CATÓLICA LISBON
SCHOOL OF BUSINESS & ECONOMICS

The evolution of savings in Brazil since 1960: the role of real interest rates

Regiane Silva Rodrigues

Dissertation submitted in partial fulfillment of requirements for the degree of MSc in Economics at the Universidade Católica Portuguesa, January 2013

Supervisor:

João César das Neves

Lisbon, January 2013

ACKNOWLEDGEMENTS

Firstly, I thank my supervisor Professor João César das Neves, for his thoughtful guidance, motivation and for allowing, since my first semester at Universidade Católica Portuguesa, a closer contact with economics I have grown to love. He is a professor I admire and a professional I take as an example. I was extraordinarily fortunate in having his as my teacher.

I am grateful to my teachers and colleagues at Católica for providing a stimulating environment in which I could learn and grow as a person and professional. I especially thank Pedro Raposo for patiently helping me to overcome the drama about the empirical model, and all his valuable insights about Stata.

I wish to thank my beloved group of friends known as "A Máfia Angolana", and especially to Marco and Elsa, for always helping me get through the difficult times, and for all funny moments. I also thank Vanda for helping me with the final details in my thesis.

Finally, and most importantly, I would like to thank my family for their unconditional love and support throughout my entire life, specially my mother that did not measure efforts to make it come true. I wish to thank my boyfriend, Jefferson, for all his support, understanding and strength to move on and not give up.

The evolution of savings in Brazil since 1960: the role of real interest rates

Regiane Silva Rodrigues

Abstract

Is there any relationship between the real rate of savings (domestic and private) and the real interest rate in Brazil? In his work Daniel Gleizer assesses that - policies to strengthen national and private savings by increasing the real interest rate did not occur in Brazil because there was not any significant relation between these variables, in the period from 1960 to 1985. However, using one of his econometric models, a classical saving function, to examine the sensitivity of savings and changes in expected real interest rate in the period from 1960 to 2011, we conclude that there is a negative and significant relation between these variables, probably due to economic, political and social stability recently achieved. Economic stability provided the economic development that caused structural changes in the Brazilian society, in this way demographic characteristics were introduced as explanatory variables since they have direct effects on savings rates. The results after the introduction of those additional controls do not contradict the previous estimations - once again the real interest rate is a significant variable to explain variations in the real ratio of domestic and private savings.

Sumário

Existe alguma relação entre a taxa real de poupança (doméstica e privada) e a taxa de juro real no Brasil? Em seu trabalho, Daniel Gleizer afirma que as políticas para aumentar a poupança nacional e privada através do aumento da taxa de juro real não resultaram no Brasil porque não havia relação significativa entre estas duas variáveis no período de 1960 a 1985. Entretanto, utilizando um dos seus modelos econométricos, uma função de poupança clássica, para estudar a sensibilidade da poupança às mudanças na taxa de juros real esperada, no período de 1960 a 2011, concluímos que há uma relação negativa e significativa entre essas varíaveis, provavelmente devido à estabilidade económica, política e social alcançada recentemente. A estabilidade económica proporcionou o desenvolvimento económico que causou transformações estruturais na sociedade Brasileira, por isso foram introduzidas características demográficas como variáveis explanatórias no modelo; uma vez que estas têm efeitos diretos sobre a taxa de poupança. Os resultados após a introdução desses controles adicionais não contradizem as estimações anteriores, novamente a taxa de juro real é uma variável significativa para explicar a evolução da taxa real de poupança doméstica e privada.

CONTENTS

1. INTRODUCTION

The Brazilian economy has been passing through various transformations over the last decades. Brazil's evolution has been both economical and social, from an underdeveloped economy to one of the references among the emerging countries.

In recent years, the implementation of policies of faster growth and job creation, combined with the rise in the minimum wage and income transfer programs transferred people who were in a situation of poverty; and now integrates the new Brazilian middle class with strong purchasing power. "*From a sluggish economy, with low growth rates, Brazil joined the roster of emerging countries leading global growth. (…) Throughout the 2000s, the Brazilian economy growth rate jumped from an annual of 2.5% to 4.5%, on average, thanks to a new economic policy, which favored the creation of jobs and investments in the internal market. From 2007 to 2010, average annual growth was not above 6% only due to -0.6% recorded in 2009 result of the international financial crisis. However, the federal government was quick to act. The government implemented a series of countercyclical measures of monetary and fiscal policy to stimulate the economy.*" (Brazilian Ministry of Economy, 2010; pg. 7)

Savings provide the means for further accumulation of capital, which produces extra outcome that can be used for future consumption. Savings do not only allow the income expansion and consumption rise, but also, the consumption smoothing in the presence of several uncertainties; the supposed action of savings decisions of private and public sector makes it fundamental to the development of less wealthy countries.

To the extent that evidence sustains some theories of saving, it is possible begin to judge the features of savings behavior and establish policies to remodel saving performance (Gersovitz, 1988). One of the policies used by many governments to promote savings was through the rise in interest rate, increasing it since it possibly explains the individual saving behavior. During the Keynesian interlude, the level of income was one of the main determinants of savings. Later, the interest rate

returned to the center of the discussion, through the several theories of consumption-saving behavior based on utility maximization, considering the present value of lifetime resources.

As referred previously, interest rates have been a possible variable explaining saving rates. Presumed positive effects of interest rates on savings became the cornerstone of the financial sector and savings policy advice most often given to developing countries: enhance real interest rates (Gleizer, 1991). Despite higher real interest rates in Brazil, saving rates have been low during decades, one of the lower in Latin America. Table 1.1 presents the values of real interest rates in a sample of 11 countries; in the next section, Table 2.2 presents the values for real saving rates for the same 11 countries.

Table 1.1: Real interest rates from 1980 to 2010

REAL INTEREST RATE							
Country	**Total range**	**1980-1984**	**1985-1989**	**1990-1994**	**1995-2000**	**2001-2005**	**2006-2010**
Developed economies	5.595	6.030	6.747	7.401	5.718	3.548	2.963
Belgium	7.083	8.857	7.024	8.715	6.259	5.078	6.564
Canada	4.836	6.437	6.740	6.702	4.836	2.189	2.110
France	5.154	2.333	5.808	7.321	5.681	4.627	ND
Germany	8.098	7.918	6.642	8.417	9.045	8.467	ND
Italy	5.319	2.873	7.433	8.531	6.439	3.199	3.437
United Kingdom	3.108	2.464	5.461	4.707	3.774	1.752	0.487
United States	5.603	10.282	6.050	4.735	6.572	2.741	3.238
Emerging economies	15.742	10.685	9.229	12.998	22.710	12.524	8.854
Argentina	6.812	ND	ND	7.010	11.695	9.686	-1.143
Brazil	48.744	ND	ND	ND	64.594	45.444	36.194
Chile	9.813	26.377	6.924	10.695	11.646	1.640	1.593
Venezuela, RB	-3.258	-4.397	-12.036	7.033	-4.894	-2.515	-2.742

Source: Table constructed by the author based on values provided by the World Bank database website.

The table shows that Brazilian real interest rates are the highest in the sample, on average. It has decreased over time, from 64.6% in 1990/94 to 36.2% in 2006/10, on average, but it still is the highest each period.

These two facts motivated this research; low saving rates even though high interest rates levels. It identifies the relation between saving rates and real interest rates, analyzing the consequences on increase domestic savings if real interest rates increase. Gleizer (1991) performed an empirical model to test the Financial

Repression (FR) Literature[1] which defended that savings and real interest rates have had a positive relation. This study extends this model till the present time and includes demographic variables as additional controls since many authors consider them determinants of saving behavior.

This research is divided between two parts; first, the documentation of the relationship between real saving rate and real interest rate. Second, an empirical model that is helpful in understanding and quantifying the nature of this relation. Section 2 presents the theoretical and empirical literature about Brazilian and international saving rates. Section 3 discusses the Brazilian experience since the 1960s, introducing the main transformations and happenings in Brazilian economy and the consequences in the aftermath. Additionally it presents some implemented policies, stressing its impact on saving rates and real rates.

Section 4 performs a series of econometric tests in order to assess the responsiveness of savings to variations in the real interest rate. The tests are based on the work developed by Gleizer (1991), as mentioned before, a conventional saving function tests the standard approach in the Economic Development literature. The model includes four demographic variables: the population growth, the urbanization growth, the youth dependency ratio and the elderly dependency ratio. The intention is to understand how the model responds to these new variables and if real interest rates remain an insignificant explanatory variable. Section 5 concludes. The appendix presents the sources of the data set used and its definitions; see Appendix 1.

[1] The theories of Financial Repression were developed by many authors, as Shaw (1973) and Fry (1980) among many others. But Fry (1988) provides the available empirical evidence and the subsequent theoretical refinements.

2. LITERATURE REVIEW

This essay will rely mostly on empirical and theoretical studies that focus on other countries and country groups (which can include Brazil) because the limited literature about Brazilian savings, in order to provide potential explanatory variables in a savings equation, as well as guidelines for the expected sign. However, there are two key empirical papers that will be central for the present study, Gleizer (1991) and Paiva and Jahan (2003), which address directly to Brazilian economy. Moreover, the empirical model is based on Gleizer (1991).

Low national saving rates are one of the most serious impediments to the achievement of higher and more sustainable growth rates in Brazil. Increasing the investment rate is crucial to accelerating economic growth, but the recurrent use of foreign savings in previous years through high external current account deficits renders difficulty in the further use of this source of external finance. Increasing national saving is, therefore, fundamental to reduce Brazilian external vulnerability and finance its return to a trajectory of high-growth (Paiva & Jahan, 2003).

Paiva and Jahan (2003) estimate a reduced equation to model the behavior of private saving in Brazil. They follow the literature in testing a wide number of possible explanatory variables; the significant ones are such as GDP per capita, government saving/GDP, inflation (proxy to macroeconomic instability), M2/GDP (proxy to the role of financial instruments in stimulating private sector saving), terms of trade, and degree of urbanization of the labor force. They use annual data for the period 1965-2000, with public and private saving rates based on national accounts data. It is an interesting empirical research on Brazilian savings although they do not consider real interest rates to explain the saving rates whereas they are based on Loayza, Schmidt-Hebbel, and Servén (2000) and real interest rates have a theoretically ambiguous impact on saving rates in this paper; see Appendix 2.

The most notable finding of Paiva and Jahan (2003) is that private saving shows a relatively high and inverse response to public saving. In this way, fiscal

consolidation is one of the best policy instruments to raise the Brazilian national saving rate. The article also assesses that increasing financial deepening has a positive impact on the saving rate. The various initiatives adopted by the Brazilian Central Bank in the last few years to strengthen and further develop financial markets and institutions may, therefore, also contribute to an increase in the national saving rate in the medium term. In line with the international evidence, the external terms of trade have a positive impact on private and national saving. Significant gains in terms of trade could be probably achieved through the removal of domestic subsidies and barriers to trade imposed by industrialized nations in sectors where Brazil has strong comparative advantage, especially in commodities.

This work will use the classical, straightforward theory of consumption-saving decision. The consumption-savings theory involves intertemporal choice as this is fundamentally a decision involving a trade-off between current and future consumption of private and government. The government's financing option is a decision that involves the amount of public saving or the size of public deficit, making it closely related to the consumption-saving decision of private consumers. An important implication of this model is the **Ricardian Equivalence theorem**[2] that states that there are conditions under which irrelevance of the size of the deficit holds (Williamson, 2008).

The prime variable in this theory is the real rate of interest which is the interest rate at which government and the private can borrow and lend. With respect to consumer choice, it is relevant how variations in the real interest rate affect savings. Microeconomic theory shows that an increase in the interest rate has an effect on savings which depends on two partial effects: an income effect that reduces saving in order to achieve any target of future wealth and a substitution effect that makes saving more attractive.

[2] The Ricardian equivalence theorem holds that consumers internalize the government's budget constraint, and then the timing of any tax variation does not affect their level of spending. Thus this theorem indicates that it does not import if the government finances its spending with tax or a debt raise, because the effect on economy is null.

Gleizer (1991) tests an empirical model that is a critical analysis of government's attempts to increase national and private savings by raising the real interest rate. His work follows two basic lines; the straight effect of interest rates on savings, and the "Euler equation" approach specifying a relation between the rate of variation of consumption over time and the expected real rate of interest. He tests the role of interest rate in the determination of domestic and private saving rates in Brazil from 1965 to 1985. The results of his econometric tests from both of the savings function and of the Euler equation, confirm that Brazilian savings respond negligibly to real interest rates, therefore, neither theory nor empirical evidence offer support for a policy of high interest rate as a mechanism to raise Brazilian savings rate.

Economies with low level of income face a strong pressure to consume. As they also have a low level of capital, this poses a problem. Propensity of consumption is a typical problem of less developed economies, which results from the desire to improve the standard of living. If saving capacity is limited, it should be supplemented by foreign capital; however, these obstacles to savings expansion have led the replacement of spontaneous savings by inflationary financing methods. Less developed countries that faced obstacles to savings appealed to inflationary processes achieving higher savings but at an extremely high social cost - real income for the poorest sectors of the economy decreased (Gastaldi, 1968)..

Hausmann (2008) analyzed the possibility of limited savings as being a source of the problem of funding cost in Brazil. If domestic savings are low relative to investment demand, country is relatively small to the global economy, and access to foreign savings is frictionless, then foreign savings would fill the gap between domestic savings and investment at the international rate.

Brazil's access to international savings has been highly unstable over decades, but in 2002-2003, it borrowed from International Monetary Fund in order to shore up its foreign liquidity. Since then its access to foreign borrowing has improved profoundly. In the meantime, the improvement in export revenues has led to a strong growth in national savings. Better access to both national and external savings has led to rising investment and an accelerating growth rate. Improving

domestic saving is essential to the country from the development point of view since there are limits to the amount that foreign saving can contribute to fund domestic investment. Firstly, as the external debt accumulates, concerns over either ability or willingness to pay causes the cost of external borrowing to go up or be shut down entirely. Secondly, limitation is the fact that external savings can cause the real exchange rate to appreciate which then affects the relative composition of output and employment (Hausman, 2008).

Table 2.2 exhibits the values for real gross domestic savings for a sample of 11 countries from 1980 to 2010. Brazil has the lowest rate among the Latin American countries and it is only high when only compared to developed countries such as the USA or France.

Table 2.2: Real Saving rates from 1980 to 2010

DOMESTIC SAVING RATES							
Country Name	**Total range**	**1980-1984**	**1985-1989**	**1990-1994**	**1995-1999**	**2000-2004**	**2005-2010**
Developed economies	22.978	22.581	23.016	22.189	23.274	23.690	23.121
Belgium	23.247	19.258	21.313	24.160	24.727	25.156	24.865
Canada	22.822	24.125	23.104	18.915	22.643	24.680	23.462
France	19.573	19.534	19.226	19.715	19.876	20.135	18.951
Germany	22.040	19.338	21.038	22.994	22.738	22.391	23.742
Italy	22.191	22.942	22.646	22.186	23.254	21.851	20.269
United Kingdom	16.609	19.048	18.469	16.267	17.216	14.846	13.808
United States	16.232	18.945	16.836	16.212	17.597	14.861	12.941
Developing economies	20.201	20.089	21.288	18.682	18.260	19.392	23.494
Argentina	21.338	23.480	21.232	16.928	17.141	22.014	27.233
Brazil	20.196	20.937	25.953	21.621	15.395	18.117	19.150
Chile	24.290	12.747	25.268	26.570	25.298	25.169	30.686
Venezuela, RB	28.688	26.888	23.159	23.141	29.853	34.256	34.831

Source: Table constructed by the author based on values provided by the World Bank database website.

2.1. GENERAL THEORY ABOUT SAVINGS

Since the theoretical and empirical evidence about Brazilian saving is limited, this subsection presents some international literature about saving behavior and its main determinants.

