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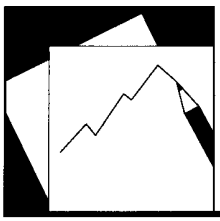

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World Saving

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World Saving[1]

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Abstract

This paper presents new evidence on the behavior of saving in the world, by extending previous empirical research in five dimensions. First, it is based on a very large and recent database, covering 165 countries from 1981 to 2012. Second, it conducts a robustness analysis across different estimation techniques. Third, the empirical search is expanded by including potential saving determinants identified by theory but not previously considered in the empirical literature. Fourth, the paper explores differences in saving behavior nesting the 2008-10 crisis period and four different country groups. Finally, it also searches for commonalities and differences in behavior across national, private, household, and corporate saving rates. The results confirm in part existing research, shed light on some ambiguous or contradictory findings, and highlight the role of neglected determinants. Compared to the literature, we find a larger number of significant determinants of saving rates, using different estimators, for different periods and country groups, and for different saving aggregates.

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I. INTRODUCTION

What does consumption theory say about the main determinants of private saving decisions and which are the empirical measures that should be used to test for their relevance in explaining aggregate consumption/saving patterns? What determines the behavior of national, private, household, and corporate saving rates in the world? Did the exceptional depth of the Global Financial Crisis change the behavioral relationships of private saving and its determinants? And do saving determinants change across different country groups?

There is a small body of empirical saving studies using macroeconomic panel datasets that address some of these questions. A review of 15 empirical studies of mostly private saving rates reveals large differences in their sample size and coverage, data sources, saving rate definitions, model specifications, and estimation methodologies. Unsurprisingly, they also show large differences in empirical results that are difficult to reconcile.

This paper addresses limitations and contradictory findings of previous empirical research, extending it in five dimensions. First, it is based on a very large and more recent panel database for world saving, covering 165 countries from 1981 to 2012. This is almost four times the size of the most comprehensive panel study published to date by Loayza et al. (2000). Second, it conducts a robustness analysis across different estimation techniques. Third, the empirical search is expanded by including potential saving determinants identified by theory but not previously considered in the empirical literature. Fourth, the paper explores differences in saving behavior across time and space, nesting the 2008-10 crisis period and four different country groups. Finally, while this paper's focus is on private saving, it also searches for commonalities and differences in behavior across national, private, household, and corporate saving rates.

Our results confirm some of the findings of the literature and unveil some novel features. Private saving rates are generally persistent and positively associated with income levels and income growth. Terms-of-trade improvements also contribute to a rise in saving through their effect on income. Permanent components of income and the terms of trade increase saving, and temporary parts of the terms of trade are saved to a larger extent than permanent parts. Saving is spurred by inflation, possibly due to precautionary motives. Increased credit availability, which is often associated with a process of financial liberalization, depresses private saving. A higher old-age dependency ratio reduces saving as the elderly finance their consumption needs with accumulated savings. Urbanization lowers private saving rates. Higher public saving reduces private saving, but exhibiting only partial Ricardian offsetting. Higher expected future growth has a positive effect on private saving, as does access to foreign borrowing. Finally, a higher share of young dependents reduces saving.

We also find that results differ across time periods and country groups. During the Global Financial Crisis, private saving inertia, income levels, and urbanization had diminished

effects on saving. Compared to private saving in other country groups, saving in advanced economies is more responsive to income growth and almost non-sensitive to demographic variables, while low-income developing countries show a lower response of private saving to income growth and less persistent private saving rates. Private saving in oil exporters is positively associated with a larger old-age population share. High-growth Asian economies' private saving rates are relatively more sensitive to real deposit rates.

We then replicate our empirical search for the national saving rate, with results that are largely in line with those reported for private saving. Finally, we check robustness of our results for private saving by estimating regressions separately on household and corporate saving. We also confirm many of the empirical findings reported for private saving at the household and corporate levels.

The paper structure is the following. In the next section we first review the determinants of private saving by briefly discussing the main consumption theories that drive the selection of empirical saving determinants. Then, we provide an overview of panel data studies on the behavior of private saving rates. Section III summarizes our data sources and construction and presents descriptive statistics, stylized facts on saving patters, and pairwise correlations with key potential determinants. Section IV outlines our empirical strategy, describing our choice of regression models. The empirical results are reported in Section V. Section VI concludes.

II. PRIVATE SAVING DETERMINANTS

We review the determinants of private saving in two steps, extending previous surveys by Schmidt-Hebbel and Servén (1997) and Loayza et al. (2000). First, we briefly discuss the main theories of consumption and saving that drive the selection of potential regressors in empirical studies on aggregate consumption and saving. Then, we provide a compact overview of the empirical panel data literature on the behavior of aggregate private saving rates.

The starting point of modern theoretical research on consumption and saving is defined by two dominant models: the permanent-income hypothesis (PIH) and the life-cycle hypothesis (LCH). In contrast to the preceding Keynesian hypothesis (KH), in which consumption is determined by current income, the PIH focuses on a representative, infinitely-lived consumer who equates consumption to permanent income net of the present value of taxes (Friedman, 1957; Hall, 1978). As a variant of the PIH, the Ricardian-equivalence hypothesis (REH) derives permanent income as net of the present value of government spending, by making use of the representative consumer's and the government's budget constraints, which are linked by tax payments (Barro, 1974). If a large number of stringent (and empirically implausible) conditions are satisfied (Seater, 1993), the REH predicts that an increase in permanent government consumption is fully offset by lower private consumption.

The PIH assumption of homogeneous consumers contradicts observed consumer heterogeneity along several dimensions, including age, income, and access to borrowing. This leads to the main competitor of the PIH, the LCH, which introduces age-related consumer heterogeneity (Modigliani and Brumberg, 1954; Attanasio and Weber, 2010). Here, aggregate saving reflects the addition of saving by different age specific, finitely-lived cohorts who save for their old-age while working, dissave during retirement, and do not leave bequests. However, these LCH predictions are also at odds with the evidence. Planned bequests are empirically large and sensitive to income levels, implying elasticities of consumption to permanent income that are significantly lower than one.

Contradicting the PIH and LCH, consumption tends to exhibit excess sensitivity, i.e., its change is correlated with predictable changes in other variables.[3] This is partly explained by the presence of durable goods (Caballero, 1991), consumption habits (external habits—Abel, 1990—or internal habits—Ferson and Constantinides, 1991), or consumer time inconsistency reflected in hyperbolic discounting (Laibson, 1997).[4]

Uncertainty can also explain in part the failures of the deterministic versions of the PIH-REH and LCH. Classical uncertainty or risk about future realizations of stochastic variables (but not about distributions of stochastic variables, which are assumed to be known and stationary) leads to precautionary saving by risk-averse consumers (Skinner, 1988; Zeldes, 1989). When risk-averse consumers face additional Knightian uncertainty (i.e., distributions of stochastic variables are unknown), precautionary saving is raised further (Miao, 2004; Hansen and Sargent, 2010).

Other theories substantially modify several key assumptions of the PIH-REH and LCH to derive behavioral predictions that are more consistent with the data. Borrowing constraints—the fact that interest rates on loans cannot be expected to rise to clear financial markets because they raise default risks (Stiglitz and Weiss, 1981) or because human capital cannot be used as collateral (Hayashi, 1982)—push consumers toward corner solutions and make borrowers' consumption levels more sensitive to credit volumes and current income than to interest rates and wealth. When precautionary saving and borrowing constraints are combined, forward-looking, risk-averse consumers incur in buffer-stock saving, anticipating tighter future borrowing constraints (Schechtman, 1976).

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[3] Related to excess consumption sensitivity is the empirical rejection of stochastic versions of the consumption Euler equation (Hansen and Singleton, 1982) and evidence of excessive equity return premiums over fixed-income asset returns (Mehra and Prescott, 1985).

[4] Hyperbolic discount functions present a high discount rate over short horizons and a low discount rate over long horizons. This discount structure induces dynamically inconsistent preferences, implying a motive for consumers to constrain their future choices.

According to the "capitalist spirit" model, which traces back to Smith and Marx, both consumption and wealth are valued by consumers (Cole et al., 1992; Fershtman and Weiss, 1993). If consumption and wealth are gross substitutes in utility, higher wealth does not raise consumption; instead, it is largely saved, contradicting the PIH-REH and the LCH.

Another dimension of consumer heterogeneity reflects differences in income and wealth across different population groups. The incidence of absolute poverty affects aggregate consumption because the poor save little. Then, utility is a positive function of the difference between current consumption and a subsistence consumption level (Christiano, 1989).[5] Therefore, the saving rate declines with absolute poverty (given income distribution) and rises with the level of income—a refined version of autonomous consumption in a conventional KH model.

Post-Keynesian models stress the positive effect of functional income inequality on aggregate saving based on the observation that workers save less than capitalists (Lewis, 1954; Kaldor, 1957). More recent models focus on various channels from personal income inequality to saving, which, taken together, suggest that the effect of income distribution on saving is ambiguous.[6]

We end this brief survey of consumption theories by referring to the integration of household and corporate saving behavior. If a set of strict (and empirically implausible) assumptions are met, household owners of corporations are indifferent between saving as households or through their corporations. They are then able to "pierce the corporate veil," offsetting one-to-one higher corporate saving by lower household saving. This hypothesis is the household-corporate saving analogue to the REH for government-private saving decisions.

Table 1 summarizes categories of saving determinants, specific variables in each category, expected signs of their saving effects according to consumption theories, and the empirical counterparts in country-panel studies based on aggregate saving data. It is important to note that each potential saving determinant is listed only once in Table 1, under the variable

[5] Variants of this theory specify the intertemporal elasticity of substitution as an increasing function of wealth (Atkeson and Ogaki, 1993) or of the distance between permanent income and subsistence consumption (Ogaki et al., 1995). An implication of the two latter hypotheses is that the sensitivity of consumption substitution grows with the level of income.

[6] On the one hand, according to LCH with bequests, wealthier individuals should have higher saving rates as bequests are a luxury (Kotlikoff and Summers, 1981 and 1988). Thus a larger share of poorer individuals can depress private saving. Similarly, the inability to borrow generally affects the poorest and this is likely to negatively affect saving (Deaton, 1991). On the other hand, income inequality may positively affect private saving through the precautionary motive (Carroll and Kimball, 1996). Moreover, if the poor face more limited access to risk diversification options or are more risk averse (especially in light of higher uncertainty), they would increase saving.

category to which it is most closely related by theory. However, both the expected sign and the signs reported in the empirical literature reflect the combined effects on saving predicted by different theoretical hypotheses. In fact, the latter relations could have opposite signs. For example, higher wealth leads to higher consumption according to the PIH but lowers consumption if wealth and consumption are substitutes in utility; hence, the expected effect of wealth on saving is ambiguous.

We now present the variable categories and discuss expected signs of the specific variables on private saving. When discussing the expected signs of the saving determinants one by one, we hold constant the influence of other variables. For example, when analyzing the effects of inflation, we take the level of current income as given.

Income. PIH and LCH predict that current income should be largely saved. Consumption habits reinforce the saving effect predicted by PIH for higher current income. However, when fundamental assumptions of the PIH and the LCH are not satisfied or when consumption habits are weak, current income may raise consumption (in the extreme, one to one) when (i) it accrues to borrowing-constrained consumers, (ii) it signals higher future income, or (iii) it accrues to poor consumers that consume close to their subsistence income level. In these cases, marginal consumption of current income is high and marginal saving is low.[7]

Income reflects (unobserved) *temporary* and *permanent* income components. This distinction makes the prediction of the PIH and the LCH sharper (as long as the separation of current income into estimates for temporary and permanent components is statistically well-grounded), being that permanent income should be consumed while temporary income should be saved. Again, however, deviations from the latter prediction are observed when the assumptions of the PIH are not satisfied, as in the three cases described above.

Higher income growth could lead to an upward estimation of wealth, which reduces saving under the PIH. Under the LCH, the general effect of growth is ambiguous. Under the wealth-in-utility theory, higher wealth leads to less consumption and more saving. Therefore, growth has an ambiguous effect on saving.

[7] When the rate of saving to income is specified as a function of income, this is consistent with a consumption function where the level of consumption is a linear function of the level of income and the product of income and the function of income. While empirically unlikely, the coefficient of the latter product (which is equal to the negative of the coefficient of the function of income in the saving ratio specification) could be positive.

Table 1. Determinants of Private Saving in Previous Studies

Variable Category	Specific Variable	Expected Sign	Empirical Findings
Income	Income level: current	Ambiguous	0 (5, 6, 13), + (1, 2, 3, 4, 7, 15), 0 or + (9)
	Income level: estimated temporary / permanent	(+) / 0 or (+)	0 (7) / 0 (7)
	Gap of current to estimated potential income	(+)	
	Income growth: current	Ambiguous	+ (7, 9, 10, 11, 12, 13, 14), 0 (15)
	Income growth: expected future	Ambiguous	+ (14)
Wealth	Total wealth	Ambiguous	
	Net assets	Ambiguous	
	Net foreign assets	Ambiguous	
Rates of return on financial assets	Real interest rate	Ambiguous	- (7, 10), 0 (1, 3, 5, 6, 11), + (2, 12, 14), 0 or + (15)
	Real return on variable-income assets	Ambiguous	
Relative prices	Consumer price index (CPI): current level	(+)	
	CPI inflation: current	(+)	- (4), 0 (1, 2, 3, 6, 10, 15), + (7, 12, 13)
	CPI inflation: expected future	Ambiguous	
	Terms of trade: current	0 or (+)	0 (13, 15), + (2, 4, 6, 7, 10, 11)
	Terms of trade: estimated temporary / permanent	(+) / 0 or (+)	+ (7) / + (7)
	Real exchange rate: level	Ambiguous	
	Real exchange rate: expected future change	Ambiguous	
Classical uncertainty (risk)	Financial risk, financial instability, financial crisis	(+) Ambiguous	
	Macroeconomic instability, macroeconomic crisis	Ambiguous	
	Political instability or political risk	Ambiguous	
	Violent conflict, war	Ambiguous	
	Variance of innovations to saving determinants	(+)	
Knightian uncertainty	Measures of Knightian uncertainty	(+) or ambiguous	
Domestic borrowing constraints	Current credit flows, current money flows	(-)	- (7, 11, 12), + (3), + or - (14)
Foreign borrowing constraints	Foreign lending	(-)	
	Current account deficit	(-)	- (1, 2, 3, 7)
	Foreign saving	(-)	- (13)
	Sovereign debt premium	(+)	
	Capital flow restrictions	(+)	0 (7)
Financial depth	Bank credit stock	Ambiguous	-(5), 0 (7)
	Financial assets	Ambiguous	
	Broad money stock	Ambiguous	0 (7, 15), + (1, 3, 4, 13)
Demographics	Old-age dependency	(-)	- (2, 3, 4, 7, 10, 11, 14, 15), 0 (5, 6, 13, 15), + (12)
	Young-age dependency	(-)	- (7, 14, 15), 0 (9)
	Urbanization	Ambiguous	- (3, 7, 15)
Poverty and distribution	Poverty	(-)	
	Income concentration	Ambiguous	- (13), 0 (3, 9)
	Wealth concentration	Ambiguous	
	Capital income share	(+)	
Fiscal policy	Public sector saving	(-)	- (1, 3, 7, 10, 15)
	Public sector budget balance	0 or (-)	- (2, 5, 6, 8, 11, 13), 0 (4), + or - (12)
	Public consumption	Ambiguous	- (2, 6) 0 (8)
Government spending components	Education and health	Ambiguous	
	Pensions	Ambiguous	
	In-kind transfers	Ambiguous	
Pension System	Pay-as-you-go pension transfers to old	Ambiguous	- (3, 4, 5)
	Mandatory fully-funded pension system contributions	0 or (+)	+ (4)
	Fully-funded pension assets	Ambiguous	0 or + (5)
Households and firms	Corporate saving effect on household saving	0 or (-)	- (15)

Notes: The qualitative results listed in the last column of this table summarize signs of saving regressors reported in 16 panel studies of private saving. Positive and negative signs correspond to statistically significant coefficient estimates, while 0 denotes coefficient estimates that are not significantly different from zero. The sources are the corresponding tables and specific columns, rows, or regressions of the following studies: 1. Corbo and Schmidt-Hebbel (1991) (table 4); 2. Masson, Bayoumi, and Samiei (1995) (table 2, "restricted model" column); 3. Edwards (1996) (table 2, column 5); 4. Dayal-Ghulati and Thimann (1997) (table 4, column 2); 5. Bailliu and Reisen (1998) (table 1, columns 3 and 4); 6. Haque, Pesaran, and Sharma (1999) (table 6, columns 4 and 5); 7. Loayza, Schmidt-Hebbel, and Servén (2000) (table 4, column 6; table 7); 8. López, Schmidt-Hebbel, and Servén (2000) (tables 4 to 6); 9. Schmidt-Hebbel and Servén (2000) (table 6, columns 7 and 8); 10. De Serres and Pelgrin (2003) (table 2); 11. IMF (2005) (table 2.2, column 1); 12. Hondroyiannis (2006) (table 5, last row); 13. Gutiérrez (2007) (table 5, regression 9); 14. Horioka and Terada-Hagiwara (2012) (table 1, models 7 to 9); and 15. Bebczuk and Cavallo (table 3.1, columns 2 and 4). 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. When denoted by two signs separated by "or", it denotes that the coresponding signs are reported in different columns. Real rates of return are measured either on deposits or loans. Each study is identified in the table by the corresponding number in parentheses.

