

Understanding Domestic Savings in Chile

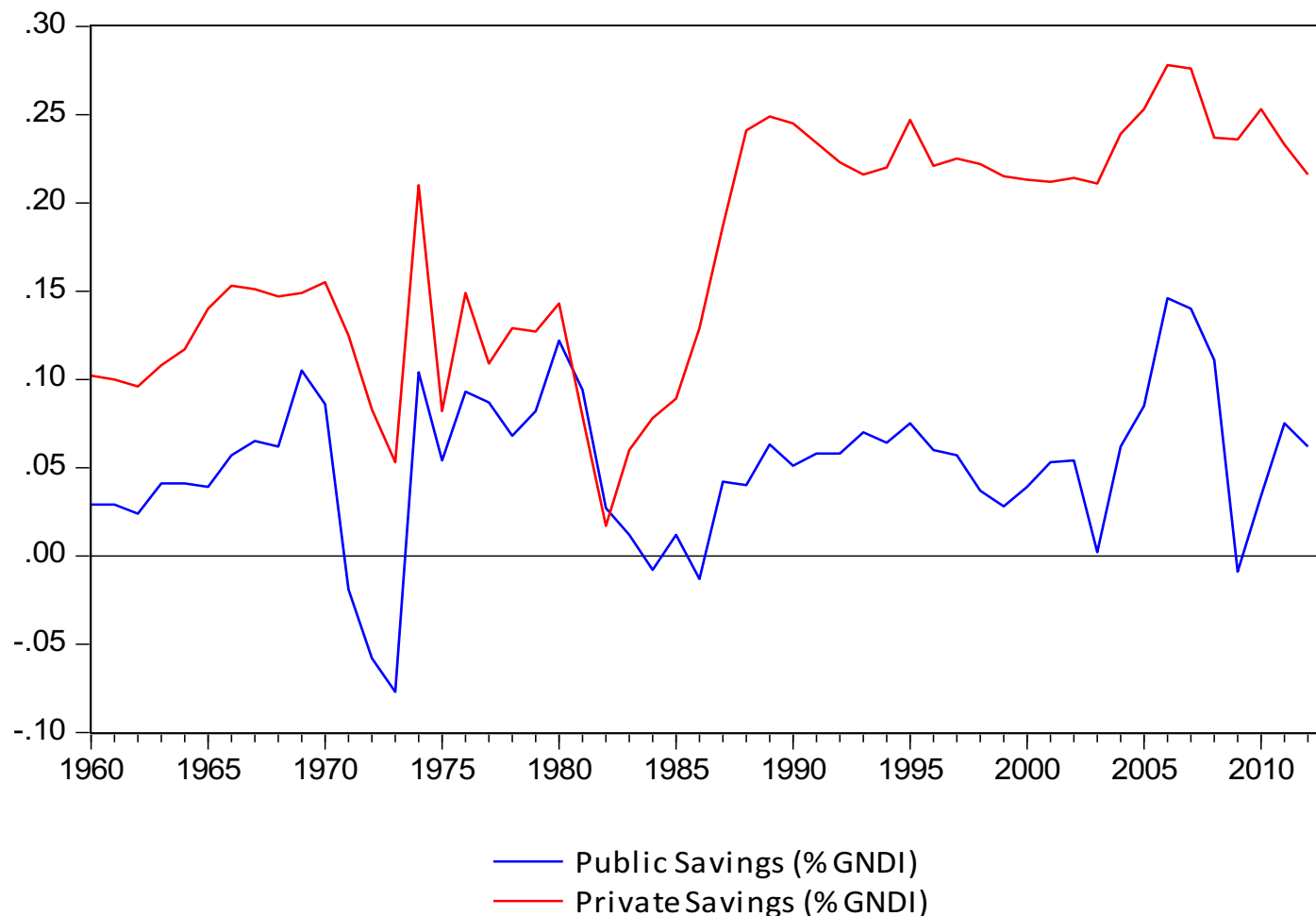
Rodrigo Cerda, Rodrigo Fuentes
Gonzalo García, José Ignacio Llodrá

IEA, Mexico

June 2017

Motivation: Savings Rate Increased

- Large increase in the saving rate in Chile during the 80's.
- Due to large and sustained increase in private savings.
- Fiscal rule after 2001