Loayza, Schmidt-Hebbel, and Servén (2000) provide a helpful summary of the findings of various studies (theoretical and empirical) regarding the impact of several variables on the ratio of private saving to GDP in developing countries; see Appendix 2. They show that some variables have a positive effect on the saving rate such as the income levels (per capita), the terms of trade, and the financial depth (proxied by a monetary aggregate). Others have a negative impact: the population dependency ratio; the current account deficit; and the public saving ratio. However, there are those that are ambiguous, the growth rate, the interest rates and the share of the population living in urban areas. Measures of macroeconomic instability (such as inflation) can increase savings for precautionary reasons, although many empirical studies have failed to establish their econometric significance.

Determinants of savings

Several studies have looked at the empirical evidence on saving from developing countries[3]. Schmidt-Hebbel, Webb and Corsetti (1992) assess that the main saving determinants considered by the literature fall into four groups: income and wealth, rate of return, foreign saving, and demographic variables. On the other hand, Loayza, Schmidt-Hebbel, and Servén (2000) identified persistence, income, growth, demographics, and uncertainty as being the non-policy determinants of saving. This subsection provides information about the main determinants of savings relevant for the econometric model.

INTEREST RATES: Due to the opposite direction of income and the substitution effects of higher interest rates, the effect of interest rates on saving cannot be predicted. In addition to these two well-known effects, rates of interest also affect saving through a wealth effect. A higher real interest rate reduces the present value of future income streams from human capital or fixed-interest financial assets. Consumption is, therefore, depressed even if the substitution and the income effects cancel each other (Schimitt-Hebbel, et al., 1992). Economists have

[3] See Gersovitz (1988) and Deaton (1989).

vividly debated the meaning of the empirical evidence. Based on non-econometric studies, McKinnon (1973) and Shaw (1973) argue that the real interest rates have a positive effect on saving rates. Fry (1988) finds statistical evidence to support this argument, although the magnitude of the effect is small. Thus, only large variations in real rates of interest would be economically relevant. With a larger data set, Giovannini (1985) found that the interest rate did not significantly affect savings; but, for Chinese urban households Nabar (2011) finds that the rise in Chinese urban saving rates is linked in part to the decline in real interest rates.

The inflation effect may also explain the impact of interest rates: assuming that nominal interest rates are constant; if the inflation rate rises, and then the real cost of borrowing lowers, which implies a positive effect on consumption and a negative effect on savings (Muradoglu & Taskin, 1996). For example, real interest rates display a negative influence on the Australian household savings, thus when real interest rates falls saving rates tend to increase (Ouliaris, 1981).

INCOME: The effect of income on savings is positive according to both the Permanent Income hypothesis and the Keynesian savings function (Muradoglu & Taskin, 1996). The permanent income hypothesis (Friedman, 1957) distinguishes between temporary and permanent components of income, and predicts that households will spend mainly the permanent income and, therefore, the temporary income will immediately be directed to savings with saving marginal propensity from this income near to one. Many studies include the per capita income as an explanatory variable for saving behavior and they find that the level of real per capita income positively affects saving rates. On one hand, rich people save more because they can afford the luxury of doing more to assure their future consumption. On the other hand, poor people are more likely to be at their biological or social minimum level of current consumption.

The importance of income is typically higher in developing than in developed countries, tapering off at medium or high income levels. In developing countries, a duplication of income per capita may probably, ceteris paribus, increase the long-run private saving rate by 10% of disposable income (Loayza, et al., 2000).

GROWTH: Growth rate is also a regular variable in saving studies for developing countries. In general, intertemporal optimizing models of saving predict that faster growth of household revenue would lower its savings because the person would save less now if he knew that higher income in the future would allow him to have both higher consumption and higher savings. In this direction, the basic permanent-income theory predicts that higher growth reduces current saving. However, in the life-cycle model growth has a double effect on saving, depending on which groups benefit the most from income growth, how exorbitant their earning profiles are, and the extent to which borrowing constraints apply. The studies that enter real GDP growth, like Collins (1989), Fry (1980), and Giovannini (1985), find positive and usually significant effects on the saving rate.

FOREIGN SAVING: The access to external borrowing in foreign markets might complement domestic savings and fill the gap between domestic investment and national savings. Therefore, capital inflows are likely to drop national savings (Muradoglu & Taskin, 1996). If the supply of foreign saving at international rates is unlimited, it passively fills the gap between national investment and national saving. In this case, foreign saving is simply the outcome of domestic saving decisions and investment decisions, not one of its determinants. Nevertheless, if lenders or regulators limit foreign saving in developing countries then the amount of disposable external funds would border the intertemporal choices of domestic savers (or investors); thus external saving becomes a determinant of domestic savings.

Some empirical studies have included foreign saving as a determinant of domestic saving rates such as Fry (1980) and Giovannini (2005) find that the effect of foreign saving is significantly negative, even though its size is small.

DEMOGRAPHICS: The life cycle hypothesis implies that demographics affect saving rates, as it predicts that saving follows a hump-shaped pattern. In other words, it is higher at middle age than at young and old ages (Loayza, et al., 2000). Micro and macroeconomic evidence confirm that an increase in the youth and elderly dependency ratios tends to lower private saving rates. The population in the

dependency ratio (younger than 15y or older than 65y) consumes out of past savings while the working age people accumulates it. It also indicates that there is a causal link between the well-organized capital markets and the family size (Hammer, 1986) both are means of maintaining income in older age. Therefore, in the development process of a country the age structure changes as well, and higher savings are likely to replace the expected benefits from younger people (Muradoglu & Taskin, 1996). This fact is a possible explanation to the low domestic saving rates in developed countries such as United States and France, see values in Table 2.2.

The urbanization rate is another demographic feature that affects national saving rates. Empirically, its effect on saving is negative a result explained in the lines of the precautionary saving motive (Loayza, et al., 2000).

PERSISTENCE: Saving rates have inertial behavior; in other words, they are highly serially correlated even after handling for other relevant factors. The responses of a variation in any determinant of saving thus realizes fully only after several years, with long-run effects estimated to be approximately twice as strong as short-run effects (Loayza, et al., 2000).

After presenting all facts, it is necessary to exhibit the trajectory followed by saving rates and real interest rates over the last few decades. The next section will therefore, present a brief history about Brazilian macroeconomic performance, highlighting the main changes on these two rates.

3. BRIEF HISTORY OF BRAZILIAN MACROECONOMIC PERFORMANCE

This section presents a brief history of Brazilian macroeconomic performance, intending to design a parallel evolution of real rates and saving rates since 1960. It describes the evolution of the components of savings over the past few years, interpreting in greater detail the reasons for the behavior of key variables. Table 3.1 summarizes the main historic and economic events from 1960 to 2011, but the text provides the complete history of the evolution of savings.

Table 3.1: Chronology of Brazilian history and economy.

Chronology of Brazilian History and Economy

1960	Inauguration of Brasília. Jânio Quadros is elected President.
1961	Jânio Quadros resigns the presidency in August 25, 1961. João Goulart, the vice-president, assumed under the parliamentary system. Inflation increased, and Brazil resorted to IMF.
1963	A plebiscite reveals the Brazilians' preference for the return of the presidential system.
1964	A military coup overthrows João Goulart's presidency, the Revolution of 1964. General Castelo Branco assumed the presidency on behalf of the military coup that overthrew Goulart. Creation of the Central Bank of Brazil.
1965	The multiparty system is abolished, and the bipartisanship is instituted: Arena and MDB;
1967	The New Federal Constitution is promulgated. Costa e Silva assumed the presidency. Cruzeiro Novo is the new currency.
1968	From 1968 to 1973 the country a period of "Brazilian miracle". However this season was marked by the concentration of wealth.
1969	Due to the illness of Costa e Silva, a Junta Militar takes power, preventing the possession of the Vice- President Pedro Aleixo. The Junta Militar hands the power to General Medici. General Emílio Garrastazu Médici assumed the presidency.
1973	First Oil Shock and the foreign trade deficit. End of the "Brazilian miracle".
1974	General Ernesto Geisel assumed the presidency.
1979	General João Figueiredo assumed the presidency. Debt crisis and the second oil shock.
1983	The country's economic crisis worsens popular tensions. Several supermarkets are looted.
1985	End of the Military Rule. Tancredo is elected president, but died before taking office. The vice, José Sarney, assumed the presidency.

1986	Cruzado Plan I (Feb. 1986 to Nov. 1986) and Cruzado Plan II (Nov. 1986 to Jun. 1987). Election to the constituent assembly that would be tasked to establishing the New Brazilian Constitution; Cruzado is the new currency.
1987	Bresser Plan (Jun. 1987 to Dez. 1987).
1988	Promulgated the Constitution of 1988.
1989	Verão Plan (Jan. 1989 to Apr. 1990). Fernando Collor is elected President. The first direct presidential election occurred in almost 30 years. Cruzado Novo is the new currency.
1990	The president elected assumed the presidency, Fernando Collor de Mello. Collor Plan I (Apr. 1990 to Feb. 1991): confiscation of savings and privatization.
1991	Collor Plan II (Feb. 1991 to Jun. 1993). Formation of Mercosul.
1992	Impeachment of president Fernando Collor. The vice-president Itamar Franco assumed the presidency.
1994	Real Plan (Aug, 1993 to Jun. 1994)*, control of inflation and poverty reduction. Real is the new currency.
1995	Fernando Henrique Cardoso is elected President.
1998	Brazil resorted to IMF again.
1999	Adoption of Inflation targeting and currency devaluation. Fernando Henrique Cardoso is reelected.
2002	Luiz Inácio Lula da Silva is elected President.
2006	Luiz Inácio Lula da Silva is reelected the president.
2007	Discovery of new wells of oil and gas, namely the Pré-sal.
2008	Brazil is considered as investment level by rating agencies as S&P; nowadays its rating is A-. Some reflects of Subprime crisis.
2009	Brazil was a borrower of IMF and became a lender in this year.
2010	Dilma Rousseff is elected the first woman president in Brazil.

Note: * This is the duration period of the three phases of implementation of the Real Plan.
Source: Table constructed by the author.

Appendix 3 to Appendix 8 present the graphical evolution of the main macroeconomic variables examined in this study, they highlight the main historical and economic events in the period 1960 to 2011.

In 1964, the government that appeared from military coup adopted an economic strategy consisted of a variety of institutional and structural reforms aimed at the country's modernization (Gleizer, 1991). The new government introduced a set of laws and decrees in the period from 1964 to 1966 in order to redefine the financial structure of the economy; one change (in 1964) occurred in the calculation of

savings remuneration that added a monetary correction for savings deposits[4]. In other words, beyond the annual fee of 6%, the money deposited in 'Caderneta' began to be updated monthly by an additional percentage charged by the Central Bank of Brazil (Barrucho, 2012). As result, national saving increased around 2.6%, on average. Table 3.2 exhibits the values for savings, real interest rates and inflation rate from 1960 to 2011.

Table 3.2: Brazilian macroeconomic indicators

	Domestic Savings (%GDP) (1)	**National Savings (%GDP)** Total (%GDP) (2)	Private Savings (%GDP) (3)	Public Savings (%GDP) (4)	**Foreign Savings (%GDP) (5)**	**Inflation (6)**	**Real Interest Rate (7)**
1960-64	18.74%	16.00%	14.88%	1.12%	0.94%	55.34%	-47.34%
1965-69	19.78%	18.58%	14.39%	4.19%	0.28%	36.42%	-18.62%
1970-74	19.77%	18.88%	13.48%	5.40%	2.28%	19.88%	-0.68%
1975-79	21.37%	19.48%	16.15%	3.33%	3.63%	41.19%	-13.84%
1980-84	21.89%	16.87%	17.50%	-0.63%	4.08%	125.02%	18.64%
1985-89	27.03%	24.44%	26.74%	-2.30%	-0.15%	514.33%	1167.48%
1990-94	21.62%	19.83%	16.10%	3.73%	-0.03%	1819.82%	3441.27%
1995-99	15.40%	13.66%	15.71%	-2.05%	1.80%	24.09%	8.22%
2000-04	18.12%	15.31%	14.62%	0.69%	0.79%	8.85%	9.91%
2005-11	19.44%	17.49%	16.87%	0.63%	0.46%	5.09%	7.81%

Source: Table constructed by the author with information provided from various sources.
(1) World Bank database;
(2) IBGE- Brazilian Institute of Geography and Statistics;
(3) Private savings = National savings - Public savings;
(4) IPEA - Institute of Applied Economic Research, until 1985. From 1986, Public savings equals the Government investment minus Financing needs of Central Government, states and municipalities in the operational concept. Government investment is the Public Gross fixed capital formation from IBGE and Financing needs is from Central Bank of Brazil;
(5) Central Bank of Brazil database;
(6) FGV - Institute Getúlio Vargas;
(7) International Monetary Fund (IFS). Real interest rate = Nominal interest rate - Inflation rate. Nominal interest rate is the Money Market interest rate.

In the early 60s, national savings were more than 16% of GDP and kept growing during the seventies. Domestic savings, on the other hand, followed a positive

[4] These saving deposits are regarding to saving books (Caderneta de Poupança). It is traditional investment, conservative and very popular among investors with lower income. It is free-tax.

growth path till the 80s. Low national savings (public and private) in the early 70s can be associated to the low inflation (less than 20%) to Brazilian standards and fast growing of GDP. In the second part of seventies, inflation increased gradually followed by the improvement of economic indexation[5] mechanisms, slowdown of growing and dropped real interest rates.

On the other hand, the public saving rate decreased systematically due to subsidies to the private sector (rising with inflation) and the increases of interest rates of public debt as a result of indexation. Public sector saving rate maintained above 5% of GDP in the early seventies, but fell hardly in 1980 (0.9%) and fluctuated around zero to negative values during the 80s because of crises and the final of military government. This framework changed in the 90s when the saving rate of public sector became positive although the values were relatively small.

The early 1980s marked the return of restraint of aggregated demand. The effects of the subsequent recession were a dramatic deterioration of public savings that, despite the cuts made in outlays, reduced due to cyclic contraction of revenue and the increase in financial expenses because of rising domestic interest rates. In the following years the inflationary process accelerated, followed by real rates, due to adjustments in the policies of the external debt crisis, implying depth and spread in the mechanisms of indexation in the financial assets, labor and goods markets. The private savings rate remained at a higher level while public savings has virtually disappeared (Reis, et al., 1998). In 1985-1989 private savings was 26.74% of GDP and public savings was -2.3%, see Table 3.2.

Brazil faced a hard inflationary period from 1988 to 1994. The main source of this inflation was the expansion of the money supply resulting from the government's financing method to its operation and development projects that was simply creating money, not out of taxes or borrowing funds. Brazilian Government has implemented various plans to control inflation. The "Cruzado" Plan, implemented in 1986, failed in the attempt to contain inflation through a policy of income-based

[5] Through the dissemination of indexed financial assets, the introduction of mechanisms to repurchase securities, additionally, the gradual periodic reduction of wage and exchange rate readjustment.

indexing, price freeze and inflationary trigger which increased wages in the same magnitude of inflation. The absence of fiscal adjustment, combined with low real interest rates and exchange rate appreciation, increased private consumption perhaps by intertemporal substitution in consumption in reverse. In the following years, two other heterodox stabilization plans in the same mold also frustrated by the absence of fiscal adjustment - the "Bresser" Plan (1987) and the "Verão" Plan (1989). Despite the little differences in the monetary and wage policies of the post-indexing periods, both resulted in outbreaks inflationary, causing large swings in real interest rate. Appendix 9 presents a summary of the most notable stabilization programs implemented in Brazil.

