The Latin American Saving Gap

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Abstract

Savings rate in Latin American countries have been stagnant over the last decades. To investigate this situation, this paper employs panel data techniques to identify savings determinants and perform counterfactual analysis using China, whose savings rate have been booming in the same period. Special attention is given to Brazil, which has fallen far behind its BRIC peers in this matter. The paper contributes to the existing literature in several ways. It combines two different and comprehensive datasets to encompass a vast array of savings determinants, including social security and demographic factors. It restates previous findings in the literature, albeit benefiting from the robustness conferred by richer datasets. For some Latin American countries, it reveals that their savings rate would increase if they perform more like East Asian countries in other areas, but the increment would not be so dramatic.

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Contents

1 Introduction

The remarkable performance of China and East Asian countries savings rate contrasts sharply to the situation of Latin American countries, specially Brazil, during the last decades. To the extent to which savings matters for growth and macroeconomic stability we ask ourselves whether there are lessons that could be drown from the East Asian experience on this matter. Interest on Latin America's low rate of savings in not new. For instance, Edwards (1996) undermines the importance of structural differences among these regions and concludes that low Latin American savings are a consequence of the magnitudes of their determinants, with per capita growth being the most important of them. Gavin et al. (1997) argue that higher growth precedes higher savings and that the most powerful long run determinant of the savings rate is economic growth. According to the authors, Latin America's low and volatile economic growth history primarily accounts for the region's chronic low rate of savings. In a counterfactual analysis, they argue that if East Asian countries had experienced the economic growth recorded by Latin America during 1970-1994, "the Asian saving rate would, other things equal, have been even lower than that recorded in Latin America". Plies and Reinhart (1999) provide insights through case studies on savings determinants in Latin America and Europe, as well as on the existence of virtuous cycles of savings and growth and policy traps of undersaving and stagnation. Gutiérrez (2007), besides presenting a good review of what has been said about this theme on the literature, extended the analysis by providing empirical evidence about key factors associated with national savings using panel data for nine selected Latin American countries for the period 1990-2003.

Given the robust association among savings, investment and growth, it is only natural that a bulk or research is concentrated in this area. The strong link between saving and investment could well imply that countries that manage to increase their saving rate, and therefore invest more, would be able to grow at a faster pace. On the other hand, countries with low rates of savings would tend to underinvest or to run large current account deficits, which would rend them more vulnerable to international crisis and restrictive macroeconomic adjustments. According to Plies and Reinhart (1999), early theories posited a causal chain from savings to growth, with proponents of financial liberalization aiming to promote savings to support higher levels of investment and growth [1]. Nevertheless, the relationship between savings and growth is quite complex, with reverse causality certainly playing an important role. The literature on the issue acknowledges this fact and the more recent research stresses the importance of the channel through

[1] See McKinnon (1973) and Shaw (1973)

which growth acceleration influences episodes of higher savings, rather than the reverse [2].

This paper analyses the recurrent issue of Latin America's low rate of savings in light of the international experience. Given the complexity to treat theoretically the process of the savings rate determination, we employed reduced-form econometric techniques on a wide variate of determinants to identify empirically the most relevant ones. We employed two broad panel datasets without restricting the analysis to the subset of Latin American countries. Our main dataset is from the World Bank and originally contained observations for 216 countries for the 1960 to 2009 period. We also used a dataset on social security assembled by Bloom et al. (2007) which was matched to the World Bank's. After estimating the relevant coefficients, we conducted a counterfactual analysis on Latin American countries having China as a benchmark.

It is our belief that this paper adds to the existing literature in the following ways: (i) although our focus is on explaining why savings rate in Latin America has traditionally been so low, it follows the approach of Edwards (1996) in the sense that the process of determination of the savings rate is evaluated in the context of the world economy. In contrast, many other papers on low savings in Latin America have limited the samples to specific countries or regions. Nevertheless, in comparison to Edwards (1996), this paper employs a much broader sample of countries and time periods, while also benefiting from more updated methodology (Arellano-Bond type estimators) to account for issues of measurement error, omitted variables and endogeneity; (ii) it contributes to the debate by presenting a result which is different from the one on Gavin et al. (1997) - the counterfactual analysis performed with estimates obtained in a broader panel of countries and a larger array of savings determinants, shows that economic growth accounts for only a part of the difference on the savings rate between LA and one of Asia's biggest savers: China; and (iii) the broader literature on savings determinants, which do not focus specifically on Latin America, also benefits from the fact this paper incorporates savings determinants that are proved to be relevant in more recent studies, such as longevity [3] and the fertility rate [4]. Additionally, in comparison with earlier studies, the use of newer and larger datasets increased the precision of the estimates and allowed us to incorporate information on social security system.

[2] See Carroll and Weil (1994)

[3] See Bloom et al. (2007) and Li et al. (2007)

[4] See Li et al. (2007)

The paper is organized as follows: sections 1 and 2 set the context by addressing very briefly the importance of the theme and updating the main stylized facts about savings and growth within the region, selected counties, East Asia and the world. In the sequence, section 3 briefly reviews the theoretical lines of thought related to the to the process of the savings rate determination. This section is also followed by a succinct review of the main empirical findings on the literature. Section 4 describes the datasets, the variables used in the analysis, and our empirical strategy. In the same section, we also talk about some analytical choices we had to make to consistently treat the subject. Section 5 presents the estimation results. In section 6, we present a counterfactual analysis exercise which asks whether the story of low savings rate in selected Latin America countries could have been different had they performed more like China in other areas such as economic growth, for instance. Section 7 presents our concluding remarks.

2 Stylized Facts

In the analysis that follows, we evaluated the behavior of gross savings, measured as a percentage of countries GDP, in the last three decades[5]. Information is grouped and presented around the World Bank taxonomy of country regions. Table 1 shows that, for the 1980 to 2009 period, savings rate in Latin America remained below the world average. In terms of the comparison with other developing regions, Latin America's savings rate surpassed only that of the very poor Sub-Saharan countries. Table 2 makes clear that the region's saving rate was around tree percentage points bellow the world average in the 80s and 90s. Nevertheless, while the region's rate was still below the world average in the 00's, the gap reduced considerably in the last decade.

