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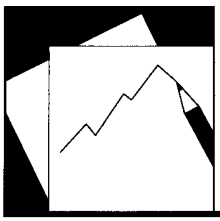

# IMF Working Paper

# Private Saving Accelerations

*Christian Ebeke*

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**IMF Working Paper**

European Department

# Private Saving Accelerations[1]

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**Abstract**

Domestic private saving rates have been on a declining trend in many Emerging Markets (EMs), raising questions about countries' ability to generate sufficient domestic resources to finance investment. This paper examines how countries have managed to achieve protracted increases in the private saving rate. The results show that episodes of sustained accelerations of private savings are mostly the result of very strong macroeconomic performance. Econometric investigations using matching estimators do not reject the result that stronger economic growth mostly precedes episodes of saving accelerations.

JEL Classification Numbers: E21; E22; O11

Keywords: Private saving; accelerations; economic performance

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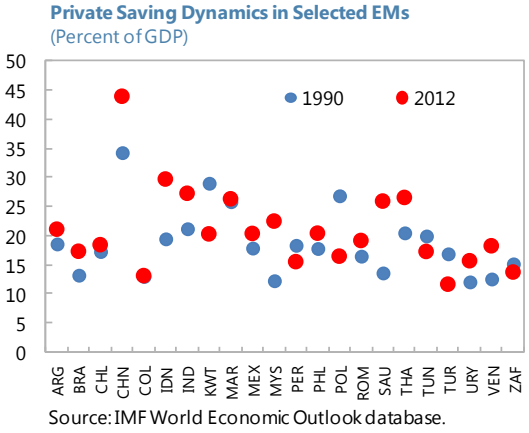
# I. INTRODUCTION

Saving and investment rates remain low in many emerging economies (EMs). Higher investment rates supported by higher savings are needed in some countries to increase growth and avoid large current account deficits, which can leave them vulnerable to shocks. Private sector savings are also important to ensure a decent retirement income for older members of society. Some EMs have been able to raise significantly private saving rates. Others have mostly experienced large (short-term) capital inflows which in many occasions fueled consumption and real-estate booms, rising macroeconomic imbalances (currency mismatches), and painful adjustments.




This paper provides a cross-country analysis of the experience of countries that have succeeded in boosting domestic private saving in a sustained. It reviews the existing literature and attempts to provide a robust statistical analysis of the economic conditions that are necessary to support saving transitions.

While several papers have analyzed the determinants of the level of the private saving ratio, very few have focused on episodes of sustained high private saving rates. The literature on the determinants of the level of the private saving ratio is vast and has broadly identified demographic variables and good macroeconomic performance as the main correlates (Edwards, 1996; Loayza et al., 2000). A curious aspect of this literature is that it does not focus on the specific episodes of protracted increases in private saving ratios. Rodrik (2000) closes this gap. He proposes a framework to identify episodes of private saving transitions/accelerations and found that these episodes are preceded by high levels of GDP growth.[2] Methodologically, Rodrik's work is similar to the literature on the accelerations of other macroeconomic variables such as real GDP growth (Hausmann et al., 2005; Berg et al., 2012).

This paper adds to the literature on saving accelerations initiated by Rodrik (2000) and examines the phenomenon using the largest possible sample of countries. We focus on the dynamics of the private sector saving-to-GDP ratio within countries, and econometrically investigate the determinants of saving accelerations. The paper contributes to the existing literature on several fronts. First, it uses comprehensive data on private sector saving ratios

[2] Throughout the text, we will be using the terms saving transitions or saving accelerations interchangeably. Saving transitions refer to episodes of protracted increase in the saving rate by more than 4 percentage points of GDP. More details on the exact identification of these transitions will be provided in the next section. Also, the word "saving" will in some occasions refer to private saving-to-GDP ratio for convenience.

produced by the IMF.[3] Second, it uses various econometric models and subsets of the data to identify the main contributors to private saving accelerations. Third, it tests a wide range of possible correlates (natural resource discoveries, globalization, fiscal performance, macroeconomic volatility, persistent high unemployment rate, etc.) of saving transitions. Fourth, it uses matching techniques to investigate the effects of saving accelerations on overall economic performance approximated by real per capita GDP growth.

The paper finds that saving transitions are not unusual worldwide and tend to be predictable. First, we have identified 86 episodes of rapid and sustained accelerations in domestic private saving ratios. The unconditional probability that a country will experience a private saving acceleration sometime during a decade is around 25 percent. Second, these private saving transitions tend to be preceded by superior economic performance: high and stable GDP per capita growth, a low unemployment rate, and sustained strong fiscal positions. They also tend to be determined by "luck": large natural resource discoveries are strong predictors of saving accelerations.

We then explore whether saving accelerations are accompanied by increases in domestic investment and commensurate real GDP growth. Using matching techniques borrowed from micro-econometric evaluation literature (to address the endogeneity of saving accelerations), we compare real per capita GDP growth and private investment ratios between countries that have experienced private saving accelerations and countries that did not, during and after the acceleration episode. We find that increases in private saving are fueled by higher growth realizations but are not necessarily a cause of stronger GDP growth, a result discussed previously by Rodrik (2000) and Carroll et al. (2000). The results show that episodes of sustained acceleration of private sector savings are mostly the result of stronger GDP growth performance and not necessarily their cause.