Wealth. Consumer wealth comprises net financial assets, real assets (housing, consumer durables), and human wealth (the discounted present value of expected future labor income). If REH holds and if households pierce the corporate veil, consumer wealth is indistinguishable from national wealth after full consolidation of household, corporate, and government assets and liabilities. As discussed above, the saving effect of wealth and its components is ambiguous.

Rates of return on financial assets. According to the PIH and the LCH, a rise in the rate of return on financial assets held by consumers entails income, substitution, and human-wealth effects. If the consumer is a net creditor (a net holder of financial assets), the substitution and human-wealth effects of a higher rate of return on saving are positive, while the income effect is negative, hence the combined net effect is ambiguous. If the consumer is a net debtor, the income effect turns positive. Thus, higher bank deposit rates are likely to have an ambiguous effect on saving while higher lending rates are likely to reduce lending and raise saving. The overall effect of higher interest rates on aggregate private saving is ambiguous.

Relative prices. Relative prices of consumption and major consumption components affect saving because they entail *intertemporal* and *intratemporal* substitution effects, as well as income effects. Higher current consumer price inflation raises current prices of consumer goods relative to past prices, leading to higher saving. At the same time, current inflation signals macroeconomic instability, raising precautionary saving. Also, higher expected future inflation lowers the ex-ante real interest rate, inducing intertemporal substitution, income, and human-wealth effects that, on balance, imply an overall ambiguous (positive) effect on saving by savers with positive (negative) net financial asset positions.

Improved terms of trade entail a direct increase in net income from abroad, benefiting consumers by a proportional positive effect on income. Regarding the composition of consumption, imported goods typically represent a much larger share of consumption than exportable goods. Therefore, higher terms of trade are likely to reduce the average consumption deflator. In sum, higher current terms of trade are likely to affect saving positively. Like in the case of income, when distinguishing between estimated temporary and permanent components of the terms of trade, the former is expected to be largely saved and the latter to be consumed.

For consumption decisions, the real exchange rate is a relative price between different categories of consumption spending: domestic to imported goods or non-traded to traded goods. A change in the current relative price level of different consumption categories has an ambiguous effect on the consumption deflator (depending on the consumption basket) and therefore on saving. Similarly, an expected future appreciation of the real exchange rate has an ambiguous effect on saving.[8]

Risk and uncertainty. The precautionary saving theory predicts that higher levels of classical and Knightian uncertainty lead to higher precautionary saving. Therefore, higher

[8] A real exchange rate appreciation entails intertemporal substitution, income and, human-wealth effects, in addition to an intratemporal consumption effect (Dornbusch, 1982). The first three effects are similar to those of an interest rate reduction because they affect the consumption-based real rate of interest. Hence, like in the case of the real interest rate, an expected real exchange rate appreciation has an ambiguous effect on saving.

financial risk measured by larger second moments of asset returns or larger market volatility indicators should lead to higher saving. However, when market volatility is extreme or financial, macroeconomic, and political forms of instability turn into crises, agents lose confidence in financial instruments and the institutions that issue or back them such that saving declines. Thus, the effect of risk and uncertainty on saving is ultimately ambiguous.[9]

Borrowing constraints. Tighter current borrowing constraints imply less access by consumers to credit, and therefore increase saving. This effect is magnified by anticipation of tighter future constraints by risk-averse consumers, giving rise to buffer-stock savings. Proxies of domestic borrowing constraints include money and credit flows in addition to current income.

A proxy of foreign borrowing constraints is foreign saving or the current account deficit, which is a valid saving determinant when the country faces a binding quantitative restriction in its access to foreign funding. In the absence of such a quantitative constraint or when a price variable such as the sovereign debt premium reflects the cost of external borrowing, the premium and the current account jointly respond to domestic saving and investment decisions. The sovereign debt premium is an important component of the cost of foreign funding and therefore affects saving like any lending interest rate that affects a debtor, i.e., positively.

Government restrictions imposed on international capital flows are likely to affect private saving. Restrictions on outflows limit capital outflows and restrictions on inflows limit issuance of foreign liabilities, hence both are likely to raise saving.

Financial depth. Development of deep and well-regulated financial and capital markets lead to a diversified supply of saving instruments that are similar to those offered in international markets. This could intensify home bias in domestic savers' allocation of worldwide saving and, possibly, raise private saving flows. Proxies of financial depth, including bank credit stocks, financial assets, or broad money holdings could be positively associated to higher saving. However, the latter are also important components of consumer wealth. Therefore, the overall impact of the latter proxies of financial depth on saving is ambiguous.

Demographics. This variable category, as well as many subsequent categories discussed below, reflects potential aggregate saving effects that stem from differences in saving behavior across different population groups. Regarding demographic heterogeneity, the LCH predicts a hump-shaped pattern of saving along the life cycle. Standard proxies of a country's demographic structure are the young- and old-age dependency ratios (the ratios of young and

[9] Current inflation is often used as a measure of macroeconomic uncertainty in empirical studies but is listed as a relative price variable in Table 1.

old people, respectively, to the active-age cohorts). The larger these groups, the smaller aggregate saving should be.

A country's rate of urbanization could affect aggregate saving through several channels. First, a conventional hypothesis holds that the "city lights" reflected in larger consumption opportunities reduce saving of city dwellers compared to the rural population. Second, farmers are likely to face larger income uncertainty and less insurance and credit opportunities than urban dwellers, leading to higher saving in rural areas. Finally, farmers tend to be poorer than city dwellers, leading to lower rural saving. Hence, urbanization affects saving ambiguously.[10]

Poverty and distribution. As average consumption out of income declines with the distance between income and a subsistence level of consumption, saving declines with a larger share of people falling below absolute poverty (for given income inequality). The effect of the relative distribution of personal income or wealth on saving is ambiguous.

Fiscal policy. The REH predicts an offset of private saving to a change in public sector saving. Full offsetting is empirically unlikely, but it is expected that a higher government balance (or higher government saving, given government investment) lowers private saving. Government consumption has an ambiguous effect on saving, depending if public and private consumption are substitutes or complements in consumer utility (López et al., 2000).

Government spending components. Government spending on education, health, and other in-kind transfers reduces private consumption when the former spending categories are substitutes of similar private consumption categories, hence private saving rises. However, government transfers to consumers paid in cash raise disposable income, and have an ambiguous effect on private saving rates. Finally, government social spending and transfers lower uncertainty faced by consumers, reducing the need for precautionary saving. Thus, the overall effect of the latter on private saving is ambiguous.

Pension system. Pension benefits paid by a pay-as-you-go system raise pensioners' consumption either fully or less than fully, having an ambiguous effect on private saving. Mandatory contributions to a fully-funded pension system reduce voluntary saving of contributors, but usually not one to one—hence, overall private saving is either maintained or increased.[11] Fully-funded pension system assets held by individuals have an ambiguous effect on saving, like wealth and any of its components as discussed above.

[10] The second and third channels of urbanization on saving are observed if the urban/rural distribution of income uncertainty, income levels, and access to insurance and credit are not controlled for separately.

[11] When mandatory pension saving is a perfect substitute for voluntary saving, total private saving is unaffected.

Households and firms. When households pierce at least in part the corporate veil, higher corporate saving is partially offset by lower household saving.

The last Column of Table 1 lists the sign results of the estimated coefficients of saving determinants reported in 15 empirical studies on mostly private saving rates based on panel samples.[12] Sample size and coverage, data sources, saving rate definitions, model specifications, and estimation methodologies vary significantly across studies.[13] For example, sample sizes range between a low of 66 country-year observations (for 12 countries) in Horioka and Terada-Hagiwara (2012) and a high of 872 country-year observations (for 69 countries) in Loayza et al. (2000).

We conclude the following points from the heterogeneous empirical literature. First, most individual studies include few potential saving determinants in the specification—on average, six regressors out of 49 potential saving determinants listed in Table 1. This disappointingly small number reflects (i) the progress in consumption theory that has added over time new potential regressors for which empirical measures are only gradually made available; (ii) the lack of data, as many studies run out of degrees of freedom when adding more regressors; and (iii) many potential regressors listed in Table 1 are close substitutes of others. However, about half of the 49 potential regressors have not been used in any single previous private saving study.

Second, signs of several reported coefficients tend to be consistent with theory, either when they are expected to be unambiguously of one particular sign or when their expected sign is ambiguous. For example, 11 studies report statistically significant private saving offset coefficients for public saving or the public sector balance. A different example is the real interest rate, whose expected sign is ambiguous—an ambiguity reflected by a wide range of significant signs in 11 studies, from negative to zero and to positive.

Third, signs reported for other coefficients by several previous studies either contradict theory or results of other studies; e.g., the coefficients for inflation, credit flows, and old-age dependency. Fourth, the dispersion of parameter point estimates (and their confidence intervals) is very large—including those that are consistent with theory. Fifth, a core set of potential saving determinants is included in most studies. These are income level and income growth, real interest rate, inflation, terms of trade, demographic variables, and public saving. Few studies include non-standard variables like temporary/permanent components of income

[12] Exceptions are two studies for private consumption rates (Corbo and Schmidt-Hebbel, 1991; López et al. 2000) and three studies for national saving rates (IMF, 2005; Gutiérrez, 2007; Horioka and Terada-Hagiwara, 2012). In Table 1, we interpret the latter studies' reported coefficient estimates as those for private saving.

[13] Except López et al. (2000), which reports estimates for a structural consumption function, all other studies are based on reduced-form equations.

flows, income distribution, public consumption, and pension-system variables. Finally, variables for which empirical measures are not readily available or theory has been developed more recently are fully absent, including financial assets, violent conflicts, and government spending components.

III. DATA AND STYLIZED FACTS

A. Sources and Construction

The world dataset constructed for this study is, to our knowledge, the most comprehensive on saving aggregates and their determinants. It contains a maximum of 4,137 observations, spanning from 1981 to 2012 and covering 165 countries. The panel dataset is unbalanced, with the number of time observations varying across countries.

The restrictions that shape our dataset come from several steps needed to improve its quality. We compile data from the IMF World Economic Outlook Database, the World Bank Worldwide Development Indicators, the UN National Accounts database, the OECD database, Haver Analytics, and several central bank web pages. The initial database then undergoes extensive cleansing to eliminate or replace faulty data, splice series, and fill gaps. For a complete list of the series compiled, the variables calculated, and the methods used for the construction of the database, see Appendix I.

B. Stylized Facts

We define the national saving rate as the ratio of gross national saving (GNS) to gross national disposable income (GNDI). Similarly, the private saving rate is defined as the gross private saving (GPS) scaled by gross private disposable income (GPDI).[14] Tables 2 and 3 present descriptive statistics and pairwise correlations for the saving ratios and core saving determinants. In both tables, the sample is the one of the private saving baseline specification, which includes 3,254 observations for 153 countries over 31 years.

[14] Differently from Loayza et al. (2000), we do not construct alternative private saving measures, adjusted for capital gains and losses due to domestic inflation and exchange-rate devaluation. These corrections, while analytically desirable, are unlikely to affect empirical results, as shown by Loayza et al. (2000).

Table 2. Descriptive Statistics

(Panel sample)

	Countries	Obs	Mean	Std. Dev.	Min	Max
Private saving/GPDI	153	3,254	20.4	12.9	-57.2	76.8
Per capita GPDI (PPP)	153	3,254	8,543	8,410	236	57,059
Real growth rate of per capita GPDI (PPP)	153	3,254	2.7	9.6	-51.1	133.8
Real deposit rate	153	3,254	1.0	5.3	-27.5	42.7
Terms of trade	153	3,254	106	34	26	587
Inflation	153	3,254	5.9	5.8	-15.2	32.9
Flow of private sector credit/GPDI	153	3,254	6.3	9.3	-33.1	173.0
Old age dependency ratio	153	3,254	11.7	7.1	0.6	39.0
Share of urban population	153	3,254	55.0	23.9	4.7	100.0
Public saving/GPDI	153	3,254	5.68	13.8	-31.0	172.0
Household saving/GPDI	48	674	8.9	7.3	-12.3	35.1
Corporate saving/GPDI	48	674	15.9	6.4	-5.4	56.5

Source: Authors' calculations.

Table 3. Correlation Matrix of Core Private Saving Determinants

(Panel sample in upper triangle, cross section in lower triangle)

	Private saving/GPDI	Per capita GPDI (PPP)	Real growth rate of per capita GPDI (PPP)	Real deposit rate	Terms of trade	Inflation	Flow of private sector credit/GPDI	Old age dependency ratio	Share of urban population	Public saving/GPDI	Household saving/GPDI	Corporate saving/GPDI
Private saving/GPDI	1.00	0.44	0.17	-0.04	0.06	-0.07	0.12	0.22	0.41	0.02	0.69	0.57
Per capita GPDI (PPP)	0.59	1.00	-0.02	0.02	-0.04	-0.27	0.30	0.64	0.72	0.06	0.11	0.29
Real growth rate of per capita GPDI (PPP)	0.38	-0.09	1.00	0.05	0.06	-0.05	0.03	-0.02	0.01	0.01	0.02	0.23
Real deposit rate	-0.11	0.11	-0.25	1.00	-0.07	-0.59	0.04	0.03	0.10	-0.05	0.00	-0.11
Terms of trade	-0.11	-0.19	0.03	-0.07	1.00	0.04	-0.03	-0.13	-0.06	0.18	-0.08	0.13
Inflation	-0.30	-0.54	0.18	-0.29	0.10	1.00	-0.02	-0.22	-0.19	-0.04	0.03	-0.07
Flow of private sector credit/GPDI	0.34	0.25	0.30	0.17	-0.13	-0.13	1.00	0.21	0.27	0.14	0.02	-0.01
Old age dependency ratio	0.19	0.57	0.03	-0.10	-0.39	-0.37	0.25	1.00	0.52	-0.18	-0.12	0.32
Share of urban population	0.47	0.71	0.06	0.12	-0.19	-0.28	0.31	0.49	1.00	0.08	-0.07	0.36
Public saving/GPDI	0.19	0.08	0.11	-0.05	0.28	-0.08	-0.09	-0.28	0.11	1.00	-0.18	0.15
Household saving/GPDI	0.61	0.17	0.09	-0.09	-0.17	-0.11	0.13	-0.17	0.01	0.05	1.00	-0.21
Corporate saving/GPDI	0.77	0.53	0.45	-0.06	0.12	-0.24	0.21	0.22	0.53	0.35	0.03	1.00

Source: Authors' calculations.

Figure 1 presents the trends in world saving rates over the sample period 1981-2012.[15] As shown in panel (a), the average national saving rate remained moderately stable around 19 percent of GNDI until the late 1990s. Since then, it climbed to 22.6 percent of GNDI in 2006, but then progressively fell to 19.5 percent in 2012. Panel (a) of Figure 1 also describes how the national saving composition changed over time. The average private saving component largely dominates the public counterpart, at about four-fifths of national saving. However, while the private saving rate remained virtually constant at 16.3 percent of GNDI, changes in public saving largely drove the changes observed in national saving after 2000. In particular, after fluctuating between 2 and 3 percent until the end of the 1990s, the public saving rate peaked at 6 percent in 2006 and remained high until the recent Great Recession, when it declined significantly.

[15] Figures 1 and 2 are based on the unbalanced panel of 165 countries to provide the most comprehensive picture of trends in the world. In the construction of the database, however, we impose that at least 50 percent of the countries have to available for every year to obtain representative averages. Using averages of a balanced sample return similar results, with the exception of oil exporters, which show higher private saving rates.

Panel (b) of Figure 1 shows the dispersion of private saving during the sample period. While the sample median private saving rate is remarkably stable at 20.5 percent of GPDI, the bands calculated for the percentile distribution of the private saving rate are wide, reflecting a large variability across countries. For example, about one half of the countries show, on average, private saving rates between 15.5 percent of GPDI and 28.5 percent of GPDI, and one-fifth shows private saving rates of more than 35 percent and less than 5 percent.

