transition deficit. For the Peruvian case, Apoyo assumes nil fiscal saving in response to the greater deficit produced. Due to the fact that such an assumption is excessively conservative, the assumptions made in the study are in line with those of Corbo and Schmidt-Hebbel as far as the last two scenarios are concerned. Specifically, a fiscal adjustment of between 60 and 80 per cent was assumed.

The pension reform was implemented at the beginning of the nineties in a context in which various structural reforms were undertaken. Among them was the tax reform which increased the government’s income significantly during the decade of the nineties [see Abusada et al. 2000]. At the same time, this was a period of reduction in the size of the State, characterized by fiscal responsibility, which was relaxed to a certain extent towards the end of the decade to allow a counter-cyclical fiscal policy. In view of the above, it seems scarcely plausible that the Government should have made no considerable fiscal effort to cover the transition deficit [the 25 per cent scenario was ruled out]. On the other hand, a total fiscal adjustment is not assumed. For this reason, a scenario of 80 per cent adjustment is suggested.

3.1.2. The response of private savings to the government deficit

As Corbo and Schmidt-Hebbel explain, the private sector can modify its level of savings to a greater or lesser extent in response to increased government deficit. The study for Chile uses the response of private savings to the government deficit as estimated in Loayza and Schmidt-Hebbel [2001]. These latter authors studied aggregate savings in Chile. They relate different measurements of savings with economic and de-
mographic variables. The method used allows long and short-term relationships to be estimated between variables of different orders of integration. Bennet, Loayza and Schmidt-Hebbel found that the coefficient of response of total private savings to the fiscal deficit varied between -0.36 and -0.57 for the period 1960-1997 in Chile.

In the Peruvian case, Apoyo presents an analysis of savings using a short sample of 14 years [1996-2009], making use of quarterly data. The estimate carried out does not control for several different variables that constitute determinants of national savings [Loayza, Schmidt-Hebbel and Serven, 2000]. This was, however, done in the Chilean case and in the current study. Table A1 shows the variables used in the estimation of the Chilean study, in Apoyo’s and in this one. This resulted in the coefficient of response calculated by Apoyo for Peru being -0.91, a value which is completely different from that calculated in the Chilean case and in this study [Table 1].

In this section and in those relating to the capital market and total factor productivity, regressions will be used in a reduced form, following Bennet, Loayza and Schmidt-Hebbel and Corbo and Schmidt-Hebbel. The former use an autoregressive distributed lag [ARDL] model, from which a co-integration relationship is derived [Pesaran, 1997; Pesaran and Shin, 1999]. In synthesis, the ARDL specification makes it possible to model the short and long-term relationships between different variables. Corbo and Schmidt-Hebbel, on the other hand, did not use that specification, but based their estimates on simple regressions. So, in this study, we proceed to present the estimates in the following way [tables A3, C3 and D3]. First the initial estimates are reported, using regressions that do not claim to identify short and long-term impacts and, finally, the results of the ARDL specification are provided, which do allow that identification to be made2.

In Table A2 there is an analysis of stationarity and structural breaks. Table A3 presents the results. The first column [OLS[1]] reports the results including the variables used by Bennet, Loayza and Schmidt-Hebbel3.

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2 For this procedure, the long-term coefficients are presented, together with tests of autocorrelation [a requirement for the correct estimation of the model] and the existence of a long-term relationship between the variables expressed in levels.

3 It is worth adding that additional estimations were made including other variables such as tax on businesses and individuals, variables that are used by those authors. The results are not presented in the appendix because the only information available was from the year 1986 onwards. However, if a model such as the one shown in Table A3 is estimated for the period 1986-2011 and later a model is estimated that includes the aforementioned variables, the results for the estimated response of public savings do not vary substantially.
The second column [OLS[2]] includes a dummy variable for the break in the intercept of the year 1990, as shown in Table A2. The third column makes a sensitivity analysis, by excluding the variables that turned out to be of no significance in the previous estimations. In this way, the response of private voluntary saving to public saving fluctuates between -0.25 and -0.4, according to OLS estimates. However, as the tests for autocorrelation and heteroscedasticity show, the estimates present these problems. The last column shows the ARDL specification, where the number of lags was selected using the Akaike criterion and it is shown that the long-term response of private voluntary saving to public saving is -0.53. This value is within the range of the parameter estimated for Chile [-0.36 and -0.57]).

3.1.3. New mandatory pension savings

Bennet, Schmidt-Hebbel and Soto [1999] estimate the figures for Chile, finding average savings of 4.6 per cent of GDP for the period 1981-2001. Mandatory savings are defined as:

\[
\text{Mandatory savings} = \text{Contributions deposited} + \text{other increases} \\
- \text{accrued fees} - \text{benefits paid} \\
- \text{other reductions} + \text{return on flow or balance}
\]

Following the Chilean study, it is worth emphasizing that the definition of return on flow is not the same as the return of the assets or the fund, because capital gains are excluded\(^4\), unlike the study made by Apoyo, which includes them. Apoyo calculated that the average mandatory savings for the period 1993-2009 amounted to 1.61 per cent of the GDP. In the present study, as in the Chilean one, capital gains are not included and mandatory savings for the period 1993-2011 amounted to 1.08 per cent of the GDP.

\(^4\) In order to exclude capital gains, Corbo and Schmidt-Hebbel’s proposal was adopted. Specifically, the estimate of the return on flow involves separating the private pension fund into two parts: stocks and the rest of the assets. In order to find the return on the part of the fund corresponding to stocks, the yield calculated on the dividends of the Peruvian Stock Exchange was used, as reported by the Global Financial Database. In the case of the rest of the fund, the rate of the certificates of deposit of the BCRP between 1993 and 1999 was used. From 2000 onwards, the BCRP states the interest rate on bonds of less than 3 years in local currency, so that information has been used.
The mandatory savings estimated in the present study are lower on average than those calculated by Apoyo [1.05 as opposed to 1.61 for 1993-2009], but give a better reflection of what has happened in Peru, for two reasons. In principle, Apoyo presents years when savings in the private pension system were negative. For example, for Apoyo, the change in mandatory savings between 2007 and 2008 was 7.4 percentage points of the GDP and was then followed by a recovery of over 8 points. Trying to argue that these abrupt changes occurred in mandatory savings seems difficult if an analysis is made of aggregate private savings for the same period [Figure 3]. In the second place, the measurement of mandatory contributions must attempt to capture the effect of the reform rather than the sharp rises or falls in the price of pension fund assets, which are related with external factors [such as commodity prices] and, to a far lesser extent, with the growth of the economy in the past few years.
FIGURE 3
Estimates of mandatory savings and total private savings in Peru, 1970-2009 [as percentage of GDP]

Mandatory savings

Total private savings
3.1.4. Households’ response to the obligation to save

Households’ obligation to save, which is implied in setting up a system of individual funding for pension purposes, can produce a decision not to save in other areas. Corbo and Schmidt-Hebbel therefore chose two values for the response of voluntary savings to the increase in mandatory savings: 0 and 0.5. In this way, voluntary savings in Chile fell between 0 and 2.3 per cent of GDP between the years 1981 and 2001. Apoyo’s study refers to an evaluation of the reform of the AFP system in Peru where, by making use of household surveys for the nineteen-nineties, it was found that for every sol paid into the private pension system, there was a reduction of 0.7 soles in voluntary savings [Carpio, 2008]. Thus Apoyo reports a reduction of 0.59 per cent of GDP in voluntary savings.

In this study, two values are used for the response of voluntary household savings to mandatory savings: 0.5 and 0.7. This is a much more conservative scenario that the one estimated in the Chilean study in terms of the impact on savings, but less than that of Apoyo. The 0.5 scenario was chosen because, on carrying out an analysis of the various saving ratios, using a structural vector autoregression model [VAR], it was found that the response of voluntary private savings to mandatory savings is close to zero\(^5\). This result is shown at the end of the study in the section dealing with robustness of results. It implies that the macro figures present a story that is not consistent with the findings when micro data are used [Carpio’s study].

3.1.5. Effects on savings

Table 2 shows the results of Corbo and Schmidt-Hebbel [2003], Apoyo [2010] and those of this present study, summarizing what has been discussed in the previous sections [3.1.1 to 3.1.4]. The impact of the pension reform on savings in Peru was found to be between 0.19 and 0.47 per cent of GDP.

The impacts discovered in terms of GDP are lower than those of the two earlier studies. In order to put the results into context, the historic increase in savings in percentage points of GDP for Chile and Peru in the post-reform period is presented in the penultimate line of Table 1. In the Chilean case, there was an increase of 19.0 points between 1982 and 2001, while the increase for Peru was much more moderate [6.7

\(^5\) This analysis must be taken with caution, because there are no figures for voluntary private savings in households, but only for the aggregate [households and businesses].
points for the period 1994-2010]. This present study finds that the reform was responsible for between 2.8 and 7.0 per cent of the increase, a range that is below the 14 per cent found by Apoyo, which is higher than the impact of the reform in Chile in the base scenario [11.9 per cent].