## II. Empirical Design: Identifying Private Saving Transitions

Following Rodrik (2000), private saving transitions are defined as episodes characterized by a *sustained* increase in the private saving rate. More formally, a country is said to undergo a private saving transition in year $T$ if:

- The three-year moving average of its saving rate over a nine-year period starting at $T$ exceeds *by more than 4 percentage points* the five-year average of its private saving rate prior to $T$.
- The private saving rate after the transition is higher than 10 percent of GDP.

More precisely, we define $S_T^f$ as the three-year moving average of the saving rate with year $T$ as the first year of the average and $S_T^b$ the five-year moving average with year $T$ as the terminal year. For example, $S_{2001}^f$ corresponds to the average for the years 2001–03, while

[3] While it would have been interesting to conduct an analysis based on disaggregated private saving data (household and corporate savings), unfortunately, disaggregated series on private savings have only become available in recent years and do not always match the duration of the sample we use in the paper.

$S^b_{2001}$ the average for the years 1997–2001. We apply a filter to search through the data for occurrences of any *T* such that the following are true:

$$S^f_{T+i} > S^b_{T-1} + x, \quad \text{for all i = 0, 1, … , n} \qquad [1]$$

$$S^f_{T+i} > 10 \text{ percent of GDP, for all i = 0, 1, … , n} \qquad [2]$$

where the parameter *x* stands for the threshold increase in the saving rate (set to 4 percent of GDP), and *n* captures the length of the horizon over which the transition is expected to be sustained. With a nine-year horizon starting at year 0, *n* = 6. The first of these conditions checks that the (moving average of the) private saving rate after year *T* exceeds the average prior to *T* by more than 4 percentage points of GDP. The second condition ensures that the average private saving rate after the candidate transition year exceeds 10 percent of GDP. If these conditions are satisfied for more than a single year in any country, we check to see whether 10 years or more separate the dates. If not, we assume that there is a single transition and designate the earliest year in the sequence as the transition year.[4]

We find a surprisingly large number of saving accelerations—86 episodes in all.[5] Table 1 shows the distribution of these accelerations across countries and years. Aside from the sheer number of accelerations, the magnitude of the typical acceleration is also striking. The average private saving rate acceleration was 13.6 percentage points of GDP when comparing private saving rates before and after the acceleration (and the median was 10.3 percentage points of GDP).

[4] One could have examined changes in private saving rates by a similar search over possible breaks in trend and then examine all and only "statistically significant" changes in private saving rate. However, as discussed in Hausmann et al., (2005), this is not appropriate for our purposes because this will identify saving transitions of very different nature due to the bias in the tests caused by the underlying variability of the private saving-to-GDP series. The filter that we use allows us to discard instances of volatility in the private saving-to-GDP rate which are not economically meaningful.

[5] To identify saving transitions, we use a sample including the largest possible number of countries, irrespective of their income groups. The beginning of the sample is 1960, but the sample is obviously unbalanced due to data availability issues.

**Table 1. Distribution of Saving Accelerations Across Countries**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Angola | 1989 | Croatia | 1998 | Morocco | 1972 | Paraguay | 1971 |
| Angola | 2003 | Haiti | 1985 | Morocco | 2000 | Rwanda | 2000 |
| Albania | 1992 | India | 1988 | Mexico | 1978 | Saudi Arabia | 1992 |
| Armenia | 2002 | India | 1999 | Mexico | 1993 | Sudan | 1998 |
| Azerbaijan | 1999 | Ireland | 1973 | Macedonia, FYR | 1995 | Senegal | 2003 |
| Burundi | 1999 | Iran, Islamic Rep. | 1990 | Mali | 2000 | Singapore | 1979 |
| Bangladesh | 1979 | Israel | 1980 | Mozambique | 1980 | Singapore | 2005 |
| Bangladesh | 2005 | Jordan | 1992 | Mauritius | 1998 | Slovenia | 1994 |
| Bolivia | 1970 | Kazakhstan | 1993 | Malawi | 1981 | Sweden | 1978 |
| Chile | 1986 | Kenya | 1981 | Malaysia | 1978 | Chad | 2005 |
| China | 1986 | Kenya | 2000 | Malaysia | 2004 | Thailand | 1984 |
| China | 2002 | Kyrgyz Republic | 1999 | Nigeria | 1971 | Trinidad and Tobago | 1982 |
| Congo, Rep. | 1988 | Cambodia | 1990 | Nigeria | 2004 | Trinidad and Tobago | 2001 |
| Algeria | 1991 | Korea, Rep. | 1971 | Norway | 1976 | Tunisia | 1989 |
| Egypt, Arab Rep. | 1987 | Korea, Rep. | 1985 | Norway | 1996 | Turkey | 1986 |
| Egypt, Arab Rep. | 2001 | Kuwait | 1980 | Nepal | 1993 | Uganda | 1972 |
| Eritrea | 1994 | Kuwait | 2003 | New Zealand | 1983 | Uganda | 2002 |
| Ethiopia | 1998 | Libya | 1999 | Pakistan | 1976 | Uzbekistan | 1997 |
| Finland | 1993 | Sri Lanka | 1976 | Peru | 1978 | Venezuela, RB | 1972 |
| Guinea | 1990 | Sri Lanka | 1990 | Philippines | 1998 | Vietnam | 1993 |
| Gambia, The | 2002 | Lesotho | 1991 | Portugal | 1972 | South Africa | 1971 |
| | | | | | | Congo, Dem. Rep. | 1983 |
| | | | | | | Zambia | 2002 |

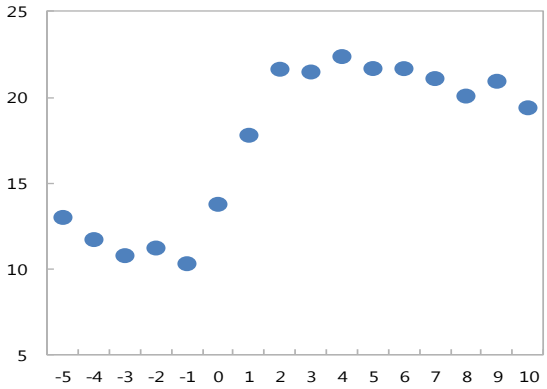
Source: IMF staff calculations.