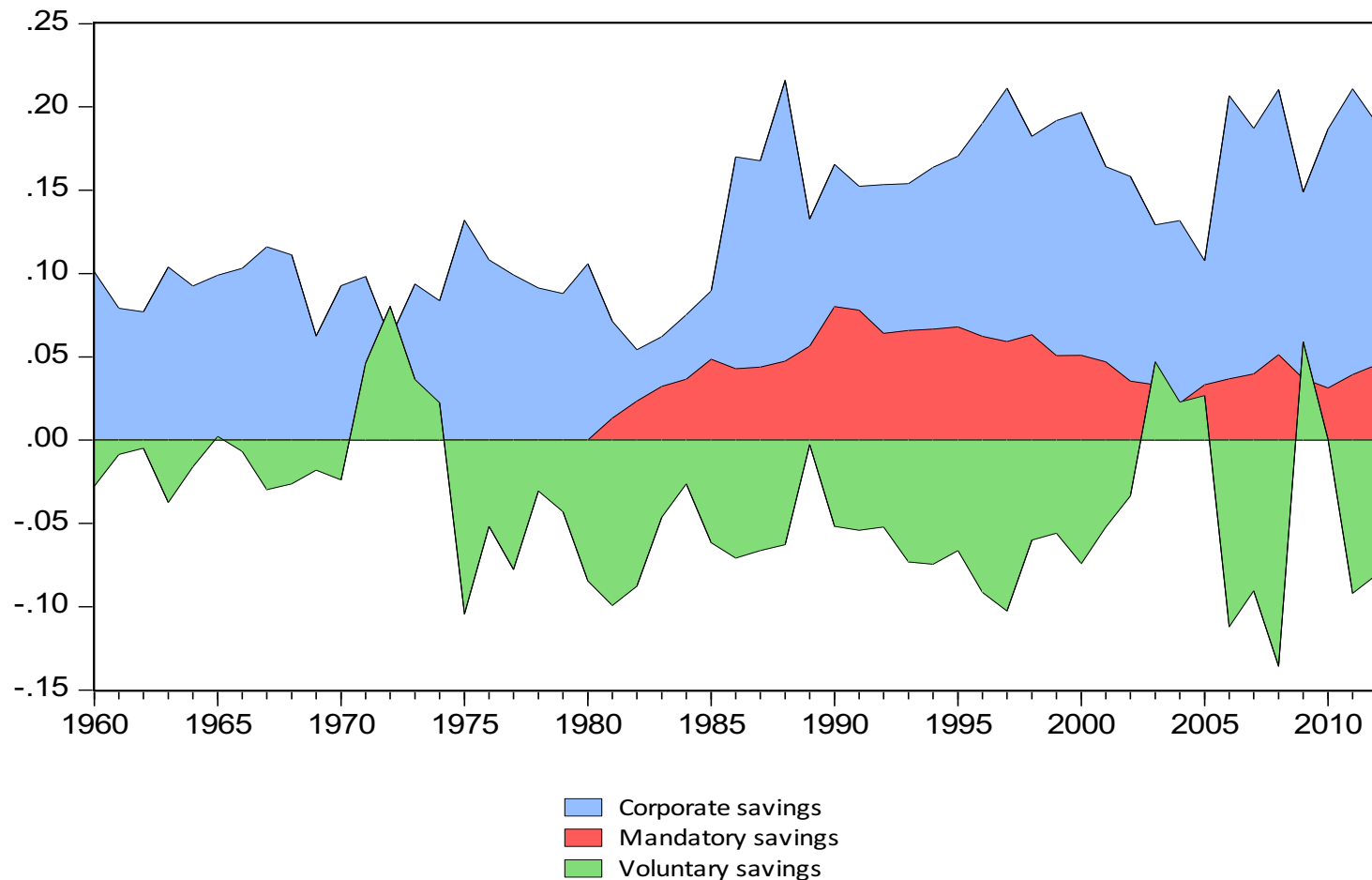
Motivation: Savings Rate Increased

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

Motivation: Composition of Savings

- Increasing mandatory savings after pension reform in 1981
- Large increase in corporate savings from levels less than 5% during the 70s to more than 10% since the mid-80's



Purpose of the paper

- To construct aggregate data on saving for Chile by type of agent: public sector, firms and households.
- To explore alternative hypotheses that may explain the raise of the level of the saving rate in Chile.
- To analyze the changes in the composition of private saving

Public Savings

- No major differences between Bennett et al. (1999) and the actual methodology of the Central Bank.
- Public savings is estimated as the sum of the savings from:
 - General Government: includes the central government plus military forces and the local government units (municipalities).
 - Public firms: includes Codelco, Banco Estado, ENAP, and others. There are 33 public firms.
 - Central Bank of Chile

Corporate Savings

- Corporate savings is defined as:

$$\text{Corporate Savings} = \text{After tax corporate profits} - \text{Distributed dividends} + \text{Private firms depreciation} - \text{Foreign firms profits}$$

- After tax corporate profits and Distributed dividends: data for SAA is obtained from FECUs sent to SVS and from Economatica database. The remaining firms from taxes data published by DIPRES and SII.
- Private firms depreciation: is estimated as the total depreciation less housing depreciation obtained from Henriquez (2008) and deducting the depreciation of government owned firms obtained from DIPRES.
- Foreign firm profits: are estimated using the data on reinvested profits, from the capital account (on the liabilities flows), published by the Central Bank.

Mandatory Savings

$$\begin{aligned} \text{Mandatory Savings} &= \text{Payment of Mandatory Contributions} \\ &+ (\text{Other Increases} - \text{Other Decreases}) \\ &- \text{Management Fee} \\ &- \text{Total Benefits Paid} \\ &+ \text{Assets Return} \end{aligned}$$