Successive increases in the national savings followed the failure of these three stabilization programs; during this period domestic, national and private savings reached its higher values, see Table 3.2. Among the plausible explanations for this increase in savings are the precautionary motives of the private sector in order to protect themselves from income fluctuations associated with the acceleration of inflation and the pending threat of taxation of financial assets by the government, increased the desired stock of real assets (Reis, et al., 1998).

In 1989, the elected president was Collor; he implemented the New Brazil Plan (or Collor Plan I) in the following year. The government confiscated savings accounts based on the idea that little available income could reduce consumption, reducing the inflationary pressure. It worked upon initiation, but a fall in credit supply brought a recession. In 1990, public saving recuperated (from -1.7% in 1989 to 5.7% in 1990) due to lower spending, lower real interest rate and also gains once-and-for-all[6] resulting from the confiscation of financial assets (Reis, et al., 1998). Private savings rate, by contrast, has fallen (from 37.5% in 1989 to 13.3% in 1990). The relatively low rates occurred because of significant increases in real interest rates and inflation instability. Finally, this plan also failed, and inflation rose again, as well as its immediate successor, the Collor Plan II.

[6] Gains once-for-all are static gains that the country receives after the opening process. These gains are coming from the efficiency of re-allocation of the productive structure is obtained when the country specializes in the production of goods in which it has comparative advantages.

In 1991, the remuneration of 'Caderneta' changed again; the savings began to be paid monthly at Reference Rate plus 0.5%, private savings increased around 2% in this year.

In 1993, Fernando Henrique Cardoso, the Minister of Finance at the time implemented the Real Plan. This plan resulted in the end of three decades of high inflation and the replacement of old currency for Real[7]; see Appendix 9 for more details. Since then, it tamed inflation without price freezes, confiscation of bank deposits or other measures of heterodoxy economy, inflation rate decreased from 1820% in 1990-1994 to 24% in 1995-1999.

The Real Plan, initially, increased private consumption and decreased the rate of domestic savings, despite the resumption of economic growth. The factors that explain such behavior are the greater access to the consumer market for low-income classes that benefited of the end of inflationary tax, the exchange rate appreciation and the deepening of trade liberalization. Those factors boosted imports and expanded the consumer credit (Cândido Júnior, 1998).

In 1999, Brazil adopted Inflation Targeting after a brief period of exchange-rate targeting that ended up in a serious currency crisis[8]. Barbosa-Filho (2007) argues that inflation targeting reduced the real interest rate of the economy, which still remained well above international standards. Additionally high real interest rates, the favorable international trade and financial conditions in the rest of the world allowed the Brazilian government to accumulate foreign reserves to repay most of its foreign debt and reduce its dependence of foreign capital in the time of 2003-2006.

After the adoption of the Inflation Target, domestic saving rate initiated a positive trend growth, from 15% in 1999 to 21% in 2004; national savings followed the

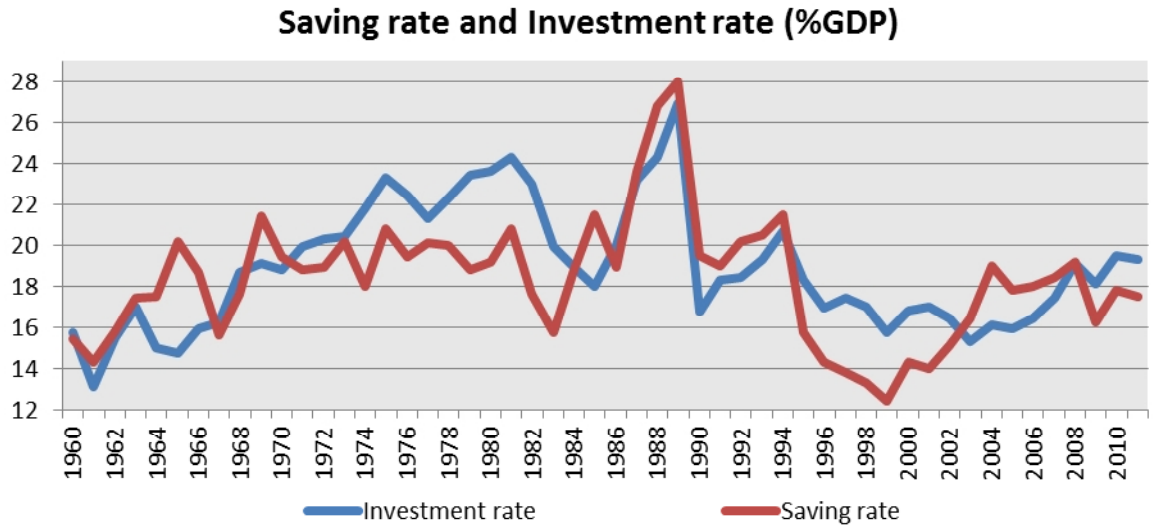
[7] The main idea was to create an index pegged 1-to-1 with the US Dollar, it was named URV. In this way, even if the prices in Cruzeiro Real continued rising, the prices in URV would have minimal variation because it was pegged to the dollar. On 1st July 1994, the URV became the Real, the new Brazilian currency replacing the Cruzeiro Real.

[8] Measures to reduce inflation rate have caused an appreciation in exchange-rate. The inevitable currency crisis came in the beginning of 1999 and resulted in a "maxi-devaluation" of the Real (Barbosa-Filho, 2007).

same path, from 12% in 1999 to 18.5% in 2004, sustained by private saving because public savings presented extremely low rates in this period. Real interest rates presented a negative trend growth, decreasing from 20.7% in 1999 to 9.9% in 2004.

In 2007, the Growth Acceleration Program was launched which mobilized more than R$ 500 billion from 2007 to 2010 in the diverse areas. The expansion of infrastructure investment is, in fact, a fundamental condition for the acceleration of sustainable development in Brazil. The PAC-2, launched in 2011, continued to boost investment in high levels in order to achieve an investment/GDP ratio of 24% by 2014 (Brazilian Ministry of Economy, 2010). In order to keep this strategy of investment and growth it is fundamental for Brazil to increase its saving rates. Diagram 3.1 presents the evolution of Brazilian investment rate and saving rate from 1960 to 2011, is possible to conclude that there is a clear positive relation between these two variables.

Diagram 3.1: Relation between investment rate and saving rate in Brazil



Source: Diagram constructed by the author.

The graph above confirms the argument of Paiva and Jahan (2003) that increasing the investment rate is essential to accelerate the economic growth, and a key mechanism to do it is through raise in the saving rate.

Brazilian Government in 2012 continued its efforts to increase saving rates. After the two noteworthy changes done in the remuneration of savings in 1963 and 1991, on May 3, 2012, savings began to be paid in the following remuneration:

- While the goal of the Selic rate is greater than 8.5% per year, still are paying 0.5% + TR, as defined in 1991.

- When the goal of the Selic rate is equal to or less than 8.5% per year, the remuneration will be equal to Reference rate (TR) + 70% of the goal Selic rate per year, paid at month basis, effective on the begin of income period (Barrucho, 2012).

One month after, the Monetary Policy Committee reduced the prime interest rate of the Brazilian economy from 9 to 8.5% p.a. It is the lowest level of the Selic rate since 1986, but keeps falling reaching the value of 7.5% p.a. in October, 2012 (Portal Brasil website, 2012).

The next section will define and specify the main features of the tested empirical model as well as its origin and particularities and methods to calculate some variables.

4. METHODOLOGY and DATA

Gleizer (1991) tested the hypothesis of the "Financial Repression" literature as mentioned previously. FR literature assesses that, in less-developed economies, the main cause of the low saving rates is the government controls on rates of interest which result in negative real interest rates on banking deposits, and create segmented and inefficient credit markets. The predominant negative real interest rates in such economics did not incentivize savings and restricted the funds supply to the banking sector. There are two main effects of FR: 1) the credit rationing reduced the level of productive investment and 2) drop in efficiency, on average, of the investment projects undertaken since projects, which yield proceeds merely beyond the roof rate of interest, were frequently financed. The policy recommendations originated from FR are those of increasing real interest rates

and controlling inflation. The possible result would be the increase in the quantity of future savings, leading to more efficient and higher investment. In other words, eliminating interest rate roofs could produce the optimal effect of increasing savings, maximizing investment and raising its average efficiency (Gleizer, 1991).

The following equation represents the standard saving function employed in the studies of interest elasticity to developing countries.

(1)

where GDS is real domestic saving, GDPpc is real GDP per capita, GDPg is the rate of growth of real output, $(i - \pi^e)$ the ex-ante short term real rate of interest and FS is real foreign savings (the current account deficit in the balance of payments).

In order to analyze the effects of real interest rates on real savings in Brazil, a saving function similar to Equation (1) is estimated. One of the dependent variables used in the set of regressions is the domestic savings rate, however, Fry (1988) defends the use of national saving since this variable evaluates the own country efforts to channel resources for investment. Gleizer (1991) assesses that this hypothesis assumes that net factor payments sent broad are positive and then national saving would exceed domestic saving by that quantity. However in Brazil where the net factor payments sent broad have been negative since the early 1960s, the use of national saving affords a depreciated view of the economy's saving effort.

Regarding the choice of the dependent variable despite the substitution and income effects of interest rate variations in the standard microeconomic theory and the FR hypothesis of a total positive effect related to private and not to domestic saving, there is no reason to assume that real interest rates contribute positively to savings. On the contrary, in countries with immense internal public debts, high real interest rates are responsible for a great share in the decrease of public saving and disposable income, due to their effects on net transfers. Since inflation alters the share of the public and the private sector in savings, some authors defend the use

of aggregate data. Yet the utilization of aggregate data implies its own distortions (Gleizer, 1991). In that way, additionally to the regression with the domestic saving rate as the dependent variable, will be estimated an equivalent model substituting it with the private saving rate.

The estimation of the expected inflation rate is an additional difficulty in Equation (1), measuring the ex-ante real interest rate is problematic because expected inflation is not observable, and so neither is the ex-ante real interest rate. The real interest rate is:

(2)

$r_t \rightarrow$ the ex-ante real interest rate on the one-period bond at time t (from time t to t+1).

$i_t \rightarrow$ the nominal interest rate on the one-period bond at time t (from time t to t+1).

$\rightarrow$ the rate of inflation expected at time t (from time t to t + 1).

This research uses two different approaches to calculate the expected inflation, the rational expectation assumption and the adaptive expectations. Starting by the hypothesis that rational expectations provide inflationary expectations. Rational expectations implies that

(3)

It means that if expectations are rational, expected errors are unpredictable given any information disposable at time t:

$$E(\varepsilon_t, \Omega_t) = 0 \quad (4)$$

$E(\ldots/\Omega_t)$ is the mathematical expectations operator conditional on all information disposable at time t, Ω_t. Errors are uncorrelated with any information available at time t-1. If the errors of forecast inflation were correlated with any information available at time t such information could be used to improve the determination of expected inflation at time t.

(5)

→ the ex-post real interest rate on the one period bond at time t (the realized real return from time t to time t + 1).

→ the actual rate of inflation from t to t + 1. The realized rate of inflation is a proxy for the expected rate.

Another procedure to determine the expected inflation is through the adaptive expectations, i.e. the expected inflation is a weighted average of past inflation rates.

(6)

which becomes

(7)

the expanded equation

(8)

provides that:

(9)

Thus, past inflation rates adequately forecast inflationary expectations. Coats and Khatkhate (1984) perform empirical tests where the following equation defines the inflation series:

(10)

The expected and actual rates are equal in the initial period. An iterative procedure determines the weights (ϕ) linked to the expected and actual inflation rate. Namely given a starting value for ϕ, it calculates an expected inflation value for each

period. Then, the generated values of the expected inflation determined the inverted money demand equation[9], in the following form, using the OLS method:

(11)

where WPI is the wholesale price index, GDP is real GDP and M is the actual money stock.

This process was repeated in order to define the weight (ϕ) that maximizes the likelihood function of the estimated price equation. Equation (10) was calculated according to this weight (ϕ), determining the expected inflation used to reach the real interest value each year. The next section presents the final results.

5. RESULTS

The principal purpose of this section is analyzing if there is any relation between the levels of Brazilian savings and interest rates through the extension of the model performed by Gleizer (1991). Evaluating his model one of its weakness is the absence of one variable on demographics. Thus besides the extension of his model till 2011, this thesis will include variables of population features as population growth rate, the urban rate, and dependency ratios (youth and elderly) in order to understand if these variables are able to improve the obtained results and its implication on real interest rates significance.

Gleizer (1991) estimated a traditional saving function using two different dependent variables, the domestic and the private saving rate. Additionally, he used two regression models, the ordinary least square (OLS) regressor and the instrumental variables (IV) regressor.

In the OLS regression, the expected real interest rate is estimated by using the adaptive expectations method described in the previous section. Gleizer (1991)

[9] In fact, this is an inverted demand for the following money equation:
$\log(M/WPI)_t = \beta_0 + \beta_1 \log GDPt + \beta_2 + \beta_3 \log(M/WPI)_{t-1}$

concluded that with the exception of the level of real GDPpc none of the variables was significant in explaining the saving rate, even though the coefficients' signs conformed to expectations. Once the lagged saving ratio was an explanatory variable in the model, he tested the serial correlation on the model through a Durbin-Watson test.

Gleizer (1991) considers the possibility of income endogeneity, then its growth rate and the real interest rate are endogenous variables in a two stages least squares estimation. Differently from the OLS estimation, in the IV regression the real interest rate was calculated according to the rational expectations assumption. The author tested two different sets of instrumental variables for the IV model. In the prime estimation (IV1), the instruments variables are: the inflation rate lagged one and two periods, the lagged dependent variable, the lagged level of per capita income, the lagged growth rate of GDP, the lagged foreign savings rate, the population growth rate, the growth rate of money lagged one and two periods, and the nominal interest rate. In the second estimation (IV2), the instruments variables are: the lagged dependent variable, the population growth rate, the real exports level, the real gross investment level, and the log of the lagged real money supply lagged. The use of Durbin-Watson test is not possible in IV estimation for calculation reasons. Therefore, the first-order autocorrelation test is the Arellano-Bond test applied to the differenced residuals in GMM estimators.

The adapted estimation performed[10] in this research presents similar results to those obtained by Gleizer (1991). As mentioned before, the supposed positive effect of higher interest rates should influence household savings and not the domestic savings. Given the unavailability of information about Brazilian household savings, Equation (1) was estimated again using the private savings rate as the dependent variable, substituting the domestic savings rate, Table 5.1 summarizes the results.

[10] The estimations were performed in the program STATA 11.

Without doubt, the most valuable finding is that real interest rates are as well as not significant at any level in each regression; its coefficients are positive in the OLS estimation and negative in the IV estimations, but the constant, the income level per capita and the foreign saving are now positive in all estimations. The coefficients sign are, in general, the same. For this period, the Durbin-Watson values are between the critical values, therefore, is impossible to make a decision about the serial correlation, then the performed autocorrelation test is the Arellano – Bond test that has a null hypothesis of no autocorrelation, the results of test for AR (1) process do not reject the null hypothesis. Appendix 10 presents the main differences between the results from Gleizer (1991) and the model estimated in this study.