### TABLE 2
**Effects on Savings**
*as percentage of GDP*

<table>
<thead>
<tr>
<th></th>
<th>Chile</th>
<th>Peru</th>
<th>Peru</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition deficit</td>
<td>-3.4</td>
<td>-0.93</td>
<td>-0.73</td>
</tr>
<tr>
<td>Fiscal savings</td>
<td>+3.4, +2.13, +0.85</td>
<td>0</td>
<td>+0.44, +0.58</td>
</tr>
<tr>
<td>1. Government deficit</td>
<td>0, -1.27, -2.55</td>
<td>-0.93</td>
<td>-0.15, -0.29</td>
</tr>
<tr>
<td>Relationship private savings/fiscal deficit</td>
<td>[-0.36, -0.47, -0.57]</td>
<td>[-0.91]</td>
<td>[-0.52]</td>
</tr>
<tr>
<td>2. Response of private savings to public deficit</td>
<td>0, +0.60, +1.20</td>
<td>+0.85</td>
<td>+0.08, +0.15</td>
</tr>
<tr>
<td>3. New mandatory pension savings</td>
<td>+4.6</td>
<td>+1.61</td>
<td>+1.08</td>
</tr>
<tr>
<td>Relationship of voluntary private savings/mandatory</td>
<td>[0, -0.36, -0.5]</td>
<td>[-0.7]</td>
<td>[-0.7, -0.5]</td>
</tr>
<tr>
<td>4. Response of households to obligation to save</td>
<td>0, -1.66, -2.3</td>
<td>-0.59</td>
<td>-0.76, -0.54</td>
</tr>
<tr>
<td>Impact on savings [% GDP]</td>
<td>+0.67, +2.27, +4.6</td>
<td>+0.94</td>
<td>+0.19, +0.47</td>
</tr>
<tr>
<td>Increase in savings post-reform</td>
<td>19.0 [82-01]</td>
<td>6.7 [94-10]</td>
<td>6.7 [94-10]</td>
</tr>
<tr>
<td>% of increase attributable to the reform</td>
<td>3.5, 11.9, 24.2</td>
<td>14.0</td>
<td>2.8, 7.0</td>
</tr>
</tbody>
</table>

### 3.1.6. Effects on investment

Just as in the previous studies on Chile and Peru, a simple ratio is estimated between savings and investment. The estimated ratio is the same as in Apoyo and gives a statistically significant estimated value of 0.527 for the period 1970-2011. With this, the impact of the reform in terms of domestic investment was found to be between 0.10 and 0.25 per cent of the GDP for the two scenarios calculated in the previous section. During
the period 1994-2010, the increase in investment was 3.01 percentage points of GDP. So the reform explained between 3.3 and 8.2 per cent of that increase during the period being analyzed.

### 3.2 Labour markets

The impact on labour markets in Chile is calculated by Corbo and Schmidt-Hebbel [2003] using three estimates: [i] a labour market model with formal and informal sectors, where the impact of the reform is associated with a decrease in the pure tax on labour [which depends on the system’s contribution rate and other factors; see section 3.2.2]; [ii] a calculation of the increase in the average productivity of labour as a result of the reallocation of workers between sectors; and [iii] the effects on employment as a product of the change in incentives for retirement.

For the Peruvian case, Apoyo [2010] works out a regression between employment and social security contributions. Apoyo warns that what they are doing is a purely statistical association, but they do not present a theoretical basis to explain why higher contributions to the AFP system lead to an increase in employment.\(^6\)

In this present study, the work done by Corbo and Schmidt-Hebbel will be followed as far as point [i] is concerned. The logic of the impacts on labour markets is based on the fact that the reform encourages formalization of employment and, as will be seen further on, this is by no means evident in Peru in the light of the data on labour informality up to 2011. In other words, the impact of the reform was far less than in Chile, so it is inferred that the impacts in productivity were not relevant [point [ii]]. In the same way as in the Chilean study, analysis of the third situation, linked with the change in retirement incentives, was omitted.

#### 3.2.1. Basic description of the model

The Corbo and Schmidt-Hebbel model of the labour market describes two sectors, formal and informal. It is based on the model of Edwards

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\(^6\) On the contrary, one would expect the causality to occur in the opposite direction, that more employment in the formal sector of the economy would be reflected in a greater flow of savings.
and Cox Edwards [2000, 2002], the object of which was to measure the impact of the Chilean pension reform. The basic characteristic of the model is that there is a formal sector that respects labour legislation and the workers are therefore subject to a pure tax on labour, while the informal sector evades the legislation. The rigidities in the formal sector mean a wage above equilibrium in that sector and a flexible wage in the informal sector that is due to the excesses of supply and demand in the formal sector. Finally, the difference in wages between the two sectors leads to unemployment, because there are workers who prefer not to work in the informal sector and look for work in the other sector.

The simulation of the model is carried out on the basis of the reduction in the pure tax on labour in the formal sector. In the Chilean case, the pension reform involved a reduction in the social security contribution rate from 26 to 11 per cent of the workers’ wage. However, those values do not reflect the reduction in the tax on labour in the formal sector. We shall be commenting below on the difference between the contribution rate and the tax on labour, but the reform meant a reduction of the tax from a level of 15 per cent of wage under the pay-as-you-go system to a level of 5.6 per cent of wage under the new system of individual accounts. The results of that reduction were an increase in total employment in the economy of between 1.3 and 3.7 per cent, resulting from more employment in the formal sector [between 3.2 and 7.6 per cent], less employment in the informal sector [between -1.1 and -1.3 per cent], and also a reduction in unemployment [between -0.7 and -2.1 per cent].

3.2.2. Contribution rate versus pure tax on labour

This point provides an explanation of the difference between the contribution rate and the pure tax on labour \( T_i \). This latter was calculated in the following way:

\[
T_i = \text{Contribution rate} \times \tau
\]

Where \( \tau \in (0,1) \) is considered as the proportion of the contribution rate that is a tax, and \( i \in \{0, 1\} \), so that \( T_0 \) is the rate of pure tax before the reform and \( T_i \) the rate of pure tax after the reform. Corbo and Schmidt-Hebbel use two contribution rates [26 per cent for the old system and 11 per cent for the new one] and two values of \( \tau \) [one before and one after the

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7 As the authors state, both are based on the classic model of Harris and Todaro [1970].
8 For a complete description of the model, see Corbo and Schmidt-Hebbel [2003] and Edwards and Cox Edwards [2000, 2002].
In order to calculate the two values of \( \tau \) the authors used different methods, by taking as given the pure tax on labour calculated by Edwards and Cox Edwards [2002] for the post-reform period. Comments on the idea behind the two methods presented by Corbo and Schmidt–Hebbel are given below:

- **Pay-as-you-go system, \( \tau \) pre-reform**: the tax \( \tau \) is calculated on the difference between the rates of return of the pay-as-you-go system and the system of individual accounts. Thus the return on the pre-reform or pay-as-you-go system is approximated by means of the growth rate of the economy, while for the return of the system of individual accounts, the historic return of the private pension fund is used. In this way, the higher yield of the private system implies that workers in the pre-reform period were faced with an opportunity cost due to being unable to obtain a higher yield. That implies the \( \tau \) takes a positive value for the period.

- **System of individual accounts, \( \tau \) post-reform**: The tax \( \tau \) of the new system is determined on the basis of the wage differences between workers who contribute to the system and workers who do not contribute. To do this, Edwards and Cox Edwards [2002] estimated a wage equation that controls for the possible effects that the characteristics of the worker and business might have on these. They found a negative impact in the wages of the workers who took part in the pension system compared to those who did not. This negative impact is reflected in the value of \( \tau \).

Comments will be made further on about the advisability of adopting one or other of the two approaches.

### 3.2.3. The reform in Peru

In Chile the contribution rate fell significantly from 26 to 11 per cent of wage. This did not happen in Peru. As may be seen in Figure 4, the contribution rate fell from 9 per cent of the wage before the reform [corresponding to the Peruvian Institute of Social Security IPSS and later to the Oficina de Normalizacion Previsional–ONP] to a post-reform level of 8 per cent for the case of the system of individual accounts or AFPs9, and

---

9 Regarding the changes in the contribution rate, the initial design of the system in the year 1993 put the private pension system [SPP] at a certain disadvantage. Added to this was the lack of early implementation of recognition bonds for those who moved across from the public system [SNP] to an AFP. In 1995 the SPP was not meeting the expected rates of enrolment, and for that reason some of the reforms needed to level
between 9 and 13 per cent for the continuation of the pay-as-you-go system, depending on the year analyzed. In terms of the contribution rate, this fell after the reform from 9 [IPSS] to 8 [AFP] per cent of the wage. That *a priori* gives a clear sign that the impact of the reform in Peru was far less than in Chile.