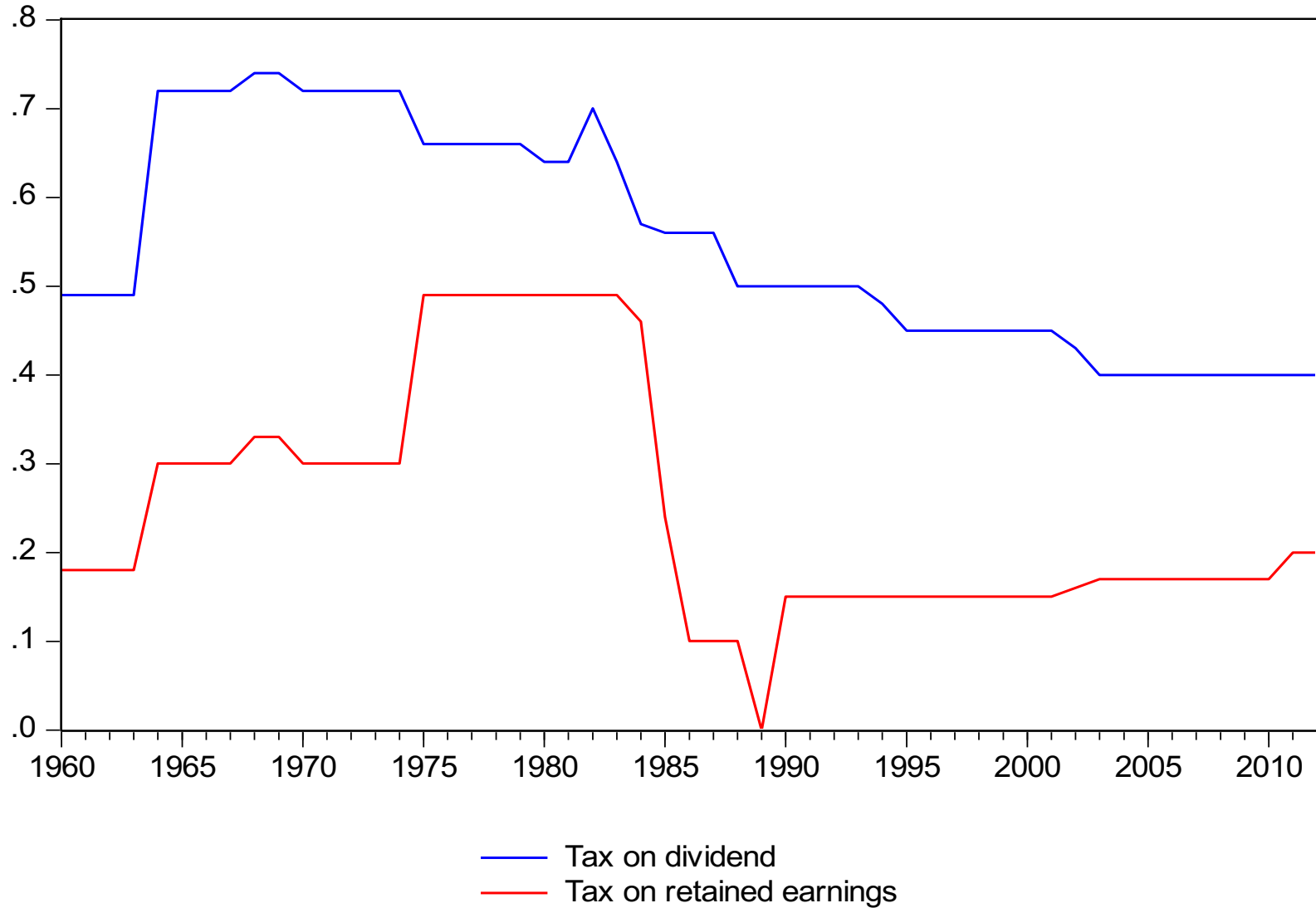
- *Payment of Mandatory Contributions*: obligatory contribution made by the households to the individual pension fund as a fixed share of its labor income.
- *Other Increases* includes Compensation Saving Accounts (CSA) and Additional Contributions.
- *Other Decreases* includes withdrawal from the CSA and other obligatory decreases informed by the Superintendence.
- *Management Fee* is the fee paid to the AFP.
- *Total Benefit Paid* is the payment received by the retired people from the individual pension fund. There are two possible retirement arrangement: Programmed Withdrawal agreed with the AFP and Life Annuity contracted with an insurance company.
- *Return on asset* includes the dividends and interests gained by the assets that compound the pension fund but excluding the capital gains from changes in asset prices. It is estimated as residual using the IPSA yield as proxy for capital gains from national instruments and MSCI World yield for international instruments.

Voluntary Savings

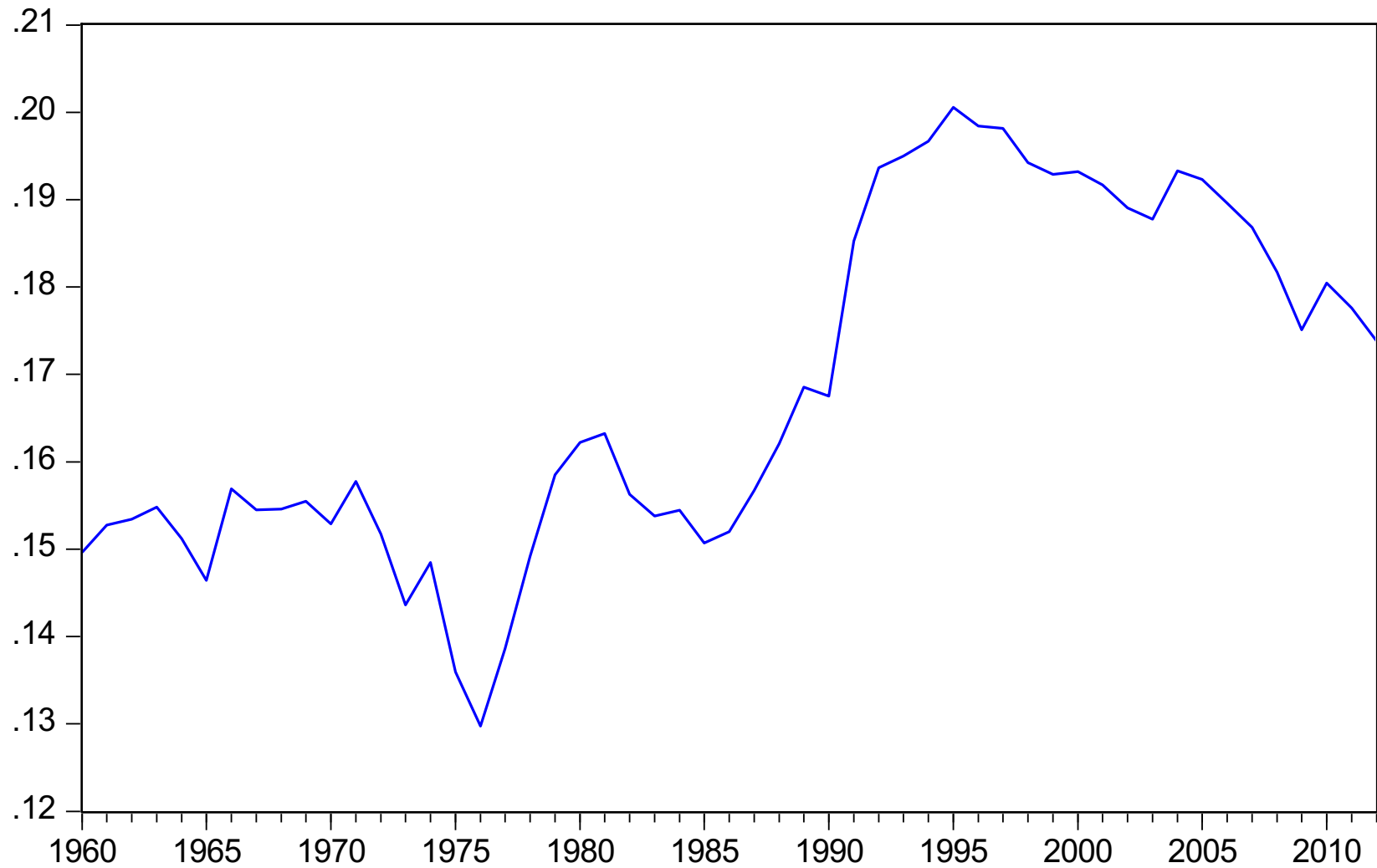
- Following Bennett et. al. (1999) voluntary household savings will be estimated as a residual.

