

Understanding domestic savings: an empirical approach

Rodrigo Cerda, Rodrigo Fuentes, Gonzalo García & José I. Llodrá

To cite this article: Rodrigo Cerda, Rodrigo Fuentes, Gonzalo García & José I. Llodrá (2020) Understanding domestic savings: an empirical approach, *Applied Economics*, 52:9, 905-928, DOI: [10.1080/00036846.2019.1646871](https://doi.org/10.1080/00036846.2019.1646871)

To link to this article: <https://doi.org/10.1080/00036846.2019.1646871>



[View supplementary material](#)



[Published online: 12 Aug 2019.](#)



[Submit your article to this journal](#)



[Article views: 716](#)



[View related articles](#)



[View Crossmark data](#)



[Citing articles: 3 View citing articles](#)



Understanding domestic savings: an empirical approach

Rodrigo Cerda^{a,b}, Rodrigo Fuentes^a, Gonzalo García^c and José I. Llodrá^d

^aEconomics, Pontificia Universidad Catolica de Chile, Santiago, Chile; ^bMinistry of Finance Chile, Budget Office, Santiago, Chile; ^cEconomics, University of Maryland, College Park, MD, USA; ^dMinistry of Finance Chile, Santiago, Chile

ABSTRACT

There are two unusual and important features in the evolution of the savings rate in Chile. First, the economy increased the average savings rate by 11 percentage points in the period 1985–2013 compared to 1960–1984, mainly due to a large change in private savings rate (10 percentage points), and an additional 1 percentage point from the public sector. The second feature is related to the change in the composition of private savings. After several years of nearly no corporate savings, this component became an important part of total savings reaching an average of almost 10% of Gross National Disposable Income (GNDI) during the period 1986–2012. Our results show that the 1984 tax reform, the boost in the marginal productivity of capital and the deepening of the financial market were the main drivers that explain the dramatic increase in corporate savings. We also found that the reduction in personal income tax after the tax reform and the higher income per capita growth helped to explain the increase in household savings, while the structural balance rule helped to explain the increase in public savings.

KEYWORDS

Measurement of savings; Chile; determinants of corporate savings; household savings; public savings

JEL CLASSIFICATION

E01; E21; O16

I. Introduction

Domestic saving is a key variable in financing investment for economies that are externally financially constrained. In the recent past, it was not only developing economies but also developed economies that lacked international market access. Thus, how to boost domestic saving becomes a relevant question for policymakers around the world. Policies related to fiscal budget management and tax incentives for corporate and household savings are on the first line of possible answers to this question. Nevertheless, the implementation of these policies might be offset by the agent's reaction. As a matter of fact, substitution effects across agents might be important, i.e. tax incentives may raise private savings while reducing fiscal savings, or a pension fund reform that increases mandatory savings will replace voluntary savings, etc.

This article empirically analyzes the effects of different policies on domestic saving rate, for Chile, which has transited from historical low savings rate to high one compared to other

Latin American countries. The first contribution of this article is the construction of a time-series data on savings per type of agent, for Chile, during the period 1960–2012. This updates previous studies by Bennett, Schmidt-Hebbel, and Soto (1999), including changes in the methodology to adapt it to institutional changes. Using this new data set, this article empirically analyzes the question at hand: how to boost the domestic saving rate in an emerging economy? The second contribution of the article is to explain how Chile increased the saving rate while explaining the important change in the savings composition between households and corporations.

Two important facts require an explanation in the evolution of savings rates in Chile. First, the economy increased the average savings rate by 11 percentage points in the period 1985–2013 compared to 1960–1984 mainly due to a large change in the level (10 percentage points) of private savings and an additional 1 percentage point from the public sector.

The increase in the savings rate started in 1985, a time when the economy was coming out of the

largest financial and sovereign debt crisis since the Great Depression, characterized by the bankruptcy of several financial institutions and the intervention of many others, lack of access to international capital markets and low future growth expectations. At that moment, Chile was implementing many important institutional reforms such as the private pension fund system; capital markets reform (1986); the reform of the banking legislation (1984); and an important tax reform (1984) that lowered corporate tax rate and avoided double income taxation, significantly simplifying the tax regime. In addition, there was a large wave of privatizations. In the following 12 years (1986–1997), the economy experienced its highest historical sustained growth. These reforms and sustained growth scenario may have had effects on household savings (part of the increase of growth was transitory) and on corporate savings (probably due to the increase in the marginal productivity of capital).

The second fact to be explained is related to the change in private savings composition. After several years of almost no corporate savings, this component became an important part of total savings, reaching an average of nearly 10% of GNDI during the period 1986–2012. While voluntary household savings have generally been negative in Chile, they became even more negative after the 1981 pension reform that established a mandatory savings scheme. The replacement of voluntary savings by mandatory savings was established during the 1981 pension reform that changed from a pay-as-you-go system to an individually funded system managed by the private sector and had an important effect on savings and investment (Corbo and Schmidt-Hebbel 2003; Fuentes 2013). In addition, corporate savings increased significantly since the second half of the 1980s, which explains a large size of the overall saving history. Several policies might have influenced the change in corporate savings, mainly the privatization process of previously nationalized companies in the 1970s and 1980s, and the changes to the tax system during the same period that provided incentives for corporate reinvestment.

Our results show that the 1984 tax reform, the boost in the marginal productivity of capital and the

deepening of the financial market were the main drivers of the dramatic increase in corporate savings. In addition, both mandatory savings and the fiscal system positively contributed, though to a lesser extent. Regarding the tax reform, before 1984, there was double income taxation from corporate profits with a large total burden (49%). The tax reform changed this system to a full imputation tax system that lowered corporate tax on accrued profits and delayed personal tax due to the distribution of profits to stockholders. Moreover, the personal income tax was applied when dividends were received. These changes generated incentives for firms to save a larger part of their profits as retained earnings. The reform also cut personal tax rates.

The article is organized as follows: Section II summarizes relevant literature to our case study. Section III focuses on methodological issues to build our macro saving data per institutional agent. Section IV shows a glimpse of the data and documents the main facts related to our two questions. Section V presents the empirical analysis per type of agent using our macro data. In addition, we also include micro evidence on corporate savings due to their relevance in explaining the increase in savings since the mid-1980s. Using empirical evidence, Section VI analyzes the policy implications of the results. Finally, Section VII presents our conclusion.

II. Related literature

At the international level, there are several studies aimed at analyzing the determinants of private savings. Following the extensive review by Loayza, Schmidt-Hebbel, and Servén (2000) and Grigoli, Herman, and Schmidt-Hebbel (2018), as shown in Table 1 we can identify the following main factors behind savings:¹

In the case of the determinants of national savings for Chile, the economic research has followed two different approaches: macroeconomic and microeconomic studies. The main studies for Chile are summarized in Table 2.

¹The articles included in this revision are Corbo and Schmidt-Hebbel (1991); Masson, Bayoumi, and Samiei (1995; 1998); Edwards (1996); Dayal-Gulati and Thimann (1997); Bailliu and Reisen (1998); Haque, Hashem Pesaran, and Sharma (1999); Loayza, Schmidt-Hebbel, and Servén (2000); Lopez, Schmidt-Hebbel and Servén (2000); Schmidt-Hebbel and Servén (2000); Attanasio and Rohwedder (2003); Attanasio and Brugiavini (2003); De Serres and Pelgrin (2003); Agenor and Aizenman (2004); Gutiérrez (2007); Horioka and Terada-Hagiwara (2012); Bebczuk and Cavallo (2014); and Grigoli, Herman, and Schmidt-Hebbel (2018).

Table 1. Empirical evidence for the saving rates: international evidence.

Factors	Correlation
Transitory income shocks	Positive
Uncertainty (measured as macroeconomic instability using inflation rate)	Positive
Capital flows restrictions	Positive
Mandatory fully funded pension system contributions	Positive
Current account deficit	Negative
Demographic factors: old and young dependency rate	Negative
Public sector balance	Negative
Real rate of interest	Ambiguous
Financial depth	Ambiguous
Income concentration	Ambiguous

These main findings are that the empirical evidence tends to support the life cycle theory and the permanent income hypothesis. Nevertheless, several macroeconomic studies have estimated a compensatory effect less than one for public and household savings, as well as a partial compensatory effect between company and household savings. In relation to taxes, there are studies that have estimated a negative influence of larger corporate taxes on company savings.² Finally, the literature for Chile has found a partial compensatory effect between mandatory and voluntary household savings, which implies that the pension system reform might have had a positive effect on household savings. However, there is no study that focuses on the reason why private savings increased or why the composition of savings in Chile shifted from households to companies since the mid-1980s.

III. Data construction: methodological issues

Public savings

The public sector in Chile is usually classified into two main branches: the financial public sector and the non-financial public sector. The financial public sector includes the Central Bank and Banco Estado, one of the largest banks in the banking system. The non-financial public sector itself has two main branches: (1) the overall government and (2) public firms. The government consists of the central government, which includes ministries, armed forces and civil services that depend on the government such as the Budget Office (Spanish acronym: Dirección de Presupuestos, DIPRES), the Internal Revenue Service (Spanish acronym: Servicio de

Impuestos Internos, SII) and the National Custom Services (Spanish acronym: Servicio Nacional de Aduanas, SNA). The central government includes regional governments, public universities and local councils. In addition, there are currently 33 public firms in Chile (according to the Budget Office, Dipres³) that employed 49,455 workers in 2013 and earned pre-tax profits equal to 1.2% of GDP in 2013.

Appendix 1 provides details on how the public savings figure was constructed.

Corporate savings

Corporate savings are basically calculated as non-distributed after-tax profits plus private firm's depreciation minus the profits of foreign companies. Appendix 1, Supplementary material, presents the sources and how each component of the corporate savings was built in more detail.

Household savings

Household savings are calculated as the difference between total private savings and corporate savings. In turn, household's savings can be divided into voluntary and mandatory savings.

Mandatory savings

Since 1981, the Chilean Pension System is based on a defined contribution scheme. Each member has an individual retirement account in which his social security contributions are deposited. These deposits are capitalized in the individuals' funds and earn a yield on investments made by administrators. When an individual retires from the labour force, his fund is used to buy a pension – generally an annuity. In the case of death of the fund owner, her surviving beneficiaries receive the pension or inherit the remaining funds. The payment amount that an individual receives as a pension depends on the savings accumulated during his life as an employee. Thus, there is a direct relationship between personal effort – including the returns on the financial investment – and the pension

²See Cerda and Larraín 2005, 2010; Vergara 2001; Cerda and Llodrá 2017.

³http://www.dipres.gob.cl/596/articles-64217_recurso_1.pdf.

Table 2. Empirical evidence for the Chilean economy.

