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The effect of international policies on borrowing and debt of developing countries

GIOVANNA BUA

Ph.D. supervisor:
PROF. ALESSANDRO MISSALE

Ph.D. coordinator:
PROF. MICHELE SANTONI

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Contents

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Introduction

At the onset of the recent financial crisis, economists' attention towards the impact of international policies on financial conditions increased considerably. This is especially true with respect to many Heavily Indebted Poor Countries, which since 1996 were already undergoing major changes in their portfolio composition due to the debt relief initiative (HIPCs/MDRI). As a matter of fact, the mutual occurrence of the two events led to significant changes in developing countries' borrowing behavior and in their debt portfolio, whose underlying patterns are still to be thoroughly analyzed.

On the one hand, low interest rates in Advances Economies (AEs) since 2009 have fueled capital flows towards high yield emerging countries, urging them to deal with capital inflows problem. On the other hand, the global financial turmoil limited the availability of external resources to poor countries and pushed them to tap their almost unexplored local markets. Also the HIPCs/MDRI Initiative - which reduced the external debt of many Heavily Indebted Poor Countries – might have favored this switch in portfolio composition.

This thesis is a collection of four essays on the impact of international policies on debt and borrowing behavior of developing countries. It focuses first on Low Income Countries (LICs) and then it enlarges the analysis to Emerging Markets (EMs).

The first two chapters are mainly concerned with the determinants of domestic public debt in LICs. The third chapter deepens into their borrowing behavior and studies the impact of the International Monetary Fund (IMF) regulation on public and private flows. Finally, the fourth paper enlarges the analysis to richer countries and studies the impact of US monetary policy on capital flows and domestic credit in Emerging Markets.

In the first chapter I introduce a new dataset on the stock and structure of domestic public debt in Low-Income Countries and I describe its evolution over time. I show that since 1996 the level of internal financing in poor countries has increased. I also bring evidence that despite domestic debt is costlier than external financing, over time poor countries have been able to increase the share of long-term domestic debt and decrease borrowing costs. Another result is that the concentration of the investor base, mainly dominated by commercial banks and by the Central Bank, may crowd out lending to the private sector. The dataset represents a complete novelty as compared to the existing datasets, because it puts together information on domestic debt in a way that ensures comparability across countries (definition of domestic debt, level of public sector, liabilities included) and it recollects up-to-date information on domestic debt composition (instruments, maturity structure and investor base).

Although the first paper identifies potential costs and benefits of internal financing in LICs, the analysis does not suffice to identify the determinants of its evolution. In the second chapter I use the new dataset to understand the reasons behind domestic debt increase despite its higher cost vis-à-vis external financing. I focus my attention on the dichotomy between demand and supply factors in order to distinguish whether borrowing behavior is mainly driven by international or by domestic determinants. The analysis shows clearly that domestic debt development in LICs is at an early stage and financial needs are still probably satisfied mainly through external financing. We also find that domestic debt is negatively correlated with moderate inflation and trade openness suggesting that in presence of monetary stability countries tend to switch toward domestic debt while countries more outward oriented issue more debt externally. Interestingly we find that internal financing is positively correlated with liquidity in circulation and hyperinflation, providing a warning signal of the tendency of governments to inflate the debt away.

In the third chapter I deepen the analysis on borrowing behavior of poor countries focusing on the impact of international prescriptions on the flows of private and public borrowing in LICs. The aim is to investigate whether restrictions on non-concessional borrowing imposed by the IMF have reduced the opportunity for LICs to borrow externally, forcing them to change their financing strategy. To assess this behavior, I use the statistical technic known as Propensity Score Matching and then study the impact of the IMF policy on the size and composition of debt flows to LICs. The results highlight interesting aspects of international policy prescriptions and their impact on developing countries. In particular they show that LICs do not accumulate loans at market rates (non-concessional) more rapidly when not subject to the limits imposes by the IMF, suggesting that poor countries may not be able to attract them in the first place. The analysis also suggests that countries turn to higher levels of non-concessional borrowing as their economies grow richer, not because of the absence of constraints imposed on their borrowing behavior. On the contrary, the results show that the presence of IMF programs can play a catalytic role in attracting resources at favorable terms (concessional).

Finally, the aim of the fourth chapter is to understand how US monetary policy affects borrowing behavior and credit in developing economies. Given that LICs have still limited access to international market and, capital flows may not react to market sentiments, I shift the focus of the analysis from Low Income Countries to Emerging Markets. Using Vector Autoregressions (VAR) I look, first, at the impact of the Federal Fund Rate (FFR) on total gross capital inflows; second, I look at whether shocks in U.S. monetary policy have a different impact on different type of flows (foreign direct investment, portfolio investments, other inflows); and finally I study the impact on US long interest rate on the breakdown of gross capital flows and credit to the private sector. The results bring evidence that restrictive monetary policy increases market risk aversion and decreases gross capital flows and credit. Also the analysis on gross flows breakdown suggests that the results are mainly driven by portfolio investments, suggesting that debt and equity flows may act as transmission mechanism of the monetary policy in EMs. Last, we show that shocks in the long term interest rate – that we interpret as shocks to the term premium - do not impact gross capital flows.

I hope that this work will add to the literature on debt sustainability in developing countries and to studies advocating the benefits and costs of a composition tilted towards long-term local currency debt. Despite Emerging Markets have proved resilient to the global financial crisis and poor countries have improved their debt external position in the wake of the debt relief initiative, governments should ensure they take active steps to manage capital inflows boom and they do not drift to an unsustainable path of debt accumulation falling in the well know "this time is different" attitude.

Chapter 1

Domestic public debt in low-income countries: trends and structure[1]

Giovanna Bua
The World Bank
Università Statale di Milano

Juan Pradelli
The World Bank

Andrea F. Presbitero
Università Politecnica
delle Marche & MoFiR

Abstract

This paper introduces a new dataset on the stock and structure of domestic debt in 36 Low-Income Countries over the period 1971-2011. We characterize the recent trends regarding LICs domestic public debt and explore the relevance of different arguments put forward on the benefits and costs of government borrowing in local public debt markets. The main stylized fact emerging from the data is the increase in domestic government debt since 1996. We also observe that poor countries have been able to increase the share of long-term instruments over time and that the maturity lengthening went together with a decrease in borrowing costs. However, the concentration of the investor base, mainly dominated by commercial banks and the Central Bank, may crowd out lending to the private sector.

JEL Codes: E62; H63; O23
Keywords: Domestic debt; Debt structure; Low-income countries, HIPCs

[1] The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent. We gratefully acknowledge the financial support of the World Bank's Research Support Budget. We also thank Reza Baqir and Alessandro Missale for comments on an earlier draft.

1. Introduction

Analyses on government borrowing and debt management in Low Income Countries (LICs) have traditionally focused on external debt. This scarcity of studies is partly due to the lack of a comprehensive database on domestic public debt and the historical prominence of external borrowing compared to domestic borrowing. Until recently, in fact, foreign liabilities have been the largest component of the public debt in LICs, the target of debt relief initiatives such as Heavily Indebted Poor Countries (HIPC) and Multilateral Debt Relief Initiative (MDRI), and the main concern of the joint Fund/Bank Debt Sustainability Framework for LICs (LIC DSF). In recent years, however, LICs made substantial efforts to develop their local public debt markets and relied heavily on domestic sources to finance budget deficits during the global crisis, sparking the attention of International Financial Institutions (IFIs) and the academic community.

Because of the constraints indicated above, the existing literature on government borrowing in LICs is relative scant and inconclusive with regard to the benefits and cost of domestic liabilities relative to foreign liabilities. Only few studies assess empirically the rationale (if any) for LIC governments to gradually shift their financing strategies towards domestic sources and away from external sources.

At any rate, domestic financing is plenty of advantages. The literature on public debt management in Emerging Markets (EMs) has shown that, in general, market depth has increased, maturities have lengthened and the investor base has broadened (Mehrotra, Miyajima and Villar, 2012). As a result, domestic debt may bring some prominent benefits: the lower exposure of the public debt portfolio to currency risk if and when the domestic debt is denominated in local currency (Hausmann, Panizza and Rigobon, 2006; Bacchiocchi and Missale 2012); a lower vulnerability to capital flow reversals (Calvo, 2005); the possibility to undertake countercyclical monetary policy to mitigate the effect of external shocks (Mehrotra, Miyajima and Villar, 2012); and the improved institutional infrastructure underlying the organization and functioning of local financial markets (Arnone and Presbitero, 2010). In general, long-term domestic currency-denominated debt reduces maturity and currency mismatches and hence tends to be safer.

However, the literature also stresses that domestic borrowing brings benefits only in the presence of a sound institutional and macroeconomic framework, and only if the debt structure features certain characteristics (Abbas and Christensen, 2010, Arnone and Presbitero, 2010, Hausmann, Panizza and Rigobon, 2006, Panizza, 2008, Presbitero, 2012b). Many developing countries are, in fact, unable to issue long-term government securities at a reasonable cost, so they are more vulnerable to rollover and interest rate risks. Moreover, domestic currency-denominated debt could substitute inflation risk for currency mismatch. The nature of the credit base may also raise vulnerabilities. Previous studies underlie the importance of a diverse investor base for lowering the cost of government debt and the volatility of market yield, and stress that a lenders' profile strongly biased toward commercial banks might worsen crowding out effects and reduce the efficiency of the banking system. Yet another aspect of the debt structure that influences vulnerability is the type of instruments issued. According to Abbas and Christensen (2010), many of the benefits of domestic debt market – saving assets, collateral function, benchmark yield curve for private lending – apply to securitized domestic debt and not to liabilities issued in captive markets or accumulated due to poor public financial management (such as arrears).

The cost-benefit analysis of financial instruments available to the government, as described above, is largely discussed with regards to EMs, while the lack of data on domestic public debt in LICs – especially the financial terms applied to domestic liabilities – has prevented extending the analysis to poorer countries along similar lines. In particular, it hindered the possibility of discussing the rationale for LICs government to increase domestic borrowing relative to external indebtedness.

Against this backdrop, the main objective of this paper is to fill the void in the literature by constructing a brand new database on domestic public debt in LICs. While the existing datasets

mainly provide information on the stock of domestic debt and interest payments, at best, our dataset also includes detailed information on maturity, currency composition, creditor base, and type of instruments. The up-to-date information on domestic debt stock and structure is comparable across LICs.

Based on our dataset, this paper characterizes the recent trends regarding LIC domestic public debt and explores the relevance of different arguments put forward on the benefits and costs of government borrowing in local public debt markets. The main stylized fact that emerges from the data is the increase in domestic government debt during the period 1996-2011 and its larger burden with respect to external public debt, at least since the mid-2000s. Short-term financing is mainly instrumented through marketable and non-marketable securities held by the banking system. Central Bank advances to the Treasury, which are typically rolled over, constitute a relevant source of long-term financing. The breakdown into HIPCs and non-HIPCs highlights significant differences in the evolution and structure of domestic debt between the two groups, with HIPCs relying more on Central Bank advances and non-HIPCs making progress in issuing securities and lengthening maturities.

The paper is structured as follow. Section 2 revises the existing literature and databases on domestic public debt in LICs. Section 3 describes our dataset and Section 4 presents some stylized facts on the evolution and structure of domestic public debt. Section 5 concludes.