Voluntary Savings = Gross National Savings – Fiscal Savings – Firms' Savings – Mandatory Household' Savings

Other variables: Taxes



Other variables: MPK



Econometric issues

- The starting point is the conceptual framework
- We don't know the dynamics
 - General to particular strategy
 - White noise residuals
- Endogeneity problem
 - Corporate firm make decisions according to neoclassical model: OLS
 - Household take into account firm decision choosing k : IV estimation

Econometric Analysis: Public Savings

Dependent Variable: Public Savings			
1961 – 2012	(1) OLS	(2) OLS	(3) OLS
Constant	0.049 (0.18)	-5.09 (-2.69)	-1.529** (-2.74)
Public Savings (t-1)	0.476** (4.57)	0.052 (0.40)	
(Copper price - HP Copper price)/HP Copper price	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 to 360 days)		0.0004 (1.12)	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	903.000	0.876
Breusch-Godfrey Serial Correlation LM Test	0.440	0.610	0.680
Heteroskedasticity Test: ARCH	0.040	0.640	0.560
Normality test	0.000	0.490	0.900

Note: Significance at 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.

Econometric Analysis: Corporate Savings

Dependent Variable: Corporate Savings				
1961 - 2012	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Return of capital net of tax	0.021 (0.04)	-0.074 (-0.16)		
Return of capital 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	0.325	0.241	0.364	0.338
Heteroskedasticity Test: ARCH ^b	0.907	0.584	0.572	0.545
Normality Test: Jarque-Vera	0.506	0.789	0.787	0.782
Note: Significance at levels of 5 %(**) and 10%(*). T-statistic in parenthesis. a, b and c: p-values are reported.				

Econometric Analysis: Household 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
Corporate savings	0.301 (1.13)		-0.192 (-0.74)		0.007 (0.02)	
Public savings	-0.738** (-5.40)	-0.660** (-5.70)	-0.730** (-5.28)	-0.754** (-4.94)	-0.788** (-4.36)	-0.785** (-5.02)
Personal Income Tax (t+1)	-0.023 (-0.26)	-0.078* (-1.85)	-0.362** (-3.09)	-0.282** (-3.70)	-0.358** (-2.65)	-0.346** (-3.37)
Income per capita growth rate	0.278** (2.19)	0.278** (2.6)	0.356** (2.63)	0.317** (2.25)	0.353** (2.27)	0.357** (2.40)
Real interest rate	-0.046 (-1.39)	-0.034 (-1.14)	0.108 (1.40)	0.112 (1.29)	0.154 (1.39)	0.156 (1.57)
Household savings (t-1)		0.173 (1.40)				
Mandatory Savings					-1.349** (-2.67)	-1.321** (-3.82)
R squared	0.329	0.517	0.689	0.574	0.562	0.546
Breusch-Godfrey Serial Correlation LM Test ^a	0.474	0.421	0.216	0.181	0.181	0.186
Heteroskedasticity Test: ARCH ^b	0.481	0.945	0.704	0.729	0.675	0.615
Normality Test: Jarque-Vera	0.866	0.648	0.816	0.765	0.869	0.773

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

Econometric Analysis: Private Savings

Dependent Variable: Private Savings				
1961 - 2012	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Public savings	-0.463** (-5.28)	-0.462** (-5.32)	-0.456** (-5.31)	-0.448** (-5.08)
Return 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)
Dependence rate	0.088 (0.69)	0.040 (0.69)		
Unemployment	-0.124 (-0.43)			
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
Heteroskedasticity Test: ARCH ^b	0.523	0.537	0.452	0.345
Normality Test: Jarque-Vera ^c	0.537	0.518	0.449	0.100
Note: Significance at levels of 5%(**) and 10%(*). T-statistic in parenthesis. a, b and c: p-values are reported				

Contributions: Firms and Households

Contribution to Corporate Savings of each determinant	Mean value for each period		Long Run Coefficient*	Contribution to Corporate Savings (% GNDI)
	1960-1984	1985-2012		
Financial intermediate ratio	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%

* Calculated as the contemporaneous coefficient divided by one minus the coefficient estimated for the lag of corporate saving.

Contribution to Household Savings of each determinant	Mean value for each period		Long Run Coefficient*	Contribution to Households 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%

Contributions: Private Savings

Contribution to Private Savings of each determinant	Mean value for each period		Long Run Coefficient*	Contribution to Private Savings (% GNDI)
	1960-1984	1985-2012		
Public savings	4.64%	5.56%	-0.818	-0.75%
Return of capital net of tax (t+1)	9.76%	15.62%	0.294	1.72%
Income per capita growth rate	0.98%	4.05%	0.079	0.24%
Financial intermediate ratio	19.67%	169.32%	0.026	3.82%
Private savings predicted change				5.04%
Private savings actual change	6.81%	16.71%		9.90%

* Calculated as one minus the coefficient estimated for the lag of corporate saving.