Paper	Objective	Data and methodology	Results
Agosin, Crespi, and Letelier 1998	To analyze the determinants of the national savings increases in Chile between 1985 and 1997.	National account annual data 1960–1995. Methodology based on VAR and VECM.	Companies and government were the agents that contributed to the national savings increment for this period. Households did not present positive net savings for this period, even after the implementation of the pension system reform. However, mandatory savings did negatively affect household's voluntary savings. The compensation coefficients between household and public savings and between household and company savings are less than one.
Hachette 1998	To analyze Chilean private savings using a model based on the Life Cycle Theory and the Permanent Income Hypothesis.	Quarterly and annual data were constructed for the periods 1985–1995 and 1975–1995, respectively.	There is a partial compensation between voluntary and mandatory savings. Growth, financial increases and temporary income are important to stimulate private voluntary savings. Partial Ricardian Equivalence is found.
Morandé 1998	To analyze why national savings were so high between 1985 and 1995.	National account annual data 1960–1995	Foreign saving was relevant for the evolution of private savings in the mid 1980s, while later national savings was supported by domestic savings.
Agosin 2001	To analyze the determinants for national savings in Chile.	National account annual data 1940–1996 - VAR	Most of the increase in private savings since the mid-1980s is due to business savings. Household saving turns out to be a stationary variable with a zero mean and do not seem to take the savings of firms into account when making their own saving decisions. Business saving is unaffected by public saving, but in the long run, business saving and foreign saving seem to be perfect substitutes. In the long run, policies that stimulate investment are likely to lead to an increase in private savings, as well as policies aimed to increase public savings.
Bennett, Loayza, and Schmidt-Hebbel 2001	To analyze the determinants for savings in Chile by aggregate agents: households (voluntary), firms and government.	- National account annual data 1960–1997 - Cointegration analysis	Partial Ricardian Equivalence is found (coef. 0.5). Financial deepening increases are negatively correlated with private saving. A decrease of the corporate tax rate can increase private saving. There is a compensation effect between household savings and company savings (coef. 0.5) and between voluntary household savings and mandatory savings (coef. 0.36–0.8). National per capita income and copper prices are positively related to public savings.
Butelmann and Gallego 2001	To analyze the determinants of voluntary household savings using microeconomic data.	Family Expenditure Survey data for two cross-section periods 1988 and 1996–1997.	Transitory income and age have significant positive effects on voluntary household savings, providing evidence for the Life Cycle Theory and the Permanent Income Hypothesis. Also, education and access to credit seem to be determinants in explaining household saving behaviour in Chile.
Gallego, Morande and Soto 2001	To analyze the relationship between household savings and the business cycle using microeconomic data.	Data from Gallego, Morandé, and Soto (2001) for the period 1977–1999	There is a positive relationship between household savings and the business cycle when consumption of durable goods is considered as savings.
Vergara 2001	Determinants of private savings and voluntary private savings.	National account quarterly data 1988:1–2000:3 - OLS	Partial Ricardian Equivalence is found (coef. 0.7). Interest rates and transitory incomes have significant positive effects on private and voluntary private savings. The tax reform implemented in 1990 had a negative effect on savings.
Corbo and Schmidt-Hebbel 2003	To analyze the macroeconomic effects of the pension system reform on the Chilean economy.	Annual data for the period 1960–2001.	Between 1982 and 2001, the domestic saving rate had an average increase of 2.3% of GDP due to the pension system reform, while investment increased to 1.2% of GDP.
Fuentes 2013	To assess the effect of the pension reform on the long-term macroeconomic balance of the Chilean economy.	Annual data 1960–2012.	For domestic savings, there was an average increase of 2.7% of GDP between 1981 and 2012 is estimated due to the pension reform.

benefits. The Pension System is managed by private institutions known as Pension Fund Administrators (AFPs).

Following the methodology proposed by Bennett, Schmidt-Hebbel, and Soto (1999),

mandatory savings are constructed as payment of mandatory contributions plus other increases minus management fee – total benefits paid minus other reductions plus assets return. Each of this item is defined as:

- *Payment of Mandatory Contributions* corresponds to the mandatory contribution made by the households to the individual pension fund as a fixed share of their labour income.⁴
- *Other Increases* include Compensation Saving Accounts⁵ (CSA) and additional contributions.⁶
- *Management Fee* is the fee paid to the Pension Fund Manager.
- *Total Benefit Paid* is the payment received by the retiree from the individual pension fund. There are two possible retirement arrangements: Programmed Withdrawal, which is a mutual decision with the Pension Fund Manager, and Life Annuity, which is contracted with an insurance company.
- *Other Reductions* include withdrawals from the Compensation Saving Accounts and other obligatory decreases informed by the Pension Superintendent.
- *Assets Returns* include the dividends and interests gained by the assets that form the pension fund but exclude capital gains from changes in asset pricing.

Voluntary savings

Voluntary savings are estimated as a residual. It corresponds to the difference between household savings and mandatory savings.

Other variables

There are some explanatory variables that are not readily available but are necessary to obtain. The three most relevant are taxes, marginal productivity of capital and the interest rate. We now describe the methodology used to construct these variables.

Taxes

The tax variables considered in this article are the personal income tax, the reinvestment tax and the dividend tax. We built a series of taxes from 1960 to 2012 with the information on the tax code from the National Library of Congress (referred to as

BCN for its Spanish name, Biblioteca del Congreso Nacional).

The personal income tax is the tax levied on personal earnings including labour and capital income. In Chile, it corresponds to the so-called Complementary Global Taxes (referred to as IGC for its Spanish name, Impuesto Global Complementario) that taxes the entire personal base income and is the only progressive tax in Chile. Generally, other taxes are at flat rates. We used the top marginal rate of the IGC to construct a time series of the personal income tax. These are available from the tax code, which has changed many times since 1960.

By contrast, the reinvestment tax rate is built from the different taxes levied on corporate profits but corresponds to the tax rate the firm pays when it retains \$1 of profits. Currently, Chile has a unique corporate tax, the so-called first category tax (impuesto de primera categoría), but throughout history, there were at least three additional taxes on non-distributed profits in different periods (from 1960 to 1963, 1968 to 1969 and 1975 to 1985).

The dividend tax variable corresponds to taxes on dividend income. Before the 1984 tax reform, corporate taxation was independent of the personal income tax, so the dividend tax was calculated similarly to a classical taxation system, i.e. as an additional tax on the cash flow at the personal level. The 1984 tax reform allowed using the paid corporate tax as a withholding tax for the personal income tax. This is similar to a full imputation taxation system. Since 1984, the dividend tax corresponds to the Global Complementary Tax.

Marginal productivity of capital. We estimate a proxy for the marginal productivity of capital by using an estimation of the capital stock corrected by the unemployment rate to capture the intensity of use over the business cycle. That series is published by DIPRES. Assuming a Cobb–Douglas production function, our estimation of the marginal productivity of capital (MPK) is given by:

⁴A rate of 10% of labour income plus a fee for the fund manager.

⁵November 1990 marked the beginning of compensation savings accounts (CSA) in order to give domestic workers compensation benefits in case the work relationship ended.

⁶It is the contribution made by insurance companies to pension fund accounts for those workers who are declared impaired or deceased and who are entitled to disability Insurance. This contribution is equivalent to the difference between the resources needed to finance the pension and the amount accumulated in the pension fund account of the affiliate at the date of death or disability. If the difference is negative, the additional contribution will be zero.

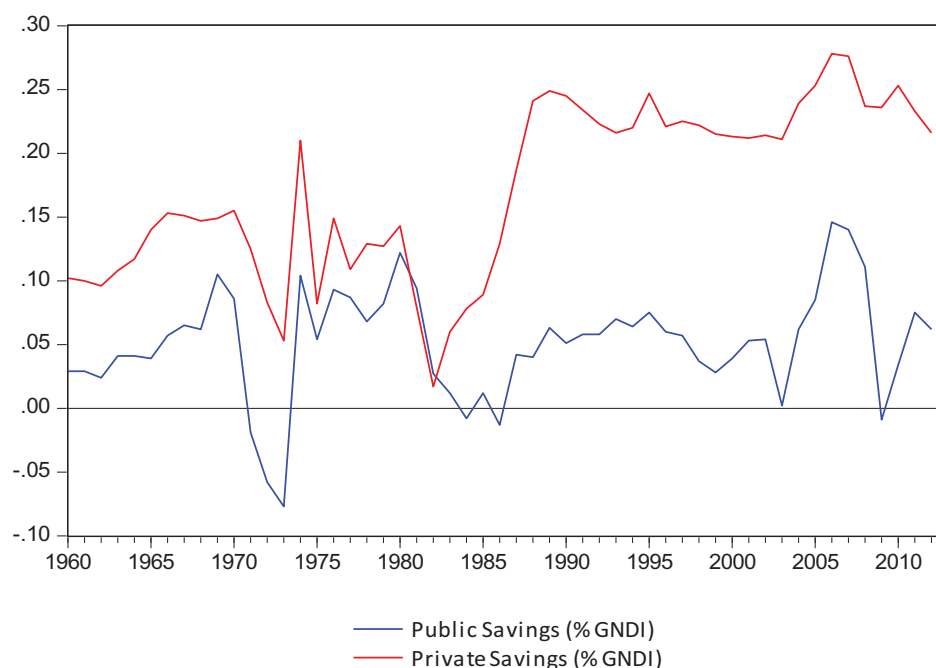


Figure 1. National savings divided in public and private savings as a percentage of disposable income.

Sources: Author's estimations.

$$MPK = \alpha \frac{Y}{K}$$

where α represents the capital share that we assume equal to 0.4, Y is GDP and K is the capital stock corrected by the business cycle.

Interest rate

The real interest rate was built as the difference between the annual nominal interest rate of banking operations and the inflation reported during the period, divided by $(1 + \text{inflation})$. Nominal interest rates series for the period 1960–1985 correspond to those published by Chile's Central Bank entitled 'Interés Corriente para Operaciones no Reajustables' (regular interest for non-indexed operations), while for 1986–2012, the deposit interest rate for operations lower than 90 days were used because this interest rate was nominal and not indexed.

Financial intermediate 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 capitalization. For the period 1960–2000, the main source of information is the

paper 'The Republic in Figures', from EH Clio Lab.⁷ For the period 2001–2012, the series are updated using data from the Central Bank of Chile, The Bank and Financial Institutions Superintendency, the Santiago Stock Exchange and DIPRES.

IV. A first glance at the data

Savings rates in Chile fluctuated between 10% and 15% of national income during the 1960s and 1970s. They decreased to levels lower than 5% during the crisis of 1982, but since 1984, national savings have had a rebound and nearly reached 25% of national income in 1989. They decreased close to 22% after the 1998 Asian crisis but had a new rebound reaching 28% in 2006 and 2007. Afterwards, savings had been fluctuating around 24%. Figure 1 illustrates the evolution of savings in Chile of both private and government savings since 1960. The large increase in the national savings rate during the 1980s is called the 'saving miracle' according to some authors (see Agosin, Crespi, and Letelier 1998; Agosin 2001). As can be seen, the 'saving miracle' was due to a large and sustained increase in private savings. In addition,

⁷EH Clio Lab is a group of researchers focus on economic history, <http://cliolab.economia.uc.cl/>.

Chile had also a temporary jump in the saving rate in the mid-2000s, which was the result of an increase in public savings.