Figure 2 takes a closer look at private saving rates. Panel (a) depicts the average private saving rate across different country groups.[16] Advanced economies had, on average, private saving rate of 27.2 percent of GPDI, about 7 percentage points higher than the sample average. Oil exporters experienced even higher private saving rates than advanced economies at times, but these countries are prone to a much higher volatility, associated to variations in oil prices. Over the sample period, average private saving rates for oil exporters fluctuated between 15.0 and 37.2 percent of GPDI. On the contrary, high-growth Asian economies show a steady upward trend since the 1980s. By the end of 2012, their average private saving rate stood at 34.7 percent of GPDI. Finally, the average private saving rate in low-income developing countries (LIDCs) is only 12.0 percent of GPDI over the sample period, at about 8 percentage points below the sample average.

Panel (b) of Figure 2 presents the private saving composition. Available data is limited to 48 countries and 674 observations for household and corporate saving.[17] The average private saving rate in this country subset of countries is 16.3 percent of GPDI, almost 4 percentage points below the average private saving rate for the whole sample, and declines slightly over time. The average household saving rate followed a downward trend since the mid-1990s, which was almost fully offset by an increasing corporate saving rate.

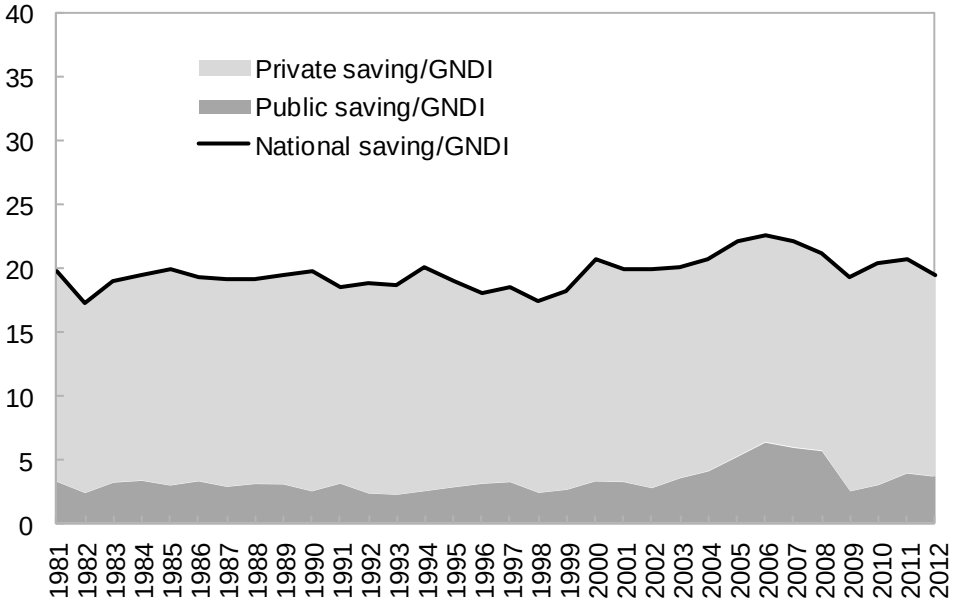
Finally, we show in Figure 3 scatter plots for pairwise panel correlations of cross-country averages between the private saving rate and its core determinants, and one scatter plot for correlations between household and corporate saving rates. The relationships reflect simple associations and certainly could be very different from partial correlations estimated in a multivariate regression. While some correlations are consistent with signs determined by theory (e.g., income level, income growth, and household and corporate saving), others do no show a clear pattern (e.g., terms of trade, public saving rate, real deposit rate), and others are inconsistent with theory (e.g., flow of private credit, old-age dependency ratio, and share of urban population).

[16] Appendix II reports the classification of countries.

[17] Despite the balanced regional and income group coverage, results should be taken with caution, considering likely measurement problems of household and corporate saving (Schmidt-Hebbel and Servén 1997).

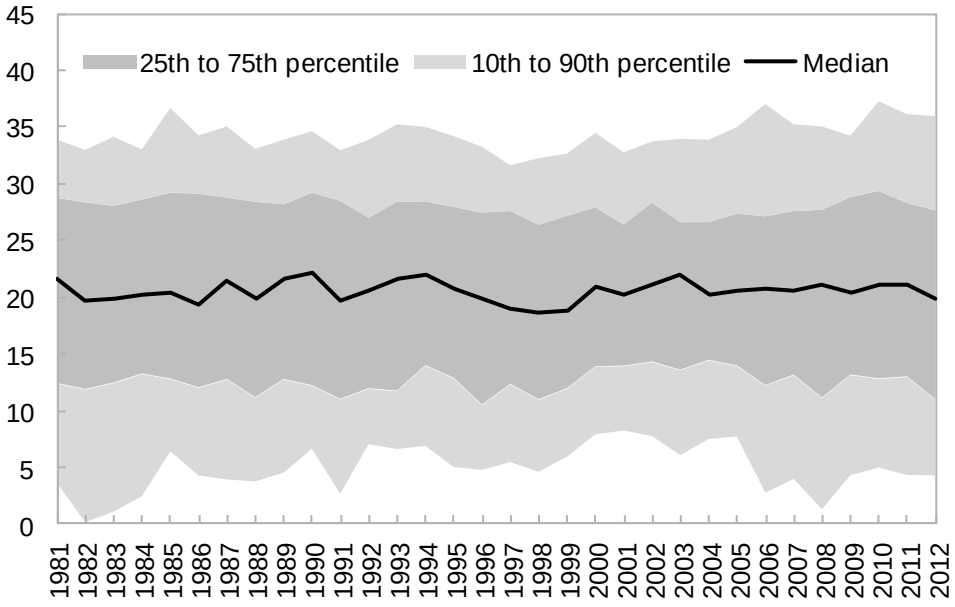
Figure 1. World Saving Rates, 1981-2012

(a) Average national, private, and public saving rates



Notes: Year averages are calculated on the unbalanced panel of 165 countries.
Source: Authors' calculations.

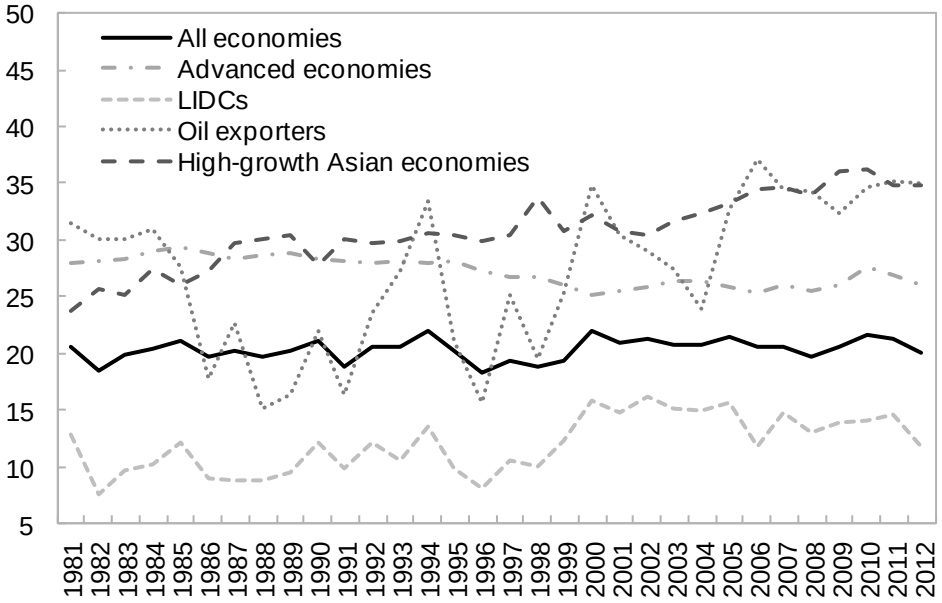
(b) Distribution of private saving rates



Notes: Year percentiles are calculated on the unbalanced panel of 165 countries.
Source: Authors' calculations.

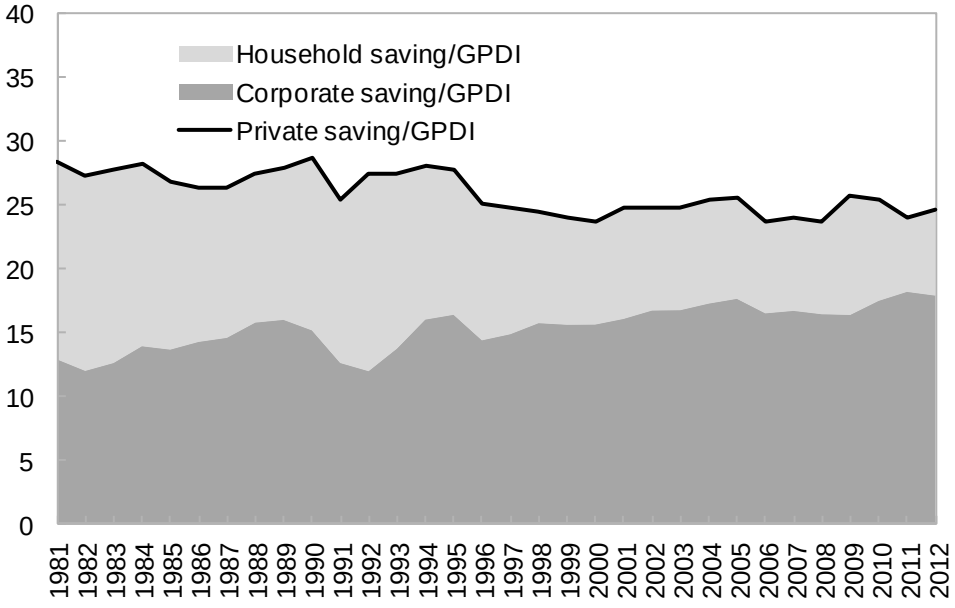
Figure 2. World Private Saving Rates, 1981-2012

(a) Average private saving rates (percent of GPDI) across country groups



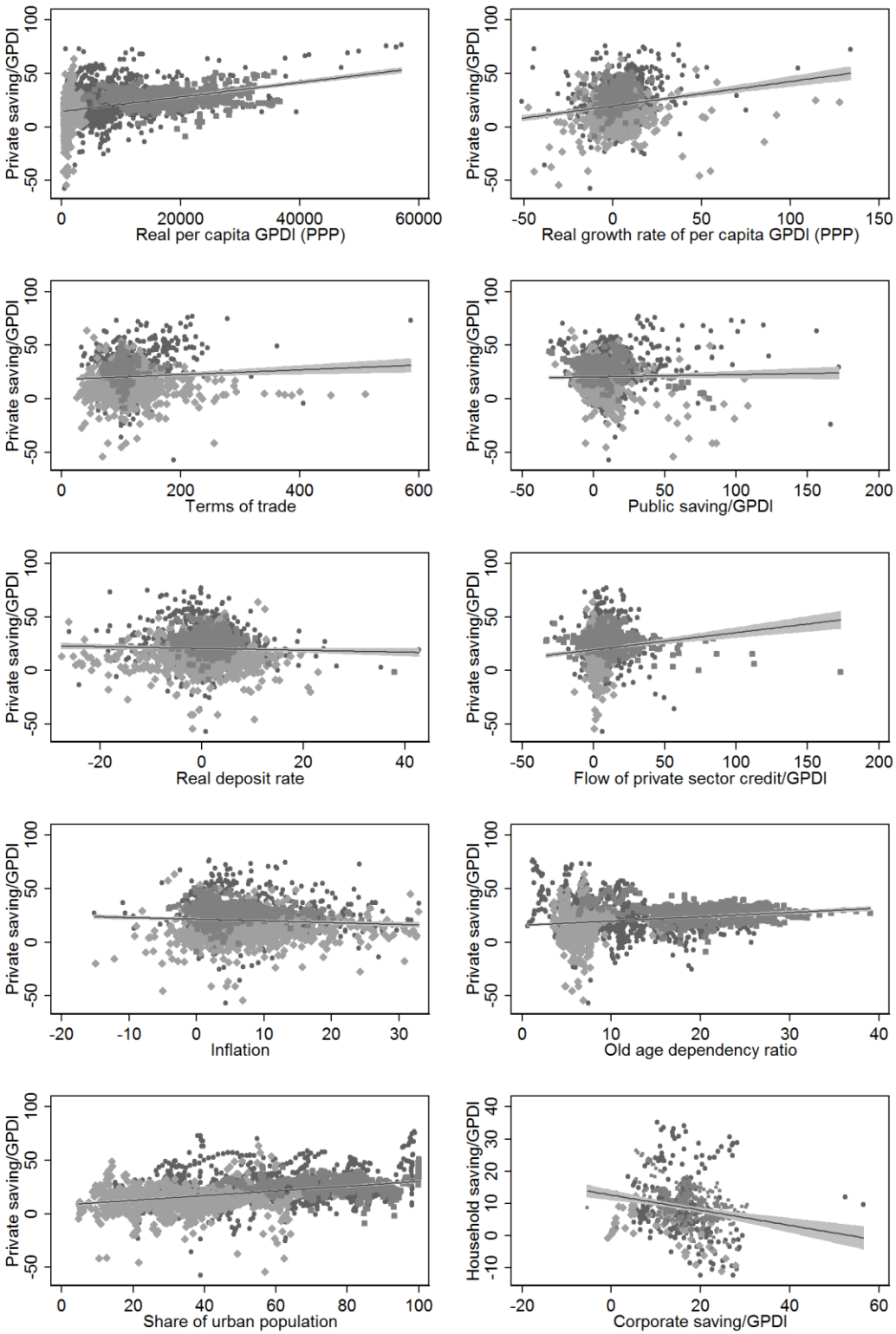
Notes: Year averages are calculated on the unbalanced panel of 165 countries.
Source: Authors' calculations.

(b) Average private, household, and corporate saving rates



Notes: Year averages are calculated on the unbalanced panel of 48 countries.
Source: Authors' calculations.

Figure 3. Pairwise Panel Correlations



Notes: Depicted regression lines and 95 percent confidence intervals are based on linear regressions with a constant term using the unbalanced panel of 153 countries. Light-grey dots represent LIDCs, dark-grey dots represent advanced economies, and black dots represent the rest of the countries in the sample.
Source: Authors' calculations.

IV. EMPIRICAL STRATEGY

Let $Y_{i,t}$ denote the private saving rate. It can be modeled as:

$$Y_{i,t} = bX_{i,t} + dZ_{i,t} + \varepsilon_{it} \quad (1)$$

where $X_{i,t}$ includes the endogenous (and predetermined) covariates for country i at time t, $Z_{i,t}$ includes (strictly) exogenous variables and an intercept, b and d are the relative coefficients, and ε_{it} is a mean zero error term that captures unobserved heterogeneity.

The selection of variables $X_{i,t}$ and $Z_{i,t}$ to be included in the baseline specification relies on consumption theory, previous empirical research (in particular, Loayza et al., 2000), as well as data availability. At a later stage, this set of regressors is complemented by other variables that are included in the specification to study their relationship with the dependent variable or to justify their exclusion from the baseline specification. In line with Loayza et al. (2000), we treat the log of real per capita GPDI in PPP terms, real growth rate of per capita GPDI in PPP terms, public saving in percent of GPDI, inflation, the real deposit rate, and the flow of private sector credit in percent of GPDI as endogenous variables, assuming that they are correlated with present, past or future error terms.[18] On the other hand, we treat the log of the terms of trade, the old-age dependency ratio, the share of urban population, and the log of the real oil price as exogenous variables.

We estimate the static model (1) using ordinary least squares (OLS) applied to both a cross-section sample of country averages and a pooled panel sample of annual observations, correcting standard errors for heteroskedasticity and autocorrelation. Comparing OLS cross-section and pooled results is informative with respect to the between and within variation in the data, and one could interpret the results as long- and short-term coefficients, however OLS estimations suffer from potentially severe econometric problems: lack of dynamics, omitted variable bias due to absent country- and time-fixed effects, and endogeneity of the $X_{i,t}$ variables.