Table 5.1: Reproduced model adapted from Gleizer (1991)

$$GDS_t = \alpha_0 + \alpha_1 GDPpc_t + \alpha_2 GDPg_t + \alpha_3 (i_t - \pi^e_t) + \alpha_4 FS_t + \alpha_5 GDS_{t-1} + \varepsilon_t \quad (12)$$

$$PvS_t = \alpha_0 + \alpha_1 GDPpc_t + \alpha_2 GDPg_t + \alpha_3 (i_t - \pi^e_t) + \alpha_4 FS_t + \alpha_5 GDS_{t-1} + \varepsilon_t \quad (13)$$

Dep. Var.	**Domestic Saving**			**Private Saving**		
1960-1985	OLS	IV1	IV2	OLS	IV1	IV2
Const.	-0.3534	-0.4187	-0.4368	-0.331	-0.4568	-0.478
	[0.0805]***	[0.0644]***	[0.0754]***	[0.1416]**	[0.1167]***	[0.1262]***
GDPg	-0.0825	-0.0936	-0.184	-0.084	-0.1058	-0.2284
	[0.0541]	[0.0482]*	[0.1011]*	[0.0951]	[0.087]	[0.1664]
GDPpc	0.0602	0.0687	0.0749	0.0485	0.064	0.0721
	[0.0123]***	[0.0102]***	[0.0131]***	[0.0216]**	[0.0185]***	[0.0219]***
RIR	0.00168	-0.00729	-0.0061	0.0082	-0.0085	-0.0052
	[0.00545]	[0.00609]	[0.0073]	[0.00958]	[0.0109]	[0.0123]
FS	-0.5544	-0.6374	-0.666	-0.9343	-1.1316	-1.166
	[0.1596]**	[0.1177]***	[0.1345]***	[0.028]**	[0.2138]***	[0.228]***
GDS lagged	0.2147	0.2133	0.0255	0.5818	0.631	0.383
	[0.1919]	[0.1631]	[0.2473]	[0.3373]	[0.2964]**	[0.4121]
N	25	24	25	25	24	25
R^2	0.9015	0.9043	0.8829	0.8062	0.7988	0.7814
F/Wald	34.78	228.66	194.52	15.8	95.64	92.48
DW	0.945	0.7365	0.8306	0.2696	0.4638	0.547

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Table constructed by the author.

Simply extending the model till 2011, the results are much different from those. The principal results obtained in the extended regressions are that, real interest rates become significant in all regressions at a confidence level of at least 95%. The coefficients of real interest rate are also uniform and negative in all regressions. Every variable presents the same coefficient signs in all estimations. This suggests that these results have emerged in recent years as the decrease in real interest rates has become settled over time. Table 5.2 summarizes the results.

Table 5.2: Results for the extended model. Equations (12) and (13) were reestimated for the period from 1960 to 2011.

Dep. Var.	**Domestic Saving**			**Private Saving**		
1960-2011	OLS	IV1	IV2	OLS	IV1	IV2
Const.	-0.0698	-0.0862	-0.0578	-0.179	-0.219	-0.158
	[0.0465]	[0.0455]*	[0.0918]	[0.0804]**	[0.0819]**	[0.1315]
GDPg	0.0919	0.11	0.0011	0.004	0.1158	-0.125
	[0.0508]*	[0.0566]*	[0.2184]	[0.0877]	[0.1013]	[0.313]
GDPpc	0.0084	0.0107	0.0043	0.0217	0.0266	0.0163
	[0.00598]	[0.0058]*	[0.0115]	[0.0103]**	[0.0104]**	[0.0166]
RIR	-0.000386	-0.00045	-0.00145	-0.00048	-0.00048	-0.0017
	[0.000098]***	[0.0001]***	[0.0005]**	[0.00017]**	[0.00019]**	[0.0006]**
FS	-0.1864	-0.1838	-0.299	-0.553	-0.5645	-0.673
	[0.1025]*	[0.0957]*	[0.1589]*	[0.17705]**	[0.1723]**	[0.227]**
GDS lagged	1.0131	0.99	1.262	0.9235	0.8825	1.203
	[0.0694]***	[0.0624]***	[0.1489]***	[0.1199]***	[0.1124]***	[0.2132]***
N	51	50	51	51	50	51
R^2	0.8661	0.8698	0.6561	0.6774	0.6563	0.4297
F/Wald	58.23	333.03	138.68	18.9	98.84	66.09
DW	2.2075	0.4445	0.723	2.2473	0.7496	0.5651

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Table constructed by the author.

Table 5.3: Testing for endogeneity through instrumental-variable estimation (GMM)

H0: Instruments are exogenous					
		Domestic Savings		**Private Savings**	
		IV1	IV2	IV1	IV2
1960-1985	Hansen's J	7.14262	6.6329	8.18822	6.27409
	p-value	0.4142	0.0363	0.4153	0.0434
1960-2011	Hansen's J	19.8292	1.44481	14.6691	2.94376
	p-value	0.006	0.4856	0.0659	0.2295

Source: Table constructed by the author.

The coefficients in the IV regressions do not change significantly relative to the OLS regressions in both Table 5.1 and 5.2, and they show the predicted signs, thus using the OLS estimation does not appear, at a first glance, to be providing inconsistent results. As the for the instruments chosen, the R-squared of the regressions are around 90% for domestic savings and 80% for private savings in Table 5.1 (for the period from 1960 to 1985) as is the F-statistic considerably high; it means the chosen instruments correlates sufficiently with the "suspect" variables to serve as instruments. Although the R-squared values in Table 5.1 are high enough when extending it drops down; in Table 5.2, for domestic saving, the variance of the dependent variables explained by the independent variables dropped for 86% (for OLS and IV1) and 65% (for IV2). For private savings the values get worst, 65% (for OLS and IV1) and 43% (for IV2). Table 5.3 exhibits the J-statistic for the test of over-identifying restrictions; as the statistics are high enough, in general, one cannot reject the null hypothesis at the usual confidence levels (1% or 5%) that the instrumental variables chosen in both IV estimations are valid instruments.

These outcomes are similar to those reached by Nabar (2011) about Chinese urban household savings. The author investigated the relation between saving rates and real interest rates in 31 provinces in China, his results from OLS and Fixed effects regressions real interest of rate influences negatively to saving rates, although its coefficients are much higher than those obtained here.

Regarding the serial correlation tests, in the OLS estimation the Durbin-Watson values are higher than the upper bound value than there is no serial correlation in these regressions. In the IV regressions, the Arellano – Bond test rejects the hypothesis of autocorrelation.

This estimation has many macroeconomic events implicit on it, from 1986 Brazilian economy underwent many transformations, more than 6 stabilization plans from 1986 to 1994 (Appendix 9 summarizes the relevant ones), changes in monetary

policy regime in 1999, changes in political leaders' orientation[11] in 2002, everything detailed in Section 3. In order to evaluate the effects of some of these transformations on economic variables Table 5.4 exhibits the descriptive statistics for the period from 1960 to 2011 and three sub-periods, 1960 to 1985 (Gleizer's (1991) model and the Military Rule period), 1986 to 1994 (instability and hyperinflation period) and 1995 to 2011 the post-Real period.

Table 5.4: Descriptive statistics

	Full Sample (1960-2011)	**1960-1985**	**1986-1994**	**1995-2011**
Domestic Savings	0.1272	0.1349	0.1592	0.0983
	[0.0342]	[0.0053]	[0.0132]	[0.0039]
National Savings	0.1127	0.1179	0.1468	0.0867
	[0.0323]	[0.0038]	[0.0153]	[0.0039]
Private Savings	0.1046	0.1048	0.137	0.0872
	[0.0383]	[0.0066]	[0.0201]	[0.0031]
Public Savings	0.00812	0.0132	0.0098	-0.00051
	[0.0192]	[0.0044]	[0.0056]	[0.0025]
Foreign Savings	0.0137	0.0216	-0.0012	0.0095
	[0.0189]	[0.0039]	[0.0053]	[0.0026]
GDP growth rate	0.046	0.0635	0.0226	0.0315
	[0.0406]	[0.0087]	[0.0119]	[0.0054]
GDP per capita	8.1073	7.9183	8.3156	8.286
	[0.3737]	[0.0843]	[0.054]	[0.0396]
Real Interest rate	4.3999	-0.0978	25.5434	0.0855
	[19.2217]	[0.0667]	[13.9315]	[0.0267]
Population Growth rate	0.02022	0.026	0.0154	0.0138
	[0.00094]	[0.0006]	[0.001]	[0.0009]
Urbanization rate	0.6923	0.5878	0.7497	0.8215
	[0.0173]	[0.017]	[0.0051]	[0.0058]
Young Dependency ratio	0.3576	0.4081	0.3501	0.2843
	[0.0083]	[0.0048]	[0.0041]	[0.0054]
Elderly Dependency ratio	0.0458	0.0368	0.0449	0.0601
	[0.0016]	[0.0006]	[0.0008]	[0.0017]

Note: Standard deviation in parentheses.
Source: Table constructed by the author.

[11] In 2002, there was the presidential election. According to Barbosa-Filho (2007), Brazilian political cycle had a speculative international capital flows associated with it, and the looming victory of a leftist candidate, Lula da Silva, resulted in massive capital outflows and an unprecedented cut in Brazil's access to foreign lines of credit. The Brazilian inflation rate reached double-digit levels at the end of 2002.

Without doubt, the variable that has had the greatest variation along these periods is the real interest rate it changed from -9.8% to 2554.3%, ending in 8.6%. Domestic, national and private savings had their greater values in the instability period due probably to precautionary reasons.

Population growth exhibits a downward trend, but the urbanization rate decreased; on the other hand, the youth dependency ratio dropped while the older one rose. These variables are additional controls in the next subsection.

5.1 ROBUSTNESS: ADDITIONAL CONTROLS

Although the previous estimations control for the main variables used in macro analyses of the determinants of saving rates in Brazil, concerns remain that the coefficients of some variables may be absorbing the effects of other omitted variables that affect the rates of saving. This subsection considers the hypothesis of demographic changes is affecting saving rates.

5.1.1 Population features

The demographic transition in developing countries, Latin American and Asian countries have been much more accelerated than in developed ones. In Brazil, the fertility decline after 1965 had an impact, obviously, reduced the population growth, see Appendix 11. These results have led to a downwards revision of fertility estimation (Fausto, 2008). As a result, the population growth rate reduced to a half over these three sub-periods; values presented in Table 5.4.

Another happening is the strong rural exodus in Brazil along the last decades. It is quite widespread - not only among specialists – the fact that, between 1960 and 1980, the Brazilian rural exodus reached a total of 27 million people. The Brazilian rural population peaked in 1970 with 41 million inhabitants (44% of the total population). Since then the rural population has suffered a relative and absolute decline, coming in 2010 with a total of 29.8 million people (15.6% of the total). The reduction of the importance of the rural population is due primarily to migration (Camarano & Abramovay, 1999).

Table 5.1.1.1: Extended model for domestic savings, adding population features as controls

$$GDS_t = \alpha_0 + \alpha_1 GDPpc_t + \alpha_2 GDPg_t + \alpha_3(i_t - \pi^e_t) + \alpha_4 FS_t + \alpha_5 GDS_{t-1} + \alpha_6 POPg_t + \varepsilon_t \quad (14)$$

$$GDS_t = \alpha_0 + \alpha_1 GDPpc_t + \alpha_2 GDPg_t + \alpha_3(i_t - \pi^e_t) + \alpha_4 FS_t + \alpha_5 GDS_{t-1} + \alpha_6 UrbR_t + \varepsilon_t \quad (15)$$

Domestic Saving

1960-2011	OLS (1)	IV1 (1)	IV2 (1)	OLS (2)	IV1 (2)	IV2 (2)
Const.	-0.4739	-0.4777	0.322	-0.4854	-0.5053	1.628
	[0.0977]***	[0.0884]***	[0.3675]	[0.092]***	[0.0899]***	[3.599]
GDPg	0.0528	0.053	-0.066	-0.0097	-0.039	0.4027
	[0.0433]	[0.0479]	[0.3621]	[0.046]	[0.0545]	[1.275]
GDPpc	0.0563	0.0569	-0.0424	0.08848	0.093	-0.329
	[0.0117]***	[0.0105]***	[0.0784]	[0.017]***	[0.0167]***	[0.7177]
RIR	-0.00019	-0.00024	-0.0023	-0.00017	-0.00019	-0.0047
	[0.0009]**	[0.00009]**	[0.0016]	[0.00009]*	[0.0001]*	[0.0073]
FS	-0.6032	-0.5984	0.0039	-0.5427	-0.5564	0.8561
	[0.1261]***	[0.1156]***	[0.555]	[0.11]***	[0.1064]***	[2.5065]
GDS lagged	0.7378	0.7323	1.676	0.5524	0.5139	3.748
	[0.0842]***	[0.0735]***	[0.7168]	[0.109]***	[0.1064]***	[5.402]
POPg	2.8465	2.8235	-2.526			
	[0.6315]***	[0.5776]***	[4.124]			
UrbR				-0.239	-0.2558	0.992
				[0.049]***	[0.05]***	[2.149]
N	51	50	51	51	50	51
R^2	0.9084	0.9123	0.1413	0.9134	0.914	-
F/Wald	72.74	518.35	55.93	77.32	531.17	12.97
DW	2.1419	0.4216	0.5498	1.9572	0.8316	0.6459

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Table constructed by the author.

Table 5.1.1.1 summarizes the estimation results for domestic savings. The negative relationship between the real interest rate is constant, but the magnitude itself is smaller than the baseline estimation (Table 5.2, Domestic saving – OLS and IV1). The aggregate saving rate is robust to the inclusion of both, the population growth and urbanization rate, except in the case of IV2 where the results are much worst. A smaller population growth yields a greater ratio of the population in older cohorts, in the long run. Since older cohorts tend to have more assets and save less (if they are already retired), per capita savings might decline as a long-run effect to a (permanent) decline in the population growth rate, it

explains the positive coefficient of population growth. The short-run effects of a sudden and permanent reduction in the population growth rate are minus obvious (Krueger, 2004). Most empirical researches surveyed indicated that the urbanization ratio contributes negatively to savings. The last result reflects the lower variance of urban income relative to rural income, which would reduce the requirement for precautionary savings (Paiva & Jahan, 2003).

Comparing to the results reported in Table 5.2, the R-squared values are better, around 90% in the OLS and IV1 estimations, but in the IV2 regression it is extremely low or even the model is not globally significant as the case of IV2 (2) because the Wald-value is considerably weak. The best results obtained are for domestic savings considering population growth as an additional control [OLS(1) and IV(1)] where every variable is significant at 5% at least except the income growth which is not significant. Appendix 12 exhibits the main changes in the key variables relatively to the baseline model presented in Table 5.2.

Table 5.1.1.2 exhibits the results for private savings. Here, the coefficient on the real interest rate is no longer statistically significant probably because population growth and urbanization rate are aggregate variables. Although the coefficient is not statistically significant, relationship between the real interest rate and the private saving rate is still negative. The coefficient on the population growth is robust (for OLS and IV1), but the results are for urbanization ratio are different, the OLS (2) regression is significant at 10%, and the IV1(2) and IV2(2) are not significant. The R-squared values improved comparing to those obtained in Table 5.2 but, similarly to the results for domestic savings, the IV2 estimation is no longer significant. Appendix 13 presents the main changes in the key variables relatively to the baseline model presented in Table 5.2.

Table 5.1.1.2: Extended model for private savings, adding population features as controls. Equations (14) and (15) were reestimated but private savings was the dependent variable.

	Private Saving					
1960-2011	OLS (1)	IV1 (1)	IV2 (1)	OLS (2)	IV1 (2)	IV2 (2)
Const.	-0.7414	-0.7455	-0.4106	-0.5171	-0.4927	3.795
	[0.1819]***	[0.1699]***	[0.4658]	[0.191]**	[0.189]**	[7.311]
GDPg	-0.0503	0.0151	-0.0802	-0.0786	-0.0069	0.8933
	[0.0807]	[0.092]	[0.2645]	[0.095]	[0.114]	[2.597]
GDPpc	0.0883	0.0888	0.0473	0.0868	0.081	-0.7687
	[0.0218]***	[0.0203]***	[0.0573]	[0.035]**	[0.0352]**	[1.462]
RIR	-0.00021	-0.0002	-0.0011	-0.000303	-0.00031	-0.0095
	[0.0001]	[0.0002]	[0.0011]	[0.0002]	[0.0002]	[0.0149]
FS	-1.1331	-1.123	-0.8752	-0.8427	-0.8073	2.033
	[0.2347]***	[0.222]***	[0.4059]**	[0.2282]***	[0.223]***	[5.105]
GDS lagged	0.5403	0.531	0.9275	0.5487	0.5627	7.06
	[0.156]***	[0.1414]***	[0.5237]*	[0.2260]**	[0.2231]**	[11.002]
POPg	3.9619	3.845	1.6792			
	[1.1752]**	[1.11]***	[3.0131]			
UrbR				-0.1952	-0.171	2.338
				[0.1009]*	[0.1049]	[4.377]
N	51	50	51	51	50	51
R2	0.7436	0.7363	0.6295	0.7027	0.6868	-
F/Wald	21.27	139.87	102.05	17.33	112.19	3.18
DW	2.6364	0.0211	0.9151	2.2536	0.5007	0.6186

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Table constructed by the author.