As we made clear in the introduction, GDP growth rate stands out among the most important determinants of the savings rate. Tables 3 and 4 present growth rate region averages for the same period. Latin America's growth rates were below the world average in the whole period largely due to the region's performance in the 80s. The region grew 0.46 percentage points above the world average in the 00s, a fact that may have helped to reduce the region's savings rate gap with respect to the world.

[5]Calculations based on raw data from the World Development Indicators

Table 1: **Gross Savings by Regions - 1980/2009 Averages**

Regions	**mean**	**sd**	**min**	**max**
East Asia and Pacific	31.18	1.67	28.27	34.00
Europe and Central Asia	20.71	0.89	18.99	22.72
Latin America and Caribbean	18.98	2.12	15.97	23.65
Middle East and North Africa	27.51	6.54	19.52	37.58
South Asia	24.65	4.71	17.36	34.94
Sub-Saharan Africa	16.49	1.98	13.14	23.39
World	21.68	0.87	18.68	22.94

Source: Own calculations based on WDI

Table 2: **Gross Savings by Regions - Decades Averages**

	Decades		
Regions	1980-89	1990-99	2000-09
East Asia and Pacific	31.24	32.26	30.05
Europe and Central Asia	20.44	20.50	21.19
Latin America and Caribbean	19.19	17.71	20.03
Middle East and North Africa	26.43	23.22	34.79
South Asia	20.66	23.14	30.16
Sub-Saharan Africa	18.58	15.19	15.70
World	21.90	21.78	21.37

Source: Own calculations based on WDI

Table 3: **GDP Growth by Regions - 1980/2009 Averages**

regions	**mean**	**sd**	**min**	**max**
East Asia and Pacific	2.48	1.62	-2.12	5.56
Europe and Central Asia	1.58	1.70	-4.70	3.94
Latin America and Caribbean	0.92	2.44	-4.34	4.66
Middle East and North Africa	0.96	2.53	-4.27	5.74
North America	1.59	2.14	-4.33	6.16
South Asia	3.78	1.92	-0.23	7.39
Sub-Saharan Afri	0.28	2.04	-3.75	4.02
World	1.26	1.40	-3.43	2.95

Source: Own calculations based on WDI

Table 4: **GDP Growth by Regions - Decades Averages**

Regions	Decades 1980-89	1990-99	2000-09
East Asia and Pacific	2.85	1.91	2.69
Europe and Central Asia	1.71	1.50	1.53
Latin America and Caribbean	-0.19	1.18	1.77
Middle East and North Africa	-1.67	2.17	2.37
North America	2.06	1.92	0.79
South Asia	3.08	3.22	5.05
Sub-Saharan Africa	-0.68	-0.59	2.10
World	1.24	1.24	1.31

Source: Own calculations based on WDI

Given the rising importance of the BRIC economies, we also present information on the savings and growth rates for Brazil, Russia, India and China. Average BRICs' savings on the last three decades was 29 percentage points. Chinas' gross savings increased from 35.45 in the 80s to 41.15 in the 90s and 45.88 in the 00s. Russia also managed to keep very high levels of saving rates (31.48 in the 90s and 33.13 in the 00s) and India's savings rate jumped from 19.91 in the 80s to 28.65 in the 00s. Of the BRIC group, Brazil if by far the worst performer. While Brazil saw the savings rate of each other country in this group rise steadily, its own savings rate droped from 23.45 in the 80s to 18.51 and 18.72 in the following two decades, respectively.

The Brazilian growth performance within the last three decades was also very poor, specially when compared to that of China and India. Even though the country's growth rate increased from an average of 0.12 in the 90s to 2.09 in the 00s, Brazil's growth rate is still falling behind Russia, and far behind China and India.

Table 5: **Gross Savings by BRICs - 1980/2009 Averages**

	mean	**sd**	**min**	**max**
BRICs	29.00	9.61	14.97	52.65
Brazil	20.23	3.72	14.97	30.37
China	40.83	5.50	33.83	52.65
India	23.73	4.62	15.41	34.13
Russian Federation	32.30	5.65	21.63	48.68

Source: Own calculations based on WDI

Table 6: **Gross Savings by BRICs - Decades Averages**

	Decades		
	1980-89	1990-99	2000-09
BRICs	26.27	28.44	31.60
Brazil	23.45	18.51	18.72
China	35.45	41.15	45.88
India	19.91	22.63	28.65
Russian Federation		31.48	33.13

Source: Own calculations based on WDI

Table 7: **GDP Growth by BRICs - 1980/2009 Averages**

	mean	**sd**	**min**	**max**
BRICs	3.92	5.33	-14.57	13.70
Brazil	1.01	3.42	-6.60	6.59
China	8.85	2.90	2.29	13.70
India	4.18	2.29	-0.99	8.23
Russian Federation	0.50	7.76	-14.57	10.00

Source: Own calculations based on WDI

Table 8: **GDP Growth by BRICs - Decades Averages**

	Decades		
	1980-89	1990-99	2000-09
BRICs	4.12	1.92	5.78
Brazil	0.82	0.12	2.09
China	8.19	8.75	9.62
India	3.35	3.62	5.58
Russian		-4.81	5.81

Source: Own calculations based on WDI

3 Savings Determinants

3.1 Theoretical Considerations

The process of savings rate determination have been a subject of theoretical research for a long time. Nevertheless, several authors have already pointed out that this literature has been somewhat fragmented, meaning that, due to its intrinsic complexity, no individual study was able to tackle all aspects of the question [6]. The theoretical literature on savings have basically followed one of two roads: models of inter-temporal optimization where an homogeneous representative agent makes consumption and savings decisions subject to an inter-temporal budget constraint and models with consumer heterogeneity derived from aggregation of finitely-lived overlapping generations.[7]

In the first group of models, consumption is equal to a permanent income which is the discounted value of labour income net of taxes. In this environment, savings is derived from income fluctuations above the permanent-income consumption level. Previsions from the permanent-income hypothesis include that income growth reduces current savings as the expectation of higher future income increases consumption in the present and that consumption fluctuations should be unpredictable. The effect of changes in the interest rate is unclear as it depends on the magnitude of the income and substitution effects, as well as on the consumer's subjective discount rate. Against the permanent-income hypothesis there exists, by now, a considerable amount of empirical work documenting the positive association between income growth and savings [8]. In addition, several studies have revealed that consumption is, indeed, subject to correlation to other variables, such as contemporaneous or lagged income changes [9]. The literature relates the so called "excess sensitivity" of consumption to the existence of consumption habits, durable goods or borrowing constraints. Furthermore, the assumption of homogeneous consumers seems to be too restrictive to incorporate the likely diverse savings behavior of different economic groups (by age or income level, for instance).