A Quandt-Andrews test shows a structural break for the mean of the national saving rate in 1987, while in the case of private savings, the break took place in 1986. Dividing the sample pre- and post-break, we found that the average rate of public savings increased by 1.7 percentage points, while private saving rate increased from 7.1% in 1960–1986 to 17.2% in 1987–2012. Table 3 shows the descriptive statistics for both periods. Another important feature of the saving rate series is the drop in the standard deviation between both periods. This change affected both the private and

public saving rates, the first decreasing from 4.2% to 2.7%, while the second from 4.9% to 3.4%.

One of the goals of this research is to explore alternative hypotheses that may explain the rise of savings rate. To do so, it is necessary to explain the increase in private savings, following the literature reviewed in Section II.

When looking at the composition of the private sector (Figure 2), we found that the private saving's surge is related to an increase in mandatory household savings (occurring as a result of the 1981 pension reform) combined with a reduction in voluntary savings (from -2.8% to -5%) plus a large increase in corporate savings from levels around 9% until 1985 to more than 17% since the mid-1980s.

Table 3. Comparison of saving rates 1960–1985 versus 1986–2012.

Statistics	National savings		Public savings		Private savings	
	1960–1986	1987–2012	1960–1986	1987–2012	1960–1986	1987–2012
Mean	11.41	23.14	4.29	5.99	7.12	17.15
Median	11.70	22.90	4.10	5.80	7.20	16.80
Maximum	21.00	27.80	12.20	14.60	14.40	24.50
Minimum	1.70	18.70	−7.70	−0.90	−1.50	12.60
Std. Dev.	3.99	2.06	4.93	3.42	4.17	2.73
Skewness	−0.15	0.43	−0.62	0.72	−0.10	0.71
Kurtosis	3.36	3.21	2.95	4.22	2.74	3.53
Jarque–Bera	0.25	0.86	1.71	3.84	0.12	2.48
Probability	0.88	0.65	0.42	0.15	0.94	0.29

Source: Author's calculations.

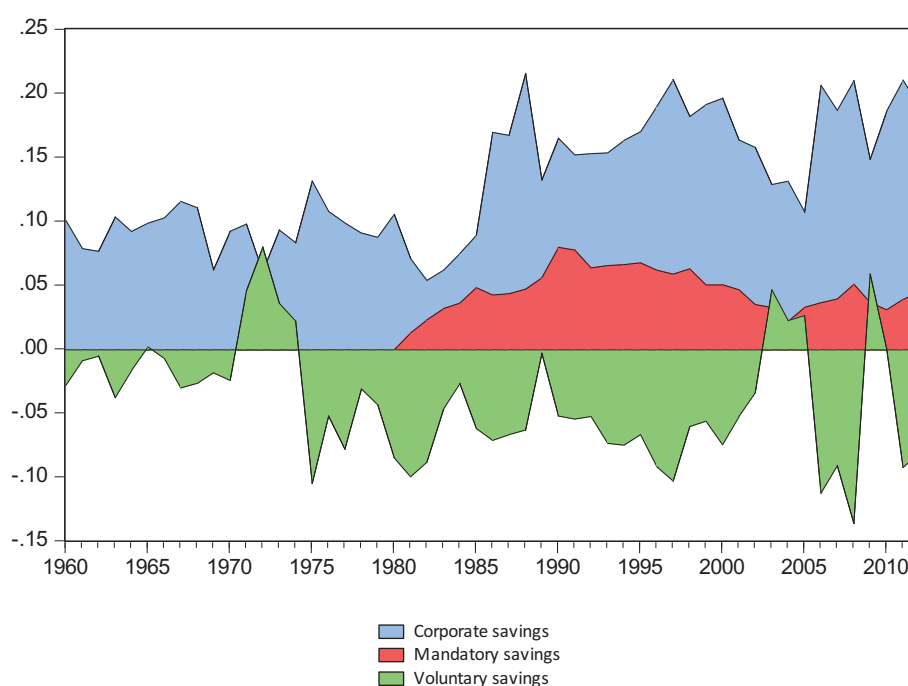


Figure 2. Composition of private savings 1960–2012.

The contribution of private saving might be a key element to be considered in the analysis of aggregate savings when looking at households. Similarly, due to its relevance in the increase of national savings, corporate private savings require consideration.

The distinction between mandatory and voluntary savings is very relevant in the case of Chile due to the pension system. In the early 1980s, Chile experienced an exhaustive pension reform. This reform had an impact on the labour market, financial sector and the private and public savings rate. According to the study of Corbo and Schmidt-Hebbel (2003) and Fuentes (2013), due to this reform, the overall increase in the saving rate was between 2 and 3 percentage points.

The pension fund reform also had significant effects on the government balance sheet as it was required to fund the transition from one system to the other. Also, note that pension fund contributions under the new system are considered private savings.

The data on private savings show that the corporate savings rate stagnated at around 9% of the national income from 1960 until the mid-1980s. After that, the corporate savings rate experienced a permanent increase of 8 percentage points of national income, reaching 17%. Several elements need to be considered in the evolution of corporate savings such as changes in tax incentives plus variables that may have affected investment decisions. Corporate savings are retained earnings with the purpose of re-investing them in the firm or in related firms throughout corporate reorganization; thus corporate savings are an important source of funds for firms. This episode is interesting because since 1980 the domestic capital market becomes more developed, and one would expect that firms would have access to less expensive sources of financing, both domestic and internationally, implying a larger debt holding.

However, the evidence indicates that this is not the case. Table 4 shows a data summary on a panel survey of Chilean firms in 2007 and 2009 (source: National Institute of Statistics and Ministry of Economy). In this table, we report the data about funding sources to finance investment. Personal resources represent more than 62% of the funding sources in 2007, increasing to 75.3% in 2009. The increase in 2009 suggests that in a year of financial stress when usually debt financing is credit constrained, personal resources become even more important in financing investment.

Following the informal evidence presented to this point, we may hypothesize that the main causes for the increase in savings should be found in tax incentives and positive shocks that may have increased desired investment. We revise the data based on this information, then do a formal statistical analysis.

Between 1984 and 2014, the tax system in Chile was fully integrated: when people received dividends from firms, the corporate tax paid by the firms is deducted from their personal tax statement. It follows that retained earnings had a different tax rate than dividends. This difference is relevant for corporate savings; when the owners of the company decide to re-invest profit, they will end up paying a lower tax rate at that time and a higher rate when they receive the returns of the reinvestment unless they keep re-investing. That system is completely different from the tax system prior to 1984 when it was not integrated and there was double taxation on profits. In fact, firms paid a corporate tax and owners paid a second tax on profit at the personal level which was paid even if no dividend was paid, i.e. the personal tax was set on an accrued base and not on a retired base (see Cerda et al. 2014). As a result, taxes at the personal level were extremely high (see Figure 3).

Figure 3 illustrates the evolution of the tax rate paid by company owners when they received dividends and the tax rate on retained earnings. Both rates were relatively high before 1984 and not very different in the period 1975–1985. Since the 1984 tax reform, the tax rate on retained earnings drops to its lowest historical level, creating an important difference between the reinvestment rate and the dividend tax. This may suggest that the tax system may have

Table 4. Investment financing at the corporate level (2007 and 2009).

How did you finance your investment? (Corporate)	2007	2009
Own resources	62.6%	75.3%
Loans	16.6%	12.7%
Leasing	8.3%	7.7%
Other	12.5%	4.2%

Source: First and second Longitudinal Firm Survey, Ministerio de Economía, 2010/2012 of Chile.

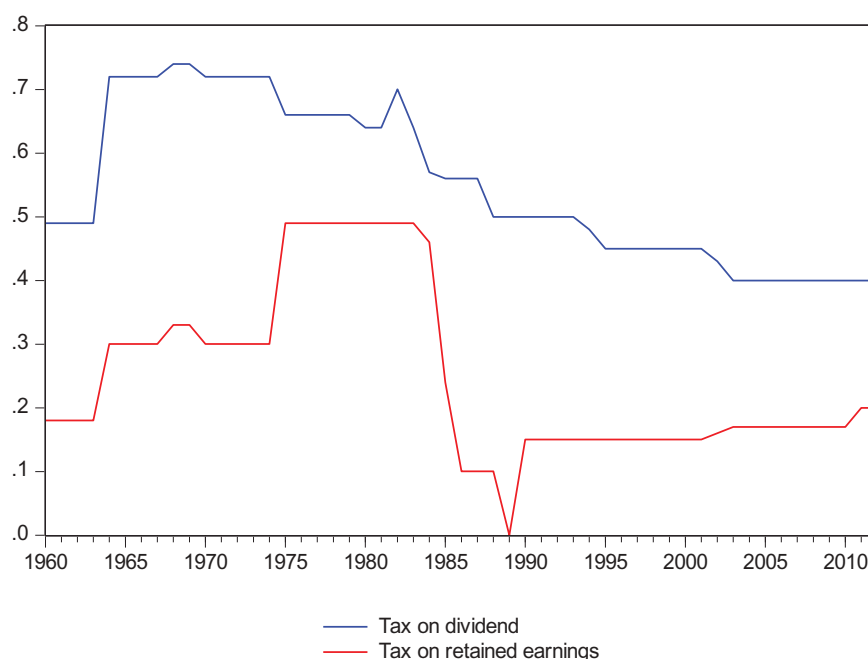


Figure 3. The evolution of tax rates from 1960 to 2012.

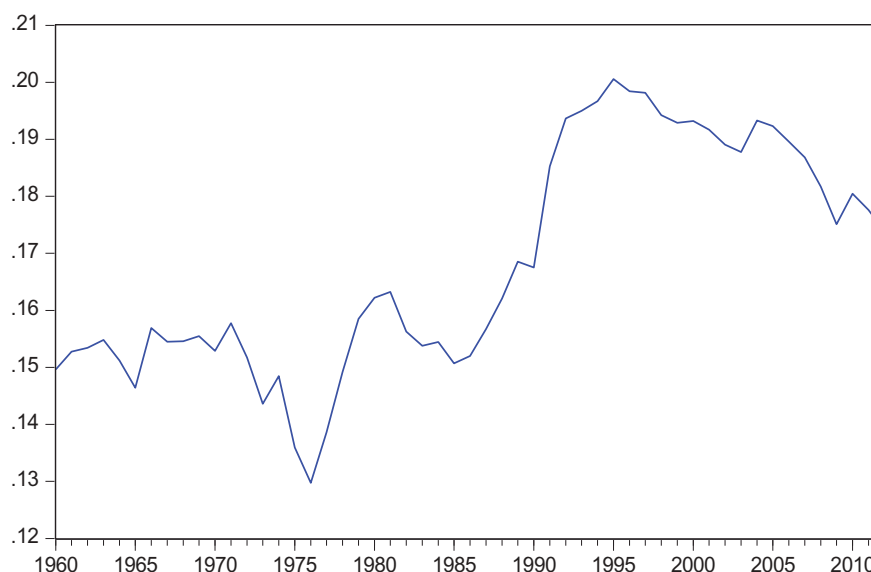


Figure 4. Marginal productivity of capital from 1960 to 2013.

produced a change in the composition of private investment.