The (unconditional) probability of private saving acceleration is estimated at 25 percent in any given decade for a typical country. The calculation is done by dividing the number of episodes by the number of country-years in which an episode could have occurred. The latter is calculated by summing up all the country-years in our sample and eliminating the 9-year window after the occurrence of each episode, since our filter takes this period as belonging to the same episode. We also remove the first 2 years for each country since by construction the acceleration could not take place at this period. Applying this rule we obtain 3,517 possible occasions in which an episode could have occurred. Dividing our 86 episodes by this number, we obtain the average probability of a growth transition taking place in any given year—in this case it is 2.5 percent. This means that a typical country would have about a 25 percent chance of experiencing a growth transition at some point in any given decade.

Saving accelerations are predominantly observed in emerging and developing countries (Figure 1). The peak of saving transitions occurred during the past decades (upper left figure), a period which has seen rising incomes in many emerging and developing countries. It is therefore reassuring that the bulk of saving transitions is concentrated in countries that are qualified today as emerging economies (according to the IMF classification, bottom left figure). The regional distribution of these accelerations is also worth analyzing. Most of these saving accelerations took place in mainly 4 regions: Sub-Saharan Africa, Latin America; MENA; and not surprisingly Asia (upper right figure). Of these 86 private saving transitions, 34 percent have experienced only one transition, and 12 percent have experienced two accelerations (bottom right figure).

A typical pattern of a saving transition involves a significant increase in the private saving rate. The typical jump in the private saving rate around the year 0 (the transition year) is about 11 percentage points of GDP. The median saving rate in our sample goes from 10 percent in the years before the transition, to about 21 percent of GDP percent in the five to ten years following the transition (Text Figure 1).

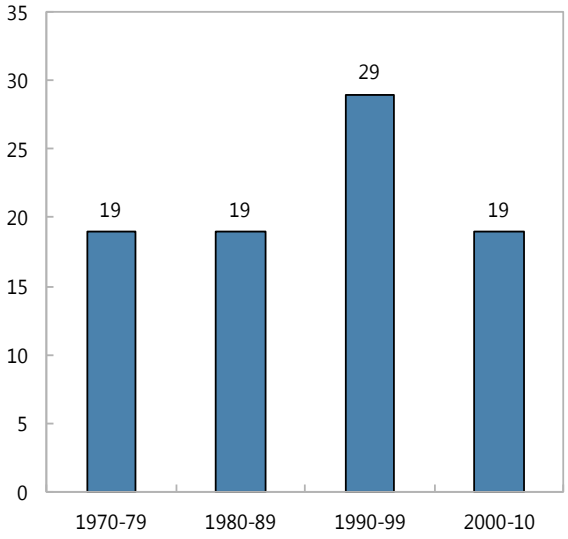
**Text Figure 1: Pattern of Private Saving Ratio Around the Acceleration Year**
(median values; in percent of GDP)



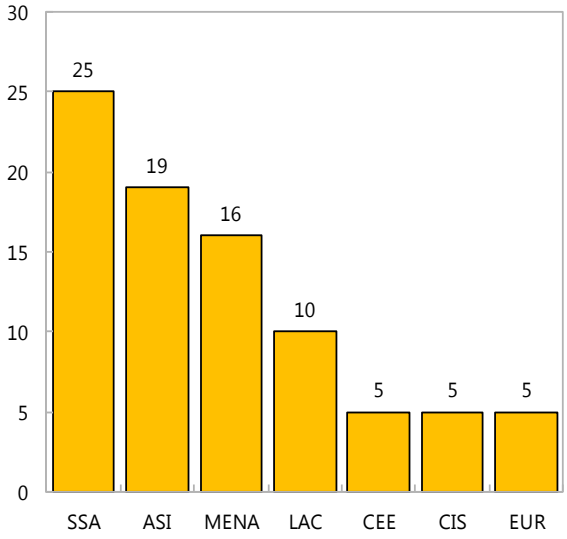

Source: IMF staff calculations.