Figure 4 also shows that levels of labour informality in Lima did not fall following the reform; on the contrary, they rose in the years that followed it [especially from 1997 onwards]. Obviously, the pension contribution rates were not the main factor determining the performance of the Peruvian labour market. On the issue of labour policy, Saavedra and Torero [2004] explain that an important process began in 1991, making the Peruvian labour market more flexible. This involved a steep reduction in severance costs and made it easier to use temporary contracts. Together with this greater flexibility, the non-wage costs paid by companies increased in 1990 during the context of the crisis and later fell in 1993 in order to facilitate the creation of formal employment. However, this last reduction was reversed by 1995. Despite the greater flexibility of the Peruvian labour market, by the late 1990s the non-wage costs as a percentage of the wage were more than 10 percentage points higher than those that existed at the end of the eighties.

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10 In the case of the public system, the contribution rate moved only upwards, as the needs to have a larger fund for the public pay-as-you-go system became more evident. There were thus two increases: from 9 to 11 per cent in 1996, and to 13 per cent in 1997, the contribution rate that is still in force today.

11 The authors point out that the Peruvian Labour Code designed during the period of the import substitution policy [from the sixties to the end of the eighties], was, according to the ILO, one of the most restrictive, protectionist and complicated in Latin America.

12 The authors found that non-wage costs had a negative effect on the demand for formal employment, while a reduction in severance costs encouraged a greater demand for formal employment.
FIGURE 4
Variables linked with the analysis of the labour market in Peru, 1986-2011

Personal contribution rate
[as percentage of wage]

Informality in Lima
[percentage of workers]

Note: The informality figures for the period 1986-2001 correspond to those calculated by Saavedra and Nakasone (2003), those for the period 2002-2011 were calculated using household surveys [ENAHO]. The definition used for formality was enrolment in a health or pension system that does not correspond to a targeted health insurance for the most vulnerable population [SIS].

3.2.4. Simulation of the model

Table B.1, included in the appendices of this chapter, shows the values of the parameters of the model and the corresponding sources of information. In terms of the pure tax on labour, we did not follow the lines of Corbo and Schmidt-Hebbel, for the reasons explained below. In the first place,
the reform did not involve the closure of the pay-as-you-go system and so the two systems still coexist in Peru. For that reason, the post-reform contribution rate was calculated as a weighted average of the rates of the private and public systems.

In the second place, the value of $\tau$ [or the percentage of the contribution rate that constitutes tax] is not necessarily positive for the post-reform period. Edwards and Cox Edwards [2002], using a cross-sectional analysis, conclude for Chile that, on average and for equivalent jobs, individuals who contributed to social security in 1994 had a wage that was 9 per cent lower than those who did not contribute. This lower wage is interpreted as a tax. Carpio [2008] found a different scenario for Peru, using household consumption instead of wages. Making use of household surveys before and after the reform [for the years 1991, 1994, 1997 and 2000], a comparison was made over time between the households that enrolled in the private system and those that did not. The results indicate that enrolment in the private system meant consumption that was 14.35 per cent higher. Since there was no evidence of lower consumption related to the reform, it is argued that the tax might have a value of zero in the case of Peru.

On the basis of the above, two exercises were carried out. The first assumes that the contribution rate to the public system is entirely a tax ($\tau = 1$), following Edwards and Cox Edwards, while the contribution rate to the private system includes no tax at all ($\tau = 0$). In the same way, the tax rate following the reform is not equal to zero, but equal to a weighted average between the tax rate of the private system [zero] and that of the public system [contribution rate]. In that way, the pre-reform tax rate is 9 per cent, while the post-reform rate is 3.66 per cent$^{13}$.

The second exercise assumes that the contribution rate in the public system has a tax component that is other than zero ($\tau \neq 0$), in line with the explanation of Corbo and Schmidt-Hebbel, while the contribution rate to the private system does not include any tax at all ($\tau = 0$). The implicit tax rate of a pay-as-you-go system was found by using the return of the private pension funds and the approximate return of a pay-as-you-go system, in the following way:

$$\tau = 1 - \left( \frac{1 + g}{1 + r} \right)^n$$

$^{13}$ In order to calculate the weights, the number of contributors in each system was used. In the case of the private system, the official figures of the Superintendence of Banking, Insurance and AFPs have been available since 1998. That year was used, when the private system had 903 thousand contributors and the public system 620 thousand.
Where \( n = 25 \) years, \( g \) is the simple average of the growth rate of the GDP between 1994 and 2012 [proxy of the yield of a pay-as-you-go system] and has a value of 5.37 per cent, and \( r \) is the simple average of the net yield of the private pension system for the same period with a value of 6.94 per cent\(^{14}\). In this way, \( \tau = 0.31 \), and the rates of pure tax pre and post reform are equal to 2.78 per cent and 1.13 per cent, respectively.

**TABLE 3**
Effects on employment

<table>
<thead>
<tr>
<th></th>
<th>Pure Tax Pre Reform ( T_o )</th>
<th>Pure Tax Post Reform ( T_1 )</th>
<th>Effects of the reform as percentage variation in total employment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chile</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulation</td>
<td>15.3</td>
<td>5.6</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Peru</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulation 1</td>
<td>9.00</td>
<td>3.66</td>
<td>0.54</td>
</tr>
<tr>
<td>Simulation 2</td>
<td>2.78</td>
<td>1.13</td>
<td>0.31</td>
</tr>
</tbody>
</table>

The results of the model are presented in Table B2. As may be seen in Table 3, the reduction in pure tax resulting from the reform meant an increase in the steady state level of employment between 0.31 and 0.54 in Peru. As was remarked earlier, the growth in employment is lower than that found in the Chilean case, where the application of the same model with different parameters gave an increase in employment of 1.3 per cent in the baseline scenario [and 3.7 per cent in the more optimistic scenario]. The main difference between the results lies in the greater reduction of pure tax in Chile: almost ten percentage points for the scenario in Table 3 and between two and five points for the case of Peru.

### 3.3 Capital markets and total factor productivity

This section focuses on measuring the contribution of the Peruvian pension system to financial development or financial depth [measured by

\(^{14}\) An adjustment of 2 percentage points is assumed for administrative expenses and deductions, in the same way as Corbo and Schmidt-Hebbel.
the FIR, Financial Intermediation Ratio] and subsequently, its contribution to total factor productivity. This is important because it is possible in this way to estimate the effect of the reform on economic growth.

The definition of FIR used corresponds to the sum of [i] the system’s liquid liabilities and [ii] the market capitalization of stocks and bonds, each of these concepts being expressed as a percentage of GDP\textsuperscript{15}. The data were taken from Beck, Demirgüç-Kunt and Levine [2009], who collected data for several countries for the World Bank in the data base called Financial Structure Dataset.

\textbf{FIGURE 5}


15 The liquid liabilities over GDP have been the traditional indicator for measuring financial depth, since the seminal study by King and Levine [1993] on the relationship between growth and financial development. That definition includes banks and other financial intermediaries. The market capitalization of stocks and bonds reflects the size of the capital market. For further details, see Beck, Demirgüç-Kunt and Levine [2009].
3.3.1. Impact of the reform on the FIR

In the Chilean case, Corbo and Schmidt-Hebbel [2003] estimate a co-integration vector to explain the development of the FIR in Chile in the period 1961-2001. The variables that explain and have a long-term relationship with the FIR are the mandatory household savings resulting from the pension reform, plus a group of variables that reflect three factors: [i] structural reforms and in particular financial liberalization, [ii] potential financial determinants that affect the demand for assets, and [iii] the cyclical effects of the financial markets. Just as in section 3.1, in the Peruvian case Apoyo omitted many of the variables used in Chile from the analysis [see Table C1]. The Chilean study found that the contribution of the flows of pension savings accounted for between 31 and 46 per cent of the increase in the FIR since the reform began.

In the same way as for section 3.1, Tables C2 and C3 present an analysis of the series’ stationarity and structural breaks, and the results of the regressions, respectively. Table C3 shows four estimates: the first is a simple regression that includes the factors determining the FIR; the second excludes the less significant variables to assess the sensitivity of the mandatory savings parameter; the third shows the ARDL estimate with all the variables [since a large number of non-significant variables is included, the long-term relationship between these is ruled out] and the fourth column shows the final ARDL estimate [the long-term relationship being significant in this case].