The second type of modes introduce consumer heterogeneity based on the idea that people behave differently as they grow old. In the life-cycle models,

[6] See Edwards (1995), p. 7 and 8

[7] See Schmidt-Hebbel and Servén (1997)

[8] See Attanasio et al. (2000), p. 11, for evidence that growth Granger-causes saving, with a positive sign. According to the authors, there is no significant effect running from saving to growth

[9] See, for instance, Flavin (1981); Hall and Mishkin (1982)

pioneered by the works of Modigliani and Brumberg (1954, 1979), the young and old borrow from the savings accumulated at mid-age, generating hump-shaped patterns of consumption and savings. Differently from the permanent-income models, given lifetime resources, consumption smoothing occurs within each age-specific cohort. The impact on aggregate savings derived from growth and interest rate changes is unclear within these models. Interest rates variations entail transferences among cohorts, while rises in the growth rates have to be of a higher magnitude on the mid-age cohorts for the net effect of the higher saving profile of this group to surpass the dissaving increment on the young and old groups. The life-cycle hypothesis has also been extensively exposed to test. Microeconomic evidence indicates that cohort-specific savings and consumption patterns do not respond as predicted to changes in the growth rates [10]. Also, Kotlikoff and L.Summers (1981) found that there is not enough savings to account for the high level of aggregate wealth in modern economies. In addition, the empirical evidence indicates that old people do save or, at least, do not dissave with the intensity predicted by these models [11].

Theoretical refinements, such as the introduction of uncertainty on both models or bequest in life-cycle models, attempted to reduce the gap between theory and the empirical results. The empirical evidence seems to support the treatment of bequest as a normal good at the higher levels of income [12]. On the other hand, the presence or risk-aversion under uncertainty leads to precautionary savings [13]. Therefore, uncertainty about life length and health costs may be another source of explanation to why the old save a positive amount of their income or dissave little. Given the relatively unsuccessful results of empirical tests on the representative-agent model under uncertainty, for reasonable values of risk-aversion coefficients, other refinements to address the determination of the savings rate theoretically were made. Buffer-stock savings models tried to account for the existence of borrowing constraints but explained little of the behavior of aggregate savings and were found to be more relevant in the context of poor households and countries [14]. Consumption habit models broke the intertemporal separability assumption on preferences by making consumption utility in each period a function of current consumption and of a stock of past consumption habits. This models tend to address more properly the evidence of excess-sensitivity of consumption and the growth-savings correlation [15].

[10] Carroll and Summers (1991); Deaton (1991)
[11] Deaton and Paxson (1994); Poterba (1995)
[12] See Menchik and David (1983)
[13] See Skinner (1988) and Zeldes (1989)
[14] See Deaton (1991)
[15] Abel (1990); Ferson and Constantinides (1991); Campbell and Cochrane (1994)

More recently, attempts to model savings have been made on the field of behavior economics [16]. Challenging some of the basic underlying assumptions of modern economics, this approach frequently focus on cases in which people do not or cannot behave rationally. In this case, people rank their consumption at different periods in their lives according to their views they have on the period they are currently living. According to Ainslie (1992) and Loewenstein and Thaler (1989), laboratory and field studies of time preference find that discount rates are much greater in the short-run than in the long-run. Harris and Laibson (2001) use hyperbolic discount functions to capture this property, and reach the conclusion that a "Hyperbolic Euler Relation implies that consumers act as if they have endogenous rate of time preference that rise and fall with the future marginal propensity to consume" [17].

3.2 Empirical Literature

In spite of all the theoretical efforts to model appropriately the determinants of consumption and savings, it seems, from the discussions in the previous section, that no single theory or model has been able to incorporate the many dimensions involved in this task. In most cases, the models are too restrictive or end up limited by technical tractability, which is typically binding when one attempts to incorporate concomitantly many of the aspects related to savings. In a different approach, a relevant part of the applied literature works with reduced-form atheoretical econometric specifications. Although not derived from closed-form solutions to consumption-optimization models, this line of work has the advantage of incorporating a diverse number and category of savings determinants.

Gutiérrez (2007) has a comprehensive review of this applied literature in which it lists the types of variables, their expected theoretical influence on savings and the empirical findings of previous panel data studies. This line of research documents positive associations between savings and income variables (level and growth), macroeconomic stability, foreign borrowing constraints, and working age population. Evidence on the relationship of savings to other variables, including the real interest rates, the type of pension systems, the level of financial development, and the distribution of income remained mixed.

[16] Deaton (2005)

[17] See Angeletos et al. (2001) for an emprirical evaluation of the Hyperbolic Consumption Model

4 Methodology

Our main motivation to write this paper was to think about the question of Latin America's low rate of savings, especially that of Brazil. Previous work from Edwards (1996), Gavin et al. (1997), and more recently Gutiérrez (2007) have attempted to do the same. Our work has some similarities with its precedents in the sense that our models are not derived from first principals. Given the richness of the datasets available nowadays, both in the cross-section and in the time dimensions, with information on a vast diversity of variables, we decided not to limit the analysis to a few specific aspects of the question. Instead, we used reduced-form econometric techniques to test for the magnitude and significance of savings determinants along the several dimensions previously pointed out within the theoretical and the applied research in the field.