## Figure 1. Distribution of Private Saving Accelerations

**Number of Accelerations by Decade**
(Full sample of countries)

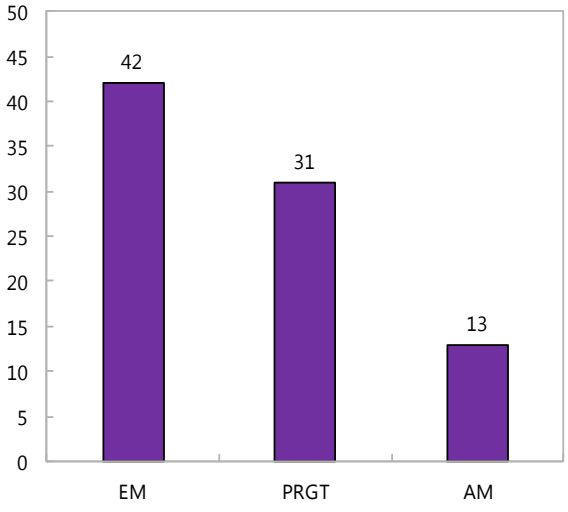



**Distribution of Saving Accelerations by Regions**
(Period covered: 1960-2012)



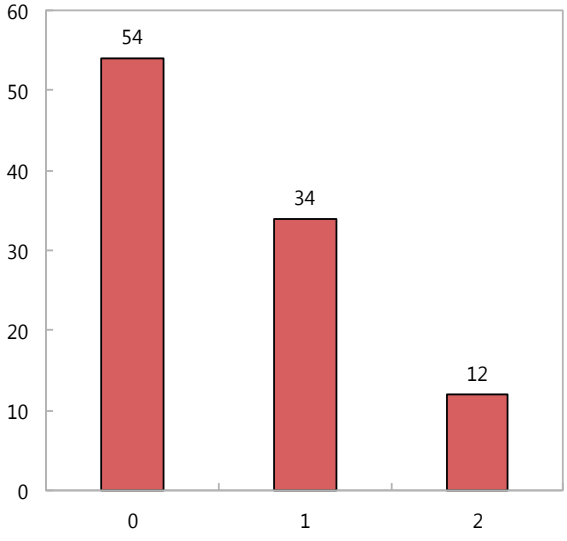

Notes: SSA: Sub-Saharan Africa; ASI: Asia; MENA: Middle East & North Africa; LAC: Latin America & Caribbean; CEE: Central & Eastern Europe; CIS: Commonwealth Independent States; EUR: Advanced European Economies.

**Distribution of Accelerations by Income Groups**
(Period covered: 1960-2012)




Notes: EM: Emerging Markets; PRGT: Poverty Reduction & Growth Trust countries; AM: Advanced Markets.

**Proportion of Accelerations**
(percent; 1960-2012)




Source: IMF staff calculations.

## III. The Econometric Model: What Makes Increases in Private Saving Sustained?

### A. The Model

This section examines the factors that could contribute to private saving accelerations. We estimate econometric models where the dependent variable is a dummy taking the value 1 in the years around the time of private saving acceleration (and 0 otherwise). More specifically, the model takes the following representation:

$$\mathrm{P}[d_{it} = 1 | \mathrm{X}_{it}] = \mathrm{X}'_{it-6,t-1}\Gamma + \epsilon_{it} \qquad [3]$$

where *d* is the dummy taking the value 1 the 3 years centered on the first year of the private saving acceleration episode (i.e., the dummy equals 1 for $t-1$, $t$, and $t+1$). A 3-year window reduces the probability that we will narrowly miss the timing of an acceleration through quirks in the data or in our method. Our comparison group consists of countries that have not had a saving episode.[6] The matrix *X* denotes the control variables.[7] To ensure consistent estimates of the parameters and to avoid reverse *causality* issues, these control variables are measured as averages over the 5 years before the saving acceleration window. This set-up aims to shed light on the "initial" macroeconomic conditions that make saving accelerations more likely.

We use a range of limited-dependent variable models while controlling for a number of macroeconomic variables. Since the focus of the paper is on aggregate private sector saving (this is mainly explained by the difficulty in obtaining sufficient cross-country data on household and corporate sectors saving rates over a sufficiently long time horizon), the choice of explanatory variables is dictated by the objective of covering both the traditional determinants of household and corporate saving rates. We therefore test a large number of potential factors that would be relevant to private saving transitions. It is worth noting that the proposed specifications attempt to shed light on the *preconditions* that make the occurrence of private saving accelerations more likely. The variables are therefore taken as averages over the period preceding the occurrence of the acceleration. We group the potential candidates as follows:[8]

[6] We also make the following adjustments to the sample. First, for each country, we drop the first four and last two years of data, since saving acceleration episodes could not have been calculated for those years based on the filter presented in the previous section. Second, we drop all data pertaining to years $t+2$, ... $t+10$ of an episode, since we are interested in predicting the timing of accelerations and given that we ensure that the minimum distance between two accelerations should be 10 years.

[7] Country-specific effects are not controlled for, since a very limited number of countries, experienced more than one acceleration (see Figure 1).

[8] All *probit* specifications control for year-specific effects (year dummies) to account for unobservable shocks that are common to all countries in the sample.

- *GDP growth and volatility*: We expect higher GDP growth rates and lower GDP growth volatility to be associated with sustained increases in private saving.[9] We use data from the IMF WEO.
- *Unemployment rate*: High and persistent unemployment should be negatively associated with private saving accelerations ex-post. In such an environment, workers would be unlikely to generate high and sustained voluntary or precautionary savings. As domestic demand is compressed, firms also do not necessarily make higher profits despite wage moderation. We use data from the IMF WEO.
- *Public sector saving rate*: The effect of the public sector saving rate is ambiguous and is therefore an empirical question.
  - On the one hand, public sector saving may lead to a drop in private saving according to the *Ricardian equivalence*.[10] But this should be short lived and crucially depends on a number of prerequisites. As discussed in Seater (1993) and Lopez et al. (2000), stringent assumptions are required for *Ricardian* equivalence to hold: full intergenerational caring, perfect capital markets, far-sighted rational consumers, absence of uncertainty and, nondistortionary taxes. In practice, these conditions are rarely met leading to rejection of full Ricardian equivalence by some papers (Lopez et al., 2000 provides a good summary of these works). It is therefore possible that high public sector savings are associated with increases in private sector saving.
  - As discussed in Lopez et al. (2000), *Ricardian* equivalence would fail (even in the absence of liquidity constraints and finite horizons) if the government were to engage in the provision of insurance to private agents against future income shocks. In this case, accumulated public sector savings will co-move with the private sector saving. Building fiscal buffers and thereby fiscal space allows for more effective countercyclical fiscal policy in periods of shocks what prevents the private sector from dissaving and helps make private sector saving accelerations more sustainable. Alternatively, higher public saving may be associated with lower public service delivery which makes the accumulation of precautionary private saving more likely. Conversely, lower private (precautionary) savings may be the result of better state-provisioned social safety nets, which reduce the need to accumulate savings. The association between public and private savings is therefore an empirical issue. Public sector savings data are drawn from the IMF WEO.