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%

Contributions: Public Savings

Contribution to Public Savings of each determinat	Mean value for each period		Long Run Coefficient	Contribution to the Change in Public Savings (% GNDI)
	1960-1984	1985-2012		
Real GDP desviation over HP trend (%)	0,55%	-0,63%	0,346	-0,41%
Real Copper price desviation 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%
TIR 90-180 days (Percent points)	-0,01	7,26	0,001	0,51%
Older adults / population (Porcentaje point)	5,24	7,29	-0,039	-7,94%
Rural Population/populariot (Porcentaje point)	23,60	14,31	0,004	-4,15%
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%

* Dummies used for identifying presidential periods have been not included in this table.

Concluding remarks

- Two main facts
 - Savings rate increases by almost 11 percentage points in the period 1987-2012 compared to 1960-1986 (10% private 1% public)
 - Large increase in the private saving is mainly explained by corporate savings that seems to substitute household savings
- Role of the public policy
 - Development of the financial market accounts for nearly 4 pp. of GNDI
 - Policies that increase productivity of the economy jointly with the 1984 tax reform increase the after-tax MPK boosted corporate savings by 3.4 pp. of GNDI
 - full imputation system
 - eliminates double taxation
 - allows taxation at the personal level when retirement of profits occurs and not in an accrual base

Concluding remarks

- Regarding household and public savings
 - Reduction in personal income tax increases the household savings in 1.92 pp. of GNDI
 - Higher growth of income per capita growth increased the household savings in 1.03 pp. of GNDI
 - Better institutions in the public as another source of savings: The implementation of the structural balance rule was a source of 0.7 pp. of GNDI

Understanding Domestic Savings in Chile

Rodrigo Cerda, Rodrigo Fuentes
Gonzalo García, José Ignacio Llodrá

IEA, Mexico
June 2017

Speculating: Tax reform 2014

- In the recent tax reform the corporate tax increased from 20% to 27% (at 2018). This should affect the taxation on reinvested profits.
- Although our model was not built to estimate the effect of the changes in the tax code system approved in 2014, it predicts a long run impact of -1.82% in the aggregate corporate saving
- A word of caution
 - Tax reform had many other changes different than just the corporate tax change.
 - Possibly, the impact on corporate savings estimated here is just the lower bound of the true impact.

Two waves of studies for Chile

- “Chilean saving history”
 - Agosín et al (1997) partial compensation effect among all types of savings
 - Morandé (1998), foreign savings until mid 80s and domestic savings after that
 - Hachette (1998) focuses on LCH and PIH
 - Bennett et al (1999) built a disaggregate dataset of savings
- Further research on specific question
 - Bennett et al (2001): partial compensation effect, negative effect of financial deepening on S_p , corporate tax on S_c , growth a price of copper positive effect on public savings
 - Agosin (2001) states that S_c explain increase in S
 - Vergara (2001): tax reform 1990 had negative impact on savings. Transitory income and interest rate explain voluntary savings
 - Butelmann and Gallego (2001) found that transitory income and age profiles explain voluntary savings

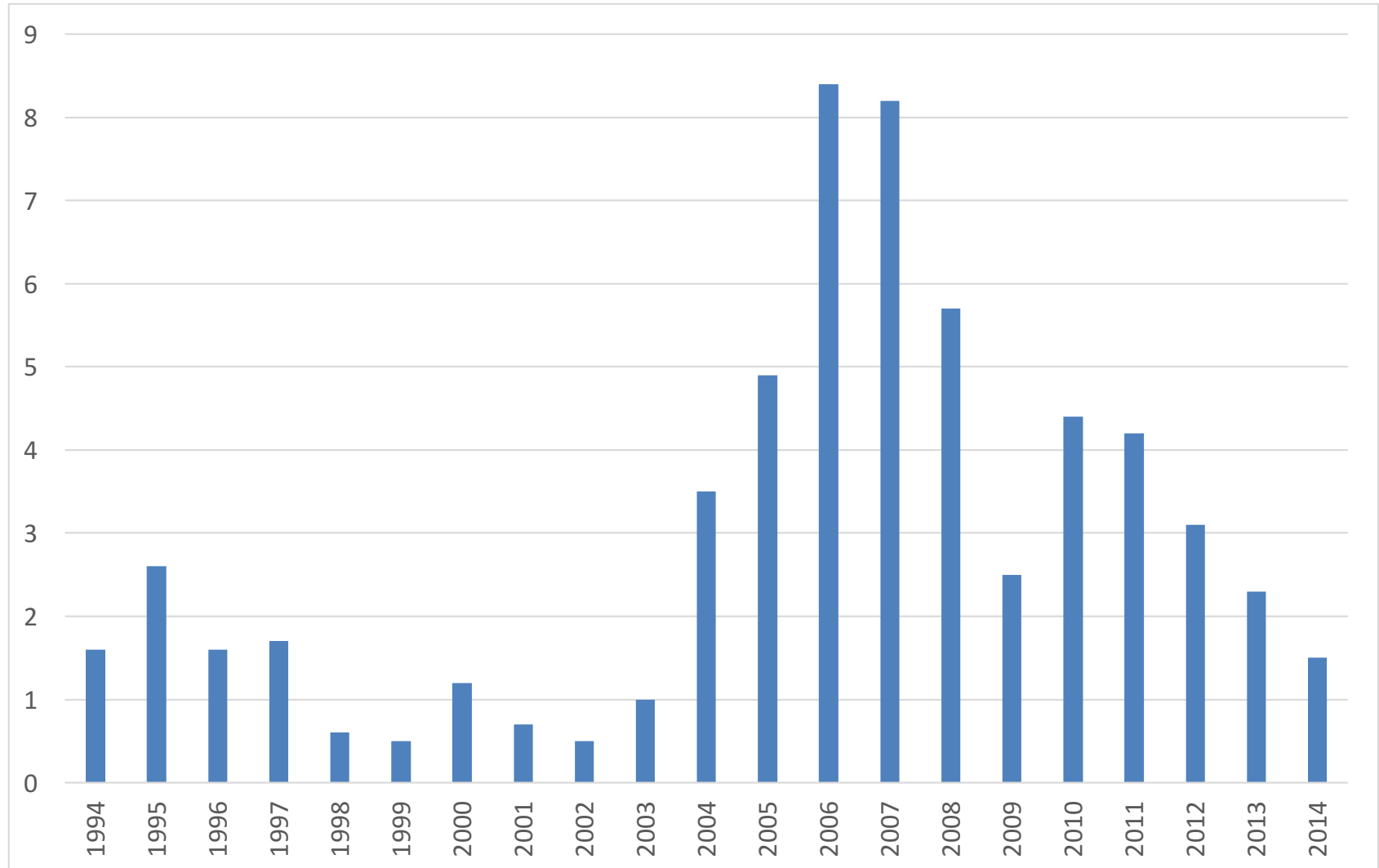
Correlations between saving aggregates 1960 - 2012