Nevertheless, this work naturally sets itself apart from the ones already mentioned, when it comes to the magnitude of the datasets employed in the analysis. We have today much more data available than other works had more than a decade ago. In addition, our work has also some important different methodological choices. Gavin et al. (1997) and Gutiérrez (2007) limit their analysis to very specific sets of countries, Latin American and East Asian countries in the first case and only Latin American countries in the second. Even though we are interested in explaining the low savings pattern of Latin America and Brazil, we believe it is important to build on the experience of the largest possible set of countries. Although there may be country and even region specific factors at play, theoretical reasoning indicates that certain factors should impact the savings rate in similar ways. Once we figured out the forces behind the savings rate determination, in a global setting, we then performed counterfactual analysis to shed light on the question of why Latin America and, particularly, Brazil are falling behind.

Another important methodological difference from previous work concerns the empirical strategy adopted. We use the system GMM estimation presented by Arellano and Bover (1995) and Blundell and Bond (1998) to specifically deal with the dynamic structure of our data and the endogeneity issues. None of the previous mentioned works used a fully dynamic panel data structure[18]. As pointed out in Loayza et al. (2000), savings inertia can arise from consumption habits and even from consumption smoothing. In their calculations, the first-order autocorrelation coefficient of the private saving rate was 0.88. The results from their estimation indicate that "lagged private saving rate has a positive and significant coefficient,

[18]Gavin et al. (1997) included lags of some variables as regressors. The regression table they presented in the appendix shows an AR(1) variable with no estimated coefficient. According to the authors, their specification allow for a "simple dynamic structure".

whose size (0.59) reveals a large degree of persistence"[19]. It is also important that the estimation procedure cope with the issue of endogeneity. The savings rate and several of our regressors are likely to be joint determined. Furthermore, unobserved country-specific effects are likely to be correlated with the regressors. Of the previously mentioned papers, only Edwards (1996) deals explicitly with the problem of endogeneity.

A third important methodological difference between our work and its precedents relates to the choice of variables. The existence of a new dataset assembled by Bloom et al. (2007), allowed us to incorporate social security variables in the analysis. We have also included demographic variables such as longevity and fertility shown to be relevant in more recent studies [20].

4.1 Datasets

Our main dataset was extracted from the World Development Indicators (WDI) and Global Development Finance (GDF), available at the World DataBank at `http://databank.worldbank.org/ddp/home.do`. It originally contained information on 216 countries from all world regions and series spanning from 1960 to 2010. Following Loayza et al. (2000), episodes of high inflation were excluded from the analysis. Thresholds of 50 percent annual inflation and interest rate were set. Observations that had missing information regarding to any variable were also excluded. The sample coverage was limited to periods of at least three annual consecutive observations. After these manipulations, we reached our core sample, composed of 2280 observations for 150 countries. Tables 9 and 10 detail the composition of the sample.

[19] Loayza et al. (2000, p. 173)

[20] Li et al. (2007)

Table 9: **Main Dataset - Region Frequency**

World Regions	Freq.	Percent	Cum.
East Asia and Pacific	382	16.75	16.75
Europe and Central Asia	391	17.15	33.90
Latin America and Caribbean	477	20.92	54.82
Middle East and North Africa	172	7.54	62.37
North America	59	2.59	64.96
South Asia	110	4.82	69.78
Sub-Saharan Africa	689	30.22	100.00
Total	2,280	100.00	

Source: World DataBank

Table 10: **Main Dataset - Income Groups Frequency**

Income Group	Freq.	Percent	Cum.
High income: OECD	410	17.98	17.98
High income: nonOECD	156	6.84	24.82
Low income	404	17.72	42.54
Lower middle income	665	29.17	71.71
Upper middle income	645	28.29	100.00
Total	2,280	100.00	

Source: World DataBank

To expand the analysis and include social security information we also used the dataset referenced at Bloom et al. (2007), available at `http://www.hsph.harvard.edu/faculty/david-canning/data-sets`, which gives social security data for 57 countries from 1961 to 2002. The authors compiled raw data from responses of various countries to a survey sent out by the Social Security Administration (Social Security Programs Throughout the World, Social Security Administration, Washington, D.C .). This data was matched with our core dataset to make a complementary dataset. Considering that the social security data did not have information for several countries on many periods, the matching process reduced considerably the number of available observations. For this alternative dataset, we have 710 observations for 53 countries.

Table 11: **Complementary Dataset - Region Frequency**

World Regions	Freq.	Percent	Cum.
East Asia and Pacific	167	23.52	23.52
Europe and Central Asia	98	13.80	37.32
Latin America and Caribbean	160	22.54	59.86
Middle East and North Africa	57	8.03	67.89
North America	46	6.48	74.37
South Asia	44	6.20	80.56
Sub-Saharan Africa	138	19.44	100.00
Total	710	100.00	

Source: World DataBank and Bloom et al. (2007)

Table 12: **Complementary Dataset - Income Groups Frequency**

Income Group	Freq.	Percent	Cum.
High income: OECD	230	32.39	32.39
High income: nonOECD	27	3.80	36.20
Low income	84	11.83	48.03
Lower middle income	178	25.07	73.10
Upper middle income	191	26.90	100.00
Total	710	100.00	

Source: World DataBank and Bloom et al. (2007)

4.2 List of Variables

The choice of variables was made based on theory, previous empirical works, and the availability of data. Our dependent variable is *Gross Savings*. It is a percentage of GDP and is calculated as gross national income less total consumption, plus net transfers [21].

In the list that follows, we present the independent variables used in the analysis.

Table 13: **Saving Determinants**

Type	Name
Income	*GDP per capita growth*
	GDP per capita PPP level
	Terms of Trade
Financial	*Real Interest Rate*
	Inflation
	M2
	Net Domestic Credit
Demographic	*Age Dependency Old*
	Age Dependency Young
	Urban Population
	Longevity
	Fertility
Social Security	*Universal Coverage*
	Retirement Incentives
	Replacement Rate

For the income, financial, and demographic variables, the data used is from the World Development Indicators (WDI) and Global Development Finance (GDF), obtained from the World DataBank [22].