Dynamics of the dependent variable are likely to be an important factor in the estimation because changes in private saving generally occur over a long period of time. More specifically, the observed private saving rate in a given year and for a given country $y_{i,t}$ may deviate from its target level $Y_{i,t}$ due to, for example, adjustment costs, consumption habits, consumption smoothing, or the lagged effects of the explanatory variables on private saving. Thus we specify a target adjustment model:

[18] One can argue that some of these variables are predetermined (or determined prior to the current period) rather than endogenous, suggesting that they are uncorrelated with the past error term. However, this distinction does not imply any change in treatment.

$$y_{i,t} - y_{i,t-1} = (1-\gamma)(Y_{i,t} - y_{i,t-1}) \quad (2)$$

where γ is the adjustment speed. This means that if $\gamma = 0$, then $y_{i,t} = Y_{i,t}$, and the adjustment toward the target value takes place immediately. Combining equations (1) and (2), we specify the following dynamic model for the observables:

$$y_{i,t} = \gamma y_{i,t-1} + \beta X_{i,t} + \delta Z_{i,t} + u_{it} \quad (3)$$

where coefficients and the error term are defined as: $(\beta, \delta, u_{i,t}) = (1-\gamma)(b, d, \varepsilon_{it})$. Therefore incomplete adjustment ($\gamma \neq 0$) leads to a form of state dependence where last period's $y_{i,t-1}$ determines this period's $y_{i,t}$. When this is not accounted for, correlation between $y_{i,t}$ and $y_{i,t-1}$ could result from unobserved heterogeneity. Hence, a more general version of model (3) would include the time-invariant unobserved country-specific heterogeneity term c_i, leading to the following specification:

$$y_{i,t} = \gamma y_{i,t-1} + \beta X_{i,t} + \delta Z_{i,t} + c_i + u_{it} \quad (4)$$

This dynamic panel model also partially controls for possible reverse causality. For example, if past private saving performance $y_{i,t-1}$ affects current income growth $X_{i,t}$, then this feedback is accounted for in model (4). Thus, we first estimate model (4) with the OLS estimator. To address endogeneity more comprehensively, we then estimate model (4) with the two-stage least squares (2SLS) estimator, which uses the lags of endogenous variables $X_{i,t}$ as instruments.

Yet the dynamic structure of the model would make OLS estimates biased downward and inconsistent even with a fixed-effects estimator because the error term u_{it} is correlated with the lagged dependent variable $y_{i,t-1}$ (Nickel, 1981). An alternative approach is to first-difference the model in equation (4) to eliminate the fixed effects c_i. However, the OLS estimator would still be inconsistent because this transformation does not affect the correlation between $y_{i,t-1}$ and u_{it}.

Under appropriate identification assumptions (or moment conditions), the difference Generalized Method of Moments (GMM) estimator would be consistent (Arellano and Bond, 1991). In particular, this estimator assumes that the idiosyncratic error u_{it} is serially uncorrelated and that past values of the endogenous variables $y_{i,t-s}$ are not correlated with the current error u_{it}. These conditions allow using the second (and higher) lags of $y_{i,t}$ as instruments for $y_{i,t-1}$, and second (and higher) lags of $X_{i,t}$ as instruments for $X_{i,t}$.

Blundell et al. (2000) and Bond et al. (2001) show that the difference GMM estimator has poor finite sample properties and that the estimator performs weakly when the dependent

variable is persistent. Arellano and Bond (1997) and Blundell and Bond (1998) propose the system GMM (S-GMM) estimator, which increases efficiency by estimating a system of two simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first differences (with lagged levels as instruments). This estimator requires the additional identifying assumption that the instruments are exogenous to the fixed effects. Thus, we estimate model (4) with the asymptotically more efficient two-step S-GMM. The two-step variant presents estimates of the standard errors that tend to be severely downward biased (see Arellano and Bond, 1991, and Blundell and Bond, 1998). However, we implement the finite-sample correction of the two-step covariance matrix derived by Windmeijer (2005), which produces unbiased standard errors.

Finally, we estimate the following more comprehensive model that includes time-fixed effects τ_t (but excludes the real oil price from the set of strictly exogenous variables $X_{i,t}$) with the two-step S-GMM estimator:

$$y_{i,t} = \gamma y_{i,t-1} + \beta X_{i,t} + \delta Z_{i,t} + c_i + \tau_t + u_{it} \quad (5)$$

While our preferred specification uses annual data with time-fixed effects, we also test the robustness of the results averaging all variables over five years. The latter specification has the advantage of abstracting from the business cycle and reducing the impact of measurement error, but at the cost of distorting and losing information about temporal dynamics of saving rates.

With the aim of testing for differences in saving behavior in specific time periods or selected country groups compared to the rest of the whole sample, we extend our preferred specification with interaction terms between our $X_{i,t}$ and $Z_{i,t}$ variables, and a dummy variable $D_{i,t}$, which takes a value of one for the specific time period or country group. More formally, we estimate the following nested model:

$$y_{i,t} = \gamma y_{i,t-1} + \beta X_{i,t} + \delta Z_{i,t} + \xi D_{i,t} y_{i,t-1} + \varphi D_{i,t} X_{i,t} + \omega D_{i,t} Z_{i,t} + c_i + \tau_t + u_{it} \quad (6)$$

where ξ, φ, and ω are the coefficients of the interaction terms. The dummy variable $D_{i,t}$ is not included as a separate regressor because it would be perfectly collinear with time-fixed effects τ_t (in the case of time periods) or the country-fixed effects c_i (in the case of country groups). The effect of the corresponding regressor $X_{i,t}$belonging to a specific time period or country group $D_{i,t}$, on the dependent variable $y_{i,t}$, is given by $\beta + \varphi$. Analogously, the effect of $Z_{i,t}$ ($y_{i,t-1}$) belonging to the same country group or time period on the dependent variable $y_{i,t}$ is given by $\delta + \omega$ ($\gamma + \xi$). We refrain, however, from analyzing other possible interactions or non-linearities as this is beyond the scope of this paper.

The S-GMM identification assumptions are tested applying a second-order serial correlation test for the residuals and the Hansen J-test for overidentifying restrictions. While the latter test is limited in that it hinges on the untestable assumption that at least one instrument is valid, it is still useful in spotting violations of validity.

V. RESULTS

We present the estimation results in the following order. We start by reporting the regression results of a baseline specification for private saving, obtained by using different estimators (Table 4). Then, we extend the baseline specification by including additional regressors (Table 5). Subsequently, we analyze differential saving behavior in a particular time period and in selected country groups (Table 6). Then, we present empirical results for other saving aggregates, namely the national saving rate (Table 7), and household and corporate saving rates (Table 8). Finally, like our analysis of the private saving rate, we extend the baseline specification for the household saving rate by including additional regressors (Table 9).[19]

A. Baseline Specification

Table 4 reports the results for our baseline specification, applying seven estimators. Column 1 shows the results of a private saving regression estimated with OLS, where data are averaged over the entire length of the panel. In Column 2, we conserve the static nature of the model, but we introduce the time dimension and estimate with the pooled OLS estimator. Starting in Column 3, we introduce dynamics by controlling for the inertia of private saving and add country-fixed effects to control for unobserved cross-country heterogeneity. We then move to estimate the specification in a 2SLS framework, where we instrument the endogenous explanatory variables with their own lags.

Finally, we report results for two-step S-GMM estimations in Columns 5 to 7. Results in Columns 5 and 6 are based on annual observations and those in Column 7 on observations of five-year averages. Column 5 (like Columns 2 to 4) includes the (log) real price of oil to proxy global events, while Columns 6 to 7 replace the oil price with time-fixed effects. Our preferred results are reported in Column 6, which applies two-step S-GMM with time-fixed effects on annual observations.

[19] Appendix III presents the contributions to the fitted values for the preferred specifications.

Table 4. Determinants of Private Saving, Different Estimators

(Dependent variable: Private saving/GPDI)

	(1) Average CS OLS	(2) Pooled OLS	(3) OLS FE	(4) 2SLS FE	(5) Two-step S-GMM	(6) Two-step S-GMM	(7) Two-step S-GMM (Five-year averages)
Lag dependent variable	.	.	0.623***	0.599***	0.600***	0.593***	0.246
	.	.	(0.027)	(0.050)	(0.077)	(0.066)	(0.155)
Ln real per capita GPDI (PPP)	0.051***	0.065***	0.062***	0.061***	0.154***	0.171***	0.235***
	(0.014)	(0.012)	(0.015)	(0.022)	(0.034)	(0.032)	(0.052)
Real growth rate of per capita GPDI (PPP)	0.650**	0.203***	0.270***	0.239	0.251***	0.255***	0.237***
	(0.311)	(0.038)	(0.037)	(0.204)	(0.038)	(0.041)	(0.080)
Real deposit rate	-0.665***	-0.231***	0.049	0.141	0.055	0.141	0.120
	(0.243)	(0.084)	(0.037)	(0.099)	(0.089)	(0.098)	(0.230)
Ln terms of trade	0.047	0.034*	0.022**	0.020**	0.048***	0.051***	0.056**
	(0.058)	(0.020)	(0.009)	(0.010)	(0.015)	(0.015)	(0.023)
Inflation	-0.144	-0.050	0.123***	0.049	0.269**	0.387***	0.328
	(0.211)	(0.096)	(0.045)	(0.096)	(0.106)	(0.124)	(0.264)
Flow of private sector credit/GPDI	0.121	-0.044	-0.076***	-0.070*	-0.075**	-0.081**	-0.091*
	(0.278)	(0.058)	(0.023)	(0.036)	(0.031)	(0.039)	(0.049)
Old-age dependency ratio	-0.387**	-0.401***	-0.142**	-0.165*	-1.032***	-1.127***	-1.662***
	(0.153)	(0.129)	(0.065)	(0.092)	(0.263)	(0.242)	(0.388)
Share of urban population	0.076	0.034	-0.069	-0.104	-0.338***	-0.391***	-0.463***
	(0.053)	(0.052)	(0.052)	(0.069)	(0.099)	(0.099)	(0.169)
Public saving/GPDI	-0.012	-0.038	-0.120***	-0.052	-0.243***	-0.252***	-0.394***
	(0.106)	(0.070)	(0.042)	(0.128)	(0.065)	(0.064)	(0.117)
Ln real oil price	.	-0.017***	-0.008**	-0.006	-0.012**	.	.
	.	(0.006)	(0.003)	(0.005)	(0.005)	.	.
Time-fixed effects	.	No	No	No	No	Yes	Yes
Lags/Instruments	.	.	.	.	1/19	1/48	1-3/37
AR(1) *p*-val.	.	.	.	.	0.000	0.000	0.206
AR(2) *p*-val.	.	.	.	.	0.318	0.286	0.388
Hansen *J*-test *p*-val.	.	.	.	.	0.627	0.753	0.220
Observations	153	3,341	3,254	2,969	3,254	3,254	671
Number of countries	.	.	153	152	153	153	153
R-squared	0.390	0.306	0.523	0.493	.	.	.

Notes: Standard errors in parentheses are corrected for heteroskedasticity and autocorrelation of the error term. System GMM estimations in columns (5) to (7) use a collapsed instrument matrix and perform the Windmeijer (2005) correction of the covariance matrix. Column (7) uses the sample 1983-2012 to have 6 periods of 5 years. The null hypothesis for the Hansen *J*-test is that the full set of instruments is valid. All estimations include a constant term. ***, **, * next to a number indicate statistical significance at 1, 5 and 10
Source: Authors' calculations.

Results are generally robust across different estimation methodologies.[20] Depending on the estimator used, the number of observations ranges between 153 (average cross-section estimation) and 3,254 (panel estimation fully exploiting both the longitudinal and time dimension of the data). The introduction of fixed effects in a dynamic context is relevant to obtain consistent signs. Moreover, even when comparing estimations including and excluding fixed effects, coefficient signs are always the same when they are statistically significant. Most variables also show similar coefficient magnitudes. Most of the differences that are observed in coefficients are when their expected signs are ambiguous, i.e., real deposit rate and inflation. The lagged dependent variable is not significant when averaging

[20] Correcting standard errors for cross-sectional dependence does not affect the results. Results are available from the authors upon request.

variables over five year periods, as autocorrelation of the dependent variable is severely reduced.

Overall goodness of fit reported for estimators other than two-step S-GMM ranges between 39 and 52 percent. Allowing for dynamics and fixed effects is instrumental to improved goodness of fit. Conventional test results for the S-GMM estimations suggest that the equation is well-specified. In particular, the results of the over-identification restrictions tests suggest that using one lag of the endogenous variables is sufficient to have a valid set of instruments. Similarly, the autocorrelation test applied to the differenced residuals returns the expected autocorrelation of order one, but no autocorrelation of order two, suggesting no autocorrelation of order one in levels and, therefore, that the lags of endogenous variables used as instruments are exogenous.

The results of our preferred estimation model in Column 6 reveal that, out of 10 regressors, eight are statistically significant at one percent, one is significant at five percent, and one is statistically not different from zero. The point estimate of 0.59 for the lagged dependent variable suggests a fairly high degree of persistence, implying that changes in saving determinants take time to exert their full impact on the private saving rate. This estimate implies that the long-run effect of permanent changes in saving determinants is 2.5 times the size of their effect observed in the first year.

In line with most of the existing literature, higher income levels and income growth accelerations contribute to higher private saving. A one pp (percentage point) increase in the level of per capita GDPI raises the private saving rate by 0.17 pp, while a one pp increase in its growth rate raises the private saving rate by 0.25 pp. These results suggest that policies aimed at boosting income are also effective in raising private saving rates.[21]

The impact of the real deposit rate is not different from zero. This finding is consistent with the ambiguous theoretical prediction, based on offsetting substitution, income, and human-wealth effects. Despite the result that its coefficient is not significant, we opt to leave the real deposit rate in the baseline specification because of its centrality in consumption theory. Terms-of-trade improvements bring about a proportionate increase in private income, raising the private saving rate. A one pp improvement in the terms of trade raises the private saving rate by 0.05 pp.

Increased macroeconomic uncertainty, proxied by higher inflation, leads to increased private precautionary saving. An increase of inflation by one pp is associated with a 0.39 pp rise in

[21] Of course causality could also run the other way, from higher saving (and investment) to growth. As noted in Loayza et al. (2000), as long as increased saving is invested productively, effective growth policies and effective saving policies have the potential to start a virtuous circle of saving, investment, and growth.

the private saving rate. According to this result, the moderation of inflation rates observed around the world since the 1990s contributed to a decline in private saving.[22] A relaxation of domestic borrowing constraints reduces private saving. An increase of one pp in the private credit ratio to GPDI reduces the private saving rate by 0.08 pp.

Consistent with the hump-shaped saving-age pattern of the LCH, we find that a one pp increase in the old-age dependency ratio is associated with a reduction of the private saving rate by 1.13 pp.[23] Also, a more urbanized population leads to lower private saving. An increase of one pp in the urbanization rate reduces the private saving rate by 0.39 pp. This result is consistent with larger consumption opportunities in urban areas and higher precautionary saving in rural areas due to larger uncertainty from volatile agricultural income.

Finally, we find that fiscal contractions reduce private saving, but the offset is only partial. A rise of one pp in the public saving rate leads to a decline in the private saving rate by 0.25 pp in the same year, a magnitude well below the unit coefficient implied by the REH. Therefore, considering also the coefficient estimate for the lagged dependent variable, an increase of one pp in the public saving rate increases the national saving rate by 0.75 pp in the same year.[24] This result is in line with the literature and the coefficient magnitude is similar to the result reported by Loayza et al. (2000).

Based on a much larger dataset than all previous studies and reporting results for seven different estimators, our preferred findings are based on an estimator (the two-step S-GMM estimator with country- and time-fixed effects and the Windmeijer correction of the covariance matrix), which has not been applied before in saving panel data studies. Of 10 saving regressors, we report nine statistically significant coefficients. Some of our coefficient estimates are similar to those reported in previous studies, as noted above for the public saving rate. However, several of our regressors' point estimates differ from comparable coefficients reported in previous studies. For example, our coefficient point estimates for income level, inflation, and old-age dependency are two or three times the magnitudes

[22] As discussed in Section II, high inflation may generate additional effects on private saving. Thus, we estimate an alternative specification by adding the square of inflation but find its coefficient to be not significant.

[23] Lee et al. (2008), Lane and Milesi-Ferretti (2011), and Phillips et al. (2013) run regressions of the current account balance on the dependency ratio defined as the ratio of the population above 65 years old to the population between 30 and 64 years old, finding a stronger statistical significance compared to the indicator using the population between 15 and 64 years old as a denominator. Our results are robust to the use of this alternative ratio.

[24] The long-run impact of the increase in public saving rate on private saving is statistically different from one, as the Wald test rejects the null hypothesis of complete offsetting with a *p*-value of 0.003.

reported by Loayza et al. (2000), and our coefficients for income growth and private credit flows are much smaller than those in Loayza et al. (2000).

B. Alternative Specifications

In Table 5, we explore the empirical relevance of other saving hypotheses mentioned in Section II, extending our preferred specification (Table 4, Column 6) by including additional explanatory variables. The additional regressors are suggested by consumption theory and some of them were used—but only exceptionally— in previous empirical work, as summarized in Table 1.