2. Domestic Public Debt Management

2.1. Fiscal deficit financing

Fisher and Easterly (1990) identify four different means of fiscal deficit financing and associate each of them with the risk of building certain macroeconomic imbalances: 1) printing money might fuel inflation, 2) running down foreign exchange reserves might trigger an exchange crisis, 3) borrowing abroad might end up in an external debt crisis, and 4) borrowing domestically might increase interest rates and lead also to a debt crisis.

In theory, the seignorage revenue the government can expect to obtain from printing money is non-linear in the inflation rate, similarly to a conventional Laffer curve. The link between money creation and inflation is well-known. In practice, however, seignorage is often a small source of resources both for developing and developed countries. Empirical evidence shows that in normal times, the maximum amount of seignorage revenue collected over an extended period of time is less than 5 percent of GDP (Easterly and Schmidt Hebbel, 1991). During fiscal crisis episodes, the seignorage can become an important (albeit temporary) means of deficit financing (Reinhart and Rogoff, 2009). By running down international reserves, instead of printing money, the government can hope to put off the inflationary effects of a fiscal deficit. This policy is also temporary because it can last just until reserves are depleted, or probably collapse even earlier as pointed out by the theoretical and empirical literature on currency crisis.

Foreign borrowing allows to finance the fiscal deficit without creating money supply-driven inflationary pressures or crowding out domestic lending to the private sector. However, external credit flows tend to be volatile, procyclical, and subject to sudden stops (Calvo, 2005). By providing not only financing but also foreign exchange, foreign borrowing may induce a real exchange rate appreciation, thus hampering competitiveness and possibly lowering investment and economic growth (Rodrik, 2008). External debt is typically denominated in foreign currency and this creates additional constraints on monetary policy and exchange rate management. For instance, according to Hausmann (2003), foreign currency-denominated debt lowers the evaluation of solvency because it heightens the dependence of debt service on the evolution of the exchange rate, which is often volatile and subject to shocks and crises. Cespedes, Chang and Velasco (2003) underline that, when there are currency mismatches in the balance sheets of local agents, currency devaluations are contractionary since they induce negative net wealth effects. Under these circumstances, Hausmann and Rigobon (2003) maintain that central banks are reluctant to let the exchange rate float and tend to intervene aggressively in the foreign exchange market and hold more international reserves.

Domestic borrowing, typically denominated in local currency, does not bring about some complications associated with external credit flows. The most prominent concern, instead, is the crowding out effect: issuing domestic debt the governments taps private savings that would otherwise be available to finance private investment. If market-determined interest rates increase, this may reduce investment demand. And if interest rates are controlled or lenders are reluctant to raise them to avoid adverse selection and moral hazard problems, the domestic government borrowing can lead to credit rationing and a reduced supply of funds for private investment.

2.2. Domestic Financing In LICs

The theoretical literature on government borrowing and public debt management in LICs is relatively scant – at least compared to advanced economies and emerging markets – and still inconclusive with regard to the benefits and costs of domestic liabilities relative to foreign liabilities. Empirical work, in particular, has been constrained by the lack of a comprehensive domestic public debt database and by the traditional emphasis placed on external borrowing as the main means of fiscal deficit financing in poor countries. The few available studies on LIC government debt reviewed in Table A1 in the Appendix gathered data from multiple sources that were deemed adequate for specific analytical purposes.[2] Available data on domestic public debt are therefore quite heterogeneous in terms of the criteria to distinguish domestic and external debt, the definition of public sector, the type of government liabilities covered, and the treatment of certain financial arrangements (e.g., on-lending operations, IMF lending to central banks under a sovereign guarantee, liabilities issued in regional capital markets). Furthermore, to the best of our knowledge, no dataset provides information on the structure of domestic public debt.

Domestic public debt started increasing in LICs from the mid-1990s, in coincidence with an upsurge in financial liberalization (Presbitero, 2012b). Subsequently, in the wake of the debt relief initiatives and the recent global financial crisis, the level and composition of public debt in LICs have changed, sparking the attention of IFIs and the academic community.[3]

In policy-oriented discussions on government borrowing and public debt management in LICs, a common presumption is that domestic financing is more expensive and riskier than external financing, thus making foreign debt preferable to domestic debt. Supporting this view, Christensen (2005) analyses the structure of public debt in 27 Sub-Saharan African countries and finds that domestic debt represents a significant burden to the budget in terms of interest payments, notwithstanding having a relatively small size. In addition, the author shows that the short-term maturity of domestic government debt is a source of rollover risk and macroeconomic instability, and documents the existence of crowding out effects on private-sector borrowing.

LICs benefiting from debt relief initiatives have attracted special attention of policy makers and researchers because of the expectations that these initiatives would help poor countries to stabilize the economy, strengthen public finances, free budget resources to finance the provision of social services and infrastructure, and implement structural reforms. In their study on debt relief and HIPCs, Arnone and Presbitero (2010) analyze the evolution and costs of domestic government debt using a World Bank dataset covering 79 developing countries in 1970-2003. They provide evidence that both the stock of domestic public debt and the associated interest payments rose in HIPCs after receiving relief. Presbitero (2012b) shows that, in fact, the reliance on internal financing has partially offset the reduction in external debt granted by multilateral and bilateral debt relief initiatives. Arnone and Presbitero (2010) argue that such trends might put forward risks to sustainable economic development and thus jeopardize the objective of spurting growth that motivated granting debt relief in the first place. Furthermore, they suggest that the objectives of creating a stable macroeconomic environment and developing local financial markets have not been reached yet. This should be a concern because the experience of EMs since the early 2000s suggests that macroeconomic stability and financial deepening are necessary for domestic public debt not to represent yet another factor of vulnerability (Borensztein, Levy-Yeyati, and Panizza, 2006). In this regard, Presbitero (2012b) shows that only countries with sound policies and institutions exhibit a pattern of rising domestic public debt and upbeat macroeconomic performance in terms of greater capital accumulation, stronger output

[2] These sources include the IMF's Monetary Survey, Staff Reports, and Article IV Reports; the World Bank's World Development Indicators and Global Development Finance database; and, if available, the websites of LICs' central banks and ministries of finance.

[3] In February 2012, the IMF's and IDA's Board drew attention to the fiscal vulnerabilities stemming from an increasing public debt in LICs, and recommended the development of benchmarks (thresholds) for total public debt in order to strengthen the LIC DSF and inform policy dialogue with country authorities (IMF-IDA, 2012).

growth, and faster financial development. Such a salutary correlation is not observed in countries with a weak institutional environment.

The increasing domestic borrowing in LICs, especially in those that benefited from debt relief, begs for an explanation. One strand of the literature challenges upfront the common presumption that domestic financing is costlier than external financing in LICs. Abbas (2005) argues that the lack of recurrent domestic sovereign defaults in poor countries might be an insight that servicing domestic debt is actually easier than repaying foreign debt, and, in a similar vein, Panizza (2008) maintains that switching the sources of fiscal deficit financing towards domestic debt might reduce the risk of sovereign defaults. Another strand moves away from purely cost-risk considerations and emphasizes supply-side constraints: facing decreasing foreign aid (including both lending and grants) relative to development financing needs, LIC governments must seek for additional domestic funding sources. Some authors argue that external credit constraints imposed by private lenders, or policy conditionality restricting non-concessional foreign borrowing imposed by IFIs, have reduced the opportunities for external financing and forced LIC governments to tap local public debt markets (Arnone and Presbitero, 2010).[4] Structural benchmarks in recent IMF programs seek to foster the development of local markets for government securities, thus ultimately favoring domestic financing (IMF and World Bank, 2001; UNCTAD, 2004; Borensztein, Levy-Yeyati, and Panizza, 2006; Arnone and Presbitero, 2010). Finally, other studies depart from the hypothesis that LIC governments use domestic public debt mainly for fiscal deficit financing, and argue that internal borrowing help sterilizing foreign exchange inflows from foreign aid or natural resource-based exports, particularly in LICs pursuing an active exchange rate management but unable or unwilling to use monetary policy for sterilization purposes (Christensen, 2005; Aiyar, Berg, and Hussain, 2005).

An alternative rationale for the rising domestic borrowing in LICs is suggested by the literature on public debt management in EMs, which also increased reliance on local financial markets since the early 2000s. Focusing on demand-side factors, a number of studies investigate an EM government's preferred debt portfolio composition and the cost-risk profile of financial instruments available, identifying important pros and cons of shifting from external to domestic borrowing. To the extent that internal financing is denominated in local currency, domestic debt reduces the exposure of the public debt portfolio to unanticipated movements in the exchange rate (Hausmann, Panizza, and Rigobon, 2006; Bacchiocchi and Missale, 2012) and ensures a higher degree of freedom to use the exchange rate as a stabilization mechanism against external shocks, i.e. lower fiscal dominance on the exchange rate policy (IMF and World Bank, 2001; Kumhof and Tanner, 2005). Also, to the extent that domestic debt is owed to resident creditors, it reduces exposure to capital flow reversals (Calvo, 2005). Domestic borrowing can improve the efficiency of the allocation of national savings if mobilized resources are used to fund public investment and not capital flight or inefficient self-investment by savers (Abbas and Christensen, 2010). Building the institutional infrastructure for the issuance of domestic public debt often supports the organization and functioning of local financial markets (Arnone and Presbitero, 2010).

On the other hand, the literature on EMs explores the disadvantages of domestic borrowing. Given that many developing countries are unable to issue long-term government securities at a reasonable interest rate, the resulting maturity mismatch can be worse than the currency mismatch associated with foreign debt (Panizza, 2008). Macroeconomic distortions and instability can be induced by an excessive domestic borrowing, including crowding out effects (Hanson, 2007; Panizza, 2008; Abbas and Christensen, 2010; and Arnone and Presbitero, 2010) and the association of large domestic debts with hyper-inflation episodes and external debt crisis (Reinhart and Rogoff, 2009). Distortions in the

[4] IMF-supported programs in LICs typically include limits on non-concessional external debt, under the Debt Limits Policy (DLP), which seek to prevent the build-up of unsustainable debt while allowing for adequate external financing (IMF, 2009). Along the same line, the World Bank lending to LICs follows the Non-Concessional Borrowing Policy (NCBP), an incentive mechanism aimed at discouraging high-risk countries that receive grants from contracting non-concessional external debt (IDA, 2006). Neither the DLP nor the NCBP apply to domestic public debt.

financial system can be also important, particularly the potentially perverse incentives facing financial institutions that invest in government debt. For instance, banks investing in public debt are more profitable but less efficient, and they are more likely to prefer short term portfolio allocation and thus build additional vulnerabilities; domestic banks and institutional investors may be induced by moral suasion to absorb excessive public debt (Hauner, 2006; Hanson, 2007; Panizza, 2008; and Arnone and Presbitero, 2010).

Some studies focus on the role of macroeconomic, political, and institutional factors in determining the composition of total public debt in terms of domestic and external liabilities. Earlier contributions in the original sin literature attempt to explain why external liabilities are denominated in a few currencies and why domestic liabilities are short term (Eichengreen and Hausmann, 1999; Eichengreen, Hausmann and Panizza, 2003; Hausmann and Panizza, 2003; Jeanne, 2003; and Mehl and Reynaud, 2005). Guscina (2008) finds that in EMs, low and stable inflation and deep financial markets are associated with a higher share of domestic liabilities in the public debt portfolio of the central government. Along the same line, Diouf and Doufrense (2012) study the security market in the WAEMU and identify demand- and supply-side factors that might hamper the issuance of long-term domestic debt instruments.