The variables on on social security were obtained from the dataset referenced at Bloom et al. (2007), and are described as follows: (i) *Universal Coverage* is a dummy that is equal to one when all employees are reported to be covered by the system; (ii) *Retirement Incentives* is another dummy that indicates the presence of

[21] In line with standard practice of empirical studies for aggregate (nacional) saving, we abstract from a separete behavioral framework for public-sector saving

[22] For a complete description of these variables, refer to `http://databank.worldbank.org/ddp/home.do`

a retirement incentive in the system (when benefits are only payable on retirement, or if benefits are conditional on an earnings test); and (iii) *Replacement Rate* is the size of the annual pension, as a percentage of the recipient's pre-retirement income. The original dataset has two variables on replacement rate, one is pay-as-you-go, where the government pays the benefits, and the second is funded, where a fund holds financial assets to meet the future claims of the pensioners. We have merged the two variables on replacement rate by keeping only the highest value when information were available on both variables at the same observation.

4.3 Econometric Strategy

The econometric methodology employed in the analysis combined the generalized method of moments with instrumental variables estimation applied to a dynamic panel data structure. It was chosen to specifically deal with the dynamic nature of our data, the endogeneity issue, and the possible presence of unobserved country-specific effects correlated with the regressors. We used what has become know in the literature of panel data as the "Arellano-Bond Estimator" [23] with the additional moments conditions suggested by Arellano and Bover (1995) and Blundell and Bond (1998), the "Blundell and Bond System GMM Estimator" [24].

To facilitate the reading, we reproduce bellow the model equations, its main assumptions, and moment conditions [25]. The savings rate is represented by S and the model is as follows:

$$S_{i,t} = \alpha S_{i,t-1} + \theta' X_{i,t} + \eta_i + \varepsilon_{i,t}$$

- X Variables that potentially affect saving rate
- η Set of unobserved, time-invariant, countryspecific effects
- ε is the error term
- $i = 1, ..., N$
- $t = 1, ..., T$
- ε not serially correlated
- $|\alpha| < 1$

[23] After Arellano and Bond (1991)

[24] Detailed description of the method can be found on Baltagi (2005), pp. 142 to 148

[25] As presented in Loayza et al. (2000)

In line with Arellano and Bond (1991), the following moment conditions apply:

$$E[s_{i,t-s}.(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad \text{for} \quad s \geq 2; \quad t = 3, ..., T$$

$$E[X_{i,t-s}.(\varepsilon_{i,j} - \varepsilon_{i,t-1)}] = 0 \quad \text{for} \quad s \geq 2; \quad t = 3, ..., T$$

As Loayza et al. (2000) pointed out, this estimator has conceptual and statistical shortcomings. First, it restricts the analysis to the time-series dimension of the data. And second, due to instruments' weakness, the asymptotic efficiency and the small-sample bias of the estimator increase with the degree of persistence of the explanatory variables.

Arellano and Bover (1995) and Blundell and Bond (1998) suggested using additional moment conditions to obtain an estimator with improved precision and better finite-sample properties. According to their work, in addition to the previously presented conditions, the following also apply:

$$E[(s_{i,t-1} - s_{i,t-2}).(\eta_i + \varepsilon_{i,t})] = 0$$

$$E[(X_{i,t} - X_{i,t-1}).(\eta_i + \varepsilon_{i,t}] = 0$$

5 Results

For the sake of completeness, besides the Arellano-Bond (AB) and Blundell-Blond (BB) methodologies, we also run regressions using other standard methods - Pooled OLS (OLS), Fixed Effects (FE), and Random Effects (RE) - even though they generate inconsistent coefficient estimates due to the fact that the lag dependent variable figures as a regressor.

In the discussion that follows bellow, we focus on the results for the Blundell and Blond System GMM estimator, since it shows the best theoretical properties among the group of presented estimators. Only in the case of the dataset with the social security information, we favored the alternative estimators for the reasons

we shall soon comment.

Tables 14 and 15 aggregate the results on all estimators, for both the analysis conducted on the datasets without and with the social security information, respectively. [26]

5.1 Dataset without Social Security

To start, we will restrict the analyses to our richer dataset in terms of the number of available observations, but which, unfortunately, do not include information on social security. We will stick to column (5) of table 16, which shows the estimates for the Blundell and Bond System GMM methodology, and present comments on the significant results. We make clear from the outset, that none of the coefficients on financial variables and macroeconomic uncertainty were statistically significant on this particular estimation method.

Persistence - Consistent to previous findings in the literature, the lagged saving rate coefficient indicates that persistence is an important characteristic of savings. Its value (0.67) is highly significant and imply that the long-run effects of other saving determinants are 2.75 as large as their short-run effects, considering that all changes in these variables were permanent.

Income Variables - All variables in this category presented positive and significant coefficients, showing that both the level and the rate of growth are important determinants of the savings rate. If Per Capita Income increased by 1000 dollars PPP, the impact on gross savings would be + 0.17 p.p. On the other hand, an increase in GDP Growth Rate of 1 p.p. raises gross savings by 0.16 p.p., and a 10 percent increase in the terms of trade increases GS by 0.21 p.p.