Another important variable to be considered in the analysis of corporate saving is its return. Since corporate savings are retained earnings for reinvestment at the same or at a related company, the marginal productivity of capital (MPK) might be a key determinant of private investment. Figure 4 plots the evolution of the MPK, showing a boom after 1986, which coincides with the golden period of the Chilean

economy. The MPK rose on average from 15% to 18% since its 1986 level. This is another plausible explanation for the increase in the corporate savings.

Regarding public savings, it is important to bear in mind that, since 2001, Chile has an explicitly implemented fiscal rule to stabilize its budget. This rule involves increasing public savings during boom years (high tax revenues) and reducing public saving during years of low tax revenues. Figure 1 plots public savings since

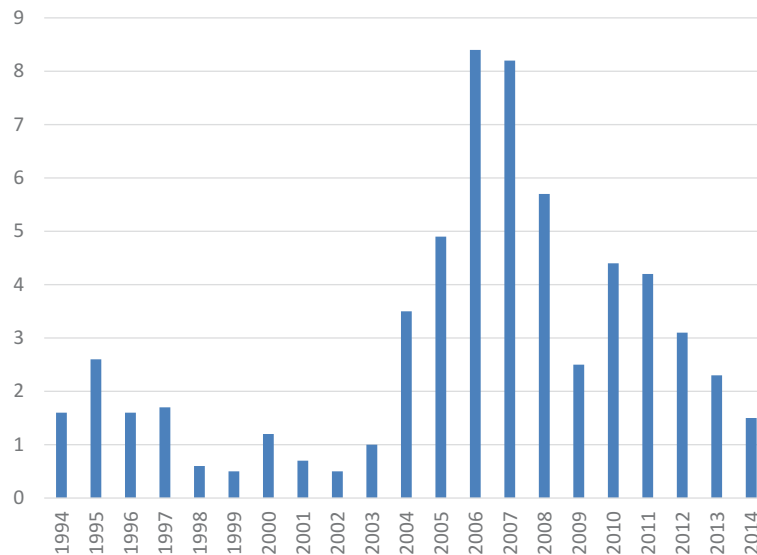


Figure 5. Fiscal mining revenue, % GDP.

1960 and highlights the increase in Chilean public savings since 1986, and years before the explicit fiscal rule were imposed. During the mid-2000s – coinciding with the boom in the highly important copper industry – government revenues experienced a large increase⁸ along with public savings. Figure 5 plots total fiscal revenue from the mining industry. It includes corporate contributions, the royalty enacted in 2004 and modified in 2010 and contributions from the large state-owned company that produce copper (CODELCO) to the central government. As it can be seen in the figure, generally, mining's revenue fluctuating between 0.5% and 2% of GDP from 1994 to 2003. Between 2004 and 2012, fiscal revenue increased and reached a contribution larger than 8% of GDP in 2006 and 2007. In 2013 and 2014, fiscal revenue from that mining decreased as a fraction of GDP to its pre-2003 levels.

The issue of the effect of the structural fiscal rule on savings is still unexplored. In this article, we provide some estimates of that result. In addition, and following Bennett, Loayza, and Schmidt-Hebbel (2001) who studied the compensation coefficients among all the components of private savings in Chile (household voluntary saving, firm savings and household mandatory

savings), we revisit this analysis with a longer time series. We also study the compensation coefficient between public and private savings in the empirical analysis.

V. Empirical results

This section presents the econometric results of saving functions by type of agents: public and private agents, the latter being divided between corporate and household savings. Before moving into the estimation results, we study the properties of the saving rates. The dependent variables are ratios (savings of agent J over GNI), which are very unlikely to have unit root in long time series, but it could be present in shorter time series like those used in this study.

We performed traditional unit root tests for the five variables of interest: voluntary savings, household savings, government savings, corporate savings and private savings, which is the sum of household and corporate savings. The results of the test are presented in Appendix 2, Supplementary material. The traditional ADF test shows that the null hypothesis of unit root can be rejected for voluntary savings, household savings and government savings, and it cannot be rejected for corporate and private savings. The Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test the

⁸Fuentes (2011) argues that fiscal savings are explained by the price of copper and the economic cycle position; moreover, the fiscal balance is affected by the price of copper with a one-year lag.

null hypothesis that the variable has a unit root with similar results.

It is known the low power of the ADF test under the presence of breakpoint in the series (Perron 1989). We performed two additional tests: the Zivot–Andrews and the ADF with a break in the intercept implemented in E-views. The Zivot–Andrews test, in which the null hypothesis is that the variable has a unit root against an alternative that the series is stationary and it has a structural break in the intercept, shows that the null can be rejected for all variables but the private saving, which is the sum of the household and corporate. What is interesting is that the test identifies a break in the year 1986, which is the same year that we identify as the major change in the taxation structure in Chile. The Unit Root Test with Break included in Eviews, in which the null hypothesis is that the variable has a unit root with an additive structural break in the intercept, the p -value for sav_{priv} is 0.0542, while for the remaining variables, the p -value is lower than 0.01, rejecting the null at the 10% level and marginally not rejected at 5%.

For each regression presented below, the hypothesis of white noise residuals cannot be rejected. Given this evidence plus the fact that saving rates are stationary when we include the possibility of a break, we are confident in our estimation results and conclusions.

Public savings

Public savings correspond to general government savings and thus includes savings from the central government, public firms and the Central Bank. In macroeconomic terms, public savings correspond to government revenues minus government expenditures, excluding public investment.

To model public savings, we include as determinants: (i) variables that allow us to distinguish between permanent and transitory fiscal revenues, (ii) variables that might determine fiscal expenditures, (iii) variables related to fiscal institutions and political regimes and (iv) the real interest rate to capture potential substitution and income effects.

Fiscal revenues depend on general economic activity and the revenues of the mining sector. They were 23.7% of GDP in 2013 and mining fiscal revenues accounted for almost 2% of GDP.

Table 5. Public savings.

Dependent variable: Public savings			
	(1)	(2)	(3)
1961–2012	OLS	OLS	OLS
Constant	0.049 (0.18)	−5.090 (−2.69)	−1.529** (−2.74)
Public savings (t-1)	0.476** (4.57)	0.052 (0.40)	
(Copper price/HP copper price) − 1	0.102** (4.91)	0.035* (1.85)	0.053** (3.21)
Ln (HP copper price)	−0.014 (−0.63)	0.137** (3.46)	0.094** (3.18)
(GDP − HP GDP)/HP GDP	0.126 (1.47)	0.415** (5.96)	0.346** (6.53)
Ln (HP GDP)	0.013 (1.21)	0.148 (1.69)	
Structural balance target	0.013* (1.86)	0.022** (4.55)	0.022** (4.53)
Interest rate (90–360 days)		0.0004 (1.120)	0.0007** (3.41)
Rural population		0.020** (2.74)	0.004** (2.02)
Unemployment (t-1)		0.129 (0.77)	
Dependency rate		−0.065** (−2.36)	−0.039** (−2.24)
R squared	0.578	0.903	0.876
Breusch–Godfrey (BG) Serial Correlation LM Test ^a	0.44	0.61	0.68
Heteroscedasticity Test: ARCH ^b	0.04	0.64	0.56
Normality test ^c	0.00	0.49	0.9
Observations	51	51	51

Notes: Significance levels of 5% (**) and 10% (*). T -statistic in parenthesis. a, b and c: p -values are reported. We also include dummy variables for presidential periods.

To distinguish between permanent and transitory shocks, we calculate Hodrick–Prescott (HP) filters on two series: (i) the copper price and (ii) the level of real GDP. To obtain a proxy for a transitory shock on copper prices and GDP, we calculate deviations from the HP filters. We define the copper price as the product of the international value of copper and the nominal exchange rate (peso/dollar), and later, we deflated by the CPI to finally obtain a measure of the real copper price measured in Chilean pesos.

Column 1 of Table 5 reports the results when we estimate public savings as a function of (i) copper price deviations from its trend and (ii) GDP deviations from its trend. Those two variables are measures of transitory shocks to the copper price and the GDP level. In addition, in column 1, we also include the HP filters on both the copper price and the real GDP to provide a measure of permanent shock. We also include the lag of the dependent variable to capture potential dynamics and a variable related to the structural balance rule implemented since 2001. In that variable, we have the effective structural stance, as a fraction of GDP. As explained above, the use of the

structural rule allows the fiscal sector to save during economic expansions and reduce savings during economic contractions. The transitory shocks on the copper price have positive and significant coefficients, while the coefficient on permanent shocks is non-significant like the real GDP transitory component. Those results indicate that the fiscal sector increases its expenditure when there is a permanent revenue increase, in a similar magnitude to the permanent shock. In contrast, when there is a positive (negative) transitory copper price shock, the fiscal sector tends to save (reduce surplus) the rainfall of income (low rainfall of income episodes). The coefficient on the structural balance is positive and statistically significant, meaning that a fiscal rule skewed to a structural surplus requires larger actual public savings. As the fiscal structural stance is measured in points of GDP, the estimates indicate that a 1 point increase in the structural balance is associated with 1.3 additional percentage points of fiscal savings in the short run and 2.2 percentage point in the long run.

Column 2 includes variables that could influence fiscal expenditure such as demographics (rural population and old-age dependency rates), economic conditions (a lagged unemployment rate that might

incentive larger fiscal expenditure programmes), the real interest rate (to capture substitution effects or income effects in case the government is net creditor or net debtor) and dummy variables for the different presidential periods.⁹ As we include additional controls, both the transitory shocks on real GDP and copper price are positive and significant, indicating that a fraction of the positive (negative) income shock is saved (smoothed with increased debt).¹⁰

While the coefficient on the GDP trend is non-significant, the coefficient on the copper price trend is positive and statistically significant, meaning that a fraction of the long-lasting (positive) copper price shocks is also saved. We expected this last coefficient to be non-statistically significant, and the result might be due to our imperfect measure of the long-run trend of the copper price. As a matter of fact, since 2001, the government has had an independent committee of economists and copper market experts that annually provide an estimate of long-run copper prices that are used to estimate fiscal revenues and determine fiscal expenditure. Figure 6 plots the long-run copper price estimates from the committee and from an HP filter. Price estimates from the copper committee are always lower than the estimate from

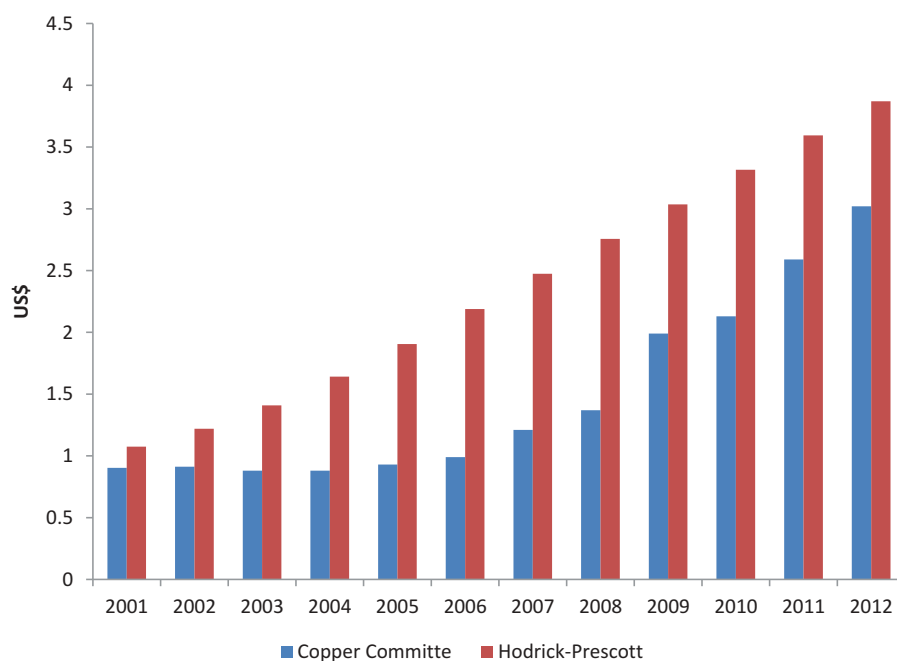


Figure 6. Long-run copper price estimates, USD\$.