5.1.2 Age structure

The youth dependency ratio decreased more than 10 percent over these 50 years, and the elder dependency ratio almost duplicated, as noted above in Table 5.4. The age structure of Brazilian population has been changing, in part due to fertility decline referred earlier, in part due to improvements in health care, i.e. between 1970 and 2000 infant mortality decreased from 115 to 30 deaths of children under 1 year old per 1,000 live births; see Appendix 14. The fall in the proportion of young people happens at a faster rate than the increase in the elderly because the growth of the adult population mediates the replacement of older people by young

people (Fausto, 2008). Shifts in the age structure possibly trigger shifts in expenditure patterns, which influence consumer prices and, therefore, the real rate of interest as well as they directly influence the saving rate (Nabar, 2011). It would indicate potential omitted variables bias in the baseline estimations reported above in Table 5.2.

Table 5.1.2.1 reports results for domestic saving regressions that include the youth and elderly dependency ratio as additional controls. The relationship between the real interest rate and the saving rates is robust to the inclusion of both, the youth and elderly dependency ratio even in the case of IV2, differently to the regressions including the population growth and urbanization rate. The magnitude itself, similar to the previous regressions, is smaller than the base line estimation, see Table 5.2. The R-squared values are slightly larger than those in the baseline model for OLS and IV1, for IV2 they are basically in the same level. Appendix 15 summarizes the comparison between these estimation results and the baseline results.

For domestic savings, the coefficients on the youth and elderly dependency ratio are robust at 1% and suggest that as the population ages, saving rates decrease possibly due to larger health expenditures and the pensions that do not match current spending. The youth dependency ratio contributes positively to saving rate. Developing countries are at an early stage in the demographic transition associated with potential near-term gains. The working age population is still increasing fast, and drops in the youth dependency rate which can afford the opportunity to raise saving rates and capital accumulation. Lower mortality rates among the young and middle-aged provide higher returns from investments in education and other sorts of human capital (Bosworth & Chodorow-Reich, 2006).

Table 5.1.2.1: Extended model for domestic savings, adding age structure as controls.

$$GDS_t = \alpha_0 + \alpha_1 GDPpc_t + \alpha_2 GDPg_t + \alpha_3(i_t - \pi^e_t) + \alpha_4 FS_t + \alpha_5 GDS_{t-1} + \alpha_6 YDR_t + \varepsilon_t \quad (16)$$

$$GDS_t = \alpha_0 + \alpha_1 GDPpc_t + \alpha_2 GDPg_t + \alpha_3(i_t - \pi^e_t) + \alpha_4 FS_t + \alpha_5 GDS_{t-1} + \alpha_6 EDR_t + \varepsilon_t \quad (17)$$

Domestic Saving

1960-2011	OLS (3)	IV1 (3)	IV2 (3)	OLS (4)	IV1 (4)	IV2 (4)
Const.	-0.6465	-0.634	-0.151	-0.266	-0.2732	-0.0733
	[0.1323]***	[0.1263]***	[0.4853].	[0.0695]***	[0.648]***	[0.1424]
GDPg	0.00497	0.0222	-0.1501	0.0573	0.0792	-0.0336
	[0.0464]	[0.0518]	[0.228]	[0.0464]	[0.051]	[0.2091]
GDPpc	0.0704	0.0694	0.0145	0.0458	0.0461	0.0082
	[0.0145]***	[0.0137]***	[0.0536]	[0.0118]***	[0.0109]***	[0.0247]
RIR	-0.00022	-0.00027	-0.0014	-0.00028	-0.00034	0.0014
	[0.00009]**	[0.0001]**	[0.0007]**	[0.00009]**	[0.0001]***	[0.0005]**
FS	-0.5226	-0.5075	-0.339	-0.414	-0.4041	-0.3162
	[0.1129]***	[0.1055]***	[0.2736]	[0.1119]***	[0.1035]***	[0.1868]*
GDS lagged	0.5233	0.5371	1.14	0.6893	0.6904	1.212
	[0.122]***	[0.1137]***	[0.539]**	[0.1107]***	[0.1005]***	[0.278]***
YDR	0.403	0.3825	0.0938			
	[0.088]***	[0.0853]***	[0.3483]			
EDR				-1.333	-1.267	-0.1715
				[0.377]***	[0.3525]***	[0.777]
N	51	50	51	51	50	51
R^2	0.909	0.9125	0.6666	0.8957	0.8986	0.6763
F/Wald	73.29	521.36	141.64	62.96	443.86	146.82
DW	1.8254	0.5858	0.8231	1.8681	0.6679	0.8032

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Table constructed by the author.

The next table, Table 5.1.2.2 reports the estimations for private savings. Despite the statistical significance (at 5% level) of real interest rate in regressions including the elderly dependency ratio. The same does not occur when the added control is the youth dependency ratio, in this case only in estimations in OLS and IV1 the real interest rate is significant (at 10% level) but in IV2 it is no longer significant. The R-squared values are slightly larger than the model presented in Table 5.2 for the OLS and IV1 estimation, but is not possible to identify a pattern for IV2 because it is lower due the inclusion of youth dependency ratio and larger due the inclusion of

the elderly dependency ratio. Appendix 16 provides a table to compare these results to those obtained in the baseline estimation.

Table 5.1.2.2: Extended model for private savings, adding age structure as controls. Equations (16) and (17) were reestimated but private savings were the dependent variable.

	Private Saving					
1960-2011	OLS (3)	IV1 (3)	IV2 (3)	OLS (4)	IV1 (4)	IV2 (4)
Const.	-0.6544	-0.6117	-0.5864	-0.3806	-0.392	-0.1685
	[0.267]**	[0.2636]**	[0.7422]	[0.1306]**	[0.126]**	[0.209]
GDPg	-0.0676	0.0065	-0.5837	-0.0314	0.0547	-0.2629
	[0.0937]	[0.1082]	[0.3496]	[0.087]	[0.099]	[0.3068]
GDPpc	0.0728	0.0688	0.0631	0.06	0.0602	0.0218
	[0.0292]**	[0.0288]**	[0.0819]	[0.022]**	[0.0214]**	[0.0362]
RIR	-0.00034	-0.00035	-0.0014	-0.00037	-0.00038	0.00166
	[0.00018]*	[0.0002]*	[0.001]	[0.00017]**	[0.0002]**	[0.0008]**
FS	-0.83	-0.7916	-0.8621	-0.7862	-0.7704	-0.6912
	[0.227]***	[0.2202]***	[0.41847]**	[0.2102]***	[0.2012]***	[0.2741]**
GDS lagged	0.5197	0.545	0.6825	0.5914	0.589	1.107
	[0.2462]**	[0.2375]**	[0.824]	[0.208]**	[0.195]**	[0.4077]**
YDR	0.332	0.2832	0.3833			
	[0.178]*	[0.1781]	[0.5327]			
EDR				-1.37	-1.233	-0.345
				[0.71]*	[0.685]*	[1.139]
N	51	50	51	51	50	51
R2	0.701	0.6876	0.3698	0.7025	0.685	0.437
F/Wald	17.19	111.17	59.03	17.32	111.85	65.69
DW	2.2238	0.5474	0.9844	2.2264	0.6193	0.8186

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Table constructed by the author.

The coefficients of the youth and the elderly dependency ratio are poorly robust. In the case of youth dependency ratio, only in the OLS estimation is it significant at 10% level. In the case of the elderly dependency ratio, it is significant in the OLS and IV1 estimations at 10% level. Regarding the coefficient signals, they are identical to those presented in domestic savings.

6. CONCLUSION

This thesis discussed the importance of the real interest rate in the determination of real domestic and real private savings, in Brazil, from 1960 to 2011. It is a comparison and an extension of the model developed by Gleizer (1991). Since his analysis covers a period when Brazil faced a serious economic, political and social instability; i.e. his research covers the period from 1960 to 1985 and the Military Rule in Brazil occurred from 1964 to 1985. His main finding is that both, domestic savings in general and private savings in particular, respond mindlessly to real rates of interest. Therefore, concluding that neither theory nor empirical evidence support a policy of high real interest rate as a resource to raise the real savings rate.

Nevertheless, the results obtained in this study allow us to conclude that real interest rate is significant for aggregate and private savings in all regressions in the period from 1960 to 2011. The coefficient sign is the same, negative in each case despite their small values. This significant and negative relationship has recently emerged possibly due to favorable economic and political scenarios. Economic instability, totally uncontrolled inflation and hyperinflation recurring frameworks marked the period from 1986 to 1994. However, after the implementation of the Real Plan in 1993, the government was finally able to tame inflation and drop considerably real interest rate. The results deny the FR hypothesis of a total positive effect relate to private savings and suggests the Microeconomic explanation which the income effect outweighing the substitution effect.

Furthermore, this thesis also added additional controls in the models considering that some coefficients could be absorbing the effects of other omitted variables that could affect saving rates. The relationship between real interest rates and the Brazilian saving rates is robust to the inclusion of other explanatory variables that proxy for invoked savings impulses. Considering the development process that Brazil is passing through and demographic change implied by this process, population features such as population growth and the urbanization ratio, and age

structure features such as the youth and the elderly dependency ratio are additional controls in the model.

In the case of population features, for domestic savings in the OLS and IV1 regressions real interest rate is significant at a level of at least 5%; but, in the regressions of private saving the real interest rate is no longer significant. In the case of age structure, the relation between real interest and real domestic saving is robust in every regression. For private saving when including the elderly dependency ratio the relationship is significant for every estimation, but when including the youth dependency ratio the relationship is robust only for OLS and IV1.

Despite the relevance of the theme for issues such as economic growth, current account sustainability and investment strategy, the limited quantity of theoretical and empirical studies of savings in Brazil requires for further work in the area. Household savings would provide a more accurate study to reach the point proposed by the FR Literature; however this data is not available in Brazil. An additional difficulty was the access to the series of long-term interest rates; standardized and more extensive series could enrich this article since the saving rate analysis is more appropriate with long-term interest rates.

7. REFERENCES

Articles

Barbosa-Filho, N., 2007. Inflation Targeting in Brazil: 1999-2006. *International Review of Applied Economics,* Volume Vol. 22(2).

Bosworth, B. & Chodorow-Reich, G., 2006. *Saving and Demographic Change: The Global Dimension.* Washington D.C., The Brookings Institution.

Camarano, A. A. & Abramovay, R., 1999. *Êxodo Rural, Envelhecimento e Masculinização no Brasil: Panorama dos Útimos 50 Anos,* Rio de Janeiro, Brazil: Instituto de Pesquisa Económica Aplicada.

Cândido Júnior, J., 1998. *Poupança Doméstica e Restrição ao Crescimento no Brasil: 1998-2006.* Brazil, Anais do XXVI Encontro Nacional de Economia ANPEC.

Coats, W. L. & Khatkhate, D. R., 1984. Monetary Policy in Less Developed Countries: Main Issues. *The Developing Economics,* Vol. XXII(4), pp. 329-348.

Collins, S. M., 1989. Saving Behavior in Ten Developing Countries. *National Bureau of Economic Research*, January, pp. 349-376.

Deaton, A., 1989. *Savings in Developing Countries: Theory and Review.* Washington, D. C., The International Bank for Reconstruction and Development.

Fausto, B., 2008. Transição Demográfica e Desigualdades Sociais no Brasil. *Revista Brasileira de Estudos de População*, Jan/Jul, Vol. 25(No: 1), pp. 5-29.

Friedman, M., 1957. A Theory of the Consumption Function. *National Bureau of Economic Research.*

Fry, M. J., 1980. Saving, Investment, Growth, and the Cost of Financial Repression. *World Development,* Vol. 8(4), pp. 317-327.

Giambiagi, F. & Montero, F., 2005. *O Ajuste da Poupança Doméstica no Brasil: 1999-2004,* Rio de Janeiro, Brazil: Instituto de Pesquisa Económica Aplicada (IPEA).

Giovannini, A., 2005. Saving and the Real Interest Rate in LDC's. *Journal of Development Economics,* Vol. 18(2-3), pp. 197-217.

Gleizer, D., 1991. Savings and real Interest Rates in Brazil. *Revista de Econometria,* Abril, Vol. XI (No: 1), pp. 63-92.

Hammer, J. S., 1986. Children and Savings in Less Developed Countries: Main Issues. *Journal of Development Economics,* Vol. 23(No: 1).

Hausman, R., 2008. *In Searching of the Chains that Hold Brazil Back,* Havard University: Center for International Development.

Krueger, D., 2004. The Effects of Demographic Changes on Aggregate Savings: Some Implications from the Life Cycle Model. *National Bureau of Economic Research*, November.

Loayza, N., Schimidt-Hebbel, K. & Servén, L., 2000. Saving in Developing Countries: an Overview. *The World Bank Economic Review,* Vol. 14(No: 393-414).

Mishkin, F., 1988. Understanding real interest rates. *National Bureau of Economic Research.*

Muradoglu, G. & Taskin, F., 1996. Differences in Households Savings Behavior: Evidence from Industrial and Developing Countries. *The Developing Economics,* Issue XXXIV-2.

Nabar, M., 2011. *Targets, interest Rates, and Households savings in Urban China,* s.l.: International Monetary Fund.

Ouliaris, S., 1981. *Household Saving and the Rate of Interest,* Vol. 57: Economic Record.

Paiva, C. & Jahan, S., 2003. An Empirical Study of Private Saving in Brazil. *Brazilian Journal of Political Economy,* p. Brazil.

Pereira, L. C. & Nakano, Y., 1991. Hiperinflação e Estabilização no Brasil: o Primeiro Plano Collor. *Revista de Economia Política,* Vol. 11(No: 4(44)).

Pio, C., 2001. A Estabilização Heterodoxa no Brasil: Ideias e Redes Políticas. *Revista Brasileira de Ciências Sociais,* Vol. 16(No: 46).

Reis, E., Issler, J. V., Blanco, F. & Carvalho, L. M., 1998. *Renda Permanente e Poupança Precaucional: Evidências Empíricas para o Brasil no Passado Recente.* Rio de Janeiro, Brazil, Pesquisa de Planejamento Económico.

Schimitt-Hebbel, K., Webb, S. B. & Corsetti, G., 1992. *Households Saving in Developing Countries: First cross-country evidence,* s.l.: The World Bank Economic Review.

Books

Fry, M. J., 1988. *Money, Interest, and Banking in Economic Development.* 1st ed. Baltimore: The Johns Hopkins University Press.

Gastaldi, J. P., 1968. *A Economia Brasileira e os Problemas do Desenvolvimento.* São Pulo, Brazil: Editora Saraiva.

Gersovitz, M., 1988. Saving and Development. In: H. Chenery & T. N. Srinivasan, edits. *Handbook of Development Economics.* New York: Elsevier Science Publishers, pp. 382-419.

McKinnon, R. I., 1973. *Money and Capital in Economic Development.* 1st ed. Washington, D. C.: The BrooKings Institution.