While these arguments are largely discussed with regard to EMs, the lack of data on domestic public debt, especially with regard to financing terms applied to domestic liabilities, has prevented extending the analysis to LICs along similar lines.

At a macroeconomic level, the balance of costs and benefits of domestic borrowing in LICs could be reflected in the effect of domestic public debt on economic growth. To the best of our knowledge, Abbas and Christensen (2010) is the only paper that explicitly addresses this issue in a sample of developing countries that includes a sufficiently large number of LICs. The authors find that domestic public debt has a positive impact on output growth provided that it does not exceed 35 per cent of bank deposits; above this threshold, debt undermines economic activity through crowding out effects and inflationary pressures. The financing terms applied to government liabilities also matter: the growth effect of domestic public debt is higher for marketable instruments that bear positive real interest rates and are held by non-bank investors.[5]

[5] Presbitero (2012a) investigates the impact of total (external and domestic) public debt on output growth in a sample of 92 developing countries and finds that debt has a negative impact on growth up to a threshold of 90 percent of GDP, beyond which the effect becomes irrelevant. This non-linear effect is consistent with debt hindering growth only in countries with sound macroeconomic policies and stable institutions. By contrast, in countries where macroeconomic policies are weak, these are likely to be the first-order constrain on growth.

3. Domestic Public Debt in LICs: A New Dataset

The Government Finance Statistics Manual (GFSM) prepared by the IMF (IMF, 2001) defines debt as "all liabilities that require payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. Thus, all liabilities in the GFS system are debt except for shares and other equity and financial derivatives". The definition of domestic debt, as opposed to external debt, is not unique and three criteria are common in practice. On a creditor residency basis, debt is domestic if owed to residents.[1] This criterion is widely used in the compilation of statistical information on government debt by official agencies following the GFSM (IMF, 2001), and is relevant to study international risk sharing and resource transfers between residents and non-residents. On a currency basis, debt is domestic if denominated in local currency. This definition enables the analysis of currency mismatch and vulnerabilities associated with the currency composition of the public debt portfolio. Finally, on a jurisdiction basis, debt is domestic if issued in local financial markets and subjected to the jurisdiction of a local court. This definition helps recognizing the implications of debt restructuring procedures.[2] Defining unambiguously domestic versus external debt is crucial, since the debt definition affects the identification of vulnerabilities and the conclusions drawn from empirical studies (Panizza, 2008).

Other dimensions are also relevant to characterize the public-sector domestic debt, most notably the definition of public sector (i.e., Central Government, General Government, or Public Sector)[3] and the type of financial liabilities included in the debt statistics (i.e., market versus non-marketable instruments). In LICs, the Central Government debt is typically better recorded and thus most studies focus on it.[4] Similarly, marketable debt instruments are usually better reported than other government liabilities. Information on domestic debts instrumented through loans, securities[5], and other accounts payable (e.g., Central Bank advances) is relatively more accessible and transparent than on insurance technical reserves and financial derivatives.[6]

Our domestic public debt dataset comprises 40 low and lower-middle-income countries over the period 1971-2011 (see Table A2 in Appendix).[7] Following the GFSM (IMF, 2001), we adopt the residency basis to define domestic debt in 35 countries, whereas the currency basis is used in 5

[1] The concept of residence in the GFSM (IMF, 2001) is not based on nationality or legal criteria, but on economic interest: an institutional unit is said to be a resident unit of a certain country when it has a center of economic interest in the territory of that country. A similar concept of residence is used in the 1993 United Nations System of National Account, the Fifth Edition of the IMF Balance of Payment Manual, and in the IMF Monetary and Financial Statistics.

[2] According to Sturzenegger and Zettelmeyer (2006), sovereign bonds come with an array of contractual features, e.g., covenants, commitments to undertake (or not) certain actions over lifetime of the bond, remedies in the event that contractual obligations are breached, and procedures for modifying the contract. Contractual clauses often differ according to the law under which the sovereign bonds fall and hence they have different implications for the scope and term of debt restructurings.

[3] In the GFSM (IMF, 2001), the General Government consists of all the governments units as well as the non-market non-for-profit institutions controlled and financed by government units. The General Government can be classified in: (i) Central Government, whose authority extends over the entire territory of the country; (ii) State Government, whose authority extends over the largest geographic area into which a country may be divided for political or administrative purposes; and (iii) Local Government, whose authority is restricted to the smallest geographic areas distinguished for political or administrative purposes. The Public Sector includes the General Government, the Public Corporations controlled by government units that engage in financial and non-financial activities, and the Central Bank.

[4] However, this implies that for countries that are highly decentralized with subnational governments that do borrow, or for countries that have large state-owned enterprises that issue debt, the central government debt is likely to underestimate the public-sector liabilities.

[5] According to the Handbook of Securities Statistics (BIS, European Central Bank, IMF, 2009), a security is a negotiable financial instrument whose legal ownership is transferable from one owner to another by delivery or endorsement. A security is designed to be traded on an organized exchange, although actual trading in secondary markets may not happen.

[6] The treatment of government (financial, liquid) assets that leads to the definition of gross versus net debt is becoming an important issue in EMs. However, just a few LICs provide data on net debt and stocks of financial liquid assets that could potentially be used to repay maturing debt.

[7] Lower-middle-income countries included in our database slightly exceed the per-capita GNI threshold separating their income category from the low-income countries.

countries because of their debt recording practices and data constraints. We include all domestic financial liabilities defined by the GFSM (IMF, 2001), with the exception of arrears, and focus on the Central Government debt as most other studies in the literature.[8] As a novelty, our dataset contains information on the level and structure of domestic public debt: along with the stock of domestic public debt, we gather data on on-budget interest payments, type of instruments, maturity, and investor base.[9]

Amongst the 40 countries, 33 are classified as LICs and 7 as lower-middle income countries. There are 38 countries benefiting from IDA lending (denoted IDA-only countries) and 2 receiving a mix of IDA and IBRD lending (denoted blend countries). HIPCs are two-thirds of the sampled countries. In terms of geographic location, 29 countries are in Sub-Sahara Africa, 5 in East Asia and Pacific, 2 in Europe and Central Asia, 2 in South Asia, one in Latin America and the Caribbean, and one in Middle East and North Africa.

As expected when dealing with LICs, the data availability is quite heterogeneous across countries and over time. In our dataset, accurate information on debt stock exists for 40 countries whereas data on debt structure is reported for 36 countries. In addition, the time span of variables included in the dataset largely differs across countries. We are therefore constrained to selectively choose panels of data to conduct meaningful descriptive analyses and comparisons in Section 4. Thus, we construct two balanced panels covering the period 1996-2011: the Debt Stock Sample contains the domestic debt stock series for 21 countries, and the Debt Structure Sample includes data on debt stock and structure for 15 countries. We also construct a balanced panel covering the period 2007-2011 for the whole sample of 36 countries, the Debt Structure Short Sample.

In the next section, we illustrate the evolution of domestic public debt in LICs using the Debt Stock Sample and we analyze the debt structure and financing terms - including on-budget interest payments, type of instruments, maturity, and investor base – using the Debt Structure Sample and the Debt Structure Short Sample. Reported time series are primarily weighted country averages, with the GDP in dollars at constant 2005 prices as weight. We complement the average figures with box-plot analysis to assess the data variability across countries in both datasets.

[8] Reporting of arrears varies largely across countries, e.g., the timing of recording could be as soon as payments are delayed, or when arrears are audited, or when they are settled or securitized. Information on debt owed by subnational governments and state-owned enterprises is available for only 7 countries in a few recent years, thus preventing us from constructing a Public Sector debt dataset.

[9] Our data sources concerning domestic public debt include IMF Staff Reports, websites of countries' Ministry of Finance and Central Bank, and consultations with World Bank country economists, IMF country desks, and debt managers members of a network established by the World Bank's Economic Policy, Debt, and Trade Department. Data on external public debt are drawn from the World Bank's Debt Reporting System (DRS).

4. Characteristic of Domestic Public Debt in LICs

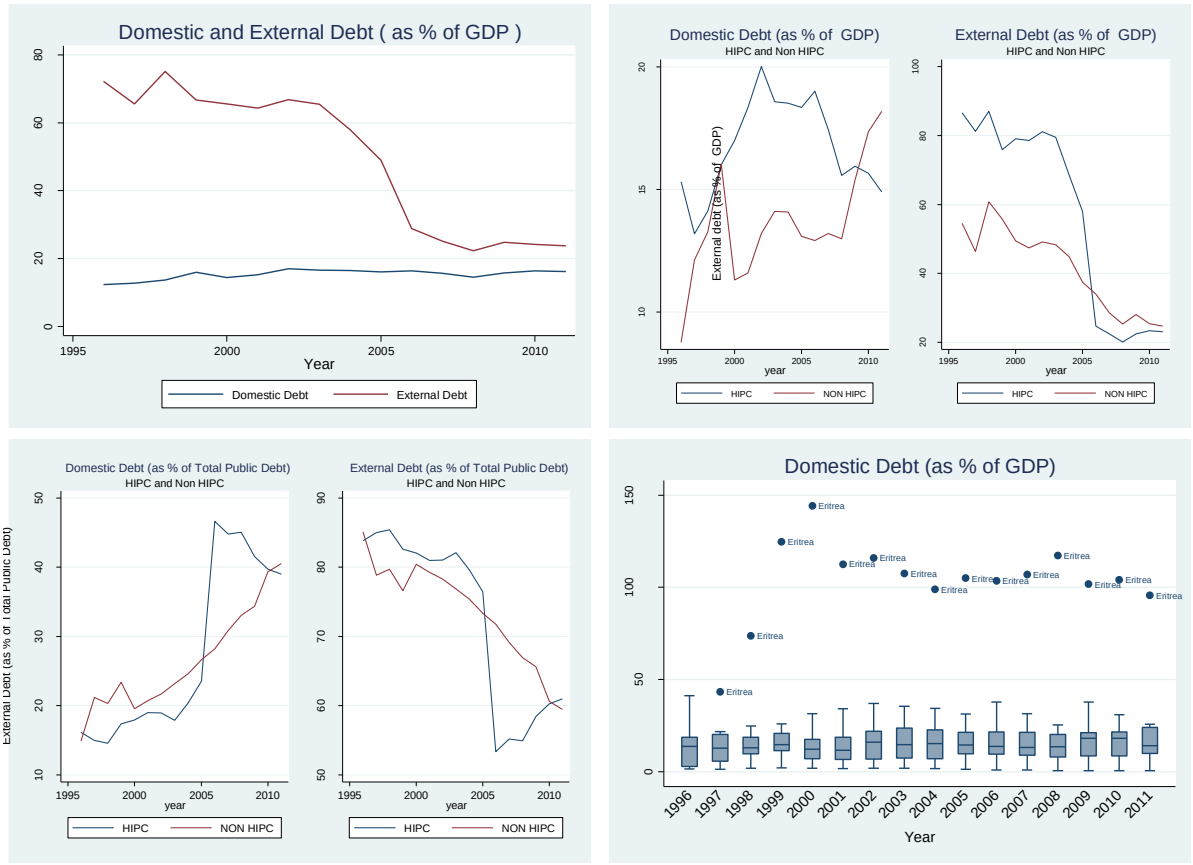
4.1. Evolution of domestic debt

Figure 1 shows the evolution of Central Government debt for the *Debt Stock Sample* in 1996-2011. On average, LIC external debt is much lower than in the past, decreasing from 72 percent of GDP in 1996 to 23 percent in 2011, whereas LIC domestic debt is on the rise, increasing from 12.3 percent of GDP to 16.2 percent. Both HIPCs and non-HIPCs managed to reduce the burden of foreign liabilities, particularly the HIPCs benefiting from debt relief initiatives that largely wrote off their financial obligations to official creditors. Trends concerning the domestic public debt, on the other hand, differ between HIPCs and non-HIPCs since the early 2000: HIPCs have reduced domestic debt since the peak of 20 percent of GDP in 2002, while non-HIPCs have increased it from 12 percent of GDP to 18 percent in the period 2000-2011. Overall, LICs now hold a public debt portfolio with a fairly balanced composition in terms of domestic and external liabilities compared to the past. In both HIPCs and non-HIPCs, the public domestic debt represented 40 percent of the total public debt in 2011, almost three times the share observed in 1996.[10]