In terms of the factors determining the FIR, the indices of financial liberalization and structural reforms [not including the financial liberalization component] have a non-significant impact. On the other hand, the rate of return of the stock-market index does have a positive effect on the FIR. Imbalances in the exchange market [approximated by the deviations of the exchange rate over its trend], the Libor rate, higher levels of inflation and the total savings rate are not relevant either in explaining the FIR. Finally, the effect of mandatory savings is significant and relatively robust in the various specifications, with a value of 0.39.

Considering that the relationship between financial development and the reform [mandatory savings] is perhaps the most important part of the study, two additional robustness exercises were done. First the terms of trade were introduced into the regressions [a variable not included in the work of Corbo and Schmidt-Hebbel]. The important increase in the FIR as from the year 2005, plus the stock-market capitalization, might be more closely linked with the recovery of commod-
ity prices than with mandatory savings. The inclusion of that variable does not make a substantial difference to the estimate for mandatory savings. The second exercise was to restrict the analysis from 1990 onwards, in addition to introducing the variable already mentioned. The estimate corresponding to mandatory saving falls to 0.22, [continuing to be highly significant] also controlling for the possible effects of terms of trade. This second estimate will be used in producing the conservative scenario when adding up the effects of the reform [see section 4.3].

3.3.2. Impact of the FIR on productivity

The impact of the pension reform on the FIR may have an impact on growth through total factor productivity [TFP]. Corbo and Schmidt-Hebbel adopt the approach of explaining the TFP by using determinants related with financial development, trade openness, structural reforms, macro-economic stability and the education level. The authors find that the contribution of the FIR between 1960 and 2001 fluctuates between 32 and 57 per cent of the change in TFP in Chile. Table D1 shows the different variables used in the Chilean studies, that of Apoyo and the present one. Once again, it is worth emphasizing the potential biases in Apoyo’s estimates, due to the failure to control for the possible effects of several variables [Table D1].

In order to proceed to the TFP analysis, a simple growth-accounting exercise was done [without controlling for the quality of the factors], following Valderrama [2001]. The steady-state analysis of the series and the results of the regressions are found in tables D2 and D3. The various columns presented in Table D3 follow the same rationale as those used for analyzing the FIR, but with an additional column to include a trend and a break in trend in the series in the early 1990s [column OLS [2]], resulting from the analysis of Table D2. This break in the trend was also found by Morón [2007]. In addition to the break in trend, the specification also controls for the cyclical component of the GDP, since productivity is picking up that component.

In terms of the results, the index of structural reforms [which excludes the financial liberalization component] turns out to be non-significant, just as in Morón et al. [2007]. This does not mean that the reforms did not have a positive effect on productivity, but that this index cannot appropriately reflect the particular dynamics of the reforms in Peru. The index
was constructed for several countries in Latin America and is a combination of variables that attempt to reflect different spheres in which the structural reforms acted [Lora, 2012]. Instead of using this index, Loayza [2008] relates economic growth directly with various measurements that reflect the different reforms that occurred [infrastructure, education, financial development, macroeconomic stability, among others], finding a positive relationship.

With regard to other variables, the terms of trade show a positive sign. The spending of non-financial public companies as a percentage of the GDP, as well as the standardized inflation, had a negative effect on productivity [though not significant for all specifications]. The trend shows a negative sign, showing that productivity fell until the beginning of the nineties, while the positive sign for the interaction between the trend and the dummy that started in 1993, reflects the opposite. As was expected, the cyclical component shows a positive sign and is highly significant. An alternative way to proceed would be to follow Morón [2007], where the cyclical component of the GDP is removed before carrying out the growth-accounting exercise.

Finally, the FIR had a positive and significant impact in all specifications. Thus, the effect of the FIR on TFP fluctuated between 0.27 and 0.37, the long-term effect being equal to 0.35. Given the set of parameters calculated, the reform of the pension system, through its effect on new savings [between 0.19 and 0.47 per cent of the GDP, See Table 1] contributed to explain between 6.7 and 17.0 per cent of the total increase of the TFP in Peru between 1994 and 2011.
4. Aggregate effects and conclusions

The first sub-section discusses the limitations of the analysis; the second presents a robustness exercise, using a structural VAR; the third, the aggregate results using the findings of section three; and the fourth, the final conclusions.

4.1 Limitation of the analysis

A study of this nature cannot capture all the effects of the reform and does not claim to do so. For example, there are effects related with the risks of the system, the quality of the institutions linked with the capital market, possible synergies or complementarities with other reforms, among others.

As Corbo and Schmidt-Hebbel explain, a first effect not included is the change in the system’s risks and their distribution. On the one hand, in the individually-funded system the risk of the return of the fund is assumed in the end by the worker, even though the fund’s investments are regulated by the government. In a pay-as-you-go system, theoretically the risk of return is determined by the development of the GDP. As the authors point out, the growth of the GDP determines the rate of return of a mature pay-as-you-go system in steady state and without political interference. Corbo and Schmidt-Hebbel also mention that another ef-
fect not captured is the change in the distribution of intergenerational risks [or solidarity], typical of all pay-as-you-go systems. The creation of a system of individual funding eliminates this aspect by the system’s nature\(^{16}\). On the other hand, neither does the study include an analysis of the potential gains resulting from the creation of the multi-funds system since 2005, which allows a better match between the risk profile of the workers and the funds.

Just as in Chile, in Peru the reform of the pension system meant the accumulation of a large quantity of investable wealth on the part of the pension funds. The Peruvian financial system had therefore to become more sophisticated, bearing in mind that the new institutional investors [AFPs] now needed a series of instruments in which to invest the contributors’ money. This study does not include estimates linked with potential improvements in the quality of the institutions.

A further limitation of the analysis is the identification of potential complementarities with other structural reforms. The method used in this study does not aim at that identification\(^{17}\). The main reforms that today characterize the Peruvian economy were carried out during the first part of the nineties. In this sense, the various policy measures potentiated each other in favour of economic recovery and long-term growth. In some cases, the reverses in specific reforms also limited or held up potential benefits resulting from the implementation of the new pension system. This is the case with the labour reform, where the reverse in the reduction of non-wage costs had a negative effect on the performance of that market.

In this study we worked with estimates that include variables that seek to capture the effects of other structural reforms. The aim of introducing those variables was to avoid overestimating the contribution of the pension reform. In order to consider the effect of other reforms, the reform indices of Lora [2012] were included. However, just as in previous studies [Morón et al. 2004] those variables turned out to be non-significant. In this sense, as Corbo and Schmidt-Hebbel are the first to recognize, it is very difficult to identify the impact of particular reforms on growth. De-

\(^{16}\) An evaluation of the distribution of intergenerational risks should include the chaotic situation of the system prior to the reform. In the Peruvian case, between 1981 and 1988 the real returns of the investments of the Peruvian pay-as-you-go system were highly negative, fluctuating between -12.7 and -93.5 per cent per year [World Bank, 1994].

\(^{17}\) For example, Chang et al. [2005] is a study that analyses the complementary relationship between trade openness and other development policies.
spite this, and considering the previous evidence, the estimates of this document produced values that are within a plausible range\(^{18}\).

## 4.2. Robustness exercise

The calculations made in the third section present the advantage of estimating regressions in a reduced form, namely, that a large number of controls can be included in the estimates. However, the main limitation of this type of analysis is that it does not allow the variables to be endogenous; in other words, that each of the variables included in each regression depends on the rest. For example, in section 3.1 the answer was given to the following question: How do voluntary private savings react to an increase in public saving? Through VAR it is possible to analyze the complementary question: How do public savings respond to an increase in voluntary private savings?

If one wishes to set up a model in which each variable depends on its own lags and those of the remaining variables, it is essential to work with a VAR. The problem of models of this type is that unless assumptions are made of the potential short and long-term impacts between the variables, it is not possible to have an interpretation of what happens with the rest of the variables when a movement or shock occurs in one particular variable. In this way, the need to make up a set of assumptions means that one must work with a number of variables that is not unduly high, in order to make the estimate plausible and credible.

A VAR is therefore estimated by making use of the following variables: voluntary private savings, mandatory private savings, public savings and FIR. The inclusion of the variables of savings, taking into account that corresponding to the reform [mandatory savings], makes it possible to corroborate the work in section 3.1 and also contrast the relationship of those variables with financial development [first part of section 3.3]. The relationship between financial development and productivity has been

\(^{18}\) Note that the final results of Table 4, in terms of percentage points of GDP growth, are to be found in a range between 0.15 and 0.52 points per year, so it might be argued that the average impact was 0.3–0.4 points. Loayza [2008] found that financial development contributed 0.3 points to growth up to 2005 [without picking up the acceleration of growth between 2006 and 2011], using a sample of countries, which implies that his estimates reflects the effects over an average or representative country [a panel was estimated]. In the end, the evolution of the reform explained over 80 per cent of the volatility in financial development, as will be seen in the following section.
studied at length in the literature and in previous studies on Peru; such as Loayza [2008].