Table 5. Determinants of Private Saving, Additional Explanatory Variables

(Two-step S-GMM; dependent variable: private saving/GPDI)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lag dependent variable	0.639***	0.599***	0.600***	0.591***	0.400***	0.621***	0.633***	0.662***	0.749***	0.592***	0.653***
	(0.131)	(0.065)	(0.064)	(0.067)	(0.133)	(0.065)	(0.085)	(0.081)	(0.079)	(0.070)	(0.076)
Ln real per capita GPDI (PPP)	.	0.171***	0.165***	0.170***	0.137***	0.155***	0.154***	.	0.159***	0.129***	0.127***
	.	(0.032)	(0.041)	(0.031)	(0.030)	(0.035)	(0.046)	.	(0.045)	(0.036)	(0.032)
Real growth rate of per capita GPDI (PPP)	0.313***	0.263***	0.236***	0.255***	0.168***	0.266***	0.268***	0.193***	0.236***	0.217***	0.175***
	(0.079)	(0.040)	(0.039)	(0.040)	(0.056)	(0.050)	(0.047)	(0.043)	(0.048)	(0.036)	(0.054)
Real deposit rate	0.168	0.140	0.163	0.139	0.081	0.147	0.049	0.156	0.049	0.066	0.158
	(0.104)	(0.096)	(0.107)	(0.097)	(0.095)	(0.109)	(0.093)	(0.150)	(0.105)	(0.110)	(0.137)
Ln terms of trade	0.046**	.	0.051***	0.051***	-0.023	0.052***	0.043***	0.044***	0.037**	0.051***	0.049***
	(0.021)	.	(0.017)	(0.015)	(0.022)	(0.018)	(0.014)	(0.010)	(0.018)	(0.016)	(0.015)
Inflation	0.344***	0.390***	0.398***	0.383***	0.202**	0.349**	0.248*	0.349*	0.207*	0.240*	0.300*
	(0.120)	(0.123)	(0.132)	(0.124)	(0.100)	(0.138)	(0.128)	(0.190)	(0.120)	(0.133)	(0.169)
Flow of private sector credit/GPDI	-0.058	-0.081**	-0.070**	-0.082**	0.012	-0.103***	-0.088*	-0.067	-0.052	-0.072**	-0.069*
	(0.043)	(0.040)	(0.033)	(0.039)	(0.020)	(0.033)	(0.047)	(0.075)	(0.038)	(0.034)	(0.037)
Old-age dependency ratio	-1.124***	-1.122***	-1.066***	-1.117***	-0.795***	-1.045***	-0.455***	-0.214**	-1.412***	-0.769***	-0.785***
	(0.348)	(0.245)	(0.283)	(0.239)	(0.223)	(0.261)	(0.159)	(0.105)	(0.437)	(0.236)	(0.223)
Share of urban population	-0.352***	-0.396***	-0.381***	-0.386***	-0.308***	-0.340***	-0.237***	0.079***	-0.392***	-0.263**	-0.285***
	(0.132)	(0.099)	(0.126)	(0.098)	(0.082)	(0.105)	(0.090)	(0.028)	(0.133)	(0.112)	(0.099)
Public saving/GPDI	-0.345***	-0.251***	-0.227***	-0.250***	-0.344***	-0.243***	-0.205**	-0.245***	-0.162**	-0.204***	-0.151**
	(0.095)	(0.063)	(0.053)	(0.064)	(0.102)	(0.063)	(0.086)	(0.071)	(0.069)	(0.065)	(0.062)
Permanent component of GPDI	0.159***	.	.	.	.	.	.	.	.	.	.
	(0.044)	.	.	.	.	.	.	.	.	.	.
Temporary component of GPDI	-0.021	.	.	.	.	.	.	.	.	.	.
	(0.155)	.	.	.	.	.	.	.	.	.	.
Permanent component of terms of trade	.	0.048***	.	.	.	.	.	.	.	.	.
	.	(0.018)	.	.	.	.	.	.	.	.	.
Temporary component of terms of trade	.	0.086***	.	.	.	.	.	.	.	.	.
	.	(0.022)	.	.	.	.	.	.	.	.	.
5-year forecast of real GDP growth	.	.	0.252***	.	.	.	.	.	.	.	.
	.	.	(0.077)	.	.	.	.	.	.	.	.
Conflict	.	.	.	1.242	.	.	.	.	.	.	.
	.	.	.	(1.556)	.	.	.	.	.	.	.
Current account balance/GPDI	.	.	.	.	0.543***	.	.	.	.	.	.
	.	.	.	.	(0.050)	.	.	.	.	.	.
Capital account openness	.	.	.	.	-0.069*	.	.	.	.	.	.
	.	.	.	.	(0.041)	.	.	.	.	.	.
Financial system assets/GPDI	.	.	.	.	.	0.000	.	.	.	.	.
	.	.	.	.	.	(0.011)	.	.	.	.	.
Young-age dependency ratio	.	.	.	.	.	.	0.287**	-0.092***	.	.	.
	.	.	.	.	.	.	(0.116)	(0.029)	.	.	.
Gini	.	.	.	.	.	.	.	.	-0.299	.	.
	.	.	.	.	.	.	.	.	(0.223)	.	.
Public health expenditure/GPDI	.	.	.	.	.	.	.	.	.	-0.301	.
	.	.	.	.	.	.	.	.	.	(0.316)	.
Public education expenditure/GPDI	.	.	.	.	.	.	.	.	.	.	-0.258
	.	.	.	.	.	.	.	.	.	.	(0.256)
Time-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lags/Instruments	1/50	1/49	1/42	1/47	1/51	1/50	1/49	1-3/59	1/48	1/46	1/49
AR(1) *p*-val.	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.028	0.000	0.000
AR(2) *p*-val.	0.310	0.268	0.340	0.287	0.382	0.285	0.288	0.494	0.348	0.301	0.153
Hansen *J*-test *p*-val.	0.190	0.690	0.519	0.748	0.112	0.692	0.126	0.102	0.546	0.115	0.272
Observations	3,141	3,245	2787	3,254	2,292	3,073	3,254	3,254	2,094	2,818	2,563
Number of countries	144	152	153	153	110	151	153	153	137	152	148

Notes: Standard errors in parentheses are corrected for heteroskedasticity and autocorrelation of the error term. System GMM estimations use a collapsed instrument matrix and perform the Windmeijer (2005) correction of the covariance matrix. The null hypothesis for the Hansen *J*-test is that the full set of instruments is valid. All estimations include a constant term. ***, **, * next to a number indicate statistical significance at 1, 5 and 10 percent, respectively.

Source: Authors' calculations.

As discussed in Section II, changes in permanent and temporary components of income levels and terms of trade have uneven effects on private saving. While the PIH and the LCH theory predicts higher permanent income to be consumed and higher temporary income to be saved, consumption theory demonstrates that under certain conditions (e.g., subsistence consumption, weak consumption habits, or credit-constrained borrowers) these predictions are violated. To study these effects empirically, we construct the permanent and temporary components of income and terms of trade by applying the Hodrick-Prescott (HP) filter to the (log) real GPDI per capita (PPP) and the (log) terms-of-trade index, and add them to the baseline specification.[25]

As shown in Columns 1 and 2, higher permanent components of income and terms of trade are mostly saved, in contrast to PIH and LCH predictions. However, while higher temporary components of income have no significant effects on the private saving rate, higher temporary components of the terms of trade are partly saved—and to a larger extent than permanent components—supporting the PIH and the LCH. Only Loayza et al. (2000) conduct a similar analysis, but find no significant effect of the income components on private saving and a larger positive effect of the temporary component of terms of trade compared to the permanent component.

As shown in Column 3, a better economic growth outlook boosts private saving. A one pp increase in expected GDP growth (five years ahead) raises the private saving rate by 0.25 pp—slightly larger than the saving response to higher current growth. Conflicts can affect private saving by raising uncertainty and therefore precautionary saving or, if extreme, destroying financial institutions and access to saving opportunities, hence reducing saving. Consistent with this, the results in Column 4 reflect a conflict coefficient that is not different from zero.

The current account balance (more precisely, its negative, equivalent to foreign saving) is often used as a proxy for foreign borrowing constraints. However, it may be endogenously determined when countries do not face restricted access to international markets. In light of this, we treat this variable as endogenous. Also, we control for capital account openness, as restrictions imposed on capital inflows and outflows can raise saving. The results of Column 5 suggest that lower foreign saving by one pp is associated with higher private saving by 0.54 pp. Regarding capital controls, fewer restrictions on capital account transactions are associated with lower private saving, but the corresponding coefficient is not significant at conventional levels.

The expected impact of financial assets on private saving is ambiguous. Financial deepening reflected in increased financial assets could raise saving, while higher wealth derived from

[25] See Appendix A.

more financial assets affects saving ambiguously. The corresponding coefficient estimate reported in Column 6 is not significant.

In Column 7, we include the young-age dependency ratio. In contrast to the predictions of the LCH, this yields a positive and significant estimate. However, this finding is driven by the strong negative correlation (-0.83 percent) between the young-age dependency ratio and the income level, which is consistent with the negative correlation between development and fertility levels. The results of the multicollinearity diagnostics suggest that the variables are nearly collinear and therefore one should be dropped from the specification.[26] Once we drop the income variable (Column 8), the young-age dependency ratio takes the expected negative sign, suggesting that an increase in the young-age dependency ratio by one pp depresses the private saving rate by 0.09 pp.

The effect of income distribution on private saving has been scarcely explored in empirical studies and economic theory does not offer unambiguous predictions about the direction of the effect of increased income inequality. We include the Gini coefficient as an additional determinant of private saving in Column 9. Its coefficient is not statistically different from zero, which is consistent with the theoretical ambiguity.

Theory suggests that government social spending and household transfers have an ambiguous effect on the private saving rate. In Columns 10 and 11, we include government spending on health and education, respectively, as our final additional regressors. Their non-significant coefficients are in line with theoretical ambiguity.[27]

In sum, we explore the possible contribution of 13 additional potential determinants of private saving in the world—four of them not considered before and most of the other nine determinants considered only exceptionally in previous research (in particular, in Loayza et al. 2000). While six of the additional regressors are not significantly different from zero, the other seven are significant. However, we decide against inclusion of these variables in our baseline specification because either they involve a significant loss of observations (expected GDP growth), they are approximations of unobservable variables (permanent and temporary components of income and terms of trade), their inclusion is analytically questionable (the current account balance, which is the difference between saving and investment), or their estimation is made imprecise (young-age dependency ratio) due to very high collinearity with another core variable.

[26] Multicollinearity diagnostics for the specification including both the young-age dependency ratio and the log of real per capita GPDI (PPP) present a variance inflation factor close to the threshold value of 10 for these variables.

[27] In some studies on the current account determinants (Kerdrain et al., 2010; Phillips et al., 2013) health expenditure reduces the need for precautionary saving and therefore the current account balance.

C. Time Periods and Country Groups

We now turn to analyze differential effects in saving behavior that could be expected in a particular time period and in specific country groups. For this purpose, we test for differences in private saving patterns in a nested model. We generate interaction terms between the dummy variable corresponding to the selected period or country group and every variable of the baseline specification, which are added to the baseline variables. By including these interaction terms in the specification, we assess if the results for the selected subsamples are statistically different from those for the rest of the sample.

In Table 6 we report our findings for one selected time period, the 2008-10 Global Financial Crisis (Column 1). Focusing only on this particular crisis is warranted by the exceptional depth of the Great Recession and its global repercussions. We then report results for four different country groups, selected by their economic o structural significance (Columns 2 to 5). We continue using our preferred baseline specification (Table 4, Column 6), based on the two-step S-GMM estimator applied to annual observations. The estimates for the coefficients of the core variables are robust to inclusion of the additional interaction terms, except those reported in Column 3, when the subsample of LIDCs is analyzed.[28]

The results in Column 1 suggest that the 2008-10 Global Financial Crisis had a significant impact on some coefficients of private saving determinants. The degree of persistence of the private saving rate fell significantly, with a point estimate reduced from 0.62 to 0.46, reflecting a temporary decline in consumption and saving inertia and a relatively higher sensitivity to the combined effect of contemporaneous changes in saving determinants. The effect of the income level on the private saving rate fell during the crisis period. While a one pp increase in the income level raises the private saving rate by 0.13 pp in non-crisis times, its impact declined to 0.07 pp during 2008-10.

The role of demographics in driving saving changed significantly during the crisis years. On one hand, the negative impact of old-age dependency on private saving declined during the crisis, but this reduction was not significant at conventional levels. However, a very significant and large reduction of the saving response to urbanization was observed during the crisis. While in normal times urban residents save less than rural inhabitants, this difference almost disappeared during the crisis, when the private saving response to a one pp rise in the share of urban population declined to -0.06 pp from -0.28 pp in non-crisis times. Hence, the rural population was relatively more affected by the crisis than urban residents.

[28] This reflects both the large size of the subsample of LIDCs (almost one-third of the 153 countries; see Appendix II) and their distinctive private saving behavior.

Now we turn to the differential saving behavior in four distinct country groups. The results in Column 2 for 33 advanced economies show that private saving is more sensitive to growth in advanced economies than in the rest of the world. A one pp increase in income growth rate raises the private saving rate by 0.44 pp in advanced economies, compared to 0.26 pp in non-advanced economies.

Table 6. Determinants of Private Saving, Interactions

(Two-step S-GMM; dependent variable: private saving/GPDI)

	(1)	(2)	(3)	(4)	(5)
	X= 2008-10	X= Advanced	X= LIDC	X= Oil exporters	X= High-growth Asian economies
Lag dependent variable	0.621***	0.612***	0.855***	0.588***	0.569***
	(0.067)	(0.071)	(0.058)	(0.083)	(0.066)
Ln real per capita GPDI (PPP)	0.131***	0.151***	0.086***	0.145***	0.161***
	(0.027)	(0.035)	(0.024)	(0.046)	(0.031)
Real growth rate of per capita GPDI (PPP)	0.252***	0.258***	0.373***	0.227***	0.228***
	(0.042)	(0.048)	(0.043)	(0.045)	(0.042)
Real deposit rate	0.147	0.112	0.335***	0.172*	0.087
	(0.116)	(0.102)	(0.076)	(0.096)	(0.095)
Ln terms of trade	0.042***	0.055***	0.020	0.037*	0.053***
	(0.016)	(0.017)	(0.037)	(0.022)	(0.015)
Inflation	0.454***	0.343***	0.448***	0.290**	0.300**
	(0.139)	(0.133)	(0.115)	(0.124)	(0.143)
Flow of private sector credit/GPDI	-0.067	-0.195*	-0.137***	-0.072	-0.083**
	(0.049)	(0.103)	(0.031)	(0.051)	(0.038)
Old-age dependency ratio	-0.868***	-0.997***	-0.375***	-0.992***	-1.054***
	(0.203)	(0.283)	(0.117)	(0.355)	(0.232)
Share of urban population	-0.276***	-0.345***	-0.128**	-0.307**	-0.356***
	(0.088)	(0.114)	(0.051)	(0.137)	(0.099)
Public saving/GPDI	-0.211***	-0.251***	-0.090	-0.370***	-0.246***
	(0.067)	(0.081)	(0.057)	(0.125)	(0.067)
X * Lag private saving/GPDI	-0.156***	0.132	-0.441***	0.047	0.099
	(0.055)	(0.099)	(0.090)	(0.143)	(0.165)
X * Ln real per capita GPDI (PPP)	-0.060***	-0.069	0.031	0.046	0.348
	(0.022)	(0.049)	(0.056)	(0.057)	(0.473)
X * Real growth rate of per capita GPDI (PPP)	-0.049	0.178***	-0.268***	0.059	0.594
	(0.079)	(0.059)	(0.078)	(0.079)	(0.411)
X * Real deposit rate	0.029	0.010	-0.272	-1.234*	2.783**
	(0.177)	(0.131)	(0.240)	(0.648)	(1.245)
X * Ln terms of trade	0.025	0.031	-0.005	-0.050	-0.492
	(0.021)	(0.076)	(0.069)	(0.076)	(0.607)
X * Inflation	-0.103	0.252	-0.278	-1.011	3.578*
	(0.192)	(0.172)	(0.299)	(0.785)	(1.957)
X * Flow of private sector credit/GPDI	0.031	0.126	0.452*	-0.101	0.027
	(0.037)	(0.107)	(0.255)	(0.142)	(0.079)
X * Old-age dependency ratio	0.343*	0.941***	-0.235	1.574**	-6.208
	(0.177)	(0.342)	(0.754)	(0.795)	(7.712)
X * Share of urban population	0.219***	0.353***	-0.054	-0.358	-0.322
	(0.070)	(0.132)	(0.130)	(0.282)	(0.852)
X * Public saving/GPDI	-0.137	-0.027	-0.223	0.322*	-2.392
	(0.122)	(0.101)	(0.147)	(0.168)	(2.270)
Time-fixed effects	Yes	Yes	Yes	Yes	Yes
Lags/Instruments	1/65	1/65	1/65	1/65	1/65
AR(1) *p*-val.	0.000	0.000	0.000	0.001	0.000
AR(2) *p*-val.	0.379	0.28	0.490	0.192	0.417
Hansen *J*-test *p*-val.	0.571	0.370	0.304	0.443	0.995
Observations	3,254	3,254	3,254	3,254	3,254
Number of countries	153	153	153	153	153

Notes: Standard errors in parentheses are corrected for heteroskedasticity and autocorrelation of the error term. System GMM estimations use a collapsed instrument matrix and perform the Windmeijer (2005) correction of the covariance matrix. The null hypothesis for the Hansen *J*-test is that the full set of instruments is valid. All estimations include a constant term. ***, **, * next to a number indicate statistical significance at 1, 5 and 10 percent, respectively.