[9] Income growth volatility is computed as the standard deviation of annual real per capita GDP growth rate over the past five years.

[10] Some clarifications are worth mentioning. First, we are not assessing the contemporaneous relationship between public and private savings as the former enters the model with sufficient lags. We assess whether accumulated public savings before the private saving acceleration eventually takes place explains the likelihood of observing sustained increases in private savings ex-post. Second, the effect we measure if more the contribution of ex ante public sector savings to the magnitude but also the durability of private saving increases.

- *Economic globalization*: Are countries that are highly integrated into the global economy, either through trade or financial links, more likely to experience sustained increases in private saving rates? The answer is ambiguous.
  - On the one hand, globalization leads to economic gains (diversification and productivity improvements) which can translate into episodes of sharp improvements in private sector balance sheets.
  - On the other hand, high integration into the global economy can be associated with episodes of increased volatility which can be harmful for growth and private saving. Finally, financial openness may operate as a risk-sharing mechanism which relaxes the need to maintain elevated levels of savings, thus reducing the correlation between domestic saving and investment (Feldstein and Horioka, 1980, type of story).

  To answer this question empirically, we control for trade and financial openness. The financial openness variable is from the updated version of Chinn and Ito (2008) whereas trade openness (measured as exports and imports normalized by GDP) are drawn from the IMF WEO.

- *Financial development*: We also control for the depth of the domestic financial system. As pointed out by Ferrucci and Miralles (2007), the impact of domestic financial system deepening could go both ways. On the one hand, it reduces constraints on borrowing, thereby increasing current consumption and reducing saving. On the other hand, it increases the availability of diverse saving instruments, as well as expected returns. The ratio of M2-to-GDP is used as the proxy for financial deepening. Bank deposits (in percent of GDP) are also tested. Series are drawn from the World Bank's Financial Development and Structure Database.

- *Natural resource discoveries*: Major natural resource discoveries in a given country are potentially correlated with structural breaks in saving rate dynamics. We include in the model the values of oil discoveries drawn from the recent work by Cotet and Tsui (2013). We expect natural resource discoveries to translate into accelerations in private saving.

## B. Correlates of Saving Accelerations: Econometric Results

### Baseline Estimates

A good macroeconomic environment is found to be a key factor behind private saving accelerations (Table 2).

- The results indicate that public saving and output growth volatility are among the main determinants of saving accelerations. The negative effect of output volatility (a sensible measure of macroeconomic uncertainty) on saving accelerations suggests that persistent macroeconomic instability erodes existing buffers and makes it harder to sustain precautionary saving over the long term. Both household and corporate sector saving rates are negatively affected.

- In contrast to the *Ricardian equivalence* prediction, our econometric results show that higher public savings are positively correlated with the probability of private saving accelerations.
- Three other important results are worth flagging. First, countries that suffer from elevated and protracted unemployment are less likely to experience a private saving acceleration for the reasons described above (columns 2 and 5). Second, financial openness is negatively correlated with private saving accelerations (columns 1, 2, and 5). In other words, countries that have access to foreign capital are less likely to experience large and sustained increases in domestic private savings, all else equal. Third, "luck" also has its own contribution to private saving successes. Indeed, the results show that large natural resource discoveries precede episodes of private saving accelerations (columns 6 and 7).