LICs are quite heterogeneous with regard to reliance on domestic debt, as the box-plot in Figure 1 and the Table A3 in Appendix suggest. For instance, Cambodia has virtually no domestic liabilities and Eritrea has an amount almost equal to its GDP. Most LICs have increased the stock of domestic debt (relative to GDP) since the mid-1990s, but there are exceptions such as Ethiopia, Rwanda, Solomon Islands, and Tanzania, whose level of domestic debt decreased. We do not find evidence of LICs uniformly substituting domestic debt for external debt (or viceversa): the pairwise correlations between the ratios of domestic and external debt to GDP in 1996-2011 for each individual LIC, have a positive sign in some countries and a negative sign in others. Country-specific circumstances may then play a role in the pattern of substitution (if any) between local and foreign financing in LICs

[10] Arnone and Presbitero (2010) argue that the share of domestic debt drastically increased in HIPCs soon after receiving external debt relief. But the share slightly decreased since 2006, possibly because HIPCs re-engage in securing foreign financing to take advantage of the new borrowing space created by the debt relief and the lower global interest rates. A scaling-up of public investment projects has been observed in some HIPCs (Arnone and Presbitero, 2010).

Figure 1: Domestic and External Debt



Source: our elaboration on the LIC domestic public debt dataset.

4.2. Financial cost and burden

A main concern about domestic debt relates to its financial cost and burden relative to external debt. For the *Debt Structure Sample* in 1996-2011, Figure 2 displays implicit interest rates as proxies of borrowing *cost*. The nominal implicit interest rate is calculated as the interest payments in the current year divided by the average debt stock in the current and preceding year.[11] For the domestic debt, we calculate the real implicit interest rate by subtracting the GDP deflator inflation from the nominal rate. For the external debt, we add the average depreciation rate of the local currency against the US dollar and SDR in order to capture losses (or gains) resulting from exchange rate fluctuations in the presence of foreign currency-denominated external debt. On average, the cost of external borrowing never exceeded 4 percent per annum and has been always much cheaper than the nominal cost of domestic borrowing, even including the currency depreciation losses. The domestic nominal implicit interest rate, however, declined significantly from 18 percent per annum in 1996 to 8 percent in 2011. On average, the real cost of domestic borrowing is also lower than in the past and quite often the real implicit interest rates are negative and thus encourage borrowing from local sources. Both HIPCs and non-HIPCs achieved lower nominal borrowing costs in recent years. The domestic implicit interest rate is slightly lower in HIPCs as they rely more on advances from the Central Bank, which are relatively inexpensive vis-à-vis other sources of domestic financing.

Figure 2 also shows simple measures of the financial *burden* of public debt in LICs: the interest payments on domestic debt, and the interest payments on external debt plus the valuation effect induced by exchange rate fluctuations. By construction, the financial burden of a given type of debt mechanically combines its implicit interest rate (i.e., borrowing cost), its share in the total public debt (weight), and the size of the public debt (volume). As a consequence of the large reduction in foreign liabilities relative to GDP and the stability of external borrowing cost, the burden of external debt in LICs fell from nearly 2.2 percent of GDP in the late 1990s to 0.3 percent in recent years. LICs also experienced a mild drop in the burden of domestic debt from 1.7 percent of GDP to 1.3 percent, driven instead by a cheaper domestic borrowing cost.

On average, therefore, LICs currently face a heavier burden stemming to domestic liabilities compared to foreign liabilities. But the cross-country heterogeneity observed earlier with regard to reliance on domestic borrowing leads also to variations in the associated financial burden. For instance, in 2011 Malawi and Kenya afforded domestic interest payment around 3 percent of GDP, whereas Guinea-Bissau, Rwanda, and Togo paid less than 0.5 percent. More generally, we found a different pattern between HIPCs and non-HIPCs, with the former benefiting, since 2005, from a much larger reduction in the domestic interest bill than non-HIPCs. Given that the stock of domestic debt was not extremely different in the two groups (Figure 1), the lower cost of domestic debt in HIPCs may be a side effect of debt relief programs, which could have fostered local financial development and brought down borrowing costs. In addition, the HIPCs took advantage of external debt relief and, after 2000, the share of interest payments on external debt quickly converged to the low values of non-HIPCs

[11] Our choice of using the average debt stock as denominator is justified by the large share of short-term liabilities in the domestic debt that accrue interests the same year in which they are issued. Other studies use the current debt stock as denominator (Christensen, 2005) or the previous debt stock (Arnone and Presbitero, 2010).

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Figure 2: Cost of Domestic and External Borrowing

Source: our elaboration on the LIC domestic public debt dataset.

4.3. Instruments

The structure of domestic public debt in terms of type of instruments matters. According to Abbas and Christensen (2010), the development of local government debt markets helps supply a benchmark yield curve for private lending contracts as well as financial instruments that serve as saving assets and collateral vehicles. But these benefits are to be expected from government debt instrumented through securities, not from government debt issued in captive markets or liabilities associated with arrears and overdrafts.

For the *Debt Structure Sample* in 1996-2011, Figure 3 shows the composition of the domestic public debt portfolio in terms of major instruments defined by the GFSM (IMF, 2001), namely loans, securities, other accounts payable (e.g., Central Bank advances), insurance technical reserves, and currency and deposits (e.g., judiciary deposits). Securities and Central Bank advances to the Treasury are the main sources of domestic financing in LICs. On average, since the early 2000s securities constitute three-quarters of domestic debt whereas Central Bank advances are nearly one-fifth. The breakdown in HIPCs and non-HIPCs reveals a remarkable difference in the structure of government debt: the share of securities is much higher in non-HIPCs and, conversely, the share of Central Bank advances is larger in HIPCs (possibly because their markets are relatively less developed and the pressures of fiscal dominance and debt monetization are more acute). Interestingly, we find out an upsurge of Central Bank advances in response to the financial crisis in both groups.

The box-plot in Figure 3 and the Table A3 in Appendix show differences across individual countries. On average, Kenya, Ghana, and Tanzania issue securities exclusively, in contrast to Guinea-Bissau, Haiti, Guinea, and Burundi, in which securities are a small share of the domestic public debt.

Figure 3: Domestic Debt by Type of Instrument

Source: our elaboration on the LIC domestic public debt dataset.

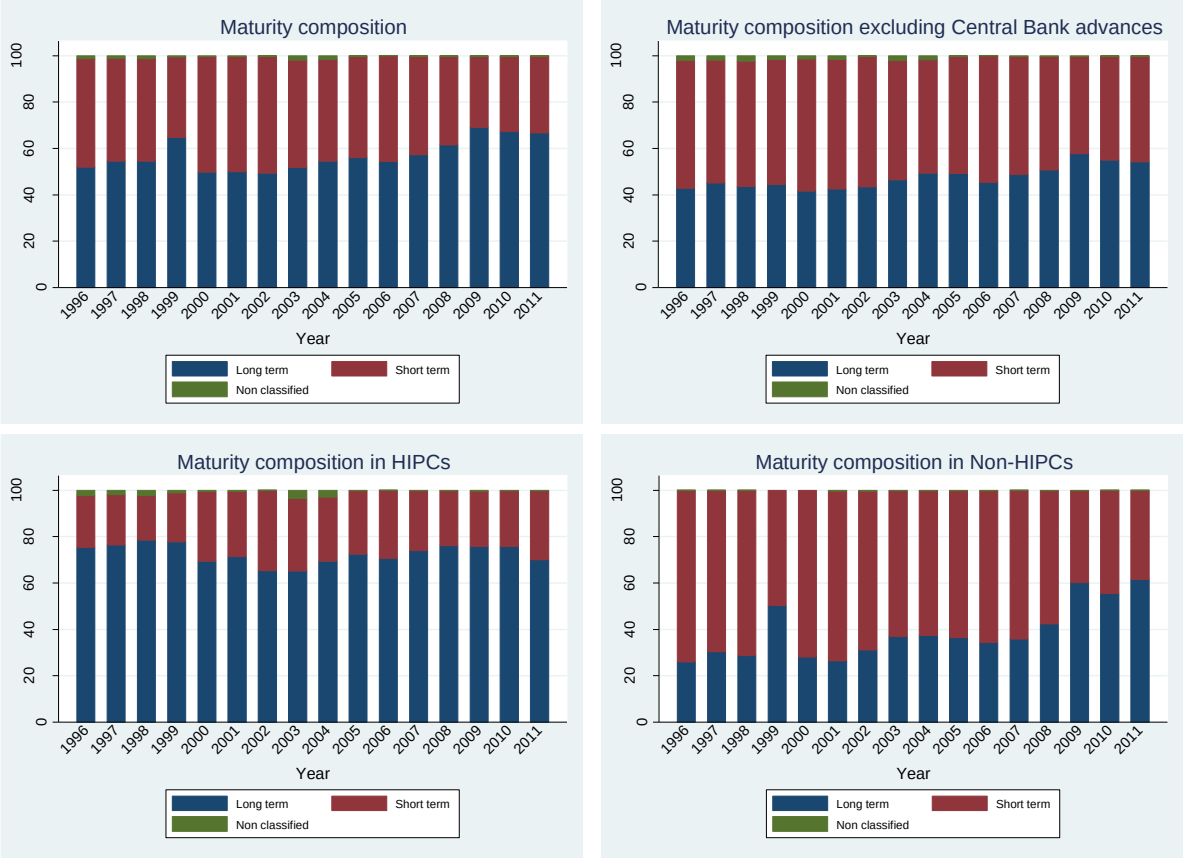
4.4. Maturity

A common presumption about the choice between domestic and external debt is that a government faces a tradeoff concerning maturity and currency mismatch: domestic debt is often denominated in local currency but of shorter maturity relative to external debt. In fact, many developing countries are unable (or unwilling) to issue long-term government securities in local financial markets at a reasonable interest rate (Panizza, 2008; Hausmann and Panizza, 2003; Mehl and Reynaud, 2005).