Source: Authors' calculations.

Similar to the results obtained for the crisis years, the urban population saves more in advanced economies than in other countries. This reflects that the latter demographic groups are relatively larger in advanced than in other economies and that they hold higher levels of wealth, saving more. A one pp increase in the old-age dependency ratio lowers the private saving rate by 0.99 pp in non-advanced economies, and only by 0.05 pp in advanced economies. Likewise, a one pp increase in the share of urban population reduces the private saving rate by 0.34 pp in non-advanced economies, while its effect is almost nil in advanced economies.

Column 3 reports the differential effects for 47 LIDCs, in comparison to all other countries. Predictably, the persistence of private saving rates in LIDCs is relatively lower (the point estimate declines from 0.85 for non-LIDCs to 0.41 for LIDCs), reflecting higher saving volatility. While for advanced economies we document a higher income growth sensitivity of private saving in Column 1, for LIDCs we observe a result that is consistent with the latter. Namely, their sensitivity to saving is much lower than that of non-LIDC countries. An increase of one pp in income growth raises the private saving rate by 0.10 pp, compared to 0.37 for non-LIDCs.

In Column 4, we report differences in private saving behavior of 20 oil-exporting countries. In these countries, the share of the elderly is smaller than in other countries but they tend to be richer. Hence, here we observe not only what we document for advanced economies, i.e., private saving is almost insensitive to the number of elderly, but the evidence fully contradicts the LCH as the share of elderly raises private saving. While a one pp increase in the old-age dependency ratio lowers the private saving rate by 0.99 pp in non-oil exporters, it raises the private saving rate by 0.58 pp in oil exporters.

Finally, Column 5 highlights differences in private saving behavior in 10 high-growth Asian economies. High-growth Asian countries are significantly different from the rest of the world in their interest rate sensitivity to saving. While in other countries private saving is insensitive to the real deposit rate, a one pp rise in the real deposit rate in high-growth Asia largely increases the private saving rate by 2.8 pp. High-growth Asia's sensitivity to inflation appears also to be larger than in the rest of the world, but this difference is not significant at conventional levels.

In sum, we identify important differential effects of saving behavior, using nested specifications for the 2008-10 crisis and four distinct country groups. During the 2008-10 crisis period, private saving in the world exhibited less persistence, a lower sensitivity to income levels, and a lower sensitivity to urbanization than in other periods during 1981-2012. Private saving in advanced economies is more responsive to income growth and is almost non-sensitive to demographic variables (the population shares of elderly people and of urban residents), in comparison to other countries. Consistent with the higher growth

sensitivity of private saving in advanced economies, for LIDCs we report a lower response of private saving to income growth than in non-LIDCs. Saving persistence is also smaller in LIDCs. For oil exporters we find two surprising but plausible results. Their sensitivity of private saving to the share of old-age population is positive, contradicting the LCH. Their sensitivity of private saving to public saving is almost nil, contradicting the REH. Finally, high-growth Asian economies' private saving rates are highly sensitive to real deposit rates, in contrast to other countries, where saving does not respond to real deposit rates.

D. National Saving

Table 7 presents the results for national saving rate regressions. As in Loayza et al. (2000), we assume that national saving is driven by the same determinants included in our baseline regression for private saving, with the exception of the public saving rate, which now is excluded from the specification because it is part of the dependent variable. Our scale variable for national saving is GNDI. As in Table 4 for the private saving rate, we apply different estimators to check for robustness. Again, we refer to the results in Column 6 as our preferred estimation model, in light of using the two-step S-GMM estimator based on annual observations, including country and time-fixed effects.

The sample used for our national saving regressions is very similar in size and coverage to the sample for the private saving regressions.[29] Goodness of fit for the results reported in Columns 1 to 4 ranges from 36 to 61 percent, which supports the specification used in our private saving regressions for this dependent variable. The identification tests for the S-GMM estimations suggest that the lags of the endogenous variables are exogenous and that the instrument set is valid.

The build-up of highly significant coefficient estimates as we progress from Column 1 to 6 is relatively similar here to the comparable results for the private saving rate reported in Table 4. The two-step S-GMM results for five-year averages are weaker than those obtained for private saving. However, the results of our preferred specification (Column 6) are remarkably similar to those obtained for private saving, generally regarding sign, size, and significance of coefficient estimates. One moderate difference is that the negative influence of demographic variables on private saving is smaller in magnitude in the case of national saving. The one major difference is the following. While the real deposit rate has no significant impact on private saving, it turns out to be positive and significant for national saving, as a one pp increase in the real deposit rate raises the national saving rate by 0.15 pp. This may be explained by the fact that national saving includes saving of the public sector. In most countries, the government is a net debtor and has issued significant amounts of gross

[29] For the preferred specification, we now have 154 countries and 3,278 observations, including one additional country with 24 annual observations.

fixed-income debt, implying that the income effect of higher interest rates on saving is positive.

Table 7. Determinants of National Saving, Alternative Estimators

(Dependent variable: national saving/GNDI)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Average CS OLS	Pooled OLS	OLS FE	2SLS FE	Two-step S-GMM	Two-step S-GMM	Two-step S-GMM (Five-year averages)
Lag dependent variable	.	.	0.667***	0.643***	0.685***	0.686***	0.240
	.	.	(0.034)	(0.040)	(0.069)	(0.074)	(0.159)
Ln real per capita GNDI (PPP)	0.044***	0.058***	0.042***	0.050***	0.101***	0.101***	0.128**
	(0.011)	(0.011)	(0.010)	(0.012)	(0.025)	(0.026)	(0.058)
Real growth rate of per capita GNDI (PPP)	1.022***	0.297***	0.261***	0.305***	0.270***	0.273***	0.303*
	(0.295)	(0.046)	(0.021)	(0.054)	(0.024)	(0.029)	(0.170)
Real deposit rate	-0.650***	-0.283***	0.018	0.087	0.077	0.148**	0.159
	(0.198)	(0.075)	(0.025)	(0.080)	(0.052)	(0.060)	(0.250)
Ln terms of trade	0.030	0.040**	0.017**	0.015**	0.024***	0.025***	0.036*
	(0.049)	(0.019)	(0.007)	(0.007)	(0.009)	(0.010)	(0.020)
Inflation	-0.297*	-0.100	0.117***	0.063	0.293***	0.395***	0.320
	(0.170)	(0.080)	(0.030)	(0.050)	(0.066)	(0.080)	(0.279)
Flow of private sector credit/GNDI	0.322	0.043	-0.065***	-0.040**	-0.090***	-0.077**	-0.006
	(0.282)	(0.071)	(0.017)	(0.020)	(0.027)	(0.033)	(0.066)
Old-age dependency ratio	-0.641***	-0.647***	-0.124**	-0.153**	-0.657***	-0.631***	-0.993***
	(0.104)	(0.112)	(0.052)	(0.063)	(0.192)	(0.194)	(0.370)
Share of urban population	0.076*	0.033	-0.038	-0.078*	-0.241***	-0.246***	-0.240
	(0.043)	(0.046)	(0.033)	(0.046)	(0.077)	(0.082)	(0.176)
Ln real oil price	.	-0.008*	-0.005**	-0.005**	-0.010***	.	.
	.	(0.005)	(0.002)	(0.002)	(0.004)	.	.
Time-fixed effects	.	No	No	No	No	Yes	Yes
Lags/Instruments	.	.	.	.	1/17	1/46	1-4/39
AR(1) *p*-val.	.	.	.	.	0.000	0.000	0.228
AR(2) *p*-val.	.	.	.	.	0.299	0.264	0.359
Hansen *J*-test *p*-val.	.	.	.	.	0.955	0.966	0.127
Observations	154	3,382	3,278	3,007	3,278	3,278	679
Number of countries	.	.	154	153	154	154	154
R-squared	0.470	0.358	0.615	0.590	.	.	.

Notes: Standard errors in parentheses are corrected for heteroskedasticity and autocorrelation of the error term. System GMM estimations in columns (5) to (7) use a collapsed instrument matrix and perform the Windmeijer (2005) correction of the covariance matrix. Column (7) uses the sample 1983-2012 to have 6 periods of 5 years. The null hypothesis for the Hansen *J*-test is that the full set of instruments is valid. All estimations include a constant term. ***, **, * next to a number indicate statistical significance at 1, 5 and 10 percent, respectively.

Source: Authors' calculations.

E. Household and Corporate Saving

Now we separately analyze the saving determinants for the two components of private saving, household and corporate saving. Our unbalanced panel sample is significantly reduced, comprising 48 countries over the period 1981-2012, corresponding to 674 observations. While data availability for household and corporate saving is limited in comparison to private and national saving, the sample covers a balanced subset of countries in different regions and across different income levels.

In Table 8 we report the results of the estimations using the two-step S-GMM estimator. However, we do not introduce time-fixed effects as they would raise the number of instruments beyond the number of the countries in the sample. As a substitute, we use the (log) real oil price. The S-GMM identification tests suggest that the instrument set is valid and that the lags of the endogenous variables are exogenous.[30]

As a benchmark reference, we report in Column 1 the results for private saving as the dependent variable, for the same restricted sample we use subsequently for household and corporate saving regressions. Except for the terms of trade, the signs, significance levels, and magnitudes of coefficients for our core private saving determinants are similar in this small sample to those reported for the full sample before (Table 4, Column 5).

Based on the same baseline specification, Columns 2 and 3 (4 and 5) report the results for the household (corporate) saving rate. Column 3 (5) adds the corporate (household) saving rate to the core regressors to test for substitution between corporate and household saving rates, i.e., to check the extent to which households (corporations) pierce the corporate (household) veil.

Columns 2 and 4 show similar results for five saving determinants to those reported for private saving in Column 1. Yet important differences emerge. Household saving, like private saving, responds significantly and positively to the real deposit rate and to inflation, while corporate saving is insensitive to the two latter variables. Private credit flows lower significantly both private and corporate saving but not household saving. While the urban population share and public saving reduce national saving, neither variable affects household and corporate saving separately.

Both household and corporate saving react negatively and significantly to higher corporate and household saving, respectively. The magnitude of offset coefficients, reported in Columns 3 and 5, is large: 0.58 and 0.79, respectively. Hence, while households pierce the corporate veil to a large degree, corporations pierce the household veil to an even larger degree. Much of an increase in one component of private saving is offset by a reduction in the other.

[30] The goodness of fit measured in a dynamic OLS model with fixed effects (not reported here but available upon request), using the same explanatory variables, is 55 percent.

Table 8. Determinants of Household and Corporate Saving, Baseline Specification

(Two-step S- GMM; dependent variable: household saving/GPDI, corporate saving/GPDI)

	(1) Y = Private saving/GPDI (restricted sample)	(2) Y= Household saving/GPDI	(3) Y= Household saving/GPDI	(4) Y = Corporate saving/GPDI	(5) Y = Corporate saving/GPDI
Lag dependent variable	0.817***	0.748***	0.619***	0.763***	0.573***
	(0.083)	(0.161)	(0.139)	(0.051)	(0.119)
Ln real per capita GPDI (PPP)	0.166***	0.111**	0.092**	0.085***	0.141*
	(0.045)	(0.048)	(0.036)	(0.027)	(0.072)
Real growth rate of per capita GPDI (PPP)	0.444***	0.105**	0.194***	0.315***	0.298***
	(0.042)	(0.042)	(0.047)	(0.045)	(0.065)
Real deposit rate	0.199*	0.401***	0.268**	-0.130	0.033
	(0.113)	(0.154)	(0.122)	(0.131)	(0.141)
Ln terms of trade	0.039	0.003	0.041*	0.020	0.033
	(0.033)	(0.020)	(0.025)	(0.025)	(0.031)
Inflation	0.370***	0.425***	0.326***	0.018	0.212*
	(0.135)	(0.165)	(0.103)	(0.176)	(0.118)
Flow of private sector credit/GPDI	-0.147***	-0.030	-0.059*	-0.075***	-0.120***
	(0.043)	(0.030)	(0.034)	(0.028)	(0.041)
Old-age dependency ratio	-0.941***	-0.631**	-0.431**	-0.442***	-0.766*
	(0.285)	(0.287)	(0.191)	(0.152)	(0.427)
Share of urban population	-0.438***	-0.292*	-0.140	-0.243**	-0.355
	(0.145)	(0.156)	(0.133)	(0.099)	(0.226)
Public saving/GPDI	-0.279***	-0.165	-0.095	-0.021	-0.088
	(0.069)	(0.118)	(0.079)	(0.060)	(0.062)
Ln real oil price	-0.005	-0.001	0.001	-0.005	-0.008
	(0.008)	(0.006)	(0.004)	(0.005)	(0.008)
Corporate saving/GPDI	.	.	-0.581***	.	.
	.	.	(0.150)	.	.
Household saving/GPDI	.	.	.	.	-0.790***
	.	.	.	.	(0.147)
Time-fixed effects	No	No	No	No	No
Lags/Instruments	1/20	1/20	1/20	1/20	1/20
AR(1) *p*-val.	0.018	0.000	0.004	0.000	0.005
AR(2) *p*-val.	0.728	0.389	0.852	0.274	0.371
Hansen *J*-test *p*-val.	0.864	0.694	0.360	0.541	0.924
Observations	674	674	674	674	674
Number of countries	48	48	48	48	48

Notes: Standard errors in parentheses are corrected for heteroskedasticity and autocorrelation of the error term. System GMM estimations use a collapsed instrument matrix and perform the Windmeijer (2005) correction of the covariance matrix. The null hypothesis for the Hansen *J*-test is that the full set of instruments is valid. All estimations include a constant term. ***, **, * next to a number indicate statistical significance at 1, 5 and 10 percent, respectively.

Source: Authors' calculations.