Shaw, E. S., 1973. *Financial Deeping in Economic Development.* 1st ed. New York: Oxford University Press.

Williamson, S. D., 2008. *Macroeconomics.* 3rd edition ed. Washington University in St. Louis: Pearson International Edition.

Websites

Barrucho, L. G., 2012. *BBC Brasil.* [Online]
Available at:
http://www.bbc.co.uk/portuguese/noticias/2012/05/120504_regras_poupanca_lgb.shtml
[Accessed 14 May 2012].

Brazilian Ministry of Economy, 2010. *Ministry of Economy of Brazil.* [Online]
Available at: http://www.fazenda.gov.br/portugues/docs/perspectiva-economia-brasileira/edicoes/Economia-Brasileira-Em-Perpectiva-Especial-10.pdf
[Accessed August 2012].

Portal Brasil website, 2012. *Taxa básica de juros cai para 8, 5% e é a menor da história do País.* [Online]
Available at: http://www.brasil.gov.br/noticias/arquivos/2012/05/30/taxa-basica-de-juros-cai-para-8-5-e-e-a-menor-da-historia-do-pais
[Accessed 16 May 2012].

8. APPENDIX

Appendix 1: Variables names, definition and source.

Code	Variable	Definition	Source
GDS	Real Gross Domestic Savings	Real domestic savings as a proportion of GDP at constant prices. Domestic savings equal national savings plus net factor payment sent to abroad.	World Bank
NS	Real National Savings	Real national savings as a proportion of GDP at constant prices.	IBGE
PbS	Real Public Savings	IPEA's statistics and Public savings = government investment - financing needs. Real Public savings over GDP at constant prices.	1960-1985: IPEA 1986-2009: IBGE and Central Bank of Brazil
PvS	Real Private Savings	It equals Real National savings minus Real Public savings, as a percentage of Real GDP.	Author's own calculation.
FS	Real Foreign Savings	The Real Foreign savings is the balance of current account in dollar converted to Real at the exchange rate in the end of each year, deflated by CPI (from IGV); as a proportion of GDP at constant prices.	Central Bank of Brazil
GDPg	Real GDP growth rate	Growth rate of real GDP.	IBGE
GDPpc	GDP per capita	Natural logarithm of Real GDP per capita. Defined as nominal GDP deflated by CPI and normalized by population.	IBGE
i	Nominal Interest rate	Money market interest rate.	IMF - IFS
π^e	Expected Inflation rate	The Inflation rates on the Wholesale price index (WPI). In 2010, this series denomination changed to Producer price index. Base, 2004 = 100.	Institute Getúlio Vargas (IGV)
POPg	Population growth ratio	The growth rate of the total population each year.	IBGE
UrbR	Urbanization ratio	The proportion of the total population that lives in urban areas.	IBGE
YDR	Young Dependency ratio	The sum of people younger than 15 years as a proportion of the total population.	OECD Statistics
EDR	Elderly Dependency ratio	The sum of people older than 65 years as a proportion of the total population.	OECD Statistics

Source: Table constructed by the author.

Appendix 2: Main determinants of Private saving rates.

Determinants of the rate of Private Savings to Income in Panel Studies

Variable category	Specific variable	Sign predicted by Theory	Empirical findings
Income	Income level: Actual	0 or +	+ (1, 2, 3, 4, 7) 0 (5, 6)
	Temporary/permanent	+/0 or +	0/ 0 (7)
	Terms of trade: Actual	0 or +	+ (2, 4, 6, 7)
	Temporary/permanent	+/0 or +	+/ + (7)
	Growth rate actual	Ambiguous	+ (2, 3, 7) 0 (4, 5, 6)
Rates of return	Real interest rate	Ambiguous	-(7) 0(1, 3, 5, 6) + (2)
Uncertainty	Variance of innovations to savings determinants	+	
	Inflation or other measures of macroeconomic instability	+	
	Measures of political instability	+	-(4) 0(1, 2, 3, 6) +(7)
Domestic borrowing constraints	Private credit flows	-	+ (3) - (7)
	Broad money flows	-	
	Income	-	
Foreign borrowing constraints	Foreign lending	-	
	Current account deficit	-	- (1, 2, 3, 7)
Financial depth	Private or domestic credit stocks	Ambiguous	- (5)
	Money stocks	Ambiguous	+ (1, 3, 4) 0 (7)
Fiscal policy	Public savings	-	- (1, 3, 7)
	Public surplus	-	- (2, 5, 6) 0 (4)
	Public consumption	Ambiguous	- (2, 6)
Pension system	Pay-as-you-go pension transfers	0 or -	- (3, 4, 5)
	Mandatory fully funded pension contribution	0 or +	+ (4)
	Fully funded pension assets	Ambiguous	0/ + (5)
Demographics	Old- and/or young-age dependency	-	- (2, 3, 4, 7) 0 (5, 6)
	Urbanization	Ambiguous	- (3, 7)
Distribution of income and wealth	Income concentration	Ambiguous	0 (3)
	Wealth concentration	Ambiguous	
	Capital income share	+	

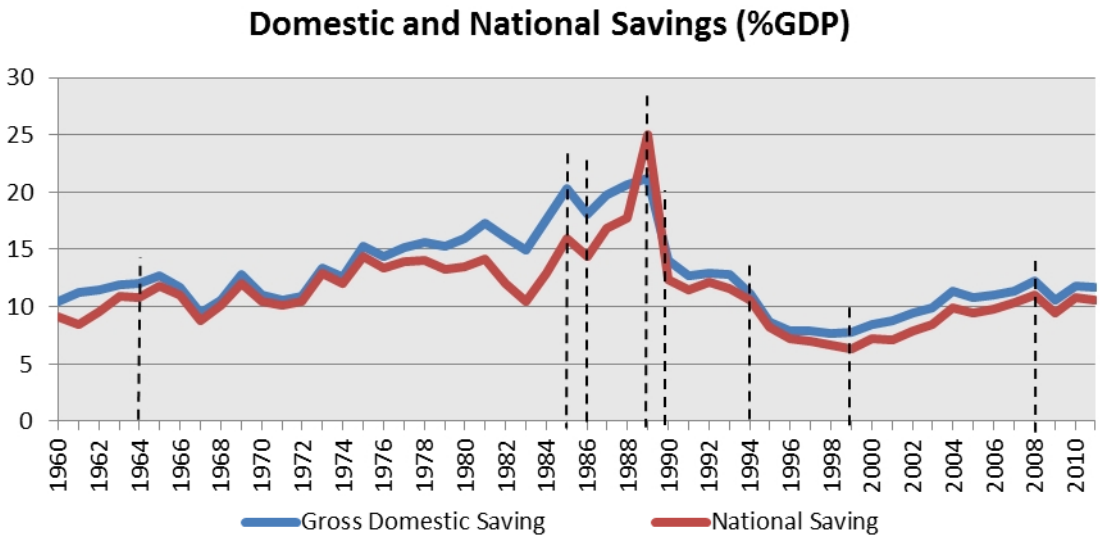
Note: the qualitative results listed in the last column summarize significant signs of saving regressors in the following studies:

1. Corbo and Schimidt-Hebbel (1991: table4)
2. Masson, Bayoumi, and Samiei (1995: table 2, "restricted mode" column)
3. Edwards (1996: table 2, col. 5)
4. Dayal-Gulati and Thimann (1997: table 4, col. 2)
5. Bailliu and Reisen (1998: table 1, cols. 3 and 4)
6. Pesaran, Haque, and Sharma (2000: table 6, cols. 4 and 5)
7. Loayza, Schmidt-Hebbel, and Servén (2000: table 4, col. 3 and table 7, various columns)

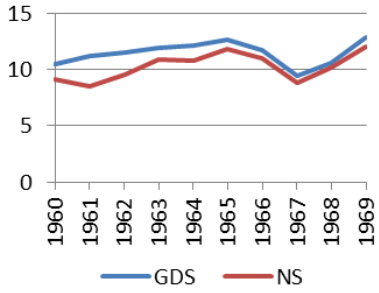
Significant coefficient signs are identified by a plus or a minus. Results identified by a zero mean either an insignificant coefficient in the corresponding column of the original study or, when the variable is omitted from the particular specification reported in the column, a significant or insignificant variable in a different column of the same table. A zero in the third column means that theory predicts no effect.

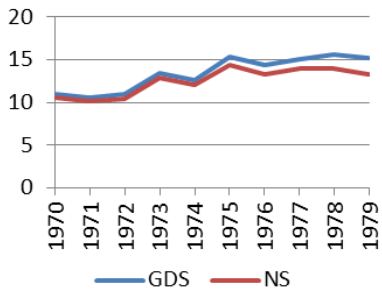
Source: Loayza, Schmidt-Hebbel, and Servén (2000).

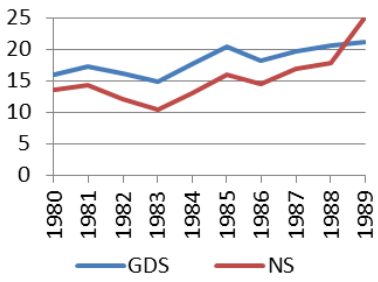
Appendix 3: Evolution of domestic and national savings.

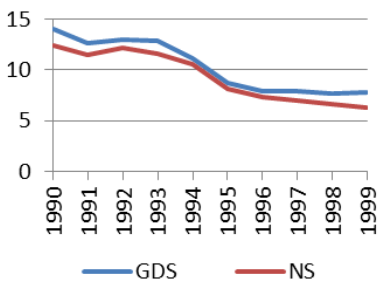


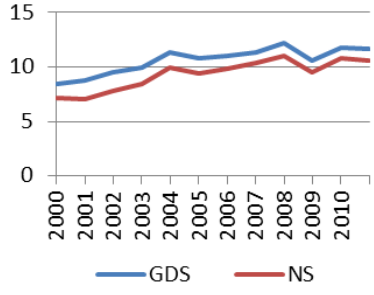
Source: Diagram constructed by the author.



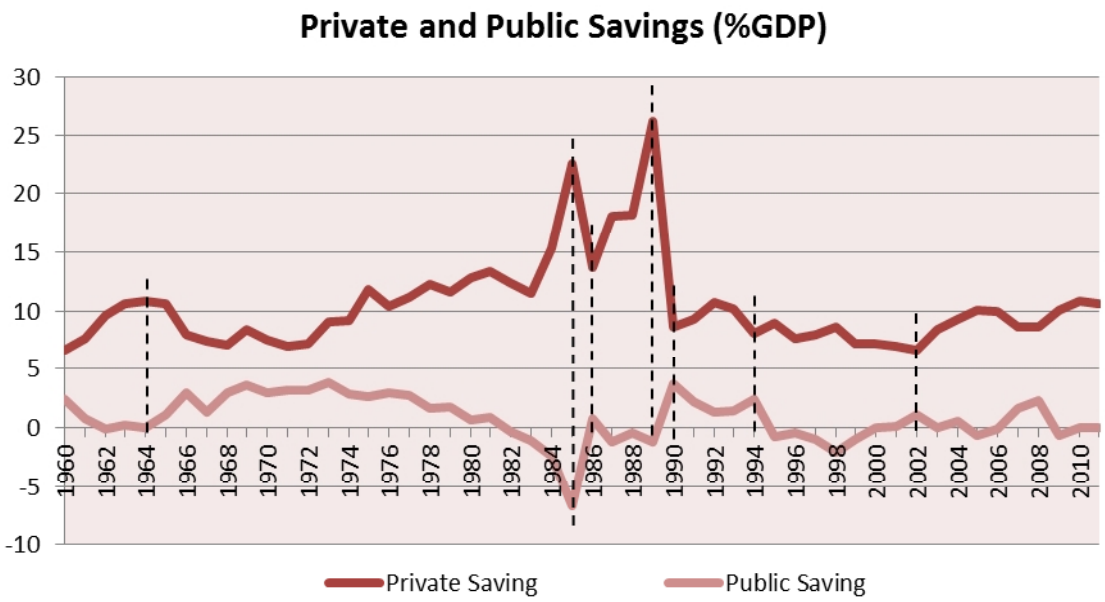




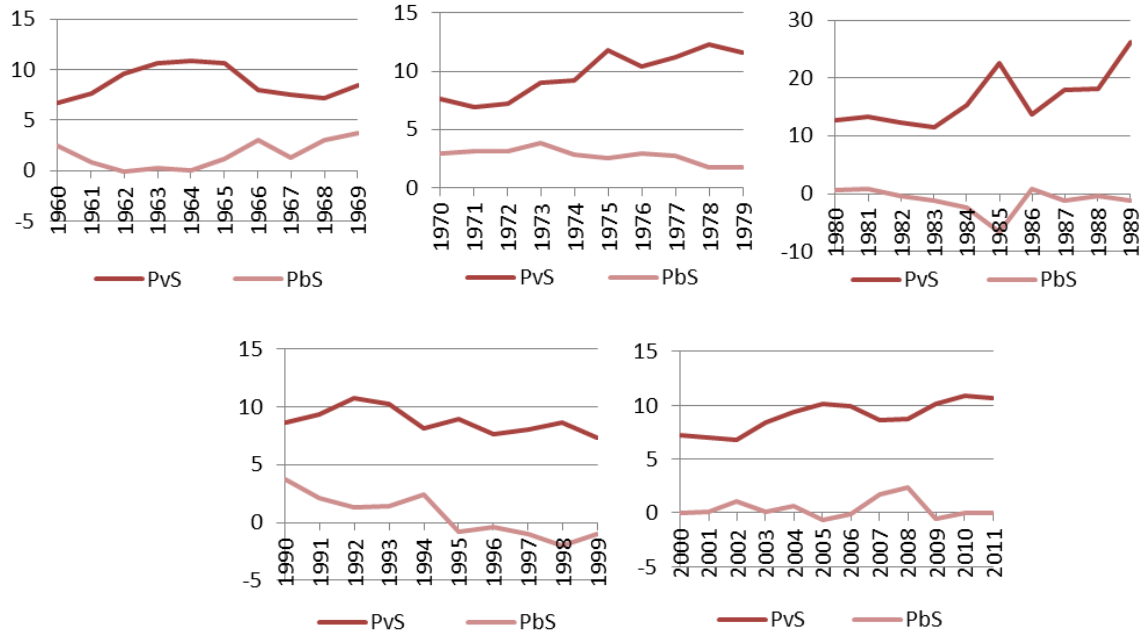




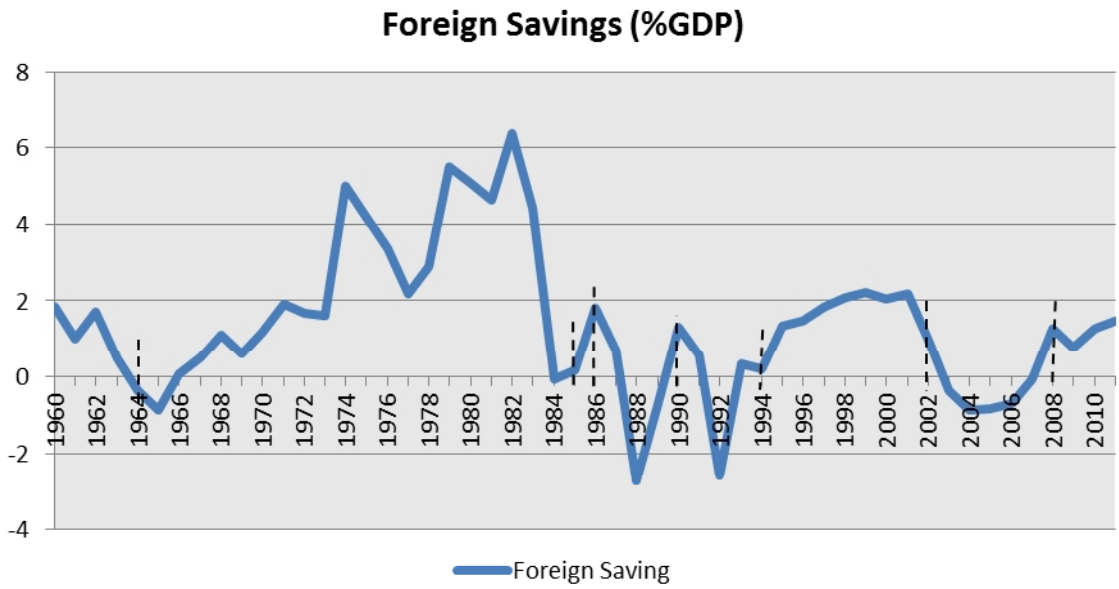
Appendix 4: Evolution of private and public savings.