Demographic Variables - Only two of our demographic variables presented negative and statistically significant coefficients: the proportion of old people in population and fertility. Our results indicate that an increase of 1 per cent in proportion of the elderly population dampens gross savings by 0.43 p.p, and if woman in a country were to have one more child on average, gross savings would be reduced by 2 p.p.. Although not statistically significant at the 5 percent level, life expectancy were borderline. Its (-0.132) coefficient indicates that if people were

[26] Our results were submitted to a series of robustness checks, which included, besides standard statistic tests, a variate of model configurations. For instance, we run the model with dummies for income groups, dummies for world regions, with additional savings lags, with additional lags of the instrumented variables, and several different parsimonious versions of the model. In all cases, the results here presented are robust

Table 14: **Analysis <u>without</u> Social Security**

	(1) OLS	(2) RE	(3) FE	(4) AB	**(5) BB**
Lag GS	0.673***	0.434***	0.368***	0.447**	**0.636*****
	(0.0414)	(0.0291)	(0.0307)	(0.157)	(0.0324)
GDP PC	0.137**	0.140*	0.0182	0.0185	**0.168****
	(0.0410)	(0.0606)	(0.117)	(0.295)	(0.0610)
GDP Growth	0.234***	0.213***	0.203***	0.176*	**0.155****
	(0.0563)	(0.0507)	(0.0506)	(0.0888)	(0.0567)
RIR	-0.107***	-0.0975***	-0.0810**	-0.0122	-0.0960
	(0.0250)	(0.0265)	(0.0286)	(0.0728)	(0.0712)
Inflation	-0.0102	-0.00930	0.00837	0.0110	0.000132
	(0.0299)	(0.0315)	(0.0328)	(0.0786)	(0.0852)
M2	0.0131	-0.0179	-0.0420	-0.129	0.0199
	(0.0207)	(0.0461)	(0.0693)	(0.132)	(0.0172)
Net Dom Credit	-1.284	0.685	2.482	6.699	-1.998
	(2.150)	(5.128)	(6.210)	(8.728)	(1.212)
Terms of Trade	0.00678	0.0242**	0.0319**	0.0606*	**0.0214***
	(0.00783)	(0.00904)	(0.0111)	(0.0246)	(0.00873)
Age Dep Old	-0.273**	-0.491***	-0.315	-0.0882	**-0.430*****
	(0.0889)	(0.0957)	(0.194)	(0.446)	(0.0881)
Age Dep Young	0.0194	-0.0135	0.00149	-0.179	0.0219
	(0.0552)	(0.0615)	(0.0721)	(0.147)	(0.0546)
Urban Pop	0.00754	0.0289	0.0935	-0.0316	0.0229
	(0.0163)	(0.0350)	(0.112)	(0.198)	(0.0266)
Longevity	-0.0417	0.162***	0.369***	0.159	-0.132
	(0.0589)	(0.0476)	(0.0928)	(0.249)	(0.0703)
Fertility	-1.156	-1.004	-1.297	-0.497	**-2.047***
	(0.711)	(0.723)	(0.850)	(2.005)	(0.874)
Constant	13.15**	5.405	-11.28	11.32	21.93***
	(4.579)	(4.247)	(11.03)	(29.23)	(5.900)
Observations	2279	2279	2279	1919	2096

World DataBank Dataset
Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

to live 10 years longer, on average, the effect on aggregate savings would be a reduction of 1.32 p.p..

5.2 Dataset with Social Security

Our results for the analysis on the dataset with the social security are presented on table 15. The first thing to consider in this case is the reduced amount of data available for the analysis. This fact seems to have a heavier impact on the precision of the Arellano and Bond and Blundell and Bond System GMM estimates. Because those methods use lags of the endogenous variables as internal instruments, the estimation procedures reduces even more the number of observations available for the regressions.

In contrast with the results in table 14, in the case of the dataset with social security, the only significant coefficients on the Arellano and Bond estimation is the lagged gross savings (which indicates saving persistence), and for the Blundell and Bond System GMM estimates, the lagged gross savings and the GDP growth. Furthermore, in the case of the lagged gross savings, for both the Arellano and Bond and the Blundell and Bond System GMM estimator, the estimates increments due to the inclusion of the social security variables seemed too big when compared to the variations for the lagged gross savings of the other three alternative estimators.

On the other hand, although the pooled OLS is our simplest estimation method, its results on the two datasets are quite compatible. In addition, table 14 reveals that the OLS results on the dataset without social security are the closest to those of our preferred Blundell and Bond System GMM estimation method. This gave us some degree of confidence to consider the results for the social security variables of table 15, column (1).

Social Security Variables - The highly significant result we have on the social security variables is that on Replacement Rate. It tells us that, on average, a 10 percent increase in the annual pension relative to the pre-retirement income would lead to a 0.28 p.p. increase on aggregate savings. At first sight, it seems strange to think that people will save more knowing that they will perceive a higher share of their active life salary upon retirement. Nevertheless, we must look at this result from a different perspective. First, we must be absolutely clear that, besides household savings, our dependent variable includes enterprise and government savings. Therefore, of an economy's resources basically what is not consumed is included in our definition of savings. So the more beneficial and more expensive

Table 15: **Analysis with Social Security**

	(1)	(2)	(3)	(4)	(5)
	OLS	RE	FE	AB	BB
Lag GS	0.655***	0.470***	0.395***	0.387*	0.724***
	(0.0366)	(0.0366)	(0.0426)	(0.170)	(0.0779)
GDP PC	0.0940	0.174**	0.194*	0.255	0.110
	(0.0584)	(0.0664)	(0.0772)	(0.801)	(0.182)
GDP Growth	0.237***	0.191***	0.156**	0.0975	0.232*
	(0.0499)	(0.0480)	(0.0503)	(0.229)	(0.0974)
RIR	-0.0816***	-0.0843***	-0.0661	-0.0581	-0.0252
	(0.0234)	(0.0255)	(0.0353)	(0.132)	(0.0569)
Inflation	-0.0105	0.00610	0.0189	-0.0135	0.0673
	(0.0261)	(0.0336)	(0.0414)	(0.124)	(0.0724)
Net Dom Credit	-0.688	-1.073	-1.391	-0.303	4.702
	(0.939)	(1.184)	(1.400)	(7.316)	(2.591)
M2	0.0311**	0.0257**	0.00958	-0.0380	-0.0377
	(0.00989)	(0.00997)	(0.0261)	(0.108)	(0.0354)
Terms of Trade	-0.0140	-0.00847	-0.00764	-0.00213	-0.00271
	(0.00827)	(0.0124)	(0.0159)	(0.0418)	(0.0199)
Age Dep Old	-0.114	-0.291*	-0.417*	-0.426	-0.157
	(0.0787)	(0.121)	(0.181)	(0.795)	(0.384)
Age Dep Young	0.117	0.129	0.177	0.0876	0.121
	(0.0624)	(0.0953)	(0.128)	(0.551)	(0.185)
Urban Pop	0.00750	-0.0141	0.0319	0.168	-0.0697
	(0.0148)	(0.0286)	(0.123)	(0.872)	(0.117)
Longevity	-0.0390	0.0893	0.131	0.127	0.156
	(0.0457)	(0.0936)	(0.149)	(0.484)	(0.251)
Fertility	-2.049**	-2.365*	-2.281*	-0.219	-2.056
	(0.686)	(1.030)	(1.083)	(6.536)	(2.448)
Universal Cov	-0.121	-0.202	0.325	1.048	0.416
	(0.558)	(1.259)	(2.275)	(6.088)	(3.449)
Retirement Incent	0.0893	0.636	1.110	0.647	-0.160
	(0.408)	(0.523)	(0.591)	(1.126)	(1.656)
Replacement Rate	**2.764*****	2.301**	0.603	3.183	0.947
	(0.506)	(0.729)	(0.931)	(7.654)	(3.112)
Constant	8.639*	6.348	1.878	-8.615	-2.621
	(3.866)	(6.600)	(9.430)	(67.51)	(24.22)
Observations	709	709	709	570	638