As was mentioned, it is necessary to have a number of assumptions in order to achieve the identification of the model. Specifically, to identify the long-term impacts between the variables, the following assumptions were made: [i] voluntary private savings are not affected in the long term by the other variables, [ii] public savings do not respond to voluntary private savings and financial development in the long term and, finally [iii] voluntary private savings do not respond in the long term to financial development. The results of the functions impulse-response are given in Figure E1.

The conclusions are as follows: in the long term, financial development responds positively to mandatory savings or pension reform. What is more, the variance decomposition analysis indicates that over 80 per cent of the volatility of the FIR is explained by the evolution of voluntary savings. In the second place, it is confirmed that where there is an increase in fiscal deficit, voluntary private savings increase [result of section 3.1]. Even more important, the response of voluntary savings to mandatory savings is almost nil. This contradicts Carpio’s result [2008] to a certain extent, which finds a high negative correlation [-0.7] between the variables [using micro data]. For this reason, two fairly conservative scenarios were used [-0.5, -0.7] in section 3.1.

4.3. Aggregate effects

In order to calculate the aggregate effects, work was done with the series of capital, employment and productivity resulting from the growth-accounting exercise. Counterfactual scenarios were estimated for each of these three series, named in this way because it is assumed in these scenarios that the reform did not take place. Specifically, in the counterfactuals, there is no record of the net increase in savings that affected capital and productivity or of the reduction in the pure tax on labour that affected employment. The difference between

---

19 In this estimate voluntary household savings are not used, but the aggregate.

20 In order to calculate the capital series without the reform, the contribution of the new net savings [and related investment] was excluded from the gross formation of capital since 1993. For the net savings, the two scenarios in Table 2 are considered. The same thing was done to calculate the productivity without the reform. The contribution of net savings was excluded from the FIR and then the latter’s contribution
what actually happened and the counterfactual scenario is the impact of the reform.

Tables 2 and 3 provide two scenarios for the net effects on savings and a further two for the impact on employment. The scenarios used for study purposes were a conservative one, which assumes the lowest impacts on net savings and employment, and a less conservative one, which considers the greatest effects on the two variables. These are Scenarios I and II in Table 4. For each of these two scenarios, four counterfactuals of growth are reported: [i] without a net increase in savings resulting from the reform, [ii] without an increase in employment resulting from the reform, [iii] without an increase in productivity resulting from the reform and [iv] without the three combined effects resulting from the reform.

<table>
<thead>
<tr>
<th>Growth</th>
<th>Scenario I</th>
<th>Impact I</th>
<th>Scenario II</th>
<th>Impact II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variation in GDP that occurred in Peru [93-11]</td>
<td>5.3541</td>
<td>0.0096</td>
<td>5.3303</td>
<td>0.0237</td>
</tr>
<tr>
<td>Counterfactual: without net increase in savings [93-11]</td>
<td>5.3444</td>
<td>0.0094</td>
<td>5.3377</td>
<td>0.0163</td>
</tr>
<tr>
<td>Counterfactual: without increase in employment [93-96]</td>
<td>5.3447</td>
<td>0.1311</td>
<td>4.8778</td>
<td>0.4762</td>
</tr>
<tr>
<td>Counterfactual: without the three effects [93-11]</td>
<td>5.2040</td>
<td>0.1501</td>
<td>4.8379</td>
<td>0.5161</td>
</tr>
</tbody>
</table>

In principle it must be pointed out that the annual growth of the Peruvian economy for the period 1993-2011 was 5.35 per cent on average. The results indicate that without the net increase in savings there would have been a lower level of investment and gross capital formation, which
would have affected the level of total capital in the economy. In this way, there would have been a lower level of growth, with 0.01 and 0.02 percentage points for the two scenarios in Table 4. In the second place, it was assumed that the impact on employment occurred only during the first few years of the reform, since as from 1997 the level of informality in the economy showed an increase [unrelated with the reform] which was only reversed as from the second half of the 2000s. The impact concerning the labour market in percentage points of growth was lower than that corresponding to savings, with values of 0.01 and 0.02 points for the two scenarios. The most important channel was that of financial development and productivity, with a contribution that was around 0.13 and 0.47 percentage points.

Finally, adding the three effects together, if the pension reform in Peru had not taken place, there would have been a lower rate of economic growth. This impact would have fluctuated between 0.15 and 0.52 percentage points of GDP growth per year.

4.4. Final comments

The creation of a private pension system in Peru has contributed to an important extent to the economic recovery which began in the year 1993. The study identifies the fact that the accumulation of contributions –or new savings– that occurred boosted the country’s economic development and this, in turn, had a positive effect on productivity and economic growth. This accumulation effect is not present in the pay-as-you-go system which still exists alongside the private system in Peru. On the contrary, the public system presents a constant financial deficit that fails to ensure its sustainability in the long term.

The parallel has been drawn throughout the document between the reforms in Chile and Peru. Perhaps the most important difference between the two experiences is the low coverage of the Peruvian system, due mainly to the very high levels of informality in the labour market and, to a lesser extent, the continuation of the public pay-as-you-go system. This has meant that the new mandatory savings generated by the reform have been less in Peru: 1.1 per cent of GDP on average in Peru 18 years after the implementation of the reform and 4.6 per cent of GDP on average in Chile after 20 years of reform [Corbo and Schmidt-Hebbel [2003]. Although approximately 20 years after the creation of the SPP, the growth of the Peru-
vian economy was almost 0.7 points higher on average than the growth of Chile following the reform, the lower savings generated were decisive in the lower impact of the reform: between 0.15 and 0.52 percentage points of growth per year on average in Peru compared with between 0.22 and 0.93 points in Chile.
### TABLE A1
Variables used in different studies to analyze the response of private savings to government deficit

<table>
<thead>
<tr>
<th></th>
<th>Chile</th>
<th>Peru - Apoyo</th>
<th>Peru - Present Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable to be explained.</td>
<td>Private savings</td>
<td>Variable to be explained.</td>
<td>Variable to be explained.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private savings</td>
<td>Voluntary private savings</td>
</tr>
<tr>
<td>Explanatory variables:</td>
<td></td>
<td>Explanatory variables:</td>
<td>Explanatory variables:</td>
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<td>Public savings</td>
<td></td>
<td>Public savings</td>
<td>Public savings</td>
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<td>World growth</td>
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</tr>
<tr>
<td>Trade openness</td>
<td></td>
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<td>Trade openness</td>
</tr>
<tr>
<td>Bank credit</td>
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<td>Bank credit</td>
</tr>
<tr>
<td>National income per capita</td>
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<td>Growth of GDP</td>
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<td>Dependency rate</td>
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<td>n.a.</td>
<td>n.a.</td>
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<tr>
<td>Real interest rate</td>
<td></td>
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<td>Real interest rate</td>
</tr>
<tr>
<td>Rate of tax on companies</td>
<td></td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Rate of tax on individuals</td>
<td></td>
<td>Private investment</td>
<td>n.a.</td>
</tr>
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</table>

n.a. Not available
### TABLE A2
Unit root tests
Series for estimating voluntary private savings

<table>
<thead>
<tr>
<th></th>
<th>Voluntary private savings</th>
<th>Public savings</th>
<th>Trade openness</th>
<th>Bank credit</th>
<th>GDP Growth</th>
<th>Real interest rate</th>
<th>External savings</th>
<th>Personal tax rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
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<tr>
<td>Unit root</td>
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<td>Yes</td>
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<td>ADFGLS Stat</td>
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<td>-1.759</td>
<td>-1.053</td>
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<td>-3.726</td>
<td>-1.678</td>
<td>-1.167</td>
<td>-1.196</td>
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<td>Si</td>
<td>Si</td>
<td>Si</td>
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<tr>
<td>Z-A(A) Stat</td>
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<td>-3.372</td>
<td>-4.141</td>
<td>-</td>
<td>-</td>
<td>-5.354</td>
<td>-</td>
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<tr>
<td>Unit root</td>
<td>No*</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>No**</td>
<td>-</td>
</tr>
<tr>
<td>Z-A(B) Stat</td>
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<td>-4.220</td>
<td>-3.182</td>
<td>-3.291</td>
<td>-</td>
<td>-</td>
<td>-5.146</td>
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<tr>
<td>Unit root</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>No**</td>
<td>-</td>
</tr>
<tr>
<td>Z-A(C) Stat</td>
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<td>-4.710</td>
<td>-3.697</td>
<td>-4.076</td>
<td>-</td>
<td>-</td>
<td>-5.326</td>
<td>-</td>
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<tr>
<td>Unit root</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>No**</td>
<td>-</td>
</tr>
<tr>
<td>First order diff.</td>
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<td>ADF Test</td>
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<td>-5.059</td>
<td>-9.501</td>
<td>-4.437</td>
<td>-</td>
<td>-</td>
<td>-6.105</td>
<td>-</td>
</tr>
<tr>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>-</td>
<td>-</td>
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<td>-</td>
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<td>-4.987</td>
<td>-8.441</td>
<td>-4.385</td>
<td>-</td>
<td>-</td>
<td>-5.186</td>
<td>-</td>
</tr>
<tr>
<td>Unit root</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>-</td>
<td>-</td>
<td>No</td>
<td>-</td>
</tr>
</tbody>
</table>