	Public	Firms	Households	Voluntary	Private
Public	1.000				
Firms	0.244	1.000			
Households	-0.676	-0.333	1.000		
Voluntary	-0.596	-0.196	0.972	1.000	
Private	-0.599	0.118	0.897	0.931	1.000

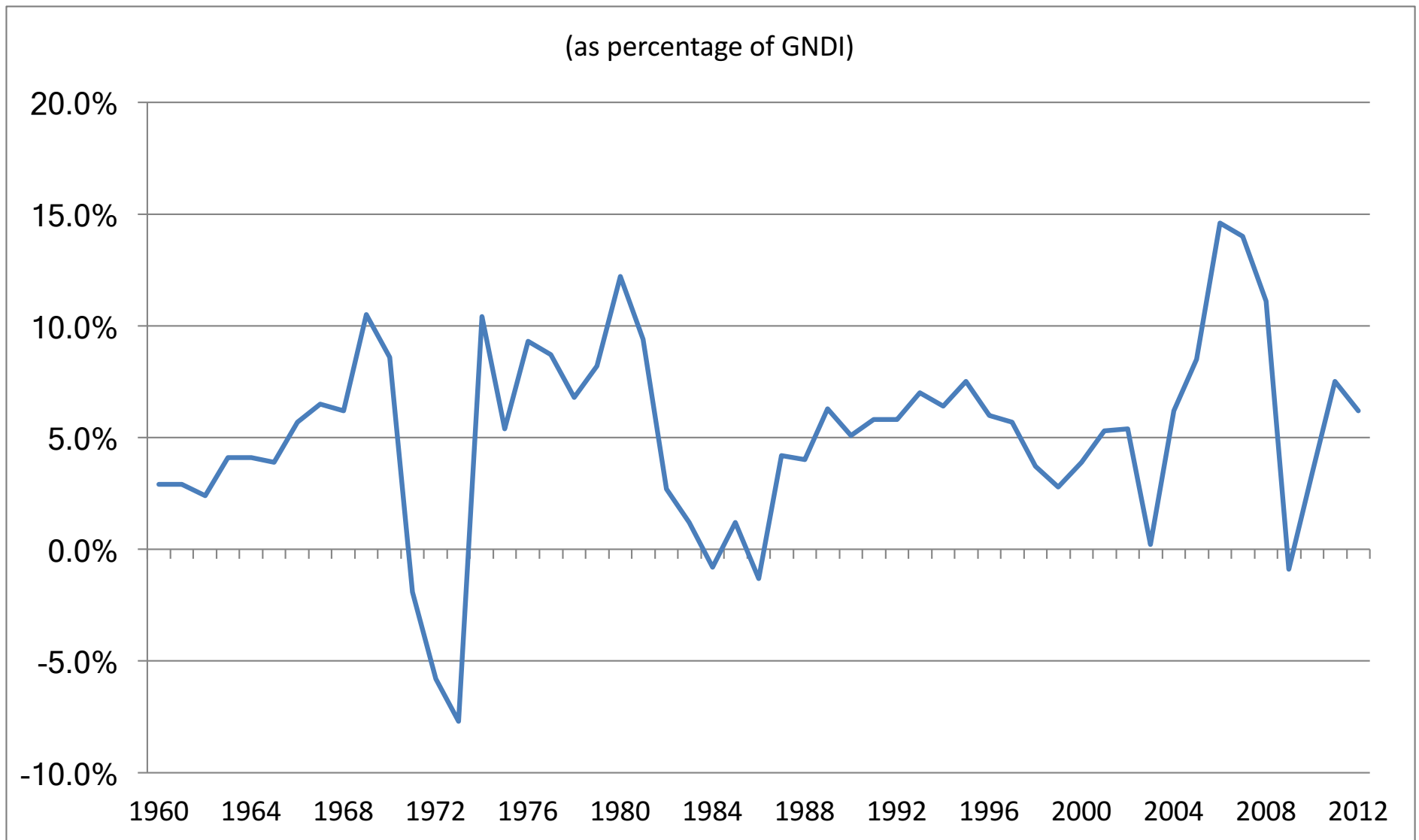
Source: Author's calculations

Fiscal rule and copper revenues

(as % of GDP)