⁹The estimates of these coefficients are available upon request.

¹⁰It is true that the actual pension fund system is a fully funded one. However, there are still people receiving pensions from the state according to the old pay-as-you-go system.

the HP filter, indicating that the decisions on the budget were based on a more conservative estimate of the long-term copper price, compared to the measure used in our regressions. Thus, our estimate on the long-run copper price might be capturing at least a part of a transitory shock.

The interest rate has a positive effect on fiscal savings in line with the usual substitution effect, but it is not significant since the structural balance rule still has a positive effect on savings. The coefficient on the rural population is significant and positive as generally more fiscal expenditure is needed in urban centres. Unemployment has also a non-significant coefficient. This is not surprising since, beginning in 2002, Chile developed an unemployment insurance scheme, and the scope of government programmes related to unemployment was generally limited (in the case of the 1983 crisis, temporary job programmes were created and later discontinued). Finally, the dependency ratio shows a negative and statistically significant coefficient, as the country experienced a demographic transition – increases the fraction of the population who are elderly – tax revenues have declined, but social expenditures on the elderly have increased.¹⁰ The coefficient on the lagged dependent variable becomes small and statistically non-significant.

In column 3, we do not include non-significant variables and obtain our final model on public savings. Interest rate is significant and positive, and the remaining determinants that increase public savings are the transitory shocks both on real GDP and copper price, the long-run copper price, the structural balance and the rural population rate. The only determinant with a negative effect on public savings is the dependency rate.

Private savings

Private savings comprised corporate savings and household savings; the latter includes both mandatory and voluntary savings. In this section, we use standard conceptual framework based on life cycle – the permanent income hypothesis. We will proceed with the analysis of savings by each private agent: corporate and household. Later, we study total private savings behaviour.

Corporate savings

As defined in Section IV, corporate savings are mainly defined as retained earnings plus depreciation. This is basically the part of cash flows re-invested into the company. In other words, company owners have two alternative choices: to (a) receive dividends and make their consumption/saving decisions or (b) save them in the company. In a neoclassical conceptual framework for investments, firms maximize the present value of cash flows, obtaining the condition that – after-tax – marginal productivity of capital is equal to the cost of the use of capital. It is almost impossible to construct a long time series of capital cost for an economy like Chile since there is no good statistics on the components of the capital. Therefore, we take the advantage of the first-order condition of the maximization process and use the marginal productivity of capital (derived from a Cobb–Douglas production function) net of corporate taxes.

Table 6 shows the results of the regression for corporate savings. The first column presents the results for the after-tax marginal product of capital, which is divided into two components: (a) the marginal product of capital and (b) the reinvestment tax rate. None of these variables appear to be statistically significant. In the following columns, the corporate savings in t depend on the after corporate tax marginal productivity of capital (ATMPK) in t and $t + 1$, which is consistent with the conceptual framework. As expected, the contemporaneous ATMPK is not statistically significant in any of the specifications, but one period ahead is not statistically significant in the simplest specification either. When we drop the contemporaneous ATMPK, then the ATMPK in $t + 1$ becomes positive and statistically significant, which is consistent with the idea of forward-looking agents.

Columns 2 through 4 show the strength of the result when controlling for other variables. The financial intermediation ratio is positive and statistically significant. This variable captures the deepening of the financial market, ensuring that firms have the option of separating investment decisions from financing and dividend ones. Other variables such as personal income tax and the growth rate of the economy are not statistically significant. Further, the inclusion of these variables does not change the effect of ATMPK on corporate savings.

Table 6. Corporate savings.

Dependent variable: Corporate savings					
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
1961–2012					
Constant		−0.006 (−0.40)	0.021 (1.09)	0.013 (0.21)	0.020 (1.09)
MPK(t)	−0.038 (−0.05)				
Reinvestment tax rate	−0.014 (−0.16)				
MPK(t + 1)	0.470 (0.62)				
Reinvestment tax rate (t + 1)	−0.070 (−0.82)				
MPK net of tax		0.021 (0.04)	−0.074 (−0.16)		
MPK net of tax (t + 1)		0.538 (1.24)	0.428 (1.02)	0.382** (1.78)	0.366** (2.01)
Financial intermediate ratio			0.017** (2.34)	0.018** (2.81)	0.017** (2.36)
Personal income tax				0.008 (0.12)	
Income per capita growth rate				−0.010 (−0.12)	
Corporate savings (t-1)		0.513** (4.14)	0.374** (2.75)	0.369** (2.78)	0.367** (2.86)
R squared		0.684	0.710	0.710	0.710
Breusch–Godfrey Serial Correlation LM Test ^a		0.325	0.241	0.364	0.338
Heteroscedasticity Test: ARCH ^b		0.907	0.584	0.572	0.545
Normality Test: Jarque–Bera ^c		0.506	0.789	0.787	0.782

Notes: Significance levels of 5% (**) and 10% (*). *T*-statistic in parenthesis. a, b and c: *p*-values are reported.

These results are very important in explaining the large increase in the investment rate in Chile financed with corporate savings. The Chilean economy experienced a process of rapid growth since the mid-1980s, which is shown in the large increase in the ATMPK. In addition, in 1986, there was a structural change in the tax scheme that included a reduction in the corporate tax rate along with the end of stockholders being taxed for reinvested profits. That change in the tax system also helps to explain the increase exhibited by the ATMPK. Finally, starting in the late 1970s, there is continuous development of the financial market as reflected in access to loans and in the more active stock market due to a massive privatization of state-owned companies, the implementation of the private pension system and the development of the insurance and long-term capital markets, among many other structural changes that took place at the time.

Household and voluntary savings

The estimation of an equation for household savings is a challenge since this variable is measured as the sum of voluntary plus mandatory savings, while we do not have a direct measurement of the former. Therefore, we calculate the

voluntary savings as a residual by subtracting mandatory savings and corporate savings from the total private savings, which may be considered as a noisy measure. We estimate an equation for total household savings separated from the equation for voluntary savings. Later, we will show the validity of estimating an equation for households as a whole.

In our framework, household savings are a function of corporate savings (to check for corporate veil), fiscal savings (to check for the crowding-out effect of the fiscal policy), taxes and transitory and permanent income. Besides the other two types of savings, we include more traditional determinants such as the growth rate of per capita income (to control transitory savings), real interest rates, dependency rate, inflation (a measure of uncertainty) and unemployment (transitory shocks).

Given that a household may decide whether to save in their own company (retained earnings) or in another instrument, a problem of endogeneity is expected when estimating this equation. We used two-stage least-square method, using those variables included in the estimation of corporate savings as instruments, from the previous section.

Table 7. Household and voluntary savings.

Dependent variable	Households savings (1)–(4)				Voluntary savings (5)–(6)	
1961–2012: (1)–(2) 1977–2012: (3)–(6)	(1) 2SLS	(2) OLS	(3) 2SLS	(4) OLS	(5) 2SLS	(6) OLS
Constant	−0.104 (−0.59)	−0.016 (−0.11)	0.463* (1.77)	0.459 (1.49)	0.588* (1.78)	0.672** (2.06)
Corporate savings	0.293 (1.04)		−0.322 (−1.32)		−0.143 (−0.35)	
Public savings	−0.732** (−5.26)	−0.658** (−5.51)	−0.689** (−4.96)	−0.715** (−4.43)	−0.720** (−4.42)	−0.731** (−4.65)
Personal income tax ($t + 1$)	−0.067 (−0.62)	−0.104 (−1.23)	−0.409** (−2.53)	−0.287** (−2.13)	−0.480** (−2.53)	−0.507** (−2.73)
Income per capita growth	0.266** (2.04)	0.269** (2.47)	0.387** (2.88)	0.323** (2.05)	0.375** (2.46)	0.350** (2.27)
Real interest rate	−0.035 (−0.95)	−0.026 (−0.76)	0.095 (1.22)	0.090 (0.95)	0.134 (1.32)	0.148 (1.51)
Household savings ($t-1$)		0.171 (1.38)				
Dependency young	0.002 (0.80)	0.002 (0.68)	−0.003 (−0.61)	−0.005 (−0.76)	−0.004 (−0.66)	−0.005 (−0.77)
Dependency old	0.005 (0.51)	0.004 (0.51)	−0.009 (−0.82)	−0.015 (−1.05)	−0.017 (−1.02)	−0.022 (−1.54)
Mandatory savings					−1.451** (−2.40)	−1.676** (−4.12)
R squared	0.344	0.522	0.741	0.591	0.659	0.591
BG Serial Correlation LM Test ^a	0.477	0.478	0.221	0.290	0.192	0.384
Heteroscedasticity Test: ARCH ^b	0.144	0.228	0.462	0.426	0.543	0.603
Normality Test: Jarque–Bera ^c	0.566	1.193	0.716	0.625	0.881	0.833

Notes: Significance levels of 5% (**) and 10% (*). T -statistic in parenthesis; a, b and c: p -values are reported.

Table 7 presents the results for household savings. The first column of results in Table 7 shows the general equation estimated using IV. Corporate savings have a coefficient equal to 0.3, although it is not statistically significant at the classical level. When we limited the sample to the post-financial liberalization period (column 3), the coefficient becomes equal to −0.3, but still not statistically significant but closer to the −0.55 found by Bennett, Loayza, and Schmidt-Hebbel (2001) for the 1960–1997 period. The results for voluntary savings are even smaller in absolute value.

Government savings have a coefficient around −0.75, which is statistically different than zero. This is larger (in absolute value) than the −0.4 found by Bennett, Loayza, and Schmidt-Hebbel (2001) but similar (−0.7) to what Vergara (2001) found using quarterly data. There is a substitution effect between household savings and public savings as the theory will predict.

It is important to highlight that the differences with the study by Bennett, Loayza, and Schmidt-Hebbel (2001) are the sample used and the specification of the model. Specifically, we include personal income tax that has a negative and statistically significant effect on household and voluntary savings.