**Table 2. Determinants of Private Saving Accelerations in Emerging and Advanced Economies**

| Dependent variable: | | | | | | | |
|---|---|---|---|---|---|---|---|
| Saving acceleration dummy | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Real per capita GDP growth | 0.00813*** | | | | | | |
| | (0.00214) | | | | | | |
| Per capita growth volatility, log | -0.00312 | -0.0177* | -0.0129* | -0.0192** | -0.00385 | -0.0244*** | -0.0256*** |
| | (0.00771) | (0.00957) | (0.00754) | (0.00752) | (0.00645) | (0.00864) | (0.00866) |
| Public saving-to-GDP | 0.00589*** | 0.00631*** | 0.00676*** | 0.00682*** | 0.00459*** | 0.00582*** | 0.00596*** |
| | (0.000859) | (0.00131) | (0.000964) | (0.00102) | (0.000881) | (0.00128) | (0.00122) |
| Trade openness | -6.92e-05 | 0.000152 | 4.01e-05 | 9.43e-05 | 3.76e-05 | 2.50e-05 | 4.13e-06 |
| | (0.000140) | (0.000128) | (0.000129) | (0.000121) | (8.54e-05) | (0.000169) | (0.000165) |
| Financial openness | -0.00929** | -0.0154*** | -0.00161 | 0.00314 | -0.00780** | | |
| | (0.00451) | (0.00476) | (0.00534) | (0.00515) | (0.00328) | | |
| M2-to-GDP | 3.25e-05 | -6.37e-05 | 0.000354* | | | | |
| | (0.000176) | (0.000176) | (0.000183) | | | | |
| Bank deposits-to-GDP | | | | 0.000163 | -0.000138 | | |
| | | | | (0.000196) | (0.000134) | | |
| Unemployment rate | | -0.00233* | | | -0.00266** | | |
| | | (0.00134) | | | (0.00120) | | |
| Oil discoveries per capita, log | | | | | | 0.217** | 0.213** |
| | | | | | | (0.0989) | (0.0965) |
| Real per capita GDP, log | | | -0.0740* | -0.0989*** | -0.103* | -0.0386 | -0.0523 |
| | | | (0.0389) | (0.0384) | (0.0596) | (0.0480) | (0.0481) |
| (Real per capita GDP, log)$^2$ | | | 0.00349 | 0.00483* | 0.00569 | 0.000719 | 0.00171 |
| | | | (0.00254) | (0.00247) | (0.00347) | (0.00301) | (0.00300) |
| Intercept | -0.244*** | -0.104* | 0.113 | 0.344** | 0.355 | 0.0871 | 0.173 |
| | (0.0513) | (0.0561) | (0.157) | (0.146) | (0.242) | (0.187) | (0.191) |
| Year-specific effects | Yes | Yes | Yes | Yes | No | No | Yes |
| Number of accelerations | 51 | 19 | 50 | 45 | 18 | 44 | 44 |
| Countries | 126 | 80 | 125 | 113 | 78 | 99 | 99 |
| Observations | 1,901 | 821 | 1,901 | 1,733 | 1,198 | 1,618 | 1,568 |

Note: Coefficients reported are marginal effects evaluated at the average of the control variable. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff estimates.

## Robustness Checks

Robustness checks do not alter the main finding that a good macroeconomic environment is the critical factor behind private saving accelerations. We start by showing the results of the modified *logit* framework suggested by King and Zeng (2001) that is designed to better

handle rare-occurrence bias (Table 3). This method is particularly useful to the modeling of relatively rare event data such as the saving acceleration episodes. In presence of rare binary events, standard statistical procedures, such as *logit* or *probit* regressions can underestimate the probability of occurrence of the event due to the high concentration of nonevents in the data.[11] They appear broadly similar to the estimates using the *probit* model. Saving accelerations tend to be preceded by high economic growth and low growth volatility, higher public savings, and lower unemployment. Saving accelerations are also strongly correlated with large discoveries of natural resources.

**Table 3. Correction for Rare Occurrence Bias: ReLogit Specifications**

| Dependent variable: | | | | | | |
|---|---|---|---|---|---|---|
| Private saving acceleration dummy | (1) | (2) | (3) | (4) | (5) | (6) |
| Real per capita GDP growth | 0.0987*** | | 0.121*** | | | |
| | (0.0292) | | (0.0307) | | | |
| Per capita growth volatility, log | -0.00352 | -0.216 | | -0.112 | -0.401*** | -0.356*** |
| | (0.114) | (0.201) | | (0.223) | (0.127) | (0.124) |
| Public saving-to-GDP | 0.0761*** | 0.130*** | 0.0835*** | 0.138*** | 0.0937*** | 0.0815*** |
| | (0.0121) | (0.0216) | (0.0160) | (0.0220) | (0.0203) | (0.0200) |
| Trade openness | -0.00225 | 0.00131 | -0.00199 | 0.000953 | -0.000689 | 0.000857 |
| | (0.00294) | (0.00272) | (0.00267) | (0.00282) | (0.00293) | (0.00260) |
| Financial openness | -0.120 | -0.304*** | 0.0341 | -0.274** | 0.0352 | |
| | (0.0838) | (0.106) | (0.0998) | (0.113) | (0.106) | |
| Bank deposits-to-GDP | -0.00164 | -0.00396 | 0.00511 | -0.00225 | | |
| | (0.00332) | (0.00364) | (0.00330) | (0.00429) | | |
| Unemployment rate | | -0.0979** | | -0.0890* | | |
| | | (0.0433) | | (0.0483) | | |
| Real per capita GDP, log | | | -1.552** | -3.327 | -0.552 | -0.657 |
| | | | (0.654) | (2.071) | (0.791) | (0.754) |
| (Real per capita GDP, log) $^2$ | | | 0.0748* | 0.185 | 0.0115 | 0.0169 |
| | | | (0.0437) | (0.121) | (0.0509) | (0.0477) |
| Oil discoveries per capita, log | | | | | 2.608* | 3.387** |
| | | | | | (1.556) | (1.547) |
| Intercept | -2.987*** | -2.505*** | 3.971* | 11.90 | 1.439 | 1.884 |
| | (0.282) | (0.505) | (2.357) | (8.334) | (3.002) | (2.910) |
| Number of accelerations | 46 | 18 | 45 | 18 | 42 | 44 |
| Countries | 122 | 79 | 121 | 78 | 97 | 99 |
| Observations | 2,106 | 1,200 | 2,101 | 1,198 | 1,521 | 1,618 |

Notes: Relogit is a *logit* model corrected for rare occurrence bias as suggested by King and Zeng (2001). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Using the sub-sample of EMs and low-income countries (LICs) only does not materially alter the results. The estimation results discussed so far used the entire sample of countries, including developed countries. As another robustness check, we present the analogous results for a sample that includes only developing countries (Table 4). In most aspects, the findings are quite similar, except for the financial development variable which now turns out to be statistically (and positively) correlated with the probability of saving accelerations. This result can be explained by the fact that the marginal benefit associated with further financial deepening is stronger in the sub-sample of EMs and LICs.