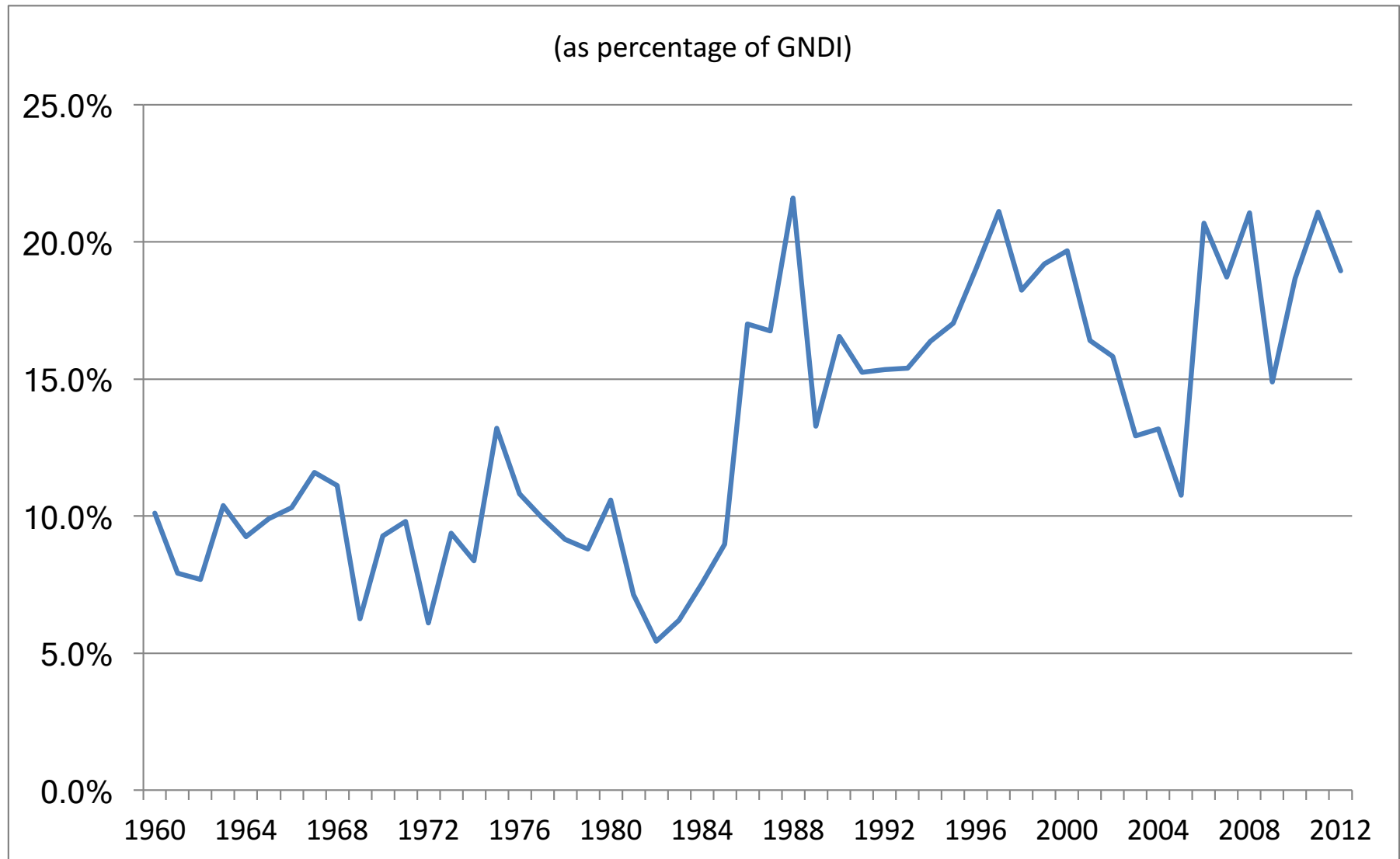


Evolution of Public Savings

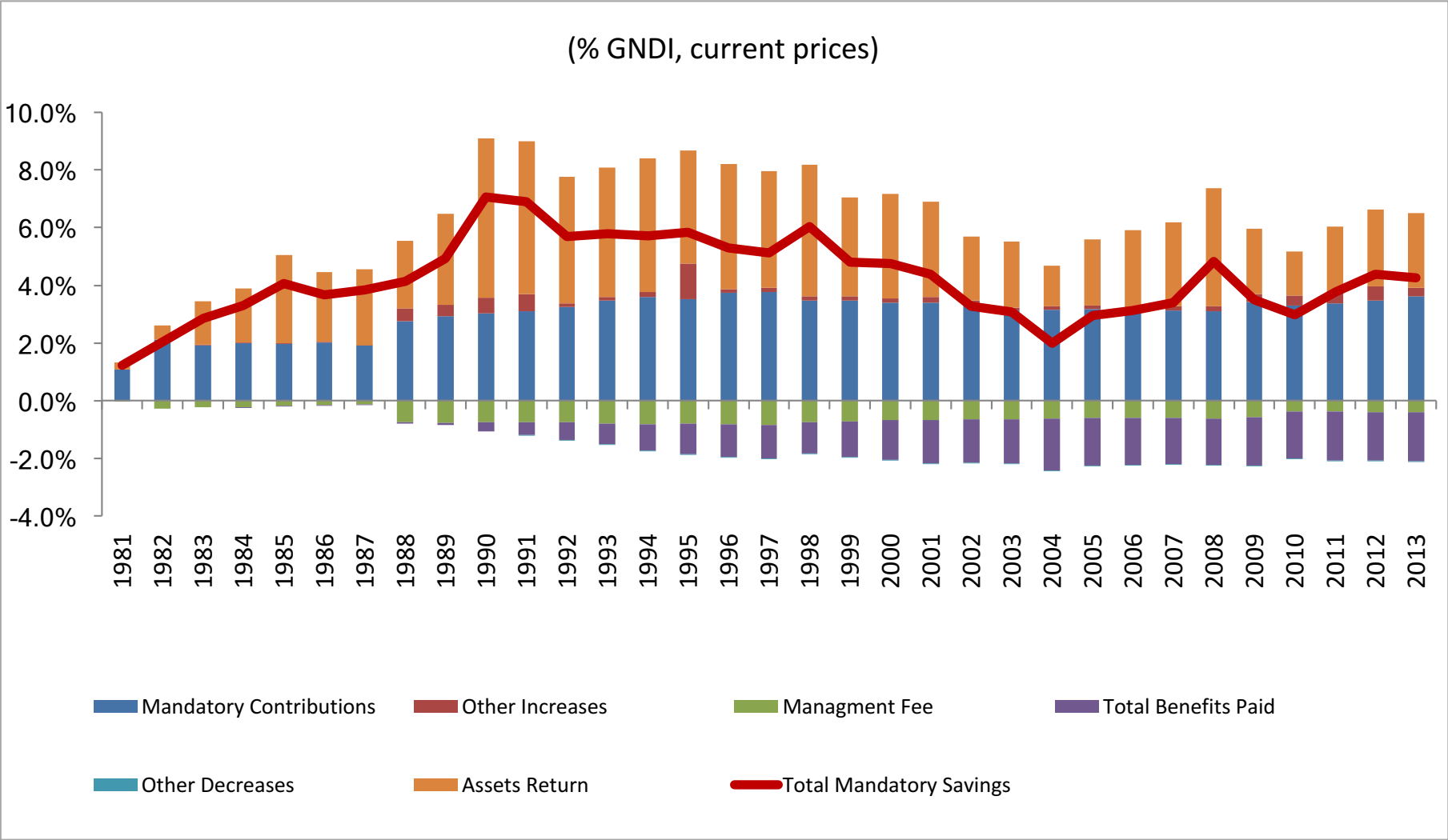


Source: Authors estimations

Evolution of Corporate Savings



Composition of Mandatory Savings



Source: Superintendency of Pensions and authors estimations

This presentation

- Motivation and purpose of the paper
- Review of the literature
- Conceptual framework
- Data construction and methodological issues
- Empirical analysis
- Policy implications
- Concluding remarks

This presentation

- Motivation and purpose of the paper
- **Review of the literature**
- Conceptual framework
- Data construction and methodological issues
- Empirical analysis
- Policy implications
- Concluding remarks

This presentation

- Motivation and purpose of the paper
- Review of the literature
- **Conceptual framework**
- Data construction and methodological issues
- Empirical analysis
- Policy implications
- Concluding remarks

This presentation

- Motivation and purpose of the paper
- Review of the literature
- Conceptual framework
- **Data construction and methodological issues**
- Empirical analysis
- Policy implications
- Concluding remarks

This presentation

- Motivation and purpose of the paper
- Review of the literature
- Conceptual framework
- Data construction and methodological issues
- **Empirical analysis**
- Policy implications
- Concluding remarks

This presentation

- Motivation and purpose of the paper
- Review of the literature
- Conceptual framework
- Data construction and methodological issues
- Empirical analysis
- **Policy implications**
- Concluding remarks

This presentation

- Motivation and purpose of the paper
- Review of the literature
- Conceptual framework
- Data construction and methodological issues
- Empirical analysis
- Policy implications
- **Concluding remarks**

Firms

- Maximize the present value of the cash flows