The relative share of long- and short-term domestic debt instruments could be explained by either demand or supply factors. The government may hesitate to issue long-term debt if the yields curve is sufficiently upward-sloped, so that borrowing costs increase with tenors. However, even if the government recognizes the benefit of extending the maturity profile, supply-driven factors may limit its ability to do so. In a volatile macroeconomic environment, the market might be not ready or willing to absorb long-term government debt in view of significant inflation and default risks (Christensen, 2005). Moreover, the banking system, which often dominates the government debt market in LICs, generally has a strong incentive for buying T-bills, given that these instruments provide a regular flow of earnings and have a privileged treatment (e.g., a zero credit risk) in the calculation of risk-based capital adequacy requirements (Diouf and Dufrense, 2012). An investor base lacking mutual funds, pension funds, and insurance companies, all institutions that typically have long-term investment horizons, hampers the possibility of extending the maturity of public debt. In this regard, it is a well-established principle that the maturity profile's length can be viewed as a measure of the degree of market development.

For the *Debt Structure Sample* in 1996-2011, Figure 4 displays the composition of the domestic public debt portfolio in terms of maturity. Long-term (short-term) debt has original maturity of more (less) than one year at the date of issuance. In the first panel, we treat Central Bank advances as long-term liabilities because in practice they are not callable and can be safely assumed to be rolled over on a continuous basis (even advances that are technically short-term instruments). In the second panel, we exclude Central Bank advances altogether from the series of domestic debt and re-calculate the maturity composition. On average, LICs have managed to lengthen their domestic public debt portfolio, with the share of long-term liabilities in the total domestic debt increasing from 52 percent to 67 percent in 1996-2011. The maturity lengthening persists even if Central Bank advances are excluded. Differentiating between HIPCs and non-HIPCs suggests that the overall increase in the share of long-term has been driven solely by the later. HIPCs, by contrast, had a relatively larger share but it has remained quite stable since the mid-1990s. Table A3 in Appendix shows similar figures for individual countries.

Figure 4: Domestic Debt by Maturity



Source: our elaboration on the LIC domestic public debt dataset.

4.5. Investor base

Investors in LIC government debt are few in nature and often also in number. Domestic public debt instruments are held primarily by commercial banks, the Central Bank, financial institutions in the non-banking system (e.g., mutual funds, pension funds, and insurance companies), and non-financial institutions (e.g., non-financial corporations and individual investors). The investor base in local financial markets is typically narrow and highly concentrated (Arnone and Presbitero, 2010).

Previous studies underlie the benefits of a diverse investor base in terms of lowering borrowing costs as well as reducing market yield volatility. Broadening the investor base attenuates the monopoly power of a particular group of financial institutions, bringing down interest rates and rollover risks (Christensen, 2005). Larger crowding out effects are to be expected when the investor base is strongly biased towards commercial banks. As indicated above, the banking system generally has a strong incentive for buying government debt and seeking profitability in lending to the public sector. This may lead to relatively weaker incentives to extend credit to riskier private borrowers and even lower efficiency in banking operations and financial intermediation (Hauner, 2006). Crowding out effects are especially harmful in LICs because small- and medium-sized private companies heavily rely on bank financing, with negligible (if any) opportunities in corporate bond and stock markets.

Other potential distortions in the incentives facing financial institutions that invest in government debt. First, banks are more likely to prefer a short-term portfolio allocation, thus raising rollover risk for the government. Second, domestic banks and institutional investors may be induced by moral suasion to absorb excessive public debt, which may amplify the deleterious effect of a debt crisis in case the government is following unsustainable policies (Panizza, 2008). Third, a large bank exposure

to government securities could undermine the solvency of financial institutions in times of economic distress, potentially leading to a systematic banking crisis (Diouf and Dufrense, 2012). Distortions also arise when it is the Central Bank that finances the government's short-term cash imbalances through overdraft facilities for managing daily transactions and cover unexpected shortfalls in revenue (Johnson, 2001). A higher independence of the Central Bank helps lowering the leverage of the government in borrowing though these facilities.

For the *Debt Structure Sample* in 1996-2011, Figure 5 shows the participation of investors holding the domestic public debt. On average, the banking system comprising commercial banks and the Central Bank holds nearly three-quarters of the domestic liabilities, with a quite stable participation. Within the banking system, the share of commercial banks has increased since the early 2000s. The breakdown into HIPCs and non-HIPCs reveals that the former rely much more on Central Bank lending (e.g., advances) whereas the later tap commercial banks and other market investors.

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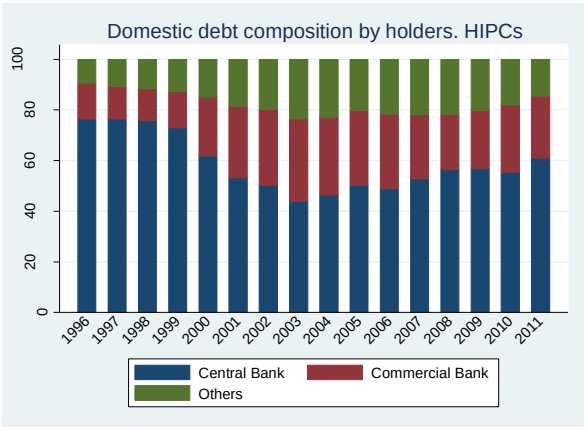
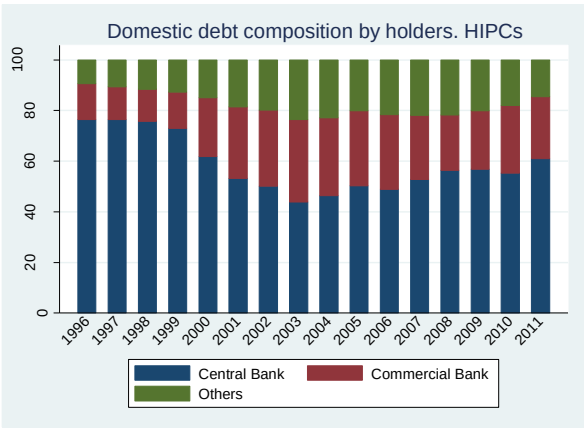
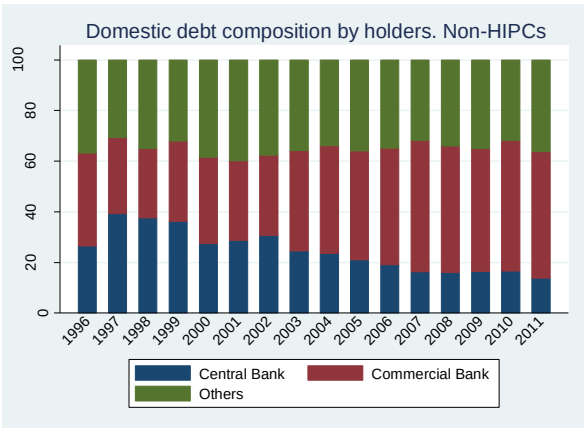
Figure 5: Domestic Debt by Holder







Source: our elaboration on the LIC domestic public debt dataset.

4.6. Relationships between cost of domestic debt, maturity, and investor base

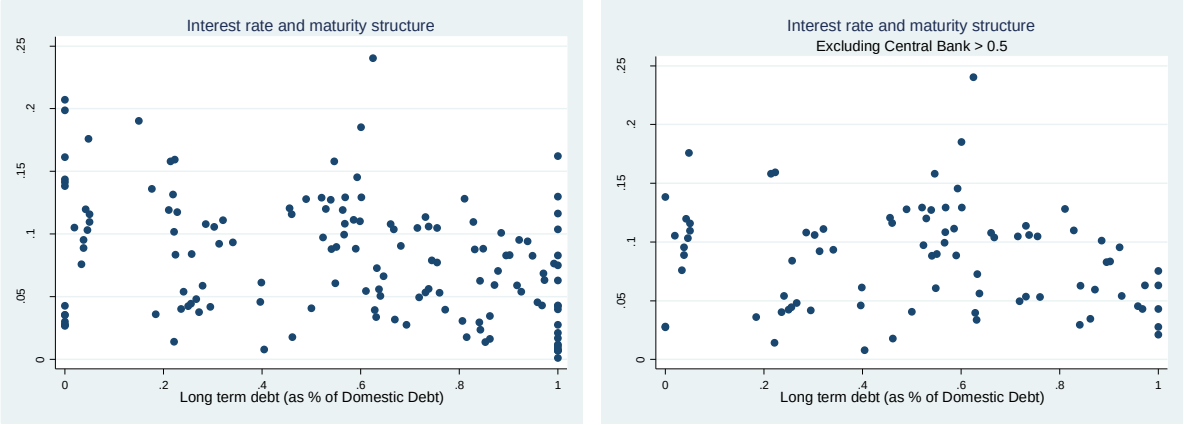
Using the *Debt Structure Short Sample*, which can be seen as a constellation of domestic public debt portfolios for 36 countries in recent years, the casual inspection of simple correlations provides preliminary evidence on the relationships between cost of domestic debt, maturity, and investor base.

Figure 6 (left panel) shows observed pairs of cost of domestic public debt (proxied with the implicit interest rate) and the share of long-term instruments. The simple correlation between the two variables is -0.31 and statistically significant, suggesting that debt portfolios of longer maturity face lower cost than debt portfolios of shorter maturity. This finding is at odds with the common perception that LICs are unable to issue long-term liabilities at a reasonable interest rate in domestic financial markets. Admittedly, the observations include countries (mostly HIPCs) where a large share of public domestic debt is held by the Central Bank, who often lends long and cheap. Excluding the observations where the Central Bank share exceeds 50 percent in the Figure 6 (right panel), the correlation goes to -0.15 (albeit not statistically significant) but it does not become positive, as that perception would imply.

The negative correlation between the cost and the maturity of domestic debt would imply that only countries where the average cost of debt is low can afford to issue long-term (costlier) debt. Given that a low nominal implicit interest rate may reflect a more efficient market or a lower inflation rate, the inverse relationship between cost and maturity is consistent with countries with more developed domestic financial markets and better macroeconomic policies being able to issue longer term instruments at a lower cost. This suggests that some LICs are reaping the benefits of developing domestic financial markets and improving macroeconomic management. In fact, measuring the degree of financial development by the savings-to-GDP ratio and the ratio of credit to the private sector over GDP, we find that the correlation between the implicit interest rate and the share of long-term domestic debt is negative and significant for countries where the development of financial markets is above the median, and not significantly different from zero in countries with a low level of financial development.[12]

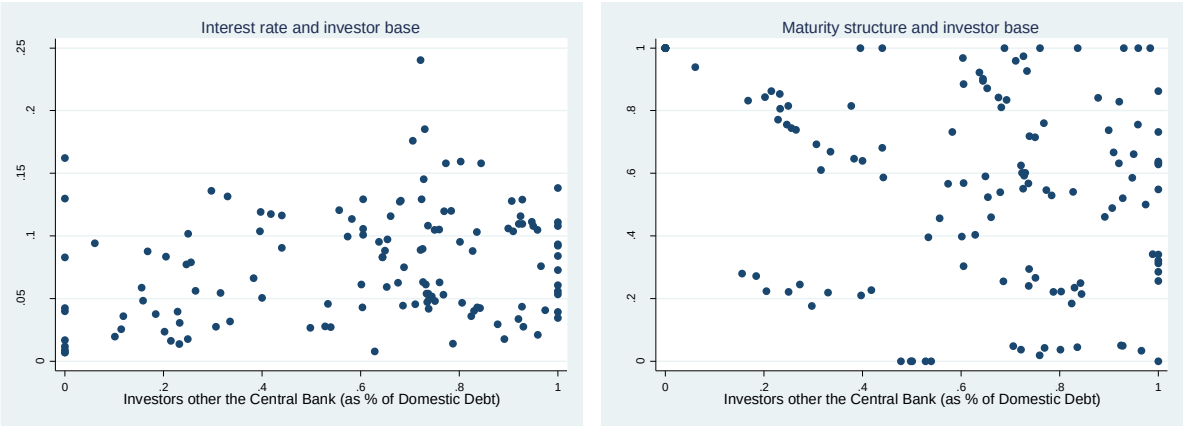
[12] Specifically, when using the savings-to-GDP ratio, the correlation between the implicit interest rate and the share of long-term debt is equal to -0.40 for countries in which the savings-to-GDP ratio is above the sample median and to -0.14 (non statistically significant) in countries where the ratio is below the media. The corresponding values when using the ratio of credit to the private sector over GDP are -0.36 (statistically significant) and 0.10 (non statistically significant).