This variable is not included in the previous regressions, although Vergara (2001) includes tax burden over GDP ratio, which is different than the marginal rate. Personal income tax has a negative coefficient and statistically significant for some specifications.

Per capita growth rate (GDP¹¹) is positive as expected. The coefficient on the real interest rate is negative, similar to what Loayza, Schmidt-Hebbel, and Servén (2000) obtained. It is important to consider that the interest rate coefficient is non-statistically significant and very small.

In column 2, we provide OLS estimates, which should be consistent as we exclude corporate savings (which was not significant, provided evidence of corporate veil and was the source of potential endogeneity in column 1). The results are similar to the 2SLS, with some minor changes. The compensation coefficient of public savings is smaller than that in the previous regression. Personal income tax has a negative coefficient but is now statistically different than zero. The interest rate enters with a negative sign with an even lower t -value, remaining non-significant.

The interest rate was regulated during the 1960s and part of the 1970s. Thus, it is difficult to interpret financial transaction as a result of the funding supply

¹¹We tried to estimate transitory income using the cyclical component of the HP filter, but the variable did not show a statistically significant effect.

and demand. In the mid-1970s, there were concrete serious attempts to liberalize it. This could be the explanation for the negative coefficient on the interest rate in the regression. So, the third and the fourth columns of Table 7 show the same regressions as in the previous two columns using a shorter sample: 1977–2012. The results change in some important aspects. The conclusions regarding corporate and government savings are not different than the previous analysis, nor is the growth rate of per capita GDP. However, the magnitude and statistical significance level of the personal income tax and the sign for the interest rate do change. We now obtained a positive sign for the interest rate, although it is not statistically significant.

The dependency rate was not statistically significant. Although it is not the most common result in the literature, there are some studies that have found no effect of dependency rate on household savings (e.g. Bailliu and Reisen 1998; Haque, Hashem Pesaran and Sharma 1999). Instead of just using the dependency rate, we report the results in Table 7, using youth dependency ratio and old dependency ratio. In all reported regressions, the coefficients of these variables were not statistically significant.

One could argue that household savings are hidden under the effect of voluntary savings since it is the sum of voluntary and mandatory savings. The last two columns of Table 7 show the same regressions this time using voluntary savings as a dependent variable and mandatory savings as control for the period 1977–2012. The results are almost the same as in the previous two columns. The only important difference is the positive coefficient for the interest rate, which is not statistically significant.

The point estimate of the mandatory saving coefficient is -1.4 , showing larger compensation from voluntary savings facing an increase in the mandatory savings (Bennett et al. found a coefficient lower than -1 in absolute value but using a shorter time period). The latter type of savings is tax deductible, which may be causing such a large compensation coefficient; in other words, people obtain an extra reward (a tax shield) for saving in a retirement account. Moreover, people with saving capacity are high-income workers who pay taxes and can take advantage of

this type of savings. In any case, the hypothesis that the coefficient of mandatory savings is equal to -1 cannot be rejected; this means that it is valid to estimate an equation for household savings.

In summary, as expected, government saving and personal income tax negatively affect household savings, and transitory income positively affects household savings. Corporate savings negatively affect household savings, but the coefficient is not statistically significant when properly estimate using IV. The interest rate enters with a positive coefficient in the equation when we use a period that excludes interest rate controls.

Total private savings

Starting from what we have learned in the previous sections, we can model private savings. This variable is a function of (i) public savings which capture the eventual crowding out between public and private saving, (ii) the marginal productivity of capital net of corporate taxes to measure the real return relevant to corporate savings and (iii) personal income tax. In addition, other important variables are (iv) the growth rate, which is a proxy for transitory income that may affect household savings; (v) the dependency rate (ratio of the number of people younger than 15 and older than 64 to the working-age population); and (vi) unemployment and the inflation rate that attempt to capture uncertainty and a possible precautionary saving effect.

Table 8 presents the results. As expected, the estimates are consistent with the previous sections. The table contains four columns; the first one includes all the regressors mentioned above. As expected, public savings have a negative effect on private savings with a short-run coefficient equal to -0.46 and a coefficient of up to -0.68 in the long run. An increase in public savings is partially compensated by a reduction in private savings. This is comparable to Vergara (2001) who studies private savings determinants as a whole, finding a compensation coefficient equal to -0.7 .

The coefficient on the future after corporate tax marginal productivity of capital (ATMPK) is positive (as far as the authors know this variable was not included in previous studies of savings in Chile). An increase in the future ATMPK raises the desired capital stock and therefore increases

Table 8. Private savings.

Dependent variable: Private savings				
1961–2012	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Constant	−0.169 (−1.36)	−0.125* (−1.86)	−0.010* (−1.77)	0.003 (0.18)
Public savings	−0.463** (−5.28)	−0.462** (−5.32)	−0.456** (−5.31)	−0.448** (−5.08)
Marginal productivity of capital net of tax ($t + 1$)	0.910** (3.65)	0.915** (3.71)	0.900** (3.69)	0.537** (2.93)
Personal income tax	0.072 (1.14)	0.078 (1.26)	0.088 (1.46)	
Income per capita growth rate	0.167* (1.86)	0.185** (2.35)	0.183** (2.34)	0.144* (1.84)
Dependency rate	0.088 (0.69)	0.040 (0.69)		
Unemployment	−0.124 (−0.43)			
Inflation/(1+ inflation)	0.050* (1.71)	0.051* (1.76)	0.047 (1.66)	
Financial intermediate ratio	0.037** (2.21)	0.032** (2.74)	0.027** (3.04)	0.014** (2.15)
Private savings ($t-1$)	0.324** (2.67)	0.307** (2.71)	0.332** (3.13)	0.451** (5.08)
R squared	0.889	0.888	0.887	0.875
Breusch–Godfrey Serial Correlation LM Test ^a	0.916	0.902	0.869	0.814
Heteroscedasticity Test: ARCH ^b	0.523	0.537	0.452	0.345
Normality Test: Jarque–Bera ^c	0.537	0.518	0.449	0.100

Notes: Significance levels of 5% (**) and 10% (*). T -statistic in parenthesis. a, b and c: p -values are reported.

investment today. An important part of investment in Chile has been funded with retained earnings due to tax incentives since 1984. It is important to notice that an increase in corporate taxes will reduce investment through its effect on corporate savings. Consistent with the previous section, the growth rate of per capita income positively affects private savings through increasing voluntary savings. The financial intermediation ratio as a proxy of financial market development has a positive effect on the large increase in the saving rates starting in 1987 since it coincides with the rapid development of the financial market.

Personal income tax, dependency, unemployment and inflation rates are not statistically significant (these results are similar to those in Bennett, Loayza, and Schmidt-Hebbel 2001). In particular, it seems that an increase in personal income tax generates a substitution effect, shifting the composition of private savings from household savings to corporate savings; in other words, it has a composition effect but not a level 1 on private savings (at least not significantly different from zero). The second column eliminates unemployment, and the third eliminates dependency rate. The last column eliminates

inflation and personal income tax. Through all these columns, the marginal effect of the statistically significant variables does not change.

Micro evidence on corporate savings

Corporate savings deserve further attention, as they experienced a permanent increase in the mid-1980s from 9% to 17% of the national income. Using aggregate time-series data, we found evidence that taxes, marginal productivity of capital and financial deepening are the main drivers of this type of savings. In this section, we make an effort to validate those results using data at the firm level. To do so, we obtain data from publicly traded private firms from the database Economatica. The data on dividends – which are important in constructing savings – are available from 1997 on. Thus, the firm data set covers the period from 1997 to 2013. Similar to the definition of corporate savings in the subsection on Corporate savings, we construct corporate savings by adding up after-tax corporate profits and depreciation and subtracting paid dividends. Then, we scale corporate savings per firm's net income, which is calculated by taking revenues and adjusting for business costs, depreciation, interest expenses, taxes and other

expenses. In sum, our measure of corporate savings rates will vary across firm and year:

where sub-indexes i and t denote firm and year. Corporate tax rate, τ_{it} , is measured by dividing the effective corporate tax payments by pre-tax profits. We exclude cases in which firms had negative corporate tax rate (this is the case when they have negative profits). We measure the effective interest rate faced by firms, r_{it} , by dividing total financial expenses by non-short-term debt. In addition, we construct four different measures of the marginal product of capital, MPK_{it} . The first measure is similar to Tobin's q ; it corresponds to the market value of the firm's equity divided by its book value. The second measure is the firm's EBITDA divided by the book value of assets. The third measure is the EBITDA divided by non-short-term debt; while the fourth is the EBITDA divided by the book value of machinery, equipment and buildings. We drop 5% of outliers in terms of effective interest rate and the effective corporate tax rate. We end up with a data set of 215 firms and 18 years.

In our empirical approach, we estimate the following equation:

$$\frac{S_{it}}{Y_{it}} = \beta_0 + \beta_1 \tau_{it} + \beta_2 i_{it} + \beta_3 MPK_{it} + \mu_{it} + \gamma_t$$

where μ_{it} is a fixed effect and γ_t is a time effect. Table 9 presents the estimates using the fixed-effect method, while Table 10 presents GMM

(Arellano-Bond 1991) estimates since it allows for dynamics by including a lag of the dependent variable. In both tables, column (1) includes the effective tax rate, while columns (2) to (5) also include the effective interest rate and the marginal product of capital. Columns (2) to (5) differ in the measure of the marginal product of capital used. In all the columns, we include time dummies for each year in the sample.

The results in Table 9 are consistent with our previous results using macro data. The coefficient on the tax rate is statistically significant, and its coefficient ranges between -0.09 and -0.14 . The coefficient on the interest rate is negative but not statistically significant. Allowing for some dynamics, the coefficient of the lagged dependent variable is very small but always statistically significant. The coefficient of the effective tax rate is smaller but statistically different from zero. The coefficient of the interest rate is always negative and statistically significant ranging between -0.02 and -0.08 in the long run. Finally, the coefficient on the marginal product of capital is positive and statistically significant for all measures.

In summary, our microeconomic evidence is in line with the macroeconomic evidence. The tax rate is a key determinant of the corporate savings rate. This is an important warning to economies that have recently changed their tax codes, and the tax system will have an important effect on corporate savings.

Table 9. Corporate savings, fixed-effect method.

	(1)	(2)	(3)	(4)	(5)
Effective tax rate (τ_{it})	-0.135*** (-3.42)	-0.093** (-2.03)	-0.123*** (-3.21)	-0.136*** (-3.46)	-0.140*** (-3.74)
Effective paid interest rate (r_{it})		-0.110 (-1.02)	-0.134* (-1.66)	-0.037 (-0.46)	-0.009 (-0.11)
MPK_{it} , Measure (1)		-0.001 (-0.43)			
MPK_{it} , Measure (2)			0.328*** (10.97)		
MPK_{it} , Measure (3)				0.000** (2.29)	
MPK_{it} , Measure (4)					0.000*** (3.08)
Observations	2446	1622	2446	2444	2413
R-squared	0.025	0.028	0.075	0.027	0.028
Number of firms	215	169	215	215	212

Notes: Significance levels of 5% (**) and 10% (*). T -statistic in parenthesis; Significance level of 1% (***).