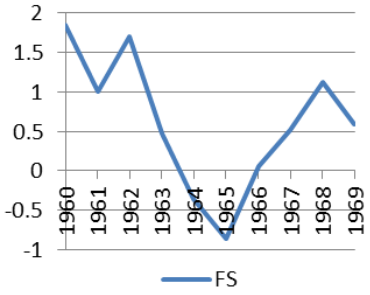
Source: Diagram constructed by the author.

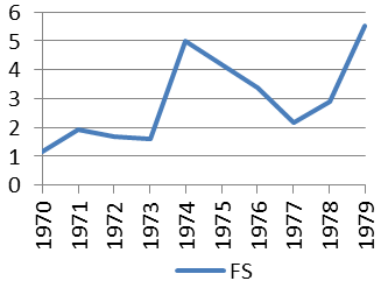


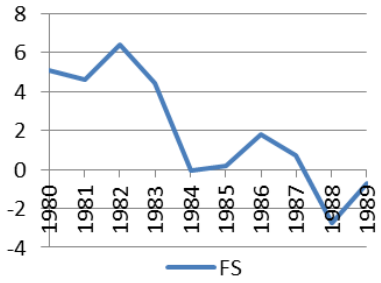
Appendix 5: Evolution of foreign savings.

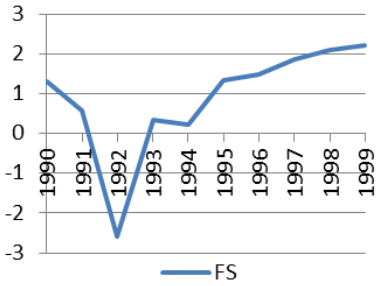


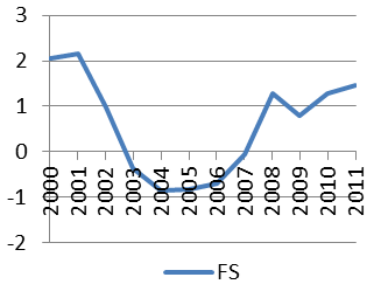
Source: Diagram constructed by the author.



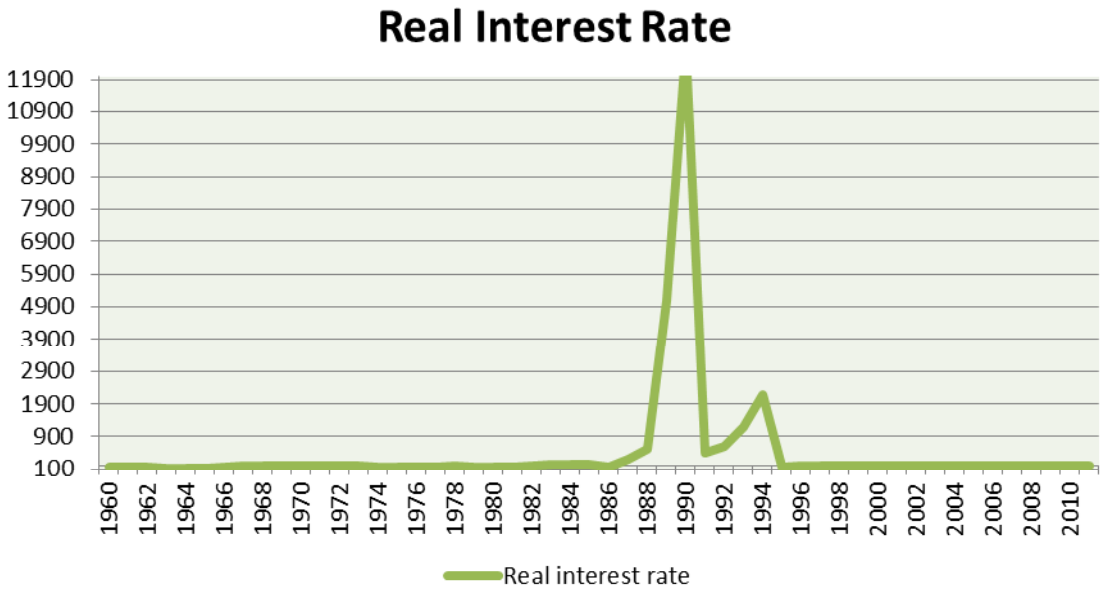




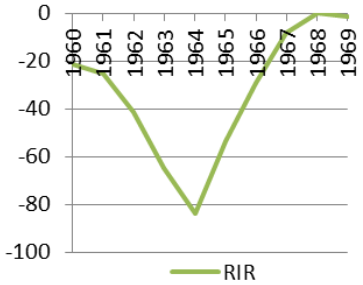


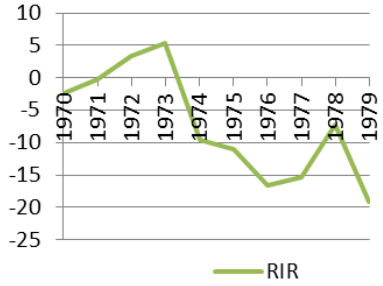


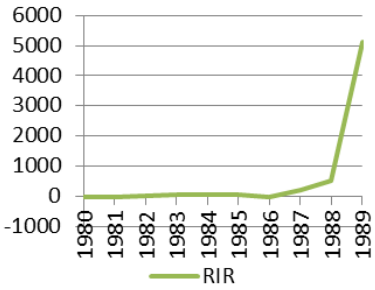
Appendix 6: Evolution of real interest rate.

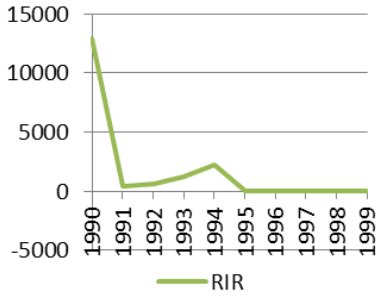


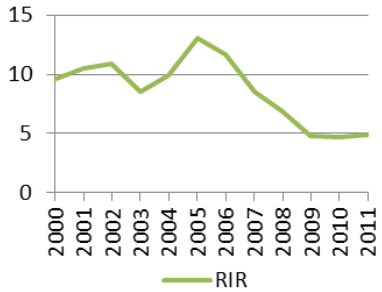
Source: Diagram constructed by the author.

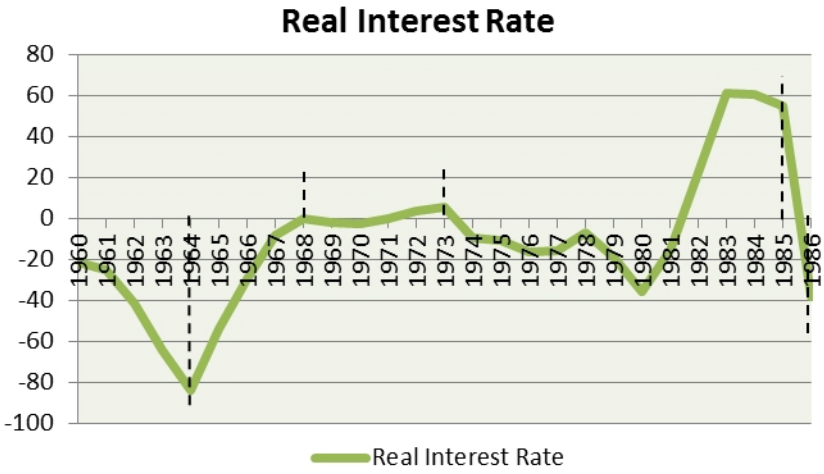




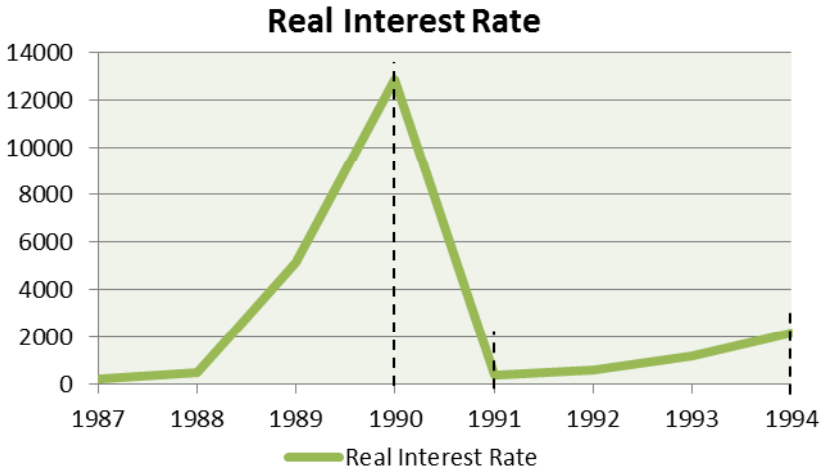




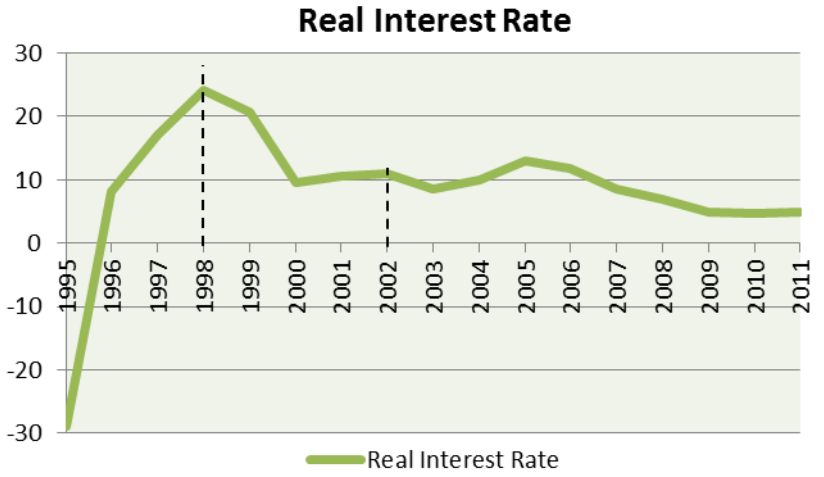




Source: Diagram constructed by the author.

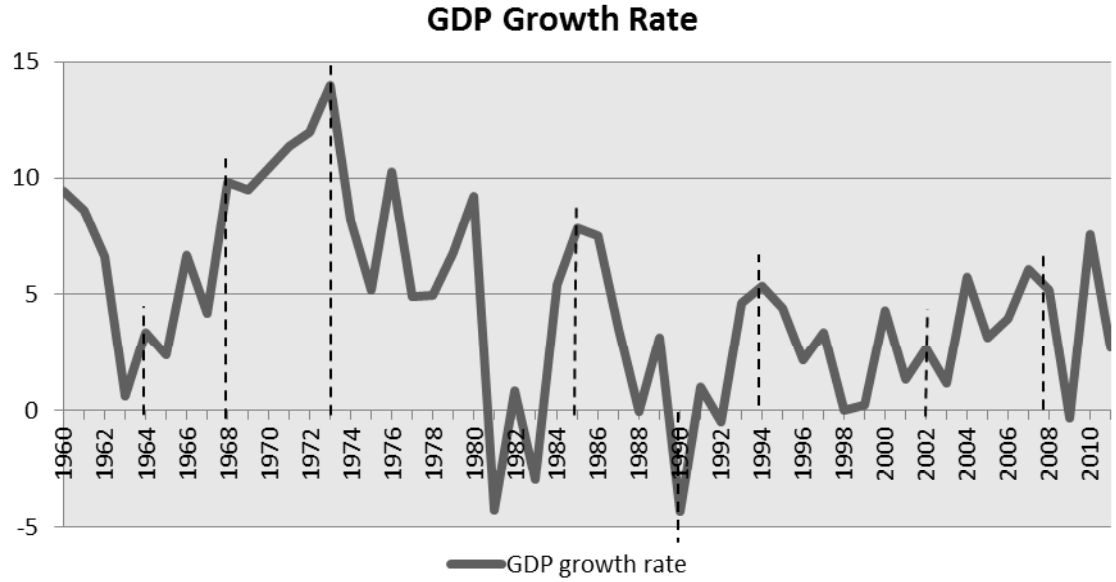


Source: Diagram constructed by the author.

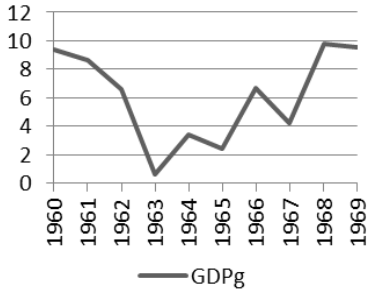


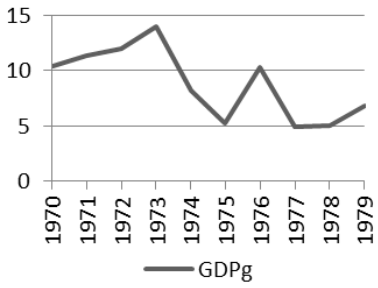
Source: Diagram constructed by the author.

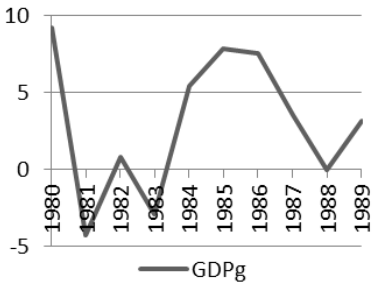
Appendix 7: Evolution of GDP growth rate.

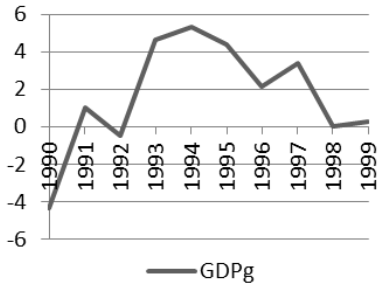


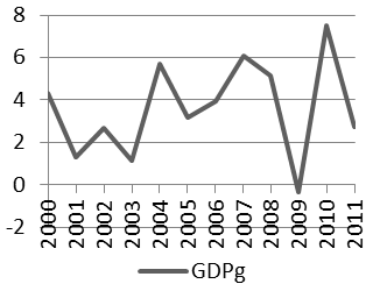
Source: Diagram constructed by the author.