Figure 6: Implicit interest rate and maturity



Source: our elaboration on the LIC domestic public debt dataset.
Note: Correlation is -0.31 in left panel (144 obs.) and -0.15 in right panel (85 obs.).

Figure 7: Implicit interest rate, maturity, and investor base



Source: our elaboration on the LIC domestic public debt dataset.
Note: Correlation is 0.25 in left panel (132 obs.) and -0.33 in right panel (133 obs.).

Figure 7 presents the relationship between the share of domestic public debt held by investors other than the Central Bank, the cost of domestic public debt (left panel) and the share of long-term instruments (right panel). A positive, statistically significant correlation (0.25) between the non-Central Bank holdings and the cost of debt is consistent with the view that LIC governments with larger reliance on commercial banks and other financial institutions as sources of local funding face higher financial costs on their domestic liabilities. On the other hand, a negative, statistically significant correlation (-0.33) between non-Central Bank holdings and the share of long-term instruments supports the view that those LIC governments also bear domestic liabilities of shorter maturity. This finding is consistent with a preference for short-term instruments by commercial banks, which in turn might lead to reflect supply-side limits to the issuance of long-term debt instruments (Diouf and Dufrense, 2012). Panizza (2008) highlights the associated rollover risk and macroeconomic vulnerability of such a short-term maturity profile.

Correlations identified in Figure 7 have the expected signs and are statistically significant. Yet LICs face quite heterogeneous financing terms even when they have similar shares of domestic public debt held by non-Central Bank investors. Figure 8 reports the distribution of proxy variables of financial cost and maturity of debt portfolios, distinguishing between three groups of portfolios: the groups 1, 2, and 3 correspond, respectively, to debt portfolios whose share held by non-Central Bank investors is up to one-third, between one- and two-thirds, and more than two-thirds. Mean values of financial

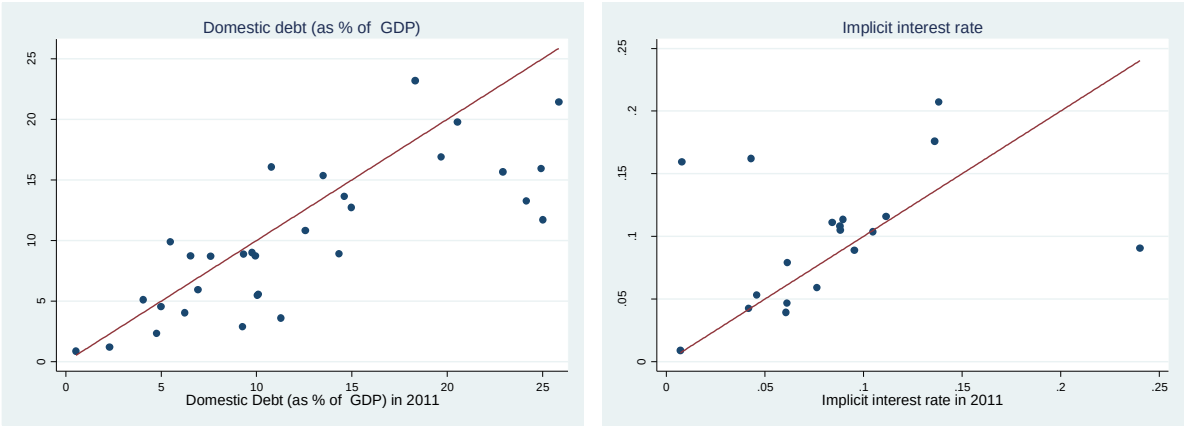
cost and maturity variables do vary across groups, but the overall distributions of these variables are quite disperse and tend to overlap between groups 2 and 3.

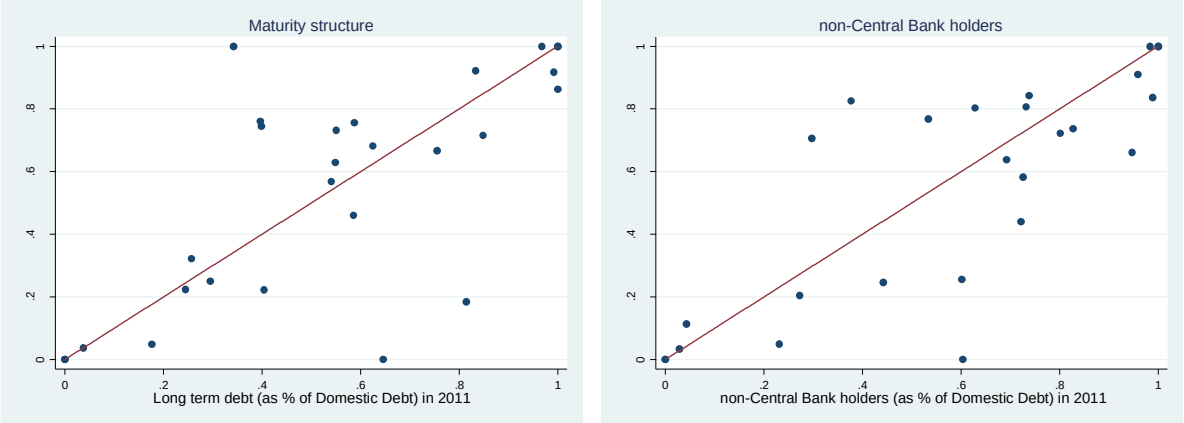
As a response to the global crisis in 2009, LICs were recommended to use their available fiscal space to implement countercyclical policy responses and support aggregate demand (IMF, 2010). Most LICs did not curtail spending despite of falling revenues, and those with much stronger pre-crisis macroeconomic policy buffers even accelerated the growth rate of real primary expenditures, including public investment. Budget deficits widened and LICs resorted to domestic and external financing to fill the gap. According to IMF (2010), more than half of the additional deficit was financed by domestic sources, including borrowing in local government debt markets, central bank financing, or drawing down government deposits. Figure 9 (upper panels) indicates that most LICs in our sample indeed increased their public debt relative to GDP between 2007 and 2011, and benefited from an implicit cost of domestic borrowing broadly unchanged. LICs whose share of domestic public debt held by non-Central Bank investors was up to one-half in 2007 tended to borrow more from them and so exhibit a higher share in 2011 (Figure 9, lower panels). In a sense, the anti-crisis response induced these LICs to rely more on previously untapped domestic sources of financing. On the other hand, LICs with the Central Bank holding relatively more government debt in 2007 did not have an homogeneous reaction, as some tended to borrow more from the monetary authority and others increased reliance on market investors.

Figure 8: Implicit interest rate, maturity, and investor base

Source: our elaboration on the LIC domestic public debt dataset.
Note: Groups 1, 2, and 3 correspond, respectively, to debt portfolios whose share held by non-Central Bank investors is up to one-third, between one- and two-thirds, and more than two-thirds.

Figure 9: Domestic Debt Level and Structure in 2007 and 2011.





Source: our elaboration on the LIC domestic public debt dataset.

5. Conclusions

Several low-income countries are now taking advantage of lower debt burdens, thanks to the debt relief programs of the late 1990s and early 2000s. Since then, they started relying on a growing basis on internal financing. The change in the composition of financing sources, related also to decreasing foreign aid and increasing foreign direct investment and remittances, could have several implications for debt sustainability and for the scaling-up of public investment and poverty-reduction expenditures. In theory, domestic debt could bring several benefits to LICs, but it could also crowd out private investment and thus hinder the growth process. However, the existing empirical evidence on the balance of costs and benefits of domestic borrowing in LICs is quite scant.

One of the main limitations that institutions and researchers face when dealing with the macroeconomic effects of government financing in LICs is poor data quality. In particular, data on domestic debt in LICs have been so far quite heterogeneous in terms of definitions and coverage. This paper introduces a new dataset on the stock and structure of domestic debt in 40 LICs over the period 1971-2011. With respect to the existing datasets, this one puts together information on domestic debt in a way that ensures comparability across countries (definition of domestic debt, level of public sector, liabilities included) and it recollects up-to-date information on domestic debt composition (instruments, maturity structure and investor base). In particular, we have been able to build two balanced panels covering the period 1996-2011: one with data on domestic debt stock series for 21 countries, and the other including data also on domestic debt structure for 15 countries. In this way, we have been able to analyze the evolution of internal financing in poor countries in the last fifteen years with a certain granularity, as not has been done so far.

The descriptive analysis of the stock and structure of domestic public debt in LICs highlights some interesting patterns and identifies marked differences in the evolution and composition of government liabilities across countries, especially between HIPCs and non-HIPCs. First, domestic debt increased from 12.3 percent of GDP in 1996 to 16.2 percent of GDP in 2011, almost reaching the size of external debt. However, we do not find evidence that LICs uniformly substituted domestic debt for external debt. Second, the debt burden on domestic debt is higher that on external debt but it has decreased over time, consistently with lower borrowing costs due to financial deepening. Third, we find that LICs have been able to increase the share of long-term instruments over time. Maturity lengthening went together with a reduction in borrowing costs. This correlation is at odds with the common perception that LICs are unable to issue long-term liabilities at a reasonable interest rate, and it suggests that some LICs are reaping the benefits of developing domestic financial markets. Fourth, there is evidence of an increase in the share of securities in government debt, especially for non-HIPCs. However, Central Bank advances, still important for many HIPCs, increased in response to the global financial crisis. Finally, a source of concern is the concentrated investor base, mainly dominated by commercial banks and the Central Bank, which may crowd out lending to the private sector and undermine financial stability.

Our preliminary descriptive analysis provides some useful insights on the macroeconomic effects of domestic borrowing in LICs. However, we believe that further research is required and our data set could provide a useful source to better inspect the tradeoffs that governments in poor countries have to face when choosing how to finance public spending. One natural way to exploit this data set is to see how the size of domestic debt is correlated with the characteristic of the economy (e.g., financial development, institutional framework, access to international capital markets) and how the increase in domestic debt affects public debt sustainability in LICs. Ongoing research work at the World Bank addresses these issues. Second, we think that a relevant issue to explore is the extent to which increasing domestic debt affects bank lending to the private sector and possible crowds out investment. At the aggregate level, better data could help to identify the correlations between capital flows to developing countries, pointing out possible sources of vulnerability.