World DataBank and Bloom et al (2007) Datasets
Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the social security system is, the more it will have to rely on savings to finance it. It is not about the choices the families will make in the future, but about the amount of resources available in economy to pay for a more protective system.

6 Counterfactual Analysis

Given the significant results of the previous section, we proceeded a simple and intuitive exercise. We took the seven largest Latin American (LA) economies (Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela) and simulated how differently these countries would have performed if their saving determinants were more like the Chinese ones [27] .

Table 16: **Savings Rate Responses to Changes in Significant Determinants**

Country	(1) GS	(2) GDP Gr	(3) GDP	(4) Age Dep	(5) Fertility	(6) TOT	(7) GS Est
Argentina	18.97	2.33	(1.14)	2.28	1.32	(0.46)	23.30
Brazil	**16.30**	**1.67**	**(0.75)**	**(0.55)**	**0.82**	**(0.27)**	**17.22**
Chile	19.28	6.17	(1.30)	0.58	0.59	(0.99)	24.33
Colombia	17.33	3.69	3.34	(5.09)	1.72	(0.41)	20.58
Mexico	21.19	4.14	(1.34)	(0.69)	1.65	(0.25)	24.70
Peru	18.63	2.96	(0.39)	(0.87)	2.14	(0.65)	21.82
Venezuela	27.39	7.15	(0.96)	(1.29)	2.07	(1.11)	33.25
Averages	19.87	4.01	(0.36)	(0.80)	1.47	(0.59)	23.60

Source: World DataBank
(1) GS - countries averages from 2000 to 2009
(2),(3),(4),(5)and(6) Savings increment in percentages, if LA countries performed like China in the 00s
(7) GS Estimated - countries averages from 2000 to 2009

Table 16 shows the cumulative effects on each selected LA country savings rate of changing the values of their determinants to its Chinese 2000 to 2009 averages. We will illustrate how table 16 works by describing the impact of these changes in the group worst saver: Brazil. Column (1) reveals that the Brazilian savings average in the 00s was 16.30. In the same period, Brazil grew at a 2.09 rate, while China grew at a 9.62. Column (2) says that if Brazil had grown 9.62 percent on average in the 00s, its saving rate would have increased by 1.67. Column (3) takes into account the effect of column (2) and the effect of the change in the level of GDP per capita. Since per capita income in Brazil is higher than in China, the effect is negative. The result of taking all five determinants into consideration is shown on column (7), Brazil would have had an average saving rate of 17.22, instead of 16.30. The group of the seven biggest LA economies saving

[27] Although this counterfactual exercise is illustrative, rigorously speaking it is not very technically precise, because several of our explanatory variables are jointly determined with our dependent variable

average (19.87) is quite close to the hole region average (20.03). Therefore, if LA had performed more like China in the 00s, it is fare to imagine that its saving rate would have been around the 23.60 instead of 20.03, which, indeed, would be more than the world saving average of 21.37 for this period. Yes, it would improve, but apparently not to the point of dramatically transforming the regions poor saving performance into something like East Asia.

Table 17: **Savings Rate Responses to Changes in Significant Determinants**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Country	GS	GDP Gr	GDP	Age Dep	Fertility	TOT	GS Est
China	46.65	(9.12)	0.74	0.59	(0.88)	0.26	38.23

Source: World DataBank
(1) GS - country average from 2000 to 2009
(2),(3),(4),(5)and(6) Savings increment in percentages, if China performed like Brazil in the 00s
(7) GS Estimated - country average from 2000 to 2009

On the table 17, we have inverted the question. We asked ourselves what would happen to the Chinese savings rate if China, one of the world biggest savers, had performed like Brazil in other significant areas. To start, its 46.65 average saving rate would suffer a substantial reduction due to the Brazilian considerable weaker growth performance in the 00s. Adding all effects, it becomes clear that China would save less, but not to the point of transforming the country into a poor saver like Brazil.

7 Conclusion

This paper employed reduced-form econometric techniques to conduct an empirical analysis of the main saving determinants found in the theoretical literature in an attempt to better understand why the Latin American countries, specially Brazil, save so little.

We used a dynamic panel data structure to allow for savings persistence and included income, financial, demographic, and social security variables in the analysis. Our results indicate that, besides lagged savings, the income variables GDP, GDP Growth, and the terms of trade positively impact savings with significant coefficients. The demographic variables which represent the share of old people in the economy and the fertility rate were also significant and with a negative sign. Of the social security variables, the replacement rate seems to be relevant and impact savings positively.

With the estimated coefficients, we conducted a counterfactual on selected Latin American countries having China as a benchmark. We concluded that, from

the magnitudes of the saving determinants estimates and from the results of the counterfactual exercise, that there must be something else at place at countries like China and other heavy savers to account for such a steep differential gap between their saving rates and that of Latin American counties and the rest of the world.