Table 10. Corporate savings, Arellano–Bond method.

	(1)	(2)	(3)	(4)	(5)
Lagged $\frac{S_{it}}{Y_{it}}$	0.019*** (23.86)	−0.034*** (−25.28)	−0.009*** (−8.58)	0.045*** (53.26)	0.047*** (44.94)
τ_{it}	−0.185*** (−94.63)	−0.136*** (−45.82)	−0.185*** (−71.45)	−0.182*** (−80.34)	−0.210*** (−75.55)
i_{it}		−0.055*** (−10.42)	−0.083*** (−14.1)	−0.023*** (−4.24)	0.045*** (9.40)
MPK _{it} , Measure (1)		0.013*** (20.16)			
MPK _{it} , Measure (2)			0.645*** (222.46)		
MPK _{it} , Measure (3)				0.000*** (712.66)	
MPK _{it} , Measure (4)					−0.000*** (−43.11)
Observations	1696	1059	1696	1695	1678
Number of ncode	190	140	190	190	188
Sargan Test	151.1	116.8	159.6	150.5	150.2
Autocorrelation (2)	0.891	−0.218	1.418	0.995	1.558

Notes: Significance levels of 5% (**) and 10% (*). *T*-statistic in parenthesis; Significance level of 1% (***).

VI. Policy implications

In the last 30 years, Chile's growth rate increased considerably. Between 1961 and 1984, the economy's average growth rate was 2.9% per year, increasing to 5.3% between 1985 and 2013. An important part of the increase in growth rate is explained by a larger investment rate, which increased from 15.6% of GDP to 22.3% of GDP in the same period.¹² Chile raised its savings rate substantially – by almost 12 percentage points – mainly through corporate savings (8 percentage points), while the public sector increased its savings by nearly 1% of disposable income. How could Chile sustain such a large increase in saving rate?

In this section, we quantify the contribution of each savings determinant in the extensive change in private savings after 1985 and the change in the composition of savings. We divide the sample into two with 1985 being a breakpoint. We begin by focusing on corporate savings. Using the long-run coefficients of the third column of Table 7 and the mean values of the explanatory variables in each period, we calculate the contribution of each

determinant to the increase in corporate savings. Table 11 shows these calculations. The FIR as a percentage of GDP rose from 20% to 169%, increasing corporate savings by 4 percentage points. On the other hand, the increase of 6 percentage points in the marginal productivity of capital net of tax ($t + 1$) meant an expansion of 3.4 percentage points in corporate savings. This upsurge of the marginal productivity net of tax is explained by an increase of the MPK from 15% to 18% and a drop in corporate tax from 35.8% to 15.2%. In sum, our model predicts an increase in corporate savings of 7.41 percentage points post 1985, slightly lower than the actual change of 7.88 percentage points.

Table 12 shows a similar exercise for household savings. Public savings show a long-run coefficient of −0.80, which reflects the existence of the Ricardian Equivalence effect, however without a complete compensation effect. This means that the increase in public savings from 4.64% to 5.56% of GNDI was offset by a decrease in household savings by almost 0.74 percentage points. The average increase in the growth rate of per capita income

Table 11. Contributions to corporate saving average change between 1960–1984 and 1985–2012.

Contribution to corporate savings of each determinant	Mean value for each period		Long-run coefficient ^a	Contribution to corporate savings (%GNDI)
	1960–1984	1985–2012		
Financial intermediate ratio (%GDP)	19.67%	169.32%	0.027	4.02
MPK net of tax ($t + 1$)	9.76%	15.62%	0.578	3.39
Corporate savings predicted change				7.41
Corporate savings actual change	9.04%	16.92%		7.88

^aCalculated as the current coefficient divided by one minus the coefficient estimated for the lag of corporate saving.

¹²We used nominal GDP and nominal investment. If we use real GDP and real investment, those figures are 12.5% and 17.9%.

Table 12. Contribution to household saving average change between 1960–1984 and 1985–2012.

Contribution to household savings of each determinant	Mean value for each period		Long-run coefficient ^a	Contribution to household savings (%GNDI)
	1960–1984	1985–2012		
Public savings (% of GNDI)	4.64%	5.56%	−0.798	−0.74
Income per capita growth rate	0.98%	4.05%	0.336	1.03
Personal income tax (t + 1)	65.90%	45.50%	−0.094	1.92
Real interest rate	−8.92%	2.39%	−0.041	−0.46
Households savings predicted change				1.76
Households savings actual change	−2.23%	−0.22%		2.01

^aCalculated as one minus the coefficient estimated for the lag of corporate saving.

from 0.98% to 4% meant an increase in household savings by 1% of GNDI because the long-run coefficient (0.34) is much smaller than 1. According to the theory of permanent income, only a small fraction of increase in the average income was considered permanent by households. The largest contribution to the increase in household savings comes from the reduction of personal income tax from 65.9% to 45.5%, which induced an increase in household savings of 1.92% of GNDI. Finally, the real interest rate contributed −0.46% to the increase of household saving between both periods, where its negative value for the first period was due to a long period of financial repression and the hyperinflation process occurring in the 1970s.

Table 13 summarizes the results for private savings. Adding up, the models predict that private savings should have increased by 9.2 percentage points, while it increased by 9.9 percentage points. The main drivers are the FIR, the after-tax marginal

Table 13. Contribution to private savings, average change between 1960–1984 and 1985–2012.

Contribution to private saving (% of GNDI)	Predicted (%)	Actual (%)
Corporate savings	7.41	7.88
Households savings	1.76	2.01
Total change	9.17	9.89

productivity of capital, the income per capita growth rate and the personal income tax. The improvement in the fiscal budget had a negative but economically small effect on private savings.

Table 14 exhibits the contribution of each determinant to the average change of public savings between similar periods used for private savings. The change on public savings was approximately 1 percentage point between 1960–1984 and 1985–2012, increasing from 4.63% to 5.58%. Public savings have two determinants that may predict an important decrease in public savings in the second period: (i) the old-age

Table 14. Contribution to public savings, average change between 1960–1984 and 1985–2012.

Contribution to public savings of each determinant	Mean value for each period		Long-run coefficient	Contribution to change in public savings (%GNDI)
	1960–1984	1985–2012		
Real GDP deviation over HP trend (%)	0.55%	−0.63%	0.346	−0.41
Real copper price deviation over HP trend (%)	−3.19%	−0.03%	0.053	0.17
Log (HP trend of real copper price)	18.02	18.38	0.094	3.32
Internal Rate of Return (IRR) 90–180 days (percent points)	−0.01	7.26	0.001	0.51
Older adults/population (percentage points)	5.24	7.29	−0.039	−7.94
Rural population/population (percentage points)	23.60	14.31	0.004	−4.15
Presidential period 1971–1973	0.12	0.00	−0.102	1.22
Presidential period 1990–1993	0.00	0.14	0.037	0.53
Presidential period 1994–1999	0.00	0.21	0.074	1.59
Presidential period 2000–2005	0.00	0.21	0.095	2.05
Presidential period 2006–2009	0.00	0.14	0.137	1.95
Presidential period 2010–2012	0.00	0.11	0.154	1.65
Balance budget fiscal rule	0.00	0.06	0.022	0.13
Public savings, predicted				0.62
Public savings, actual	4.63%	5.58%		0.95

dependency and (2) the decrease in rural population. Both effects induce larger fiscal expenditure implying an expected reduction of public savings in around 11 percentage points. These effects are offset mainly by (1) copper rainfall (the long run/permanent component) during the 2000s and (2) an attitude towards savings from the government since the midst of our sample, captured by the dummy variables for presidential periods. The fiscal rule is also an important explanatory variable, but because the rule has been in place since 2001, it has little effect on the average fiscal savings of 1985–2012. We might hypothesize that the attitude towards fiscal savings since the mid of the eighties resulted in the implementation of the fiscal rule at the beginning of the 2000s. In summary, the model predicts an increase in 0.62 percentage points, which is compared with the actual increase of 0.95 percentage points.

Are these results different than those found using international evidence? Two recent studies provide important international evidence on savings. Grigoli, Herman, and Schmidt-Hebbel (2018) made a complete revision of empirical papers on savings, and they provide their own evidence using a panel data of countries from 1981 to 2012. They document a reduction in the private saving rates around the world but with an increase in the participation of corporate savings and a decline in household savings. What makes the case of Chile interesting is that this economy increased the saving rates, with a larger share of corporate savings. Also, for Chile, this process looks more like a regime change that took place around the mid-1980s, while for the rest of the world, these changes were smooth over time.

Grigoli, Herman, and Schmidt-Hebbel (2018) do not consider the tax system in the analysis, probably because the data set to conduct that analysis is hard to build. Variables like dependency rate or youth dependency rate tend to be statistically significant, while in our results they are not, which could be due to the fact that this variable exhibits larger variation across countries than over time for a particular country.¹³ They found partial substitution between public savings and private saving, which is what we found for the case of Chile.

Chen, Karabarbounis, and Neiman (2017) also focus on the large increase in the share of corporate savings and the decline in household savings around the world. They argue that the main mechanism to explain this change is based on the fact that labour share has declined over time, while profit share has increased. There is certainly a drop in the cost of capital for the firms, which has increased profit in a context where the production function exhibits an elasticity of substitution greater than 1. They claim that profit increase is the major reason for this change of composition in savings since taxes or dividend payments do not seem to play a role. Again, the study of a country case, like in our article, allows us to pick more specific effects of changes not only in tax rate but also in the tax system, which affects the cost of capital of the firms. In addition, we found that the marginal productivity of capital is a key variable in explaining the observed increase in corporate savings during the 1986–2012 period.

Considering only the case of Chile, what can we learn that is not present in the international literature? The tax scheme, which includes the rate as well as instruments to increase savings (e.g. taxing only distributed profit in a fully integrated system), seems to be an important mechanism to boost savings (Tables 11 and 13). Also, the reduction in the marginal tax rates contributed to the increment of voluntary household savings rates (Table 12).

Increase in public savings is partially offset by a decline in private savings. In line with the literature, the coefficient is less than -1 in absolute value, so any effort to improve fiscal savings will have a positive effect on national savings. In this case, the dependency rate and the reduction of the rural population are the most important variables that negatively affect public savings. On the other hand, the political will of fiscal discipline since the 1980s has played a major role in augmenting the public savings rate.

The change in the pension system also had an impact on national savings. Corbo and Schmidt-Hebbel (1991) and Fuentes (2013) argue that the net increase in total savings is around 2.5 percentage points. Our estimation results show a very high substitution coefficient between mandatory

¹³In fact, for developed economies, they found no statistically significant effect of dependency ratio on savings.

savings and voluntary savings, above of what studies with microdata have found (e.g. Attanasio and Rohwedder 2003). The coefficient will depend on the specific features of the pension reform considered. The Chilean case was the most radical reform, which includes some unique characteristics that make comparison very difficult.