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Appendix

Table A1: Databases on LIC public debt.

Database	Country coverage	Domestic debt definition	Public-sector definition	Liabilities included	Observations
Christensen (2005)	27 non CFA Sub-Saharan African countries (of which 15 LICs) over 1980-2000.	Not defined.	Central Government.	Domestic debt is defined as gross securitized government debt composed of treasury bills, development stocks, and bonds. It excludes arrears, advances from the central bank, and commercial bank loans.	The dataset has limited country coverage. It contains information on domestic debt structure for 15 LICs up to 2000.
Arnone and Presbitero (2010)	79 developing countries (of which 17 LICs) over 1994-2003.	Domestic debt is defined as debt owed to creditor resident in the same country.	Central Government.	Domestic debt is defined as gross securitized government debt, including treasury bills, bonds, notes, and government stocks. It excludes arrears, advances from the central bank, commercial banks loans, debentures, and government guaranteed debt.	The dataset contains information on domestic debt structure for 17 LICs up to 2003.
Abbas and Christensen (2010)	93 LICs and emerging markets over 1970-2007.	Domestic debt is defined as domestic currency debt owed to domestic citizens.	Central Government.	Domestic debt is defined as commercial bank's gross claims on the Central Government plus central bank liquidity paper.	The dataset excludes government debt held by retail investors and non-banking institutions.
Abbas et al. (2010)	174 countries in 1791-2009. For LICS the data coverage starts in 1970.	Different definitions.	General Government (or Central Government if no data on General Government are available).	It provides data on total public debt (external plus domestic). Public debt data are collected from different sources and liabilities included in the definition might differ across countries.	Definitions of public debt differ across countries. The paper does not disaggregate public debt into external and domestic.
Panizza (2008)	130 countries over 1990-2007.	Domestic debt is defined as debt issued under the jurisdiction of a local court.	Central Government (or General Government if no data on Central Government are available).	It provides data on total public debt (external and domestic). Public debt data are collected from different sources and liabilities included in the definition might differ across countries.	Public sector definition and liabilities differ across countries.
Presbitero (2012b)	44 LICs over 1970-2010 (data are available for 41 LICs).	Different definitions.	Central Government (or General Government if no data on Central Government are available).	It provides data on domestic public debt, collected from different sources and liabilities included in the definition might differ across countries.	This is an extension and an update of the Panizza (2008) data set.

Table A2. LIC Domestic Public Debt Dataset

Country name	Income Group	Region (i)	Lending category	Debt Relief	Domestic debt stock (ii) (iii) (iv)	Instruments	Maturity	Investor base	Main data source	Debt Stock Sample	Debt Structure Sample	Debt Structure Short Sample
Burundi	LIC	AFR	IDA	HIPC	1971-2011	1975-2011	1975-2012	1975-2013	Website	x	x	x
Benin	LIC	AFR	IDA	HIPC	2000-2012	2000-2012	2007-2012	n/a	IMF			x
Burkina Faso	LIC	AFR	IDA	HIPC	2003-2011	2003-2011	2003-2011	2003-2011	PRMED			x
Bangladesh	LIC	SA	IDA		1998-2011	1998-2011	1998-2011	1998-2011	IMF			x
CAR	LIC	AFR	IDA	HIPC	2002-2011	2002-2011	2002-2011	2002-2011	IFS (v)			x
Comoros	LIC	AFR	IDA	HIPC	1982-2011	n/a	n/a	n/a	IFS (vi)	x		x
Eritrea	LIC	AFR	IDA	HIPC	1995-2008	1995-2010	1995-2010	1995-2010	IFS (vii)	x		x
Ethiopia	LIC	AFR	IDA	HIPC	1988-2010	1988-2010	1988-2010	1988-2010	PRMED	x	x	x
Ghana	LMIC	AFR	IDA	HIPC	1981-2011	1982-2011	1981-2011	1996-2011	Website	x	x	x
Guinea	LIC	AFR	IDA	HIPC	1995-2011	1995-2011	1995-2011	1995-2011	IMF	x	x	x
The Gambia	LIC	AFR	IDA	HIPC	2005-2010	2005-2010	2005-2010	2005-2010	Website			x
Guinea Bissau	LIC	AFR	IDA	HIPC	1995-2011	1995-2011	1995-2011	1995-2011	IMF	x	x	x
Haiti	LIC	LAC	IDA	HIPC	1996-2010	1996-2010	1996-2010	1996-2010	PRMED	x	x	x
Kenya	LIC	AFR	IDA		1977-2011	1977-2010	1982-2010	1977-2010	Website	x	x	x
Kyrgyz	LIC	ECA	IDA		1996-2011	1996-2011	1996-2011	1996-2011	IMF	x	x	x
Cambodia	LIC	EAP	IDA		1993-2011	n/a	n/a	1993-2011	IFS	x		x
Lao PDR	LMIC	EAP	IDA		2006-2011	n/a	n/a	n/a	IMF			
Liberia	LIC	AFR	IDA	HIPC	2003-2011	2006-2011	2006-2011	2006-2011	PRMED			
Madagascar	LIC	AFR	IDA	HIPC	1998-2011	1998-2011	1998-2011	1998-2011	IMF			x
Mali	LIC	AFR	IDA	HIPC	2008-2011	2000-2011	2000-2011	2000-2011	IMF			x
Myanmar	LIC	EAP	IDA		1989-2011	n/a	n/a	1989-2011	IFS	x		x
Mozambique	LIC	AFR	IDA	HIPC	1999-2011	1999-2011	1999-2011	1999-2011	PRMED			x
Mauritania	LIC	AFR	IDA	HIPC	2005-2011	2005-2011	2005-2011	2005-2011	PRMED			x
Malawi	LIC	AFR	IDA	HIPC	1980-2011	1980-2011	1980-2011	2002-2011	PRMED	x	x	x
Niger	LIC	AFR	IDA	HIPC	1998-2010	n/a	1998-2010	n/a	PRMED			x
Nepal	LIC	SA	IDA		1986-2011	1986-2011	1986-2011	1986-2011	Website	x	x	x
Rwanda	LIC	AFR	IDA	HIPC	1981-2011	1981-2011	1981-2011	1981-2011	Website	x	x	x
Senegal	LMIC	AFR	IDA	HIPC	2002-2011	2002-2011	2002-2011	2002-2011	IMF			x
Solomon Islands	LMIC	EAP	IDA		1980-2011	1988-2011	1988-2011	1988-2011	Website	x	x	x
Sierra Leone	LIC	AFR	IDA	HIPC	1978-2011	1978-2011	1978-2011	1978-2011	Website	x	x	x
Chad	LIC	AFR	IDA	HIPC	2005-2011	2005-2011	2005-2011	2005-2011	IMF			x
Togo	LIC	AFR	IDA	HIPC	1975-2011	n/a	n/a	1975-2011	IFS	x		x
Tajikistan	LIC	ECA	IDA		2001-2011	2001-2011	2001-2011	2001-2011	IMF			x
Tanzania	LIC	AFR	IDA	HIPC	1979-2011	1981-2011	1979-2011	2000-2011	PRMED	x	x	x
Uganda	LIC	AFR	IDA	HIPC	1978-2011	2002-2011	1978-2011	1978-2010	IMF	x		x
Vietnam	LMIC	EAP	Blend		2000-2011	2000-2011	2000-2011	2000-2011	IMF			x
Yemen	LMIC	MNA	IDA		1996-2011	1996-2011	1996-2011	1996-2011	IMF	x	x	x
Congo, Dem.	LIC	AFR	IDA	HIPC	2006-2011	n/a	n/a	n/a	IMF			
Zambia	LMIC	AFR	IDA	HIPC	1999-2011	2002-2011	2002-2011	2002-2011	PRMED			x
Zimbabwe	LIC	AFR	Blend		1981-2004	1981-2004	1981-2004	n/a	Web-IMF			

(i) Africa Region (AFR), East Asia & Pacific Region (EAP), Europe & Central Africa Region (ECA), Latin America & Caribbean (LAC), Middle East and North Africa Region (MNA), South Asia (SA).
(ii) Domestic debt corresponds to Central Government, with the exception of Lao PDR (General Government), Niger (Public Sector), and Congo DCR (General Government).
(iii) Domestic debt includes all financial liabilities defined by the GFSM (IMF, 2001), with the exception of Benin, Kenya, Kyrgyz, and Mauritania, whose definition includes only securities. For Benin and Mauritania, there are no data available for other liabilities. For Kenya and Kyrgyz, other liabilities are negligible and not reported.
(iv) Domestic debt is defined on a residency basis, with exception of Kenya, Nepal, Rwanda, Solomon Islands, and Yemen, where the currency basis is used because of their debt recording practices and data constrains.
(v) Banking system is the only holder of domestic debt.
(vi) There is no domestic market. Central Bank is the only holder of domestic debt.
(vii) Banking system is the only holder of domestic debt.

Table A3. LIC Domestic Public Debt Dataset – Debt Stock Sample and Debt Structure Sample

Country name	Debt Relief	Public Debt in 2011 (% of GDP)	Domestic Public Debt in 2011 (% of GDP)	External Public Debt in 2011 (% of GDP)	Variation in Public Debt/GDP in 1996-2011 (p.p.)	Variation in Domestic Public Debt/GDP in 1996-2011 (p.p.)	Variation in External Public Debt/GDP in 1996-2011 (p.p.)	Pairwise correlation between External Debt/GDP and Domestic Debt/GDP in 1996-2011	Securities (% of Domestic Debt) (i)	Loans (% of Domestic Debt) (i)	Other accounts payable (% of Domestic Debt) (i)	Other liabilities (% of Domestic Debt) (i)	Long-term debt (% of Domestic Debt) (i)	Short-term debt (% of Domestic Debt) (i)	Non-classified (% of Domestic Debt) (i)	Long-term debt (% of Domestic Debt excluding Central Bank advances) (i)	Short-term debt (% of Domestic Debt excluding Central Bank advances) (i)	Non-classified (% of Domestic Debt excluding Central Bank advances) (i)
Burundi	HIPC	46.7	19.7	27.0	-91.1	9.3	-100.3	-0.3972	26	0	61	13	67	20	13	8	57	35
Comoros	HIPC	51.2	6.2	44.9	-46.2	1.7	-47.9	-0.5552*										
Eritrea	HIPC	135.3	95.6	39.7	87.7	54.3	33.4	0.7503*										
Ethiopia	HIPC	32.2	14.2	18.1	-103.3	-10.0	-93.3	0.1783	51	0	49	0	82	18	0	62	38	0
Ghana	HIPC	45.5	24.2	21.4	-36.7	8.9	-45.6	0.0523	99	0	1	0	59	41	0	59	41	0
Guinea	HIPC	66.8	10.8	56.0	-15.0	7.9	-22.9	-0.4974*	23	0	77	0	77	23	0	0	100	0
Guinea Bissau	HIPC	44.1	18.3	25.7	-276.2	12.2	-288.3	-0.7893*	0	96	4	0	100	0	0	100	0	0
Haiti	HIPC	24.5	14.3	10.2	-14.0	1.3	-15.3	0.0761	0	0	100	0	100	0	0	0	0	0
Kenya		50.2	25.9	24.4	-6.9	12.1	-19.1	-0.5018*	100	0	0	0	54	46	0	54	46	0
Kyrgyz		53.6	4.1	49.5	16.6	-0.9	17.5	0.2531	100	0	0	0	73	27	0	73	27	0
Cambodia		31.2	0.5	30.6	-35.2	-1.8	-33.4	0.9728*										
Myanmar		25.0	24.9	0.0	0.8	1.9	-1.1	0.2583										
Malawi	HIPC	43.3	22.9	20.4	-61.7	13.2	-74.8	-0.3846	89	3	8	0	21	76	3	14	83	3
Nepal		35.5	14.6	20.9	-31.8	-0.2	-31.5	0.4884	95	5	0	0	41	59	0	41	59	0
Rwanda	HIPC	24.9	7.6	17.3	-64.6	-8.8	-55.8	0.6800*	58	0	2	40	69	22	9	69	22	9
Solomon Islands		23.7	5.5	18.2	-11.4	-11.8	0.4	0.5497*	52	19	0	29	78	19	3	78	19	3
Sierra Leone	HIPC	61.4	15.0	46.5	-60.5	10.2	-70.7	0.0945	90	0	9	1	36	64	0	30	70	0
Togo	HIPC	27.5	10.0	17.5	-72.7	3.3	-76.0	-0.8138*										
Tanzania	HIPC	39.5	9.9	29.6	-71.7	-8.7	-63.1	0.6393*	99	1	0	0	77	23	0	77	23	0
Uganda	HIPC	28.9	9.8	19.1	-32.7	8.2	-41.0	0.7211*										
Yemen		43.7	25.0	18.6	-30.2	23.5	-53.7	-0.5160*	88	0	12	0	18	82	0	10	90	0

(i) Average share in 1996-2011.

Chapter 2

Domestic public debt in Low-Income Countries: an empirical analysis.

Giovanna Bua
Università degli Studi di Milano

Abstract

In this paper we investigate the rationale for the increase in domestic debt using a newly developed database covering 21 Low Income Countries (LICs) over the period 1996-2011. To the best of our knowledge, this is the first paper that studies the determinants of public debt composition in LICs and the size of domestic debt in the economy. The results suggest that domestic debt development in LICs is at an early stage and financial needs are still probably satisfied mainly through external financing. The fiscal space granted by debt relief seems to have naturally favored the substitution of public debt portfolio toward domestic debt but it probably did not suffice on its own to foster domestic debt development. We also find that internal financing is positively correlated with the share of liquidity in the economy and with hyperinflation episodes and it is negatively correlated with trade openness and moderate inflation. Contrary to expectations we do not find evidence that financial development and quality of policy and institutions are positively correlated with domestic debt. The fragility of some results highlights that reasons for the increase of domestic debt in LICs are not as clear as in Emerging Markets (EMs).

JEL Codes: E62, H63, F34

Keywords: Public Debt; Domestic Debt; Low Income Countries; External Debt.

1.Introduction

Notwithstanding the higher cost of domestic debt in Low-income countries (LICs), the literature does not provide an unambiguous prescription on its benefits and costs and yet on the rationale for its increase. Until recently most of the studies focused mainly on external borrowing, leaving domestic debt unexplored. This scarcity was partially due to the lack of centralized data and the long reliance of LICs on foreign assistance to meet their financial needs. In this paper we intend to investigate the rationale for the increase of internal financing in LICs using a newly developed dataset.

Attention on the determinants of domestic debt in LICs has surged only in the recent years and has been motivated mainly by the potential opportunities generated by debt relief in many Heavy Indebted Poor Countries (HIPCs)[1] and by the limited availability of external borrowing from Advanced Economies (AEs) after the financial crisis. Most analyses have focused on demand-side factors, suggesting that financial constrains in traditional lending economies or policy conditionality restricting non-concessional foreign borrowing imposed by International Financial Institutions (IFIs), have reduced the opportunities for external financing and forced LICs governments to tap local public debt markets (IMF and World Bank, 2001; UNCTAD, 2004; Borensztein, Levy-Yeyati, and Panizza, 2006; Arnone and Presbitero, 2010). A notable exception is the recent study by Mu et al. (2013), which focuses on supply-side factors and stresses the importance of the quality of institutions and capital openness for the capitalization of African government security market. Finally, an alternative rationale for increasing domestic borrowing in LICs has been suggested by the literature on public debt management in Emerging Markets (EMs). Several authors have investigated the determinants of public debt composition and have identified important pros and cons of shifting from external to domestic borrowing[2]. These studies may suggest that the increase in internal financing in LICs could have also resulted from the analysis of advantages and disadvantages, where the former outweigh the latter.

The major challenges in estimating the determinants of domestic debt in LICs are the lack of data on public domestic debt in LICs, the endogeneity of most of the covariates and, the high persistence of the dependent variable. As for the first point, data on LICs government debt are scant and they are quite heterogeneous in terms of the criteria to distinguish domestic and external debt, the definition of public sector and the type of government liabilities covered. (Bua et al., 2014). This has prevented scholars to extend the analysis carried out for EMs also to LICs. Dataset that focus only on specific type of government liabilities, for example, may limit the analysis to a sub-set of domestic debt that bears specific characteristics, conducting to misleading results[3]. As for the second and third point, different econometric methodologies suffer from different limitations and none of them allows to address the two problems entirely.

To overcome these limitations, in this paper we analyze the determinants of domestic debt using a newly developed database and presenting the results for two different estimators: country fixed effect (FE) and General Method of Moment (GMM). The dataset, which has been recently developed by the author (Bua et al., 2014) and covers 21 LICs over the period 1996-2011, helps address the problem of the lack of data and their heterogeneity. The definition of domestic debt in the dataset is, in fact, homogenous across countries and it refers to all financial liabilities (i.e. marketable and non-marketable) included in the Government Finance Statistics Manual (GFSM) owed by the Central

[1] The HIPC Initiative is a coordinated action by multilateral organizations and governments to reduce to sustainable levels the external debt burdens of the most heavily indebted poor countries. In 2005, the HIPC Initiative was supplemented by the Multilateral Debt Relief Initiative (MDRI) which provides full debt relief to free up additional resources to help these countries reach the Millennium Development Goals (IMF, 2013a).

[2] Eichengreen and Hausmann (1999), IMF and World Bank (2001), Eichengreen, Hausmann and Panizza (2003), Hausmann and Panizza (2003), Eichengreen and Luengnaruemitchai (2004), Kumhof and Tanner (2005), Calvo (2005), Jeanne (2003), Mehl and Reynaud (2005), Burger and Warnock (2006), Claessens et al. (2007), Guscina (2008), Bae (2012).

[3] As shown by Abbas and Christensen (2010) securitized debt usually has positive interest rate and it tends to be growth friendly, while non-securitized debt does not present these characteristics.

Government to domestic creditors. The use of this dataset guarantees comparability across countries and allows to analyze the entire spectrum of internal financing. The choice to present the results using two different estimators is motivated by the literature in EMs, in which scholars have attempted to show results of different estimators emphasizing those consistent across techniques[4]. Fixed effect estimator overcomes the problem of omitted time-invariant country characteristics in a panel data. Generalized Method of Moment addresses the inconsistency introduced by the fixed effect in a dynamic model. As compared with other possible candidates which have been proposed to fixed the endogeneity problem, such as Anderson and Hsiao (1982) and Arellano and Bond (1991), GMM should perform better in relative short sample and in the presence of highly persistent dependent variable.

Our dependent variables are the share of domestic debt in total public debt and domestic debt as a share of GDP. The two variables enable us to capture two different dimensions of internal borrowing. The first one allows to investigate the composition of public debt, while the second one captures the depth of the domestic market.

The key results of the paper suggest that domestic debt development in LICs is at an early stage and financial needs are still probably satisfied mainly through external financing. The fiscal space granted by debt relief seems to have naturally favored the substitution of public debt portfolios toward domestic debt but it probably did not suffice on its own to foster domestic debt development. Also we find that internal financing is negatively correlated with trade openness and moderate inflation and it is positively correlated with the share of liquidity in the economy and with hyperinflation episodes. Contrary to expectation, we do not find evidence that financial development and quality of policy and institutions are correlated with domestic debt.

These results confirm previous finding which suggest that in presence of monetary stability countries tend to switch toward domestic debt (Hausman and Panizza, 2003; Burger and Warnock, 2003; Claessens et al, 2007; Mehl and Reynaud, 2005; Guscina, 2008), while countries more outward oriented issue more debt externally (Adelegan et al. 2009; Mu et al. , 2013). We interpret the significant correlation between domestic debt, liquidity in circulation and hyperinflation as a warning signal of the tendency of governments to inflate the debt away. As recently suggested by Reinhart and Rogoff (2011) in fact, domestic debt and the gain of the government from inflating down its real value may explain why governments seem to print money above the seignorage-maximizing rate.
The lack of significance of financial development is in line with the results of Mu et al. (2013) and Abbas and Christensen (2010) who find either a negative or a lack of correlation between the two variables. One possible interpretation of these results is that domestic debt in LICs is still mainly dominated by central banks - which hold primarily non-marketable instruments- and by commercial banks - which may be induced by moral suasion to absorb excessive public debt -Panizza (2008). Being this true, financial development would not play an important role in spurring domestic debt. Finally, the absence of a positive relation between domestic debt and the quality of policies and institutions confirms the results of Hausmann and Panizza (2003) and Mehl and Reynaud (2005) who both downplay the role of institutional factors in determining domestic debt in EMs.

The rest of the paper is organized as follows. Section 2 reviews the existing literature. Section 3 presents some descriptive statistics on the evolution and structure of domestic debt in LICs. Section 4 describes the data and the empirical strategy. Section 5 shows the estimation results. Section 6 discusses the robustness checks and alternative specifications. Section 7 concludes.

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[4] In their studies on original sin determinants Hausmann and Panizza (2003) and Mehl and Reynaud (2005) use a censored Tobit model. Guscina (2008) uses country fixed effect, difference-in-difference, OLS and censored Tobit model. Focusing on the size of government bond in the economy, Claessens et al. (2007) and Eichengreen and Luengnaruemitchai (2004) estimate the regressions using panel Generalized Least Squares. More recently, Mu et al. (2013) extend the baseline econometric model of Eichengreen and Luengnaruemitchai to two-phase estimation under fixed effects and introduce a generalized method of moments to account for possible endogeneity. They also present the results for pooled ordinary least squares (POLS), random effects (RE), and fixed effects (FE) models.

2. Literature review

The existing literature on domestic debt in LICs is scant. Most of the studies on debt management focused mainly on external borrowing, leaving domestic debt unexplored. This scarcity is partially due to the lack of data and the long reliance of LICs on external concessional borrowing.

Despite the recent financial crisis and the debt relief initiative have brought LICs financial development to the fore of the current debate , most of the research has so far focused on the banking sector and the stock market and only little attention has been dedicated to public and private bond markets (Detragiache et al., 2005; McDonald and Schumacher, 2007; Yartey and Adjasi, 2007; Andrianaivo and Yartey, 2009; Anayiotos and Toroyan, 2009; Kablan, 2010; and Beck et al., 2011). Even less