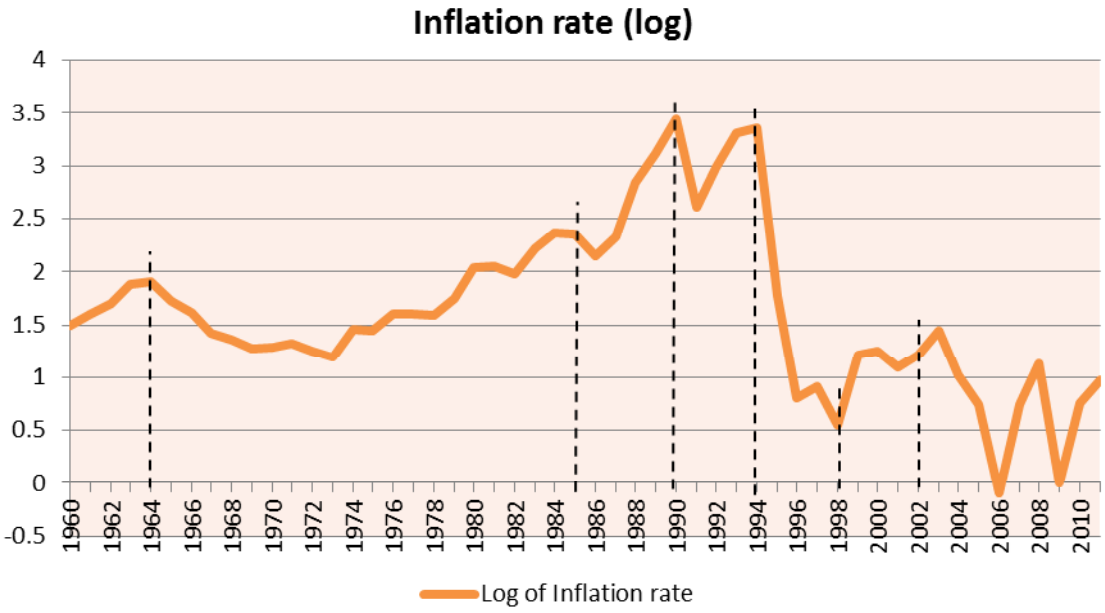




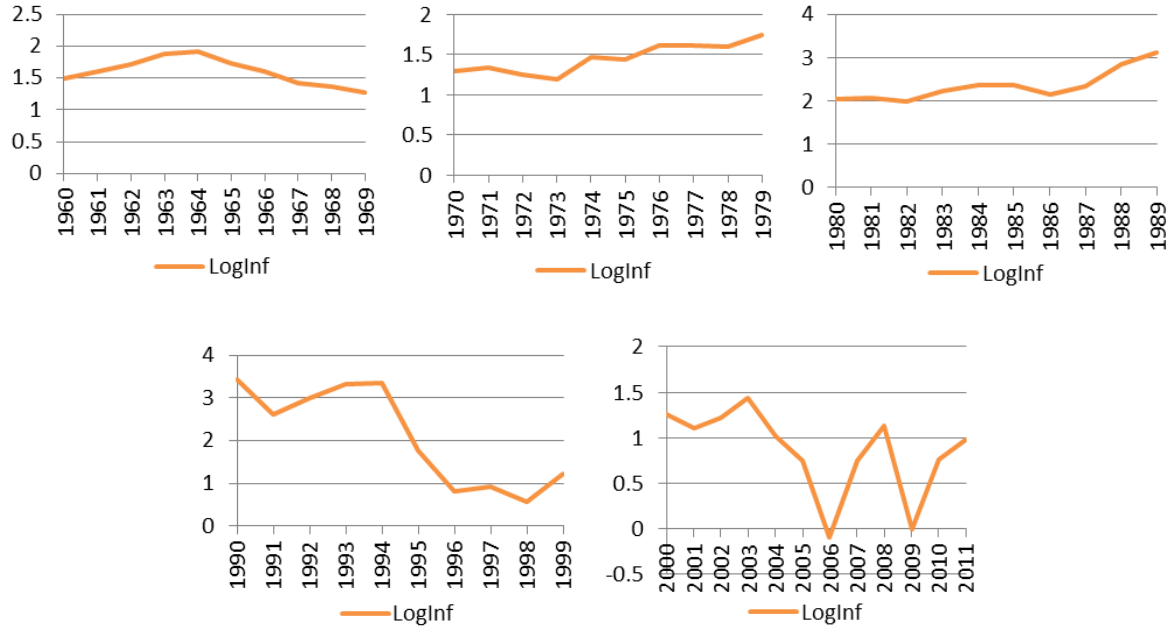




Appendix 8: Evolution of inflation rate.



Source: Diagram constructed by the author.



Appendix 9: Main Brazilian Stabilization Plans.

Date	Plan	Main Characteristics	President
Feb, 1986	Cruzado	New currency: "cruzado" replaces "cruzeiro"; Freeze of prices and wages; It Created de unemployment insurance and the wage trigger (automatic adjustment of wages each time inflation reaches a certain level); Suspension of payment of external debt.	José Sarney
Jun, 1987	Bresser	It kept freezing of prices, wages and suspension of external debt payment; It increased public tariffs; It cancelled the trigger wage.	José Sarney
Jan, 1989	Verão (Summer)	It controlled inflation by controlling the public deficit; Privatization; It established new price freeze; It determined the indexation of the economy.	José Sarney
Apr, 1990	New Brazil or Collor I	"Cruzeiro" comes back as currency; Confiscation of 70% of bank deposits and financial assets; Introduction of floating exchange rate; Liberalization and privatization; Freezes on prices; End of indexation; It closed government agencies and dismisses employees; Fiscal adjustment.	Fernando Collor de Melo
Feb, 1991	Collor II	New freeze on prices and wages; It created Financial Investments Fund where all operations in the short term were done; Ending the National Treasury Bonds Tax, which was used to index prices; End of indexation; Increasing the tax on financial transactions.	Fernando Collor de Melo
Aug, 1993	Real	New currency: "Real"; Exchange rate is fixed at R$1.00 to US$ 1.00; Raises interest rates; It facilitated imports; It provided the control of public spending; It kept liberalization and privatization; It searched measures to support the modernization of enterprises.	Itamar Franco

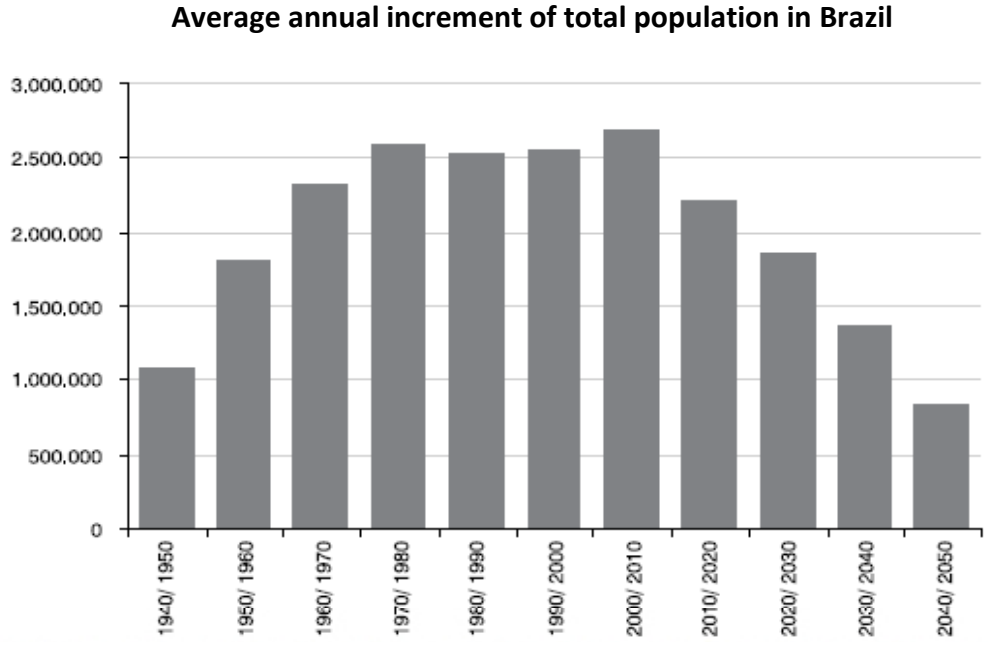
Source: Table constructed by the author, based on several papers:
Pereira and Nakano (1991);
Pio (2001);
Reis, Issler, Blanco and Carvalho (1998).

Appendix 10: Comparison between the model developed by Gleizer (1991) and the adapted model performed in this thesis.

1960-1985	Domestic Saving						Private Saving					
	OLS		IV1		IV2		OLS		IV1		IV2	
	Mine	Geizer	Mine	Gleizer	Mine	Gleizer	Mine	Gleizer	Mine	Gleizer	Mine	Gleizer
Const.	(-)***	(-)*	(+)***	(-)	(-)***	(-)*	(-)**	(-)***	(-)***	(-)***	(-)***	(-)***
GDPg	(-)	(-)	(-)*	(+)	(-)*	(+)	(-)	(-)	(-)	(+)	(-)	(+)
GDPpc	(+)***	(+)**	(+)***	(+)**	(+)***	(+)**	(+)**	(+)***	(+)***	(+)***	(+)***	(+)***
RIR	(-)	(+)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(-)
FS	(-)**	(-)	(-)***	(-)	(-)***	(-)	(-)**	(-)***	(-)***	(-)***	(-)***	(-)***
GDS lagged	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)**	(+)	(+)	(+)

Source: Table constructed by the author.

Appendix 11: Average annual increment of total population in Brazil.



Source: Fausto (2008).

Appendix 12: Comparison between the baseline model for domestic savings presented in Table 5.2 and the model including population features as additional controls.

	Domestic Saving											
	Population growth						Urbanization rate					
	OLS		IV1		IV2		OLS		IV1		IV2	
Add. Control	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Const.	(-)***	(-)	(-)***	(-)*	(+)	(-)	(-)***	(-)	(-)***	(-)*	(+)	(-)
GDPg	(+)	(+)*	(+)	(+)*	(-)	(+)	(-)	(+)*	(-)	(+)*	(+)	(+)
GDPpc	(+)***	(+)	(+)***	(+)*	(-)	(+)	(+)***	(+)	(+)***	(+)*	(-)	(+)
RIR	(-)**	(-)***	(-)**	(-)***	(-)	(-)**	(-)*	(-)***	(-)*	(-)***	(-)	(-)**
FS	(-)***	(-)*	(-)***	(-)*	(+)	(-)*	(-)***	(-)*	(-)***	(-)*	(+)	(-)*
GDS lagged	(+)***	(+)***	(+)***	(+)***	(+)	(+)***	(+)***	(+)***	(+)***	(+)***	(+)	(+)***

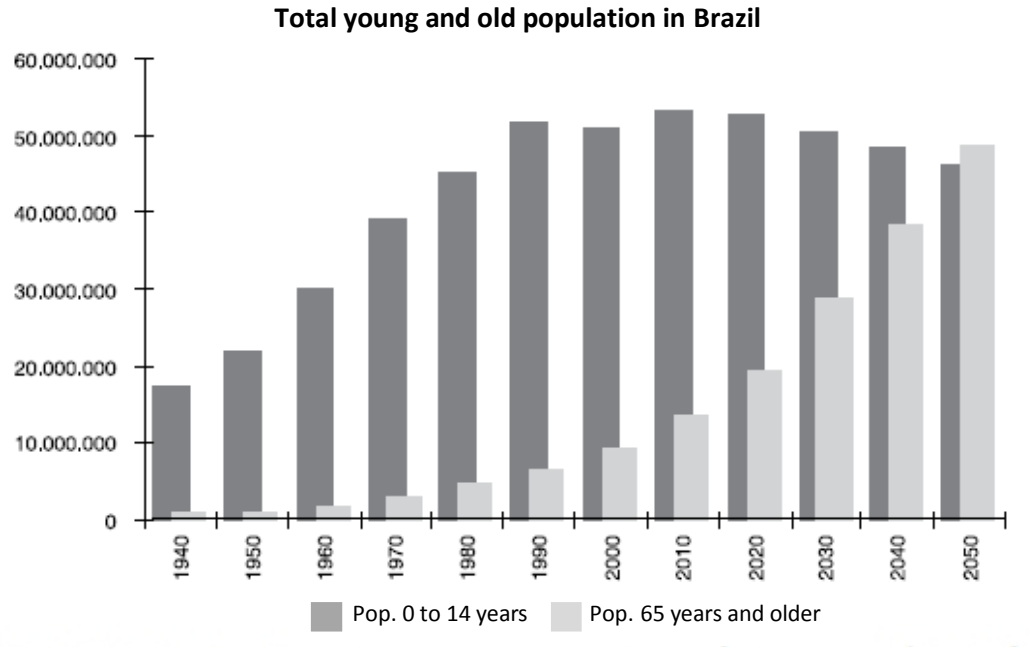
Source: Table constructed by the author.

Appendix 13: Comparison between the baseline model for private savings presented in Table 5.2 and the model including population features as additional controls.

	Private Saving											
	Population growth						Urbanization rate					
	OLS		IV1		IV2		OLS		IV1		IV2	
Add. Control	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Const.	(-)***	(-)**	(-)***	(-)**	(-)	(-)**	(-)**	(-)**	(-)**	(-)**	(+)	(-)**
GDPg	(-)	(+)	(+)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(+)	(+)
GDPpc	(+)***	(+)**	(+)***	(+)**	(+)	(+)**	(+)**	(+)**	(+)**	(+)**	(-)	(+)**
RIR	(-)	(-)**	(-)	(-)**	(-)	(-)**	(-)	(-)**	(-)	(-)**	(-)	(-)**
FS	(-)***	(-)**	(-)***	(-)**	(-)	(-)***	(-)***	(-)**	(-)***	(-)**	(+)	(-)***
GDS lagged	(+)***	(+)***	(+)***	(+)***	(+)	(+)***	(+)**	(+)***	(+)**	(+)***	(+)	(+)***

Source: Table constructed by the author.

Appendix 14: Total young and old population in Brazil.



Source: Fausto (2008).

Appendix 15: Comparison between the baseline model for domestic savings presented in Table 5.2 and the model including age structure as additional controls.

	Domestic Saving											
	Young Dependency ratio						Elder Dependency ratio					
	OLS		IV1		IV2		OLS		IV1		IV2	
Add. Control	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Const.	(-)***	(-)	(-)***	(-)*	(-)	(-)	(-)***	(-)	(-)***	(-)*	(-)	(-)
GDPg	(+)	(+)*	(+)	(+)*	(-)	(+)	(+)	(+)*	(+)	(+)*	(-)	(+)
GDPpc	(+)***	(+)	(+)***	(+)*	(+)	(+)	(+)***	(+)	(+)***	(+)*	(+)	(+)
RIR	(-)**	(-)***	(-)**	(-)***	(-)**	(-)**	(-)**	(-)***	(-)***	(-)***	(+)**	(-)**
FS	(-)***	(-)*	(-)***	(-)*	(-)	(-)*	(-)***	(-)*	(-)***	(-)*	(-)*	(-)*
GDS lagged	(+)***	(+)***	(+)***	(+)***	(+)**	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***

Source: Table constructed by the author.

Appendix 16: Comparison between the baseline model for private savings presented in Table 5.2 and the model including age structure as additional controls.

	Private Saving											
	Young Dependency ratio						Elder Dependency ratio					
	OLS		IV1		IV2		OLS		IV1		IV2	
Add. Control	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Const.	(-)**	(-)**	(-)**	(-)**	(-)	(-)**	(-)**	(-)**	(-)**	(-)**	(-)	(-)**
GDPg	(-)	(+)	(+)	(+)	(-)	(+)	(-)	(+)	(+)	(+)	(-)	(+)
GDPpc	(+)**	(+)**	(+)**	(+)**	(+)	(+)**	(+)**	(+)**	(+)**	(+)**	(+)	(+)**
RIR	(-)*	(-)**	(-)*	(-)**	(-)	(-)**	(-)**	(-)**	(-)**	(-)**	(+)**	(-)**
FS	(-)***	(-)**	(-)***	(-)**	(-)**	(-)***	(-)***	(-)**	(-)***	(-)**	(-)**	(-)***
GDS lagged	(+)**	(+)***	(+)**	(+)***	(+)	(+)***	(+)**	(+)***	(+)**	(+)***	(+)**	(+)***

Source: Table constructed by the author.