$$d_t = (1 - \tau_t^c)(Y(k_t, l_t) - w_t l_t) - p_t^I(k_{t+1} - (1 - \delta)k_t)$$

- Corporate savings are defined

$$S_t^c = (1 - \tau_t^c)(Y(k_t, l_t) - w_t l_t) - d_t = p_t^I I_t$$

Households

- The problem of the representative household

$$\max_{c_t, b_{t+1}, k_{t+1}} \sum_t \beta^t u(c_t)$$

$$c_t + b_{t+1} + M_{t+1}$$

$$= w_t l_t (1 - \tau_t^p) + (1 - \tau_t^d) [(1 - \tau_t^c) (Y(k_t, l_t) - w_t l_t) - p_t^l (k_{t+1} - (1 - \delta) k_t)] \\ + (1 + r_t (1 - \tau_t^k)) b_t + (1 + r_t (1 - \tau_t^k)) M_t$$

- She is endowed with L units of time in each period which are inelastically supplied to the labor market
- She owns an initial stock of corporate shares, $s_0 = 1$, and we suppose the household do not trade shares over time.

Households

- The first order conditions are

$$[k_{t+1}]: 0 = -\lambda_t p_t^I (1 - \tau_t^d) + \lambda_{t+1} \left[(1 - \tau_{t+1}^d) \left((1 - \tau_{t+1}^c) Y_k(t+1) + p_{t+1}^I (1 - \delta) \right) \right] \quad (3.4)$$

$$[b_{t+1}]: 0 = -\lambda_t + \lambda_{t+1} [1 + r_{t+1} (1 - \tau_{t+1}^k)] \quad (3.5)$$

$$[c_t]: 0 = \beta^t u_c(c_t) - \lambda_t \quad (3.6)$$

$$[c_{t+1}]: 0 = \beta^{t+1} u_c(c_{t+1}) - \lambda_{t+1} \quad (3.7)$$

- Combining 3.4 and 3.5

$$(1 - \tau_{t+1}^c) Y_k(t+1) = v_{t+1}$$

$$v_{t+1} \equiv \frac{[1 + r_{t+1} (1 - \tau_{t+1}^k)] (1 - \tau_t^d) p_t^I - (1 - \tau_{t+1}^d) (1 - \delta) p_{t+1}^I}{(1 - \tau_{t+1}^d)}$$

Firms, households and firms

$$c_t = r_0(1 - \tau_t^k)b_0^p + \frac{r}{1+r} \left[\sum_{j=0}^{\infty} \frac{w_j L (1 - \tau_j^p) + d_j(1 - \tau_j^d) + M_j}{(1 + r_j(1 - \tau_j^k))^j} \right]$$

$$\tau_t^c(Y(k_t, l_t) - w_t l_t) + \tau_t^l w_t l_t + \tau_t^k r_t + b_{t+1}^g = g_t + (1 + r_t(1 - \tau_t^k)) b_t^g$$

$$\frac{S_t^h}{Y_t} = 1 + \frac{r_t(b_t^p + b_t^g + M_t)}{Y_t} - \frac{S_t^c}{Y_t} - \frac{S_t^g}{Y_t} - \frac{c_t}{Y_t} - \frac{G_t}{Y_t}$$