ADF refers to the Augmented Dickey-Fuller Test
ADFGLS refers to the Augmented Dickey-Fuller Test with GLS Detrending
Z-A refers to the Zivot and Andrews Test
[A] H [a]: stationarity, there is a break in the intercept
[B] H [a]: stationarity, there is a break in the trend
[C] H [a]: stationarity, there is a break in the intercept and the trend
* Potential break in series in 1990 under steady state
** Potential break in the series in 1999, 1996 and 1999 [for the three models] under steady state
**TABLE A3**
Estimate to explain voluntary private savings, 1976-2011

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>OLS (1)</th>
<th>OLS (2)</th>
<th>OLS (3)</th>
<th>ARDL (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public savings</td>
<td>-0.405*</td>
<td>-0.258</td>
<td>-0.310*</td>
<td>-0.530</td>
</tr>
<tr>
<td>(0.233)</td>
<td>(0.196)</td>
<td>(0.153)</td>
<td>(0.321)</td>
<td></td>
</tr>
<tr>
<td>Trade openness</td>
<td>0.195**</td>
<td>0.141**</td>
<td>0.196**</td>
<td>0.047</td>
</tr>
<tr>
<td>(0.080)</td>
<td>(0.067)</td>
<td>(0.060)</td>
<td>(0.116)</td>
<td></td>
</tr>
<tr>
<td>Bank credit</td>
<td>-0.083</td>
<td>0.044</td>
<td>0.210</td>
<td></td>
</tr>
<tr>
<td>(0.098)</td>
<td>(0.087)</td>
<td>(0.153)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>-0.045</td>
<td>-0.065</td>
<td>0.052</td>
<td></td>
</tr>
<tr>
<td>(0.108)</td>
<td>(0.089)</td>
<td>(0.144)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External savings</td>
<td>-0.065</td>
<td>-0.198</td>
<td>-0.680**</td>
<td></td>
</tr>
<tr>
<td>(0.147)</td>
<td>(0.126)</td>
<td>(0.297)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real interest rate</td>
<td>-0.046**</td>
<td>0.007</td>
<td>-0.003</td>
<td>0.042</td>
</tr>
<tr>
<td>(0.003)</td>
<td>(0.018)</td>
<td>(0.017)</td>
<td>(0.032)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>11.652**</td>
<td>15.308**</td>
<td>12.619**</td>
<td>20.102**</td>
</tr>
<tr>
<td>(3.180)</td>
<td>(2.782)</td>
<td>(2.291)</td>
<td>(5.072)</td>
<td></td>
</tr>
<tr>
<td>(1.509)</td>
<td>(1.362)</td>
<td>(3.003)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| R² | 0.618 | 0.750 | 0.717 | 0.870 |
| Akaike criterion | 4.907 | 4.537 | 4.497 | 3.994 |
| Schwarz criterion | 5.215 | 4.889 | 4.717 | 4.434 |
| Durbin-Watson | 1.244 | 0.898 | 0.971 | 1.535 |
| p value of serial correlation | 0.018 | 0.000 | 0.005 | 0.148 |
| p value of heteroscedasticity | 0.002 | 0.002 | 0.001 | 0.249 |

**Test: relationship of level among the variables**

| Upper/lower bound critical values | 5.687/4.558 |
| F-stat | 5.757 |

**Error Correction Term Coefficient**

-0.492**
(0.110)

Notes:

Reported here are the coefficients of the regressions for OLS with the standard errors given in brackets. For the case of the specification ARDL, the long-term coefficients are reported. The tests for serial correlation and heteroscedasticity correspond to the Breusch-Godfrey Serial Correlation LM Test and Breusch-Pagan-Godfrey, respectively, whose null hypotheses are that there is no serial correlation and no heteroscedasticity, respectively. The test for the existence of a level relationship between the variables of the ARDL model is not conclusive if the statistic lies between the bands. If it is below the bands, the null hypothesis of no effects in the level cannot be discarded. If the statistic lies above, the null hypothesis is discarded. The critical values correspond to a confidence level of 95 per cent.

* Significant at 10 per cent.
** Significant at 5 per cent
**TABLE B1**
Parameters and sources for estimating the labour market model

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Chile</th>
<th>Peru*</th>
<th>Peru - Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workforce</td>
<td>3.7</td>
<td>2.239</td>
<td>Household survey</td>
</tr>
<tr>
<td>Employment in the formal sector</td>
<td>1.85</td>
<td>0.917</td>
<td>Household survey</td>
</tr>
<tr>
<td>Employment in the informal sector</td>
<td>1.45</td>
<td>1.146</td>
<td>Household survey</td>
</tr>
<tr>
<td>Unemployment</td>
<td>0.4</td>
<td>0.177</td>
<td>Household survey</td>
</tr>
<tr>
<td>Transfer of prices to wages in the informal market</td>
<td>0.3</td>
<td>0.916</td>
<td>Own estimate**</td>
</tr>
<tr>
<td>Elasticity of labour supply to expected wage-levels</td>
<td>0.3</td>
<td>0.38</td>
<td>Céspedes and Rendón [2012]</td>
</tr>
<tr>
<td>Weight of the informal sector in the price level</td>
<td>0.3</td>
<td>0.6</td>
<td>INEI</td>
</tr>
<tr>
<td>Elasticity of the demand for labour in relation to wage levels in the informal sector</td>
<td>-0.5</td>
<td>-0.315</td>
<td>Own estimate**</td>
</tr>
<tr>
<td>Elasticity of the demand for labour in relation to wage levels in the formal sector</td>
<td>-0.4</td>
<td>-0.19</td>
<td>Saavedra Torero [2004]</td>
</tr>
<tr>
<td>Initial tax component of the pension system</td>
<td>0.15</td>
<td>0.09</td>
<td>Own estimate***</td>
</tr>
<tr>
<td>Final tax component of the pension system</td>
<td>0.056</td>
<td>0.04</td>
<td>Own estimate***</td>
</tr>
<tr>
<td>Elasticity of formal wage in relation to level of unemployment</td>
<td>-0.186</td>
<td>0.269</td>
<td>Own estimate**</td>
</tr>
</tbody>
</table>

* The analysis concentrates on Lima.

** For the estimates the annual aggregate data was used, using the Ministry of Labour’s employment statistics and the household surveys for Lima. Simple regressions were used to discover the relationships. The results obtained are robust to changes in the estimated parameters.

*** See section 3.2.4 for the calculation of the pure tax on labour.
### Table B2
Impact of the pension reform on the labour market – Peru

<table>
<thead>
<tr>
<th>Changes in the variables</th>
<th>Simulation 1</th>
<th>Simulation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( d \ln w^N_F = \frac{\delta}{L_S - \delta \eta_F L_F} \left[ \phi L_S d \ln w_I (1-\gamma \theta) - \eta_F L_F d \ln T \frac{T}{1+T} \right] )</td>
<td>-0.002</td>
<td>-0.001</td>
</tr>
<tr>
<td>( d \ln w_I = \frac{(1 + \eta_F) d \ln w^N_F + d \ln T \frac{T}{1+T} \eta_F}{1 + \frac{L_S}{U+L_F} \phi (1-\gamma \theta) - \frac{L_I}{U+L_F} \eta_I (1-\theta)} )</td>
<td>0.010</td>
<td>0.001</td>
</tr>
<tr>
<td>( d \ln w^B_F = d \ln w^N_F + d \ln T \frac{T}{1+T} )</td>
<td>-0.084</td>
<td>-0.048</td>
</tr>
<tr>
<td>( d \ln L_F = \eta_F d \ln w^B_F )</td>
<td>0.016</td>
<td>0.009</td>
</tr>
<tr>
<td>( d \ln L_I = \eta_I d \ln w_I )</td>
<td>-0.003</td>
<td>-0.002</td>
</tr>
<tr>
<td>( d \ln L_S = \phi (1-\gamma \theta) d \ln w_I )</td>
<td>0.002</td>
<td>0.001</td>
</tr>
<tr>
<td>( d \ln L = \frac{L_F}{L_I + L_F} d \ln L_F + \frac{L_I}{L_I + L_F} d \ln L_I )</td>
<td>0.0054</td>
<td>0.0031</td>
</tr>
</tbody>
</table>
**TABLE C1**