Table 9. Determinants of Household and Corporate Saving, Additional Explanatory Variables

(Two-step S-GMM; dependent variable: household saving/GPDI, and corporate saving/GPDI)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lag dependent variable	0.666***	0.615***	0.515***	0.604***	0.189**	0.624***	0.455***	0.593***	0.504***	0.528***	0.555***
	(0.129)	(0.134)	(0.110)	(0.147)	(0.087)	(0.150)	(0.107)	(0.113)	(0.145)	(0.158)	(0.167)
Ln real per capita GPDI (PPP)	.	0.092**	0.076	0.089***	0.053	0.071**	0.028	.	0.053***	0.111**	0.116*
	.	(0.036)	(0.051)	(0.033)	(0.035)	(0.028)	(0.040)	.	(0.020)	(0.054)	(0.064)
Real growth rate of per capita GPDI (PPP)	0.253***	0.194***	0.185***	0.190***	0.143***	0.160***	0.157***	0.140**	0.212**	0.173***	0.187***
	(0.075)	(0.047)	(0.048)	(0.046)	(0.037)	(0.061)	(0.049)	(0.055)	(0.091)	(0.052)	(0.054)
Real deposit rate	0.338*	0.270**	0.166*	0.260**	0.004	0.214*	0.066	0.019	0.176	0.226	0.192
	(0.176)	(0.123)	(0.100)	(0.121)	(0.121)	(0.115)	(0.134)	(0.122)	(0.117)	(0.183)	(0.191)
Ln terms of trade	0.032	.	0.035	0.043*	-0.011	0.049**	0.028	0.028	0.007	0.057**	0.039
	(0.026)	.	(0.026)	(0.025)	(0.033)	(0.024)	(0.025)	(0.020)	(0.016)	(0.024)	(0.039)
Inflation	0.398**	0.329***	0.199*	0.311***	0.045	0.223*	0.053	-0.057	0.176	0.296*	0.329**
	(0.162)	(0.104)	(0.102)	(0.104)	(0.096)	(0.126)	(0.129)	(0.137)	(0.116)	(0.172)	(0.155)
Flow of private sector credit/GPDI	-0.012	-0.058*	-0.073*	-0.064*	0.013	-0.067**	-0.043*	-0.024	-0.049	-0.066	-0.026
	(0.035)	(0.034)	(0.039)	(0.034)	(0.021)	(0.033)	(0.026)	(0.017)	(0.031)	(0.043)	(0.038)
Old-age dependency ratio	-0.321*	-0.432**	-0.281	-0.416**	-0.065	-0.262**	-0.260*	-0.201*	-0.314**	-0.462*	-0.522
	(0.193)	(0.190)	(0.292)	(0.176)	(0.182)	(0.113)	(0.154)	(0.121)	(0.144)	(0.256)	(0.364)
Share of urban population	-0.188	-0.140	-0.127	-0.124	-0.181*	-0.056	-0.042	0.027	-0.096	-0.213	-0.295
	(0.143)	(0.133)	(0.185)	(0.123)	(0.097)	(0.091)	(0.098)	(0.060)	(0.067)	(0.200)	(0.241)
Public saving/GPDI	-0.055	-0.092	-0.063	-0.101	-0.193***	-0.200**	-0.060	-0.122	-0.054	-0.056	-0.001
	(0.077)	(0.076)	(0.067)	(0.077)	(0.072)	(0.095)	(0.068)	(0.123)	(0.079)	(0.094)	(0.108)
Ln real oil price	0.004	0.001	-0.002	-0.003	-0.003	0.004	-0.002	-0.001	-0.003	0.001	-0.005
	(0.004)	(0.004)	(0.005)	(0.010)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.007)	(0.007)
Corporate saving/GPDI	-0.460***	-0.575***	-0.574***	-0.576***	-0.439***	-0.605***	-0.404***	-0.463***	-0.362**	-0.586***	-0.460**
	(0.158)	(0.151)	(0.139)	(0.152)	(0.126)	(0.169)	(0.088)	(0.131)	(0.145)	(0.153)	(0.202)
Permanent component of GPDI	0.082**	.	.	.	.	.	.	.	.	.	.
	(0.039)	.	.	.	.	.	.	.	.	.	.
Temporary component of GPDI	-0.086	.	.	.	.	.	.	.	.	.	.
	(0.199)	.	.	.	.	.	.	.	.	.	.
Permanent component of terms of trade	.	0.041	.	.	.	.	.	.	.	.	.
	.	(0.026)	.	.	.	.	.	.	.	.	.
Temporary component of terms of trade	.	0.036	.	.	.	.	.	.	.	.	.
	.	(0.029)	.	.	.	.	.	.	.	.	.
5-year forecast of real GDP growth	.	.	0.362	.	.	.	.	.	.	.	.
	.	.	(0.431)	.	.	.	.	.	.	.	.
Conflict	.	.	.	3.952	.	.	.	.	.	.	.
	.	.	.	(2.827)	.	.	.	.	.	.	.
Current account balance/GPDI	.	.	.	.	0.298***	.	.	.	.	.	.
	.	.	.	.	(0.067)	.	.	.	.	.	.
Capital account openness	.	.	.	.	-0.119***	.	.	.	.	.	.
	.	.	.	.	(0.031)	.	.	.	.	.	.
Financial system assets/GPDI	.	.	.	.	.	-0.017	.	.	.	.	.
	.	.	.	.	.	(0.021)	.	.	.	.	.
Young-age dependency ratio	.	.	.	.	.	.	-0.078	-0.131**	.	.	.
	.	.	.	.	.	.	(0.121)	(0.059)	.	.	.
Gini	.	.	.	.	.	.	.	.	-0.063	.	
	.	.	.	.	.	.	.	.	(0.114)	.	.
Public health expenditure/GPDI	.	.	.	.	.	.	.	.	.	-0.355	.
	.	.	.	.	.	.	.	.	.	(0.477)	.
Public education expenditure/GPDI	.	.	.	.	.	.	.	.	.	.	-0.063
	.	.	.	.	.	.	.	.	.	.	(0.372)
Time-fixed effects	No	No	No	No	No	No	No	No	No	No	No
Lags/Instruments	1/23	1/22	1/23	1/22	1-3/42	1/23	1-2/30	1-2/27	1-2/32	1/22	1/22
AR(1) *p*-val.	0.003	0.003	0.022	0.004	0.072	0.009	0.018	0.015	0.008	0.024	0.013
AR(2) *p*-val.	0.598	0.841	0.511	0.628	0.06	0.861	0.591	0.829	0.715	0.721	0.585
Hansen *J*-test *p*-val.	0.285	0.36	0.427	0.318	0.189	0.283	0.292	0.115	0.249	0.446	0.097
Observations	645	674	630	674	644	674	674	674	512	651	616
Number of countries	45	48	48	48	45	48	48	48	41	48	46

Notes: Standard errors in parentheses are corrected for heteroskedasticity and autocorrelation of the error term. System GMM estimations use a collapsed instrument matrix and perform the Windmeijer (2005) correction of the covariance matrix. The null hypothesis for the Hansen *J*-test is that the full set of instruments is valid. All estimations include a constant term. ***, **, * next to a number indicate statistical significance at 1, 5 and 10 percent, respectively.

Source: Authors' calculations.

Our final set of empirical findings focuses in more detail on household saving, by exploring the impact of additional explanatory variables.[31] Analogous to Table 5 for private saving, Table 9 reports the response of household saving to 13 additional saving regressors. The results for the baseline regressors are generally robust to the inclusion of other variables. We briefly refer to the differences in results reported here, in comparison to those for private

[31] While the same extensions to the baseline specification can be estimated for corporate saving, we limit our focus to household saving as consumption theory is developed for households.

saving. In contrast to private saving, household saving does not react to the temporary and permanent components of the terms of trade (nor does it react to total terms of trade), the five-year growth forecast, and the young-age dependency ratio. Also in contrast to private saving, household saving reacts negatively and significantly to larger capital account openness.

We conclude that it is important to gather evidence on saving behavior by disaggregating private saving into its household and corporate components. To a significant extent, we confirm many of the empirical findings reported for private saving at the household level. In addition, there is strong evidence for significant substitution between corporate and household saving, both for households and corporations. The extent to which households pierce the corporate veil is about double of that estimated in Bebczuk and Cavallo (2014), who also find less persistence in household saving rates.

VI. CONCLUSIONS

Consumption theory often provides ambiguous theoretical predictions about the determinants of private saving. While the empirical literature on the topic has grown considerably in recent years, it frequently reports large differences in findings. From a review of the literature using panel data, we note that although a core set of potential saving determinants is included in most studies, these tend to be few and inclusion of non-standard variables is exceptional. Signs of reported coefficients are not always consistent with theory, and the dispersion of individual point estimates is very large, including those that are consistent with theory. In addition, variables for which empirical measures are not readily available, or theory has been developed more recently, are fully absent.

In this paper, we address limitations and contradictory findings of previous empirical research, extending it in five dimensions. First, we exploit a very large and more recent panel database for world saving, covering 163 countries from 1981 to 2012. Then, we conduct a robustness analysis across different estimation techniques. Third, we expand the empirical search by including potential saving determinants identified by theory but not previously considered in the empirical literature. Fourth, we explore differences in saving behavior across time and space, nesting the 2008-10 crisis period and four different country groups. Finally, while our focus is on private saving, we also search for commonalities and differences in behavior across national, private, household, and corporate saving rates.

The results of our baseline specification for the private saving rate are obtained using several estimators. In our preferred estimation, of 10 private saving regressors consistent with theory, we report nine statistically significant coefficients: the lagged dependent variable, the real income level, real income growth, the terms of trade, inflation, private credit flows, old-age dependency, urban population, and public saving (confirming partial Ricardian offsetting). Only the real deposit rate is not significantly different from zero, consistent with its

theoretical ambiguity. Some of our coefficient estimates are similar to those reported in previous studies, while others differ strongly.

Then we include 13 additional potential determinants of private saving—also suggested by theory—four not considered before and most of the nine other determinants included only in Loayza et al. (2000). Six of the latter variables are not significantly different from zero, while the other seven are significant: the permanent component of income, the permanent and temporary components of the terms of trade, future growth forecasts, the current account balance, capital account openness, and young-age dependency.

An overview of regional trends suggests that private saving rates evolved heterogeneously in the last three decades, for example, booming in high-growth Asia and experiencing great volatility in oil-exporting countries. In addition, the depth of the recent Global Financial Crisis raises questions on whether private saving behavior changed during those years. We find that private saving rates were less persistent, and less sensitive to income levels and urbanization than in other periods during 1981-2012. Private saving rates in advanced economies are relatively more responsive to income growth and almost non-sensitive to demographic variables, while for LIDCs we report a lower response of private saving to income growth and less persistence. For oil exporters, we find that their sensitivity of private saving to the share of old-age population is positive, contradicting the LCH. High-growth Asian economies' private saving rates are highly sensitive to real deposit rates, in contrast to other countries, where saving does not respond to real deposit rates.

We then replicate our empirical search for the national saving rate, applying the battery of different estimators to our core specification. The results for national saving are largely in line with those reported for private saving, which possibly reflects the fact that 80 percent of national saving is private.

It is important to gather evidence on saving behavior by disaggregating private saving into its household and corporate components. Therefore, we check robustness of our core saving results for private saving by estimating regressions separately on household and corporate saving. To a significant extent, we confirm many of the empirical findings reported for private saving at the household and corporate levels. However, as opposed to the partial but significant Ricardian offsetting found for aggregate private saving, we do not find evidence that higher public saving reduces either household or corporate saving separately. Finally, we report strong evidence for significant but incomplete substitution between corporate and household saving, both for households and corporations separately.

Appendix I. Data

We describe here the construction process of the database on world saving.[32] The final dataset contains 4,137 observations, spanning 31 years for 165 countries. The annex is outlined as follows: first, it explains all variables and transformed regressors used in baseline and auxiliary estimations, and documents the sources of these data; second, it explains the process for filling gaps, splicing series, or replacing faulty data; lastly, it outlines how the dataset is further cleaned, removing traces of poor-quality data.

A. Concept Construction and Variable Generation

1. Price and Inflation Variables

Consumer Price Index (CPI). CPI data is from the IMF World Economic Outlook (WEO) database. Most countries do not have the same base year for CPI. Therefore, to maintain cross-country comparability when calculating real variables, we rebase each country's CPI index with the average CPI for 2000-04.[33]

CPI-based inflation. We calculate inflation as the growth rate of the CPI, measured in percent.

Bounded CPI-based inflation indicator. The indicator of inflation used in the regressions is derived from the intertemporal consumption optimization problem of a consumer in a discrete time framework. This indicator is equal to the inflation rate divided by one plus the rate of inflation (the inflation rates expressed in decimals, not percent); an expression that is bounded between zero and one.

Purchasing Power Parity (PPP) Index. To obtain a measure of income comparable across countries, we generate a PPP conversion factor which varies across countries but not across

[32] As noted in Schmidt-Hebbel and Servén (1997), data on income, consumption, saving, and related aggregate variables from the System of National Accounts may suffer from inadequacies, inconsistencies, and biases that inevitably affected the existing empirical work. The problems range from inadequate sector coverage, incomplete measurement and variable misclassification, to exclusion of capital gains and other sources of mismatches between saving flows and wealth changes. Other issues related to the current account discrepancy which may have an impact on the calculation of saving are discussed in IMF (1987).

[33] We use an average of the CPI between 2000 and 2004 to prevent potential bias that would occur if a single base year was used. The period 2000-2004 was selected to avoid large fluctuations in PPP conversion exchange rates in the run up to the global financial crisis and before 2000, when large adjustments in several currencies were observed in the aftermath of financial crises (Mexico in 1995, Asian crises in 1997, and Russia in 1998). For Argentina, we use the private consumption deflator from the national accounts and rebase it using the average for 2000-04.

time. For each country, this factor is equal to the average PPP exchange rate observed in 2000-2004, which is taken from the WEO database.

2. Saving Variables

GNS. GNS is defined as gross national disposable income[34] less final consumption expenditure, plus an adjustment for the change the equity positions in pension funds. We collect data from the IMF WEO database, the OECD, the UN National Accounts Official Country Data (UNNA) database, the World Bank World Saving Database (WSDB), and several countries' central banks to minimize the amount of missing observations.

Gross government saving (GGS). GGS is defined as gross disposable income of the general government less general government final consumption expenditure. We collect these data from the same data sources as GNS.

GPS. GPS is defined as GNS less GGS.

Household saving. Household saving is defined as the portion of GPS corresponding to households. We collect national, government, private, and household saving data from the UNNA database as well as the OECD. We derive a ratio for household saving as the share of household saving to GNS, all over one minus the share of GGS to GNS. This transformation is made to satisfy the adding-up constraint such that the sum of household and corporate saving will always equal private saving. This constructed ratio is then applied to our variable for GPS to obtain household saving in local currency units.

Corporate saving. Corporate saving is defined as the portion of GPS that stems from financial corporations, non-financial corporations, and non-profit institutions serving households. Using the same data sources as household saving, we derive a ratio for corporate saving as the share of one minus the share of GGS to GNS minus the share of household saving to GNS, all over one minus the share of GGS to GNS. Thus, the ratio for corporate saving is the residual of the ratio for GPS and household saving. We then apply the ratio to our GPS variable in the same manner as household saving to obtain corporate saving in local currency.

3. Income Variables

GPDI. GPDI is calculated as GPS plus private consumption. Both concepts are taken from the IMF WEO database, and are measured in local currency.

[34] Gross national disposable income is equal to GDP plus net factor income from abroad plus net current transfers from abroad.

Real GPDI per capita in PPP terms. To ensure cross-country comparability, we deflate nominal GPDI by our rebased CPI deflator and divide by our rebased PPP exchange rate. We then divide by total population obtained from the World Bank Worldwide Development Indicators (WDI) database.

Terms-of-trade index. The terms-of-trade index is defined as the ratio of the deflator of exports of goods and services to the deflator of imports of goods and services, multiplied by 100. All indexes are re-scaled such that 2000 = 100 in order not to affect the estimations of constant terms in our regressions. We collect terms-of-trade indices from the IMF WEO and the World Bank WDI databases.

4. Financial Variables

Real deposit rate. We calculate the real nominal deposit rate using the Fisher equation and CPI inflation. Nominal deposit rate data are collected from IMF International Financial Statistics (IFS) database, Haver Analytics, and central bank web pages.

Flow of private sector credit to GPDI. We obtain private sector credit as a share of nominal GDP from the World Bank WDI database. From there, we convert to stocks measured in local currency. We then calculate private sector credit flows as the first difference of the average of current year and previous year stocks, both in current year prices, as a share of nominal GPDI. Additional flows for country data not found in the World Bank WDI database are calculated using data from the Bank of International Settlements (BIS), the IMF IFS database, and central bank web pages.

5. Demographic Variables

Old-age dependency ratio. The old-age dependency ratio measures the ratio of people older than 64 to the working age population (those who are between the ages of 15 and 64). The data are expressed as the proportion of elderly dependents per 100 people of working age, and is collected from the World Bank WDI database.

Share of urban population. The share of urban population is measured as the number of people living in urban areas as defined by national statistics offices divided by the mid-year estimates of total population in the country, multiplied by 100. Both data series are taken from the World Bank WDI database.

6. World Oil Price

Real oil price. We divide the nominal price of oil by US CPI and multiply by 100, then rebase as the real price of oil in time *t* divided by the average real price of oil between 1981

and 2012, multiplied by 100. Both oil price and US CPI data are taken from the IMF WEO database.

7. Additional Explanatory Variables

Permanent and temporary components of terms of trade. We construct a proxy for the permanent component of the terms-of-trade index by feeding the terms-of-trade index series and its projections in the IMF WEO database through 2019 through an HP filter. The smoothing parameter lambda is set to 6.25, as recommended for annual data in the literature. The trend component of the HP filter is then interpreted as the permanent component. We calculate the temporary component as the cycle component of the HP filter, which is measured as the deviation between the actual terms-of-trade data and the trend component.

Permanent and temporary components of income. Repeating the same process with GPDI, we download all GPDI components as well as their projections through 2019 from the IMF WEO database and feed them through a HP filter with lambda = 6.25. The temporary component is measured as the deviation between the actual GPDI data and the trend component.

Five-year forecast of real GDP growth. The IMF stores archived vintages of the WEO databases going back to 1990. These vintages contain five-year ahead projections. Using these archives, we can construct the forecast of real GDP five years ahead of time *t*. We download the Fall versions of the WEO databases between 1990 and 2013 to get as close to year-end data as possible.[35] We denote the year that the database vintage was published as year *t*, with the corresponding real GDP growth in year *t* equivalent to the "nowcast" of real GDP growth. For each country and year we take the growth forecast five years head.

Conflict. Dummy variable based on battle-related deaths, as collected from the World Bank WDI database. The variable is equal to one when battle related deaths are more than 1,000 and is equal to zero in all other cases.