One aspect of the Chilean pension reform, according to Fuentes (2013), is the large impact of the new system in the development of the domestic financial market. Private savings exhibit a large sensitivity to the financial intermediation ratio (Table 11), which was affected by the fully funded pension system started in 1981. Therefore, measures that enlarge the financial intermediation ratio may have important effects on private savings.

VII. Concluding remarks

This article aims to explain two important facts of the Chilean economy. First is how Chile substantially raised its savings rate – by almost 11 percentage points – in the period 1987–2012 compared to 1960–1986. The public sector increased its savings by nearly 1% of disposable income while the private sector raised it 10% of disposable income. The second is that the large increase in private savings is mainly explained by corporate savings that seem to substitute household savings.

The most important message that results from studying the Chilean experience is that significant changes in savings rates can be achieved through the implementation of public policies. First and by far the most important variable was the development of the financial market, accounting for nearly 4 percentage points of the savings increase as a fraction of GNDI. Fuentes (2013) argued that an important public policy that promoted the development of the financial system was the pension fund reform established in 1981. Additionally, other public policies designed to improve the economy's productivity jointly with the 1984 tax reform also affected total savings, as the increase in the after-tax marginal productivity of capital boosted corporate savings by 3.4 percentage points of GNDI. The tax reform implemented in 1984 lowered the corporate tax rate but also included other changes in the tax code such

as (i) implementing a full imputation system, (ii) eliminating double taxation and (iii) allowing taxation at personal level and not on an accrual basis when withdrawal of profits occurred. In this line, and as a third element, the reduction in personal income taxes seemed to increase household savings by 1.92 percentage points of GNDI. Finally, the increment in public savings is partially offset for a reduction of private savings. Specifically, the substitution coefficient is around 0.7, which provides an argument in favour of fiscal discipline.

Besides public policy, another determinant is that only a fraction of the increase in the average per capita income growth rate seems to be considered by households as permanent, because only a small part of the higher income was assigned to consumption (one third) and the remaining income (two thirds) would have increased household savings in 1 percentage points of GNDI. Finally, better public-sector institutions are yet another source of savings. In Chile's case, the implementation of the structural balance rule was a source of 0.7 percentage points of GNDI.¹⁴

Acknowledgement

We would like to thank Orazio Attanasio, Eduardo Cavallo, Peter Montiel, Klaus Schmidt-Hebbel, Jose Tessada, Rodrigo Wagner and the participants of the LACEA, SECHI and IEA annual meetings for their thoughtful comments to an earlier version of the paper. This paper was written as a part of the Research Network Project "Understanding Domestic Savings in Latin America and the Caribbean" financed by the Inter-American Development Bank.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Inter-American Development Bank.

References

- Agenor, P., and J. Aizenman. 2004. "Savings and the Terms of Trade under Borrowing Constraints." *Journal of International Economics* 63 (2): 321–340.

¹⁴Net of the negative effect on corporate savings.

- Agosin, M. R. 2001. "What Accounts for the Chilean Saving 'miracle'?" *Cambridge Journal of Economics* 25 (4): 503–516.
- Agosin, M. R., G. Crespi, and L. Letelier. 1998. "Explaining the Increase in Saving in Chile." <https://ssrn.com/abstract=59708> or doi: 10.2139/ssrn.59708.
- Arellano, M., and S. Bond. 1991. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *The Review of Economic Studies* 58 (2): 277–297.
- Attanasio, O., and A. Brugiavini. 2003. "Social Security and Households' Saving." *The Quarterly Journal of Economics* 118 (3): 1075–1119.
- Attanasio, O., and S. Rohwedder. 2003. "Pension Wealth and Household Saving: Evidence from Pension Reforms in the United Kingdom." *American Economic Review* 93 (5): 1499–1521.
- Bailliu, J., and H. Reisen. 1998. "Do Funded Pensions Contribute to Higher Savings? A Cross-Country Analysis." *Review of World Economics* 134 (4): 692–711.
- Bebczuk, R., and E. Cavallo. 2014. "Is Business Saving Really None of Our Business?" *Inter-American Development Bank Working Paper* IDB-WP-523.
- Bennett, H., N. Loayza, and K. Schmidt-Hebbel. 2001. "'un Estudio Del Ahorro Agregado Por Agentes Económicos En Chile" [Analysis of the Aggregate Savings by Economic Agents in Chile]." In *Análisis Empírico Del Ahorro En Chile [empirical Analysis of Saving in Chile]*, edited by, F. Morandé and R. Vergara, vol. 1, 49–81. Santiago, Chile: Central Bank of Chile. Central Banking Series, Economic Analysis and Policies.
- Bennett, H., K. Schmidt-Hebbel, and C. Soto. 1999. "Serie De Ahorro E Ingreso Por Agente Económico En Chile 1960–1997 [Series of Savings and Income by Economic Agent in Chile 1960–1997]." Discussion Paper No 53, Central Bank of Chile.
- Butelmann, A., and F. Gallego. 2001. "'estimaciones De Los Determinantes Del Ahorro Voluntario De Los Hogares En Chile" [Determinants of the Voluntary Savings of Chilean Households]." In *Análisis Empírico Del Ahorro En Chile [empirical Analysis of Saving in Chile]*, edited by, F. Morandé and R. Vergara, vol. 1, 141–190. Santiago, Chile: Central Bank of Chile. Central Banking Series, Economic Analysis and Policies.
- Cerda, R., and F. Larraín. 2005. "'inversión Privada E Impuestos Corporativos. Evidencia Para Chile" [Private Investment and Corporate Savings: Evidence for Chile]." *Latin American Journal of Economics – Ex Cuadernos De Economía* 42 (126): 257–281.
- Cerda, R., and F. Larraín. 2010. "Corporate Taxes and the Demand for Labor and Capital in Developing Countries." *Small Business Economics* 34 (2): 187–201.
- Cerda, R., J. Correa, F. Parro, and J. Peñafiel. 2014. "'el Fondo De Utilidades Tributables (FUT): Elementos Para La Discusión," [The Taxable Profit Fund (FUT): Elements for the Analysis]." *Centro De Estudios Públicos* 135: 39–87.
- Cerda, R., and J. I. Llodrá. 2017. "Impuestos Corporativos Y Capital: Veintiséis Años De Evidencia En Empresas." [Corporate and Capital Taxes: Twenty Six Years of Evidence for Firms]." *Economía Chilena [The Chilean Economy]* 20 (1): 50–71. Central Bank of Chile.
- Chen, P., L. Karabarbounis, and B. Neiman (2017). *The Global Rise of Corporate Saving*. National Bureau of Economic Research Working Paper 23133.
- Corbo, V., and K. Schmidt-Hebbel. 1991. "Public Policies in Developing Countries." *Journal of Development Economics* 36 (1): 89–115.
- Corbo, V., and K. Schmidt-Hebbel. 2003. "Efectos Macroeconómicos de la Reforma de Pensiones en Chile." In *FIAP: Pension Reforms: Results and Challenges*. Santiago Chile: CIEDESS.
- Dayal-Gulati, A., and C. Thimann. 1997. "Saving in Southeast Asia and Latin America Compared: Searching for Policy Lessons." *IMF Working Paper* 97/110, Washington: International Monetary Fund.
- De Serres, A., and F. Pelgrin. 2003. "The Decline in Private Saving Rates in the 1990s in OECD Countries: How Much Can Be Explained by Non-Wealth Determinants?" *OECD Economic Studies* 36 (4): 117–153.
- Edwards, S. 1996. "Why Are Latin America's Savings Rates So Low? An International Comparative Analysis." *Journal of Development Economics* 51 (1): 5–44.
- Fuentes, R. 2011. "Learning How to Manage Natural Resource Revenue: The Experience of Copper in Chile." In *Plundered Nations? Successes and Failures in Natural Resource Extraction*, edited by P. Collier and A. Venables, 79–113. U. K. Palgrave Macmillan.
- Fuentes, R. 2013. "The Private Pension System's Contribution to Latin America Economic Development: Evidence for Chile." A study carries out by SURA Asset Management https://www.sura-am.com/sites/default/files/documentos/1/2017_11_27/the_private_pension_systems_contribution_to_latino_american_economic_development.pdf
- Gallego, F., F. Morandé, and R. Soto. 2001. "Ahorro y Consumo de Bienes Durables en el Ciclo Económico: ¿Consumismo, Frugalidad, Racionalidad?" In *Análisis Empírico Del Ahorro En Chile [empirical Analysis of Saving in Chile]*, edited by, F. Morandé and R. Vergara, vol. 1, 105–139 Central Bank of Chile. Central Banking Series, Economic Analysis and Policies.
- Grigoli, F., A. Herman, and K. Schmidt-Hebbel. 2018. "Saving in the World." *World Development* 104 (April): 250–270.
- Gutiérrez, M. 2007. "Savings in Latin America after the Mid-1990s. Determinants, Constraints, and Policies." In *CEPAL Serie Macroeconomía del Desarrollo* N° 57, Economic Development Division, CEPAL.
- Hachette, D. 1998. "Ahorro Privado En Chile" [Private Savings in Chile]." *Cuadernos de Economía* 35 (104): 3–47.
- Haque, N. U., M. Hashem Pesaran, and S. Sharma, 1999, "Neglected Heterogeneity and Dynamics in Cross-Country

- Savings Regressions.” IMF Working Paper 99/128, Washington: International Monetary Fund.
- Horioka, C. Y., and A. Terada-Hagiwara. 2012. “The Determinants and Long-Term Projections of Saving Rates in Developing Asia.” *Japan and the World Economy* 24: 128–137.
- Loayza, N., K. Schmidt-Hebbel, and L. Servén. 2000. “What Drives Private Saving across the World?” *The Review of Economics and Statistics* 82 (2): 165–181.
- Masson, P., T. Bayoumi, and H. Samiei. 1998. “International Evidence on the Determinants of the Private Savings.”
- Ministerio de Economía. 2010/2012. “First and Second Longitudinal Firm Survey.” <http://www.economia.gob.cl/category/estudios-encuestas/encuestas-y-bases-de-datos/encuesta-longitudinal-de-empresas-ele>
- Morandé, F. 1998. “Savings in Chile: What Went Right?” *Journal of Development Economics* 57 (1): 201–228.
- Perron, P. 1989. “The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis.” *Econometrica* 57 (6): 1361–1401.
- Schmidt-Hebbel, K., and L. Servén. 2000. “Does Income Inequality Raise Aggregate Saving?” *Journal of Development Economics* 61 (2): 417–446.
- Vergara, R. 2001. “Determinantes Del Ahorro Privado En Chile.” In *Análisis Empírico Del Ahorro En Chile [Empirical Analysis of Saving in Chile]*, edited by, F. Morandé and R. Vergara, vol. 1, 83–103. Santiago, Chile: Central Bank of Chile. Central Banking Series, Economic Analysis and Policies.
- Vergara, R. 2010. “Taxation and Private Investment. Evidence for Chile.” *Applied Economics* 42 (6): 717–725.