8 Bibliography

References

Abel, A. (1990), "Asset prices under habit formation and catching up with the joneses." *American Economic Review*, 80, 38–42.

Ainslie, G. (1992), *Picoeconomics*. Cambridge University Press, Cambridge.

Angeletos, George-Marios, David Laibson, Andrea Repetto, Jeremy Tobacman, and Stephen Weinberg (2001), "The hyperbolic consumption model: Calibration, simulation, and empirical evaluation." *Journal of Economic Perspectives-Pages*, 47–68.

Arellano, M. and S. Bond (1991), "Some tests of specification for panel data: Monte carlo evidence and an application to employment equations." *Revliew of Economic Studies*, 58, 277–297.

Arellano, M. and O. Bover (1995), "Another look at the instrumental variable estimation of error-component models." *Journal of Econometrics*, 68, 29–51.

Attanasio, O. P., L. Picci, and A. E. Scorcu (2000), "Saving, growth, and investment: A macroeconomic analysis using a panel of countries?" *The Review of Economics and Statistics*, Vol. 82.

Baltagi, B.H. (2005), *Econometric Analysis of Panel Data*. John Wiley and Sons Ltd.

Bloom, D. E., D. Canning, R. K. Mansfield, and M. Moore (2007), "Demographic change, social security systems, and savings." *Journal of Monetary Economics*, Vol. 54, 92–114.

Blundell, R. and S. Bond (1998), "Initial conditions and moment restrictions in dynamic panel data models." *Journal of Econometrics*, 87, 115–143.

Campbell, J. and J. Cochrane (1994), "By force of habit: A consumption-based explanation of aggregate stock market behavior." Working Paper 4995, NBER.

Carroll, C. and L. Summers (1991), "Consumption growth parallels income growth: Some new evidence." In *National Saving and Economic Performance* (B. D. Douglas and J. B. Shoven, eds.), National Bureau of Economic Research, University of Chicago Press.

Carroll, C. D. and D. N. Weil (1994), "Saving and growth: A reinterpretation." *Carnegie-Rochester Conference Series on Public Policy*, Vol. 40, 133–192.

Deaton, A. (1991), "Household saving in ldc's: Credit markets, insurance, and welfare." Discussion Paper 153, Princeton University.

Deaton, A. (2005), "Franco modigliani and the life cycle theory of consumption."

Deaton, A. and C. Paxson (1994), "Saving, growth and aging in taiwan." In *Studies in the Economics of Aging* (D. Wise, ed.), Chicago: Chicago University Press.

Edwards, S. (1995), "Why are saving rates so different across countries? an international comparative analysis." Working paper, NBER.

Edwards, S. (1996), "Why are latin america's savings rates so low? an international comparative analysis." *Journal of Development Economics*, Vol. 51, 5–44.

Ferson, W. and G. Constantinides (1991), "Habit persistence and durability in aggregate consumption." *Journal of Financial Economics*, 29, 199–240.

Flavin, M. (1981), "The adjustment of consumption to changing expectations about future income." *Journal of Political Economy*, 89, 974–1009.

Gavin, M., R. Hausmann, and E. Talvi (1997), "Saving behavior in latin america: Overview and policy issues." Working Paper No. 346, Inter-American Development Bank.

Gutiérrez, M. (2007), "Savings in latin america after the mid 1990s. determinants, constraints and policies."

Hall, R. E. and F. Mishkin (1982), "The sensitivity of consumption to transitory income: Estimates from panel data on households." *Econometrica*, 50, 461–8.

Harris, C. and David Laibson (2001), "Dynamic choices of hyperbolic consumers." *Econometrica*, 4, 935–957.

Kotlikoff, L. and L.Summers (1981), "The role of intergenerational transfers in aggreagte capital accumulation." *Journal of Political Economy*, 90, 706–32.

Li, H., J. Zhang, and J. Zhang (2007), "Effects of longevity and dependency rates on saving and growth: Evidence from a panel of cross countries?" *Journal of Development Economics*, Vol. 84, 138–154.

Loayza, N., K. Schmidt-Hebbel, and L. Servén (2000), "What drives saving across the world?" *The Review of Economics and Statistics*, Vol. 82, 165–181.

Loewenstein, G. and R. Thaler (1989), "Anomalies: Intertemporal choice." *Journal of Economics Perspectives*, 3, 181–193.

McKinnon, R. (1973), "Money and capital in economic development." *Washington (DC): Brookings Institution*.

Menchik, P. and M. David (1983), "Income distribution, lifetime savings, and bequests." *American Economic Review*, 73, 672–690.

Modigliani, F. and R. Brumberg (1954), "Utility analysis and the consumption function: an interpretation of cross-section data." In *Post-Keynesian Economics* (K. K. Kurihara, ed.), New Brunswick, N.J.: Rutgers University Press.

Modigliani, F. and R. Brumberg (1979), "Utility analysis and the consumption function: an attempt at integration." In *The Collected Papers of Franco Modigliani, Vol. 2* (A. Abel, ed.), Carnbridge, M.A.; MIT Press.

Plies, W. A. and C. M. Reinhart (1999), "Saving in latin america and lessons from europe: An overview." In *Accounting for Saving: Financial Liberalization, Capital Flows, and Growth in Latin America and Europe*, 3–47, Washington DC: John Hopkins University Press for the Inter-American Development Bank.

Poterba, J. (1995), *International Comparisons of Household Saving*. Chicago: Chicago University Press.

Schmidt-Hebbel, K. and L. Servén (1997), "Saving across the world: Puzzles and policies." Discussion Paper No. 354, World Bank.

Shaw, E.S. (1973), *Financial Deepening in Economic Development*. Oxford: Oxford University Press.

Skinner, J. (1988), "Risky income, life-cycle consumption, and precautionary saving." *Journal of Monetary Economics*, 22, 237–55.

Zeldes, S. (1989), "Consumption and liquidity constraints: an empirical investigation." *Journal of Political Economy*, 97, 305–346.