Current account balance to GPDI. Current account balance data is collected from the IMF WEO database in U.S. dollars, and is transformed to local currency using period-average exchange rates. The resulting series is then measured as a share of nominal GPDI.

[35] In most years, the fall version of the WEO is typically released in October; otherwise, it is released in September.

Capital account openness. The Quinn Index[36] measures the overall capital controls on the private sector. The index varies between zero and 100; zero corresponds to fully restrictive capital controls and 100 corresponds to a fully open system with no capital controls.

Financial system assets to GPDI. Data on deposit money bank assets as a share of GDP are collected from the World Bank Global Financial Development Database (GFDD) as well as individual country central banks. These ratios, and the corresponding GDP series, are used to obtain stocks in local currency. We then calculate the share of financial system assets as deposit money bank assets at time $t-1$ as a share of nominal GPDI at time t.

Young-age dependency ratio. The young-age dependency ratio is the share of people younger than 15 to the working age population (between the ages of 15 and 64), percent, as collected from the World Bank WDI database.

Gini index. The Gini index, as reported in the Standardized World Income Inequality Database, measures inequality on disposable income. The index varies between zero and 100, where zero represents perfect income equality and 100 implies perfect income inequality.

Public health and education expenditure to GPDI. We measure public social spending as the sum of public health and education expenditure. We retrieve both series as shares of nominal GDP from the World Bank WDI database and the IMF Fiscal Monitor Database. These ratios are used to recover the corresponding levels in local currency and finally compute ratios to nominal GPDI.

Real world GDP growth. The IMF WEO database contains an index for aggregated real GDP across the world from which the rate of growth is calculated.

B. Data Replacement, Splicing, and Augmentation

Throughout the construction of our database, we employ several techniques to splice data or replace missing observations using multiple sources to ensure the greatest amount of observations possible.

1. Saving Variables

We first replace all WEO-based saving data series for a handful of countries. GNS, GPS, and GGS data for Spain is replaced by country authorities' data, while the same variables' data for Switzerland is replaced by OECD data.

[36] See Quinn et al., 2008. Updated dataset contains data available through 2012.

We then replace any saving series that is completely missing with data from the UNNA database. From there, we extend our GNS series by constructing a spliced series using the data we have and additional GNS observations in the UNNA database. We repeat these two steps using the World Bank WSDB in order to obtain the longest available GNS series as is possible.

We then apply the UN saving ratios of private saving and public saving to our GNS series to add additional observations to our WEO- and OECD-based private and public saving data. Following this, we apply the UN saving ratios of household and corporate saving to our augmented GPS series to create our household and corporate saving series. Subsequently, we repeat this process using OECD-based household and corporate saving ratios. Due to better data quality, we favor OECD-derived household and corporate saving data over their UN-based counterparts when data is available from both sources.

2. Income Variables

We replace our WEO-constructed GPDI series with UNNA data for Switzerland and Hungary, while we replace GDP and include missing GNDI data for Switzerland using data from the OECD. Additionally, we replace several country's terms-of-trade series with data from the World Bank WDI database when there are more observations in the WDI series than in the WEO.

3. Financial Variables

We first replace any missing nominal deposit rates with nominal outstanding deposit rates.[37] Since U.S. deposit rate data is missing from the IMF IFS database, we construct a spliced series using Haver Analytics data for U.S. deposit rates and the Federal Funds rate. Additionally, we augment data for Norway, Sweden, and Poland by splicing available IFS data with deposit rates available in Haver. Lastly, we replace any missing observations using the same splicing methods with IFS and central bank data for the United Kingdom, European Union-member economies, Iceland, Colombia, El Salvador, Iran, Iraq, Kuwait, Saudi Arabia, United Arab Emirates, India, and Burundi.

For missing data in private sector credit flow data, we use data obtained in several web pages of central bank and bank regulatory agencies in the following countries: Austria, Ireland, Australia, New Zealand, South Africa, Brazil, Colombia, Mexico, Hong Kong, and China.

[37] In the case of Afghanistan, deposit rates in foreign currency are used since overall deposit rates are not available.

Though our series for deposit money bank assets totals nearly 5,600 observations, there is still a large number of missing observations, particularly in large countries. Since they are highly correlated, we proxy assets by using liabilities and extend our series using the data we have and the percent changes of banking system liabilities from the World Bank GFDD. We then replace the entire series for Chile and supplement our existing series with additional observations for Hong Kong and Venezuela using data from central banks.

4. Demographic Variables

In Singapore and Hong Kong, the share of urban population is constantly 100 percent throughout our in-estimation sample. Thus, the share of urban population becomes collinear with the country-fixed effects. To avoid this, we add a very small amount of stochastic white noise to these observations to make them time-variant and therefore will not drop out in our fixed effects and S-GMM estimations.[38]

Finally, we fill in any remaining gaps for all variables with two missing observations or less by interpolating the averages between these points. This leaves us with an initial raw dataset containing 12,032 observations, spanning 64 years for 188 countries.

C. Dataset Cleaning

As a final step in constructing our dataset, we remove any remaining faulty data. We first drop any data from 2013 and onward, as many of these data are still estimates. We then drop the years in which more than 50 percent of our entire raw dataset contains missing private saving rates, leaving us with a dataset spanning 1981 to 2012. We continue by omitting observations in which public saving is reported as exactly zero or constant values as a share of GDP. For each country, we also exclude those observations in which GNS, GPS, or GGS are missing, as this would imply poor-quality in the country's SNA framework. Finally, we drop from our dataset countries that lack a national accounts framework for long periods (Uzbekistan and Trinidad and Tobago).

[38] For Singapore, each observation oscillates between 99.995 and 100 percent, whereas each observation for Hong Kong increases cumulatively by 0.001 percent.

Following previous empirical work on saving (e.g., Loayza et al. 2000), we drop country-year observations for which observed annual inflation rates (not our compressed inflation measure) fall outside the ± 50 percent range to reduce contamination from bouts of high inflation, which distort public and private saving and cause National Accounts statistics to be unreliable. We impose the same restriction on the real interest rate.

As a final measure, we graphically investigate clearly faulty data for GNS, GPS, and GGS as shares of GNDI. As a result, 11 country-year observations are lost: Cabo Verde 1981; Kuwait 1991; Chad 2002; Equatorial Guinea 1981, 1989, 1990, 1997, and 1999; and Republic of Congo 1987-1989. In a handful of cases, household and corporate saving data have excessive variance or magnitudes and thus both series are dropped.[39]

[39] Series for Luxembourg, Venezuela, Bahrain, Kuwait, Botswana, Guinea-Bissau, Côte d'Ivoire, Burkina Faso, Armenia, Azerbaijan, Kazakhstan, Kyrgyz Republic, Saudi Arabia, and Moldova are dropped completely. Observations for Bulgaria 2007 and Romania 1981-1997 are omitted as well.

Appendix II. Country Groups

Table A1. List of Countries

Advanced economies					
Australia	Czech Republic	Greece	Korea, Republic of	Portugal	Switzerland
Austria	Denmark	Iceland	Luxembourg	Singapore	United Kingdom
Belgium	Estonia	Ireland	Malta	Slovak Republic	United States
Canada	Finland	Israel	Netherlands	Slovenia	
China,P.R.:Hong Kong	France	Italy	New Zealand	Spain	
Cyprus	Germany	Japan	Norway	Sweden	
Low income developing countries					
Bangladesh	Chad	Gambia, The	Lesotho	Nicaragua	Sudan
Benin	Comoros	Ghana	Madagascar	Niger	Tajikistan
Bolivia	Congo, Dem. Rep. of	Guinea	Malawi	Nigeria	Tanzania
Burkina Faso	Congo, Republic of	Guinea-Bissau	Mali	Papua New Guinea	Togo
Burundi	Côte d'Ivoire	Haiti	Mauritania	Rwanda	Uganda
Cambodia	Djibouti	Honduras	Moldova	São Tomé & Príncipe	Vietnam
Cameroon	Eritrea	Kenya	Mozambique	Senegal	Yemen, Republic of
Central African Rep.	Ethiopia	Kyrgyz Republic	Myanmar	Sierra Leone	
High-growth Asian economies					
China,P.R.: Mainland	India	Korea, Republic of	Singapore	Thailand	
China,P.R.:Hong Kong	Indonesia	Malaysia	Sri Lanka	Vietnam	
Oil-exporting economies					
Algeria	Bolivia	Equatorial Guinea	Nigeria	Saudi Arabia	
Angola	Chad	Gabon	Oman	United Arab Emirates	
Azerbaijan, Rep. of	Congo, Republic of	Iran, I.R. of	Qatar	Venezuela, Rep. Bol.	
Bahrain, Kingdom of	Ecuador	Kuwait	Russian Federation	Yemen, Republic of	
Other					
Albania	Brazil	El Salvador	Macedonia, FYR	Paraguay	St. Vincent & Grens.
Antigua and Barbuda	Bulgaria	Grenada	Maldives	Peru	Swaziland
Argentina	Cape Verde	Guatemala	Mauritius	Philippines	Syrian Arab Republic
Armenia	Chile	Guyana	Mexico	Poland	Tunisia
Bahamas, The	Colombia	Hungary	Montenegro	Romania	Turkey
Barbados	Costa Rica	Jordan	Morocco	Serbia, Republic of	Ukraine
Belize	Croatia	Latvia	Namibia	Seychelles	Uruguay
Bosnia & Herzegovina	Dominican Republic	Lebanon	Pakistan	South Africa	
Botswana	Egypt	Lithuania	Panama	St. Lucia	

Notes: Advanced economies are classified according to the April 2014 IMF WEO. LIDCs correspond to all countries that are eligible for concessional financing from the IMF and have a per capita income below US$2,390. High-growth Asian economies were selected on the basis of high real GDP growth and booming private saving rates over the sample period. Oil-exporting economies are classified according to the April 2014 IMF WEO.

Appendix III. Contributions

Figure A1 shows the contributions to the fitted values of the significant variables in the preferred specifications for private (Table 4, Column 6), national (Table 7, Column 6), household (Table 8, Column 3), and corporate saving (Table 8, Column 5). The contributions are averaged for sample sub-periods 1981-96, 1997-2012, and 1981-2012. These charts help to highlight the relative importance of the explanatory variable, as well as any change over time.[40]

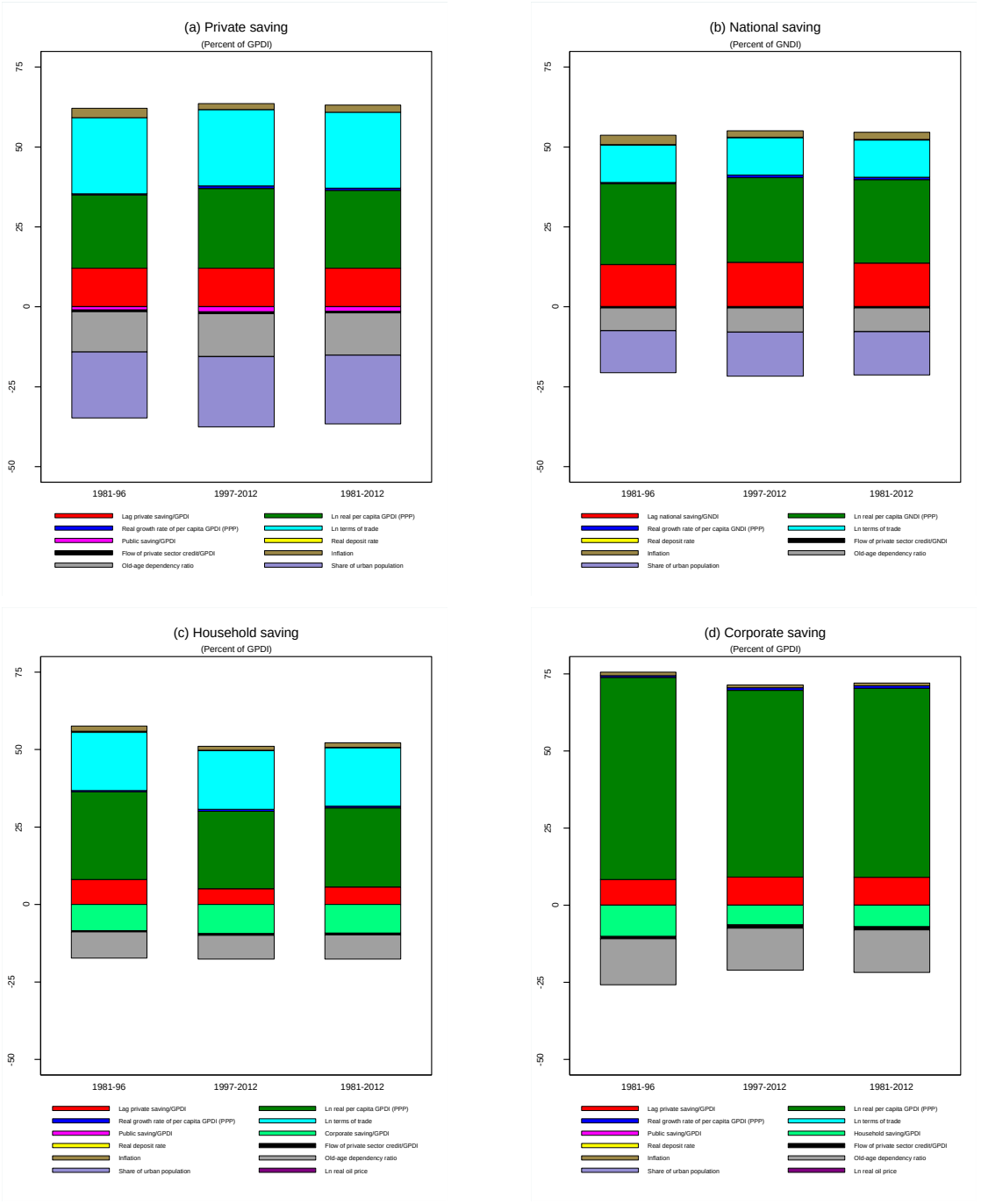
Panels (a) and (b) present the contributions for private saving in percent of GPDI and national saving in percent of GNDI, respectively. The list of variables is the same for both specifications, even though public saving is omitted in the specification for national saving rates. Contributions are remarkably stable over time. The largest positive contributions for private saving rates come from GPDI per capita (PPP) (24.3 percent of GPDI for the full sample period), the terms of trade (about 24 percent of GPDI), and the lagged private saving rate (12.1 percent of GPDI). In the case of the national saving rate, the size of the contributions of the terms of trade and national saving scaled by GNDI is broadly the same (about 12 percent of GNDI), while GNDI per capita (PPP) is more than 26 percent of GNDI. The main drag on private and national saving rates is demographics. The contribution of the share of urban population is the largest (-21.5 percent of GPDI for private saving and -13.6 percent of GNDI for national saving), followed by the old-age dependency ratio (-13.2 percent of GPDI for private saving and -7.4 percent of GNDI for national saving). Other significant variables contribute by less than 1.1 percent of GPDI.

Panels (c) and (d) depict the contributions for household and corporate saving in percent of GPDI, respectively. As for private and national saving rates, the positive contributors for household saving rates are the terms of trade, GPDI per capita (PPP), and its growth rate. While the size of the terms-of-trade contribution remains virtually constant over the two time periods (about 19 percent of GPDI), the contribution of the lagged saving rate and the income level decline over time (from 8.1 to 5.1 percent of GPDI for the lagged household saving rate and from 28.3 to 25.0 percent of GPDI for GPDI per capita). As for the negative contributions, corporate saving and old-age dependency ratio are the most important and have similar size (about -17 percent of GPDI for the full sample period when combined). In the case of corporate saving rates, income per capita has a very large contribution reflecting the large coefficient, but it declines over time (from 65.5 percent of GPDI in 1981-96 to 60.4

[40] The use of the average PPP exchange rate to convert the real GPDI/GNDI per capita in national currency into PPP yields an inflated contribution from GPDI per capita and a large and negative constant. Given that contributions from GPDI per capita and the constant term have a considerably smaller size in regressions where the real GPDI/GNDI per capita is converted in PPP terms by using the PPP exchange rate of every year (instead of the average PPP exchange rate), we calculate the contribution of log of real GPDI/GNDI per capita (PPP) net of the difference between the constants in these two regressions.

percent of GPDI in 1997-2012). The old-age dependency ratio makes the largest negative contribution (-13.9 percent of GPDI), followed by household saving (-7 percent of GPDI).

Figure A1. Average Contributions to the Fitted Values



Notes: The upper left panel shows the variable contributions calculated with the coefficients of Table 4, Column 6; the upper right panel with the coefficients of Table 7, Column 6; the lower left panel with the coefficients of Table 8, Column 3; and the lower right panel with the coefficients of Table 8, Column 5. Only statistically significant contributions are reported.
Source: Authors' calculations.

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