[11] Simple regression coefficients are reported instead of marginal effects.

**Table 4. Correlates of Private Saving Accelerations (Emerging Market Sample)**

| Dependent variable: Private saving acceleration dummy | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Real per capita GDP growth | 0.0118*** | | | | |
| | (0.00317) | | | | |
| Per capita growth volatility, log | -0.0145 | -0.0340** | -0.0252** | -0.00965 | -0.0479*** |
| | (0.0108) | (0.0147) | (0.0109) | (0.00784) | (0.0128) |
| Public saving-to-GDP | 0.00424** | 0.00498 | 0.00424*** | 0.00269** | 0.00356** |
| | (0.00171) | (0.00327) | (0.00163) | (0.00128) | (0.00171) |
| Trade openness | -0.000698** | -0.000637** | -0.000384 | -0.000400** | |
| | (0.000277) | (0.000324) | (0.000269) | (0.000157) | |
| Financial openness | -0.00106 | -0.0166** | 0.00588 | -0.00848** | 0.0125* |
| | (0.00678) | (0.00746) | (0.00703) | (0.00349) | (0.00743) |
| Bank deposits-to-GDP | 0.00132*** | 0.00167** | 0.00199*** | 0.00103*** | |
| | (0.000435) | (0.000666) | (0.000454) | (0.000298) | |
| Unemployment rate | | -0.00454** | | -0.00204** | |
| | | (0.00187) | | (0.00100) | |
| Real per capita GDP, log | | | -0.111 | -0.323** | -0.0893 |
| | | | (0.120) | (0.148) | (0.143) |
| (Real per capita GDP, log)$^2$ | | | 0.00448 | 0.0204** | 0.00315 |
| | | | (0.00873) | (0.00973) | (0.0102) |
| Oil discoveries per capita, log | | | | | 0.379*** |
| | | | | | (0.124) |
| Intercept | -0.237*** | -0.0535 | 0.327 | 1.177** | 0.304 |
| | (0.0694) | (0.0723) | (0.417) | (0.556) | (0.512) |
| Year-specific effects | Yes | Yes | Yes | No | Yes |
| Number of accelerations | 35 | 9 | 35 | 9 | 35 |
| Countries | 85 | 45 | 84 | 47 | 77 |
| Observations | 1,137 | 322 | 1,137 | 590 | 1,031 |

Note: *Probit* estimates. Coefficients reported are marginal effects evaluated at the average of the control variable. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff estimates.

## IV. Causality Between Saving Accelerations and GDP Growth

A key question is whether saving accelerations increase economic growth, or whether they are purely a consequence of strong economic growth. We examine the association between private saving accelerations and macroeconomic performance during the acceleration and post-acceleration episodes. The task is complicated by the endogeneity of saving accelerations. As an example, we found in earlier *probit* estimations that high GDP growth precedes private saving accelerations. As long as GDP growth is sustained, it is difficult to disentangle whether the direction of the causality between saving accelerations and GDP growth is bidirectional.

### Matching Estimators

We differentiate between the role of output growth during the saving acceleration phase and after the acceleration takes place. We proceed in three steps:

- First, we measure the association between the acceleration dummy variable and the average growth during the following nine years. This exercise would reveal the supplementary real per capita growth which is needed to fuel the saving accelerations.
- Second, we ask whether growth and private investment ratios are significantly higher in the long run, well after the acceleration was initiated (approximately 10 years

after). The question is whether the "pool" of resources generated during the saving acceleration phase leads to higher growth. If not, the results will indicate that growth matters the most for saving accelerations, rather than savings for growth. Armed with forward looking outcome variables help reduce the direct reverse causality issues. This approach is similar (in spirit) to Granger-causality type of tests, where precedence defines the statistical causality.

- Third, we estimate the effects of saving accelerations using propensity score matching techniques which help reduce the endogeneity bias in the occurrence of saving accelerations. Under this approach, each saving acceleration country-observation is matched with a counterfactual non-acceleration country-observation with a similar predicted probability of having experienced a saving acceleration (propensity scores). Their macroeconomic outcomes (growth and private investment ratio) are then compared using various matching algorithms.[12]

One important issue related to matching estimators is to check whether the distribution of covariates between matched observations is similar. The idea is to compare outcomes between groups (treated and untreated) that have limited statistical differences in terms of the covariates in the selection model. This can be assessed by comparing the distributions of propensity scores between the two groups or testing mean differences of variables between the two groups after matching. Table 5 (next page) shows that for the baseline matching estimator (neighbor matching), there are no longer any statistical differences between the levels of the covariates between countries that experienced a saving acceleration and countries that did not after matching on the propensity scores.