Variables used in different studies for analyzing the response of FIR to mandatory savings

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variable to be explained:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial intermediation ratio - FIR</td>
<td>Financial intermediation ratio - FIR</td>
<td>Financial intermediation ratio - FIR</td>
</tr>
<tr>
<td><strong>Explanatory variables:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandatory savings</td>
<td>Mandatory savings</td>
<td>Mandatory savings</td>
</tr>
<tr>
<td>Financial liberalization index</td>
<td>n.a.</td>
<td>Financial liberalization index</td>
</tr>
<tr>
<td>Dummies for inflation</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Privatized assets/GDP</td>
<td>n.a.</td>
<td>Privatized assets/GDP</td>
</tr>
<tr>
<td>Structural reforms index</td>
<td>n.a.</td>
<td>Structural reforms index</td>
</tr>
<tr>
<td>Return on bonds</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Return on shares</td>
<td>n.a.</td>
<td>Return on shares</td>
</tr>
<tr>
<td>Return on money</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Return on external assets</td>
<td>Total savings/GDP</td>
<td>Libor Rate</td>
</tr>
<tr>
<td>Exchange-rate deviation</td>
<td>GDP</td>
<td>Exchange-rate deviation</td>
</tr>
<tr>
<td>Total savings/GDP</td>
<td>n.a.</td>
<td>Total savings/GDP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n.a.</td>
</tr>
</tbody>
</table>
### TABLE C2
Unit root tests
Series for estimating FIR

<table>
<thead>
<tr>
<th></th>
<th>FIR</th>
<th>Exchange rate deviation</th>
<th>Privatized assets</th>
<th>Financial liberalization</th>
<th>Structural reforms</th>
<th>Standardized inflation ***</th>
<th>Return on shares</th>
<th>Libor Rate</th>
<th>Ahorro total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Levels</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit root</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ADFGLS Stat</td>
<td>0.268</td>
<td>-3.369</td>
<td>-2.092</td>
<td>-0.730</td>
<td>-0.368</td>
<td>-1.988</td>
<td>-3.781</td>
<td>-2.300</td>
<td>-2.320</td>
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<tr>
<td>Unit root</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Unit root</td>
<td>Yes</td>
<td>- Si</td>
<td>No*</td>
<td>No**</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Unit root</td>
<td>Yes</td>
<td>- Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Unit root</td>
<td>Si</td>
<td>- Si</td>
<td>No*</td>
<td>Si</td>
<td>-</td>
<td>-</td>
<td>Si</td>
<td>Si</td>
<td></td>
</tr>
<tr>
<td><strong>First order diff</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADF Test</td>
<td>-4.965</td>
<td>-11.278</td>
<td>-6.223</td>
<td>-3.750</td>
<td>-</td>
<td>-6.937</td>
<td>-5.793</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit root</td>
<td>No</td>
<td>- No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Unit root</td>
<td>No</td>
<td>- No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

ADF refers to the Augmented Dickey-Fuller Test
ADFGLS refers to the Augmented Dickey-Fuller Test with GLS Detrending
Z-A refers to the Zivot and Andrews Test

[A] H [a]: stationarity, there is a break in the intercept
[B] H [a]: stationarity, there is a break in the trend
[C] H [a]: stationarity, there is a break in the intercept and the trend

* Potential break in series in 1992 under steady state
* Potential break in series in 1990 under steady state

*** The series was adjusted in the year 1999, since levels on inflation close to zero [in this case 0.2] produce a drastic change in the development of the indicator
### TABLE C3
Estimate to explain the FIR, 1970-2009

<table>
<thead>
<tr>
<th></th>
<th>OLS (1)</th>
<th>OLS (2)</th>
<th>ARDL (1)</th>
<th>ARDL (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td></td>
<td>Long Run Coeff</td>
<td></td>
</tr>
<tr>
<td>Financial liberalization [index]</td>
<td>-0.201 (0.245)</td>
<td>0.391 (0.865)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural reforms [index]</td>
<td>-0.203 (0.285)</td>
<td>-1.303 (1.289)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Privatized assets</td>
<td>-0.015 (0.015)</td>
<td>0.009 (0.041)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return on shares</td>
<td>0.051** (0.022)</td>
<td>0.027 (0.020)</td>
<td>0.143 (0.092)</td>
<td>0.088* (0.046)</td>
</tr>
<tr>
<td>Libor Rate</td>
<td>0.045 (0.678)</td>
<td>4.250 (3.601)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange-rate deviations</td>
<td>-0.001 (0.000)</td>
<td>-0.004 (0.003)</td>
<td>-0.001 (0.001)</td>
<td></td>
</tr>
<tr>
<td>Standardized inflation</td>
<td>-0.211 (0.189)</td>
<td>-0.272 (0.182)</td>
<td>-1.520 (1.114)</td>
<td>-0.602 (0.368)</td>
</tr>
<tr>
<td>Savings</td>
<td>0.003 (0.004)</td>
<td>0.006 (0.003)</td>
<td>0.013 (0.012)</td>
<td>0.012 (0.007)</td>
</tr>
<tr>
<td>Mandatory savings</td>
<td>0.538** (0.066)</td>
<td>0.419** (0.037)</td>
<td>0.582** (0.187)</td>
<td>0.391** (0.070)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.559** (0.243)</td>
<td>0.359* (0.188)</td>
<td>1.558 (0.986)</td>
<td>0.567 (0.362)</td>
</tr>
<tr>
<td>R²</td>
<td>0.950</td>
<td>0.936</td>
<td>0.969</td>
<td>0.962</td>
</tr>
<tr>
<td>Akaike criterion</td>
<td>-2.146</td>
<td>-2.139</td>
<td>-2.497</td>
<td>-2.540</td>
</tr>
<tr>
<td>Schwarz criterion</td>
<td>-1.724</td>
<td>-1.928</td>
<td>-1.985</td>
<td>-2.241</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>1.271</td>
<td>0.910</td>
<td>1.990</td>
<td>1.861</td>
</tr>
<tr>
<td>p value of serial correlation</td>
<td>0.095</td>
<td>0.001</td>
<td>0.988</td>
<td>0.703</td>
</tr>
<tr>
<td>p value of heteroscedasticity</td>
<td>0.655</td>
<td>0.110</td>
<td>0.983</td>
<td>0.878</td>
</tr>
<tr>
<td>Error Correction Term Coefficient</td>
<td>n.a.</td>
<td>-0.453** (0.116)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Reported here are the coefficients of the regressions for OLS with the standard errors given in brackets. For the case of the specification ARDL, the long-term coefficients are reported. The tests for serial correlation and heteroscedasticity correspond to the Breusch-Godfrey Serial Correlation LM Test and Breusch-Pagan-Godfrey, respectively, whose null hypotheses are that there is no serial correlation and no heteroscedasticity, respectively. The test for the existence of a level relationship between the variables of the ARDL model is not conclusive if the statistic lies between the bands. If it is above the bands, the null hypothesis of no effects in the level cannot be discarded. If the statistic lies below, the null hypothesis is discarded. The critical values correspond to a confidence level of 90 per cent.