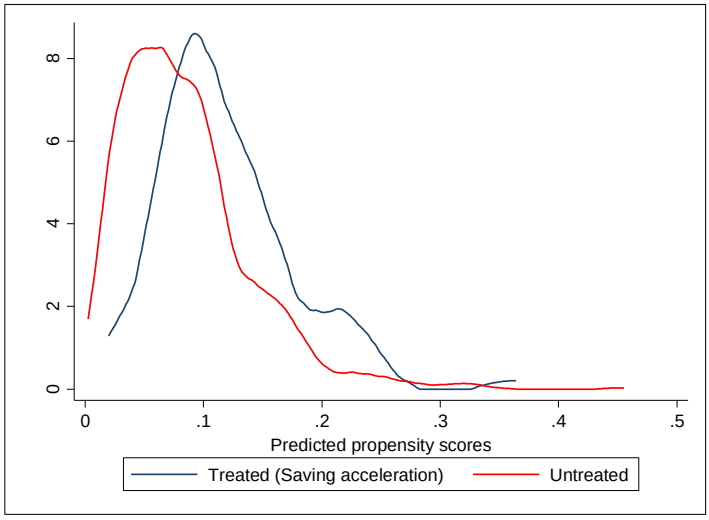
Another important aspect in this framework is the so-called overlap assumption. In our context, it states that each country has a positive probability of receiving each treatment level (positive probability of experiencing a saving acceleration). In other terms, it implies that we should be able to find a "counterfactual" for the observations in the group of countries that experienced a saving acceleration. Figure 2 plots the density functions of the propensity scores for each group (countries having experienced a saving acceleration versus others). As expected, the two density functions overlap and have most of their respective masses in regions in which they overlap each other. Thus, there is no evidence that the overlap assumption is violated.

[12] The propensity score matching technique introduced by Rosenbaum and Rubin (1983) has recently been popularized in the macroeconomic literature by various works by Lin and Ye (2007; 2009), and Lin (2010).

**Table 5. Distribution of Covariates Between the Treated and Control Groups**

| Variables | Treated (Saving acceleration group) | Control group | P-value of mean difference test |
|---|---|---|---|
| Output growth volatility | 0.78 | 0.85 | 0.48 |
| Public saving ratio | 5.05 | 5.00 | 0.95 |
| Trade openness | 55.90 | 55.81 | 0.98 |
| Financial openness | -0.48 | -0.55 | 0.67 |
| Financial Development | 39.56 | 39.91 | 0.92 |
| Oil discoveries | -0.11 | -0.12 | 0.45 |

**Figure 2. Density Probabilities Between Matched Groups**




**Econometric Results**

We find that the supplementary increase in GDP during the acceleration phase is around 1 percentage point per year while saving accelerations do not seem to significantly increase GDP growth afterwards (Table 6). They do not seem to reduce it either. The direction of causality therefore runs from higher and stable growth to private saving accelerations. Economic policies that promote a sustainable macroeconomic environment and address structural issues such as long-term unemployment and job quality therefore generate growth and commensurate sustainable increases in private saving. The results in Table 6 also demonstrate that saving accelerations are also good for capital accumulation in the long run, despite their limited effect on overall growth. In term of magnitude, the results indicate that 10 years after the acceleration took place, private investment tends to be higher by about 2.5–3 percentage points of GDP.

**Table 6. Saving Accelerations and Macroeconomic Performance During and After the Accelerations**

| | (1) Nearest-neighbor matching | (2) 3 Nearest-neighbor matching | (3) Radius matching | (4) Kernel matching |
|---|---|---|---|---|
| Change to growth during the acceleration episode | 1.321*** | 0.995*** | 1.118*** | 1.123*** |
| | (3.058) | (2.783) | (3.814) | (3.823) |
| Observations | 1,136 | 1,136 | 1,136 | 1,136 |
| Change to growth post-acceleration episode | 0.523 | 0.520 | 0.464 | 0.457 |
| | (1.054) | (1.174) | (1.296) | (1.280) |
| Observations | 1,059 | 1,059 | 1,059 | 1,059 |
| Change to private investment ratio post-acceleration episode | 2.689** | 3.215*** | 2.576*** | 2.592*** |
| | (2.414) | (3.511) | (4.130) | (4.138) |
| Observations | 810 | 810 | 810 | 810 |

Notes: Bootstrapped z-statistics for average treatment effect on the treated (ATT) are reported in parenthesis. They are based on 100 replications of the data. *, **, and *** indicate the significance level of 10 percent, 5 percent, and 1 percent, respectively. *Probit*-selection equations include the full set of determinants of saving transitions as discussed in previous section, except the unemployment rate to maximize sample size. Estimations are based on the common-support sample.
Source: IMF staff calculations.

## V. CONCLUSION

We find that private saving accelerations are relatively frequent, mostly occurring in emerging and developing countries. Of the 135 countries studied, 69 have had, at least, one private saving acceleration between 1960 and 2012. These accelerations tend to be concentrated in the group of economies still converging toward high income and living standards. Emerging and developing countries have experienced 78 percent of world's overall saving accelerations.

Strong economic performance is found to be associated with private saving accelerations. The econometric framework and the results demonstrate that superior economic performance precedes surges in private saving. This includes factors such as higher rates of GDP growth, lower GDP growth volatility, lower unemployment, and healthy public finances. We found that financial development also matters in the sub-sample of developing countries, while strong fiscal positions tend to be one of the most robust determinants of private saving transitions. "Luck" does matter as well: large discoveries of natural resources lead to a surge in private saving rate, a result which has not been discussed in the literature so far.

We also find that private saving accelerations are mostly the consequence of higher growth rather than a cause of growth *per se*. However, we found a positive and significant association between private saving accelerations and private investment in the long run, suggesting that funds were intermediated to some extent by the financial system into the real economy. The results are robust to endogeneity concerns regarding the timing of saving accelerations.

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