* Significant at 10 per cent.
** Significant at 5 per cent.
### Table D1
Variables used in different studies for analyzing the response of TFP to the FIR

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explanatory variables:</strong></td>
<td>FIR</td>
<td>FIR</td>
<td>FIR</td>
</tr>
<tr>
<td></td>
<td>Terms of trade</td>
<td>n.a.</td>
<td>Terms of trade</td>
</tr>
<tr>
<td></td>
<td>Trade openness</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>Structural reforms index</td>
<td>n.a.</td>
<td>Structural reforms index</td>
</tr>
<tr>
<td></td>
<td>Standardized inflation</td>
<td>n.a.</td>
<td>Standardized inflation</td>
</tr>
<tr>
<td></td>
<td>Labour quality index</td>
<td>n.a.</td>
<td>Labour quality index</td>
</tr>
<tr>
<td></td>
<td>Public expenditure/GDP</td>
<td>n.a.</td>
<td>Public expenditure/GDP</td>
</tr>
<tr>
<td></td>
<td>Implied tariff</td>
<td>n.a.</td>
<td>Implied tariff</td>
</tr>
<tr>
<td></td>
<td>Linear trend</td>
<td>n.a.</td>
<td>Linear trend</td>
</tr>
<tr>
<td></td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>Trend + dummy for break</td>
<td>n.a.</td>
<td>Trend + dummy for break</td>
</tr>
<tr>
<td></td>
<td>Cyclical component</td>
<td>n.a.</td>
<td>Cyclical component</td>
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</table>
### TABLE D2
Unit root tests
Series for estimating TFP

<table>
<thead>
<tr>
<th></th>
<th>TFP</th>
<th>Terms of Exchange</th>
<th>Public Expenditure</th>
<th>Cyclical component</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Levels</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADF Stat</td>
<td>-1.642</td>
<td>-1.771</td>
<td>-1.398</td>
<td>-5.269</td>
</tr>
<tr>
<td>Unit root</td>
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<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>ADFGLS Stat</td>
<td>-1.052</td>
<td>-1.098</td>
<td>-1.635</td>
<td>-5.117</td>
</tr>
<tr>
<td>Unit root</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Unit root</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>Unit root</td>
<td>No*</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
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<tr>
<td>Z-A[C] Stat</td>
<td>-4.907</td>
<td>-3.673</td>
<td>-2.840</td>
<td>-</td>
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<tr>
<td>Unit root</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
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<tr>
<td><strong>First order diff.</strong></td>
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<tr>
<td>ADF Test</td>
<td>-4.620</td>
<td>-6.619</td>
<td>-4.059</td>
<td>-</td>
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<tr>
<td>Unit root</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>-</td>
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<tr>
<td>ADFGLS Test</td>
<td>-4.632</td>
<td>-4.385</td>
<td>-2.342</td>
<td>-</td>
</tr>
<tr>
<td>Unit root</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>-</td>
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ADF refers to the Augmented Dickey-Fuller Test
ADFGLS refers to the Augmented Dickey-Fuller Test with GLS Detrending
Z-A refers to the Zivot and Andrews Test
[A] H [a]: stationarity, there is a break in the intercept
[B] H [a]: stationarity, there is a break in the trend
[C] H [a]: stationarity, there is a break in the intercept and the trend
* Potential break in series in 1994 under steady state
## TABLE D3
Estimate to explain the TFP, 1970-2009

<table>
<thead>
<tr>
<th></th>
<th>OLS (1)</th>
<th>OLS (2)</th>
<th>OLS (3)</th>
<th>ARDL (1)</th>
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<tr>
<td></td>
<td>Coefficient</td>
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<td>Long Run Coeff.</td>
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<tr>
<td>Structural reforms [index]</td>
<td>-0.575**</td>
<td>-0.103</td>
<td>0.048</td>
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<td></td>
<td>[0.242]</td>
<td>[0.211]</td>
<td>[0.202]</td>
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<tr>
<td>Terms of exchange</td>
<td>0.501**</td>
<td>0.276**</td>
<td>0.247**</td>
<td>0.277**</td>
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<tr>
<td></td>
<td>[0.097]</td>
<td>[0.079]</td>
<td>[0.069]</td>
<td>[0.068]</td>
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<tr>
<td>Expenditure of Public Companies</td>
<td>-0.005**</td>
<td>0.000</td>
<td>-0.001</td>
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<td></td>
<td>[0.002]</td>
<td>[0.002]</td>
<td>[0.001]</td>
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<td>Standardized inflation</td>
<td>0.022</td>
<td>-0.107</td>
<td>-0.241**</td>
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<td></td>
<td>[0.198]</td>
<td>[0.126]</td>
<td>[0.105]</td>
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<tr>
<td>FIR</td>
<td>0.278**</td>
<td>0.306**</td>
<td>0.377**</td>
<td>0.346**</td>
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<tr>
<td></td>
<td>[0.123]</td>
<td>[0.093]</td>
<td>[0.082]</td>
<td>[0.079]</td>
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<tr>
<td>Cyclical component of GDP</td>
<td>0.755**</td>
<td>0.819**</td>
<td>0.808**</td>
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<td>[0.133]</td>
<td>[0.112]</td>
<td>[0.116]</td>
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<td>Trend</td>
<td>-0.013**</td>
<td>-0.014**</td>
<td>-0.017**</td>
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<tr>
<td></td>
<td>[0.003]</td>
<td>[0.002]</td>
<td>[0.002]</td>
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<tr>
<td>Dummy Trend 93*</td>
<td>0.002</td>
<td>0.001</td>
<td>0.002</td>
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<tr>
<td></td>
<td>[0.002]</td>
<td>[0.002]</td>
<td>[0.002]</td>
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<tr>
<td>Constant</td>
<td>2.594**</td>
<td>3.682**</td>
<td>3.696**</td>
<td>3.773**</td>
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<tr>
<td></td>
<td>[0.597]</td>
<td>[0.409]</td>
<td>[0.350]</td>
<td>[0.354]</td>
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<tr>
<td>R²</td>
<td>0.835</td>
<td>0.951</td>
<td>0.950</td>
<td>0.979</td>
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<tr>
<td>Akaike criterion</td>
<td>-2.241</td>
<td>-3.301</td>
<td>-3.434</td>
<td>-4.005</td>
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<td>Schwarz criterion</td>
<td>-1.988</td>
<td>-2.921</td>
<td>-3.181</td>
<td>-3.493</td>
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<td>Durbin-Watson</td>
<td>0.912</td>
<td>1.066</td>
<td>0.948</td>
<td>1.179</td>
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<tr>
<td>p value of serial correlation</td>
<td>0.000</td>
<td>0.002</td>
<td>0.000</td>
<td>0.030</td>
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<tr>
<td>p value of heteroscedasticity</td>
<td>0.830</td>
<td>0.025</td>
<td>0.006</td>
<td>0.355</td>
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</tbody>
</table>

Test: relationship of level among the variables

Upper/lower bound critical values | 4.705/3.467
F-stat | 6.154
Error Correction Term Coefficient | -0.847**

<table>
<thead>
<tr>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reported here are the coefficients of the regressions for OLS with the standard errors given in brackets. For the case of the specification ARDL, the long-term coefficients are reported. The tests for serial correlation and heteroscedasticity correspond to the Breusch-Godfrey Serial Correlation LM Test and Breusch-Pagan-Godfrey, respectively, whose null hypotheses are that there is no serial correlation and no heteroscedasticity, respectively. The test for the existence of a level relationship between the variables of the ARDL model is not conclusive if the statistic lies between the bands. If it is below the bands, the null hypothesis of no effects in the level cannot be discarded. If the statistic lies above, the null hypothesis is discarded. The critical values correspond to a confidence level of 90 per cent.</td>
</tr>
<tr>
<td>* Significant at 10 per cent.</td>
</tr>
<tr>
<td>** Significant at 5 per cent.</td>
</tr>
</tbody>
</table>
Accumulated impulse-response functions for the VAR, shock is a s.d.

\[ \Delta \text{Mandatory savings} \rightarrow \Delta \text{FIR} \]

\[ \Delta \text{Voluntary savings} \rightarrow \Delta \text{FIR} \]

\[ \Delta \text{Public savings} \rightarrow \Delta \text{FIR} \]
$\Delta$ Mandatory savings $\rightarrow$ $\Delta$ Voluntary savings

$\Delta$ Public savings $\rightarrow$ $\Delta$ Voluntary savings
References


Apoyo (2010). Importancia del Desarrollo del Sistema de Pensiones en el Peru.


Lora, E. (2012). Structural reform in Latin America: What has been reformed and how it can be quantified (updated Version). Research Department Publications 4809, Inter-American Development Bank, Research Department.


Edited by
Marcela Rojas

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Alejandra Urzúa
* While SURA Asset Management has a significant interest in AFP Protección and AFP Crecer, it is not a controlling interest; therefore, data included on said companies should be considered for information purposes only.
SURA Asset Management is a Latin American company set up by GRUPO SURA in the context of its acquisition, in December 2011, of pension assets, life insurance policies and pension funds worth USD 3.6 billion.

Since then, it has been the leader of the pension industry in the region and is a specialist in saving and investment products. It manages assets worth a total of USD 102.7 billion for 15.9 million clients in Mexico, Colombia, Peru, Chile, Uruguay and El Salvador, with a 23.5% share in the pension market at regional level, as of June 2013.
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Experiences of Colombia, Mexico, Chile and Peru

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This publication is a contribution from SURA Asset Management towards the analysis and knowledge of pension management systems in Latin America. With this aim in view, distinguished economists from Colombia, Mexico, Chile and Peru have worked for over six months on a quantitative assessment of the macroeconomic effects of the pension reform in each country, estimating the impact of the creation of the individually-funded systems on the growth rate and the level of the GDP through four main channels: saving and investment; employment structure and labour productivity; capital market development and efficiency; and the evolution of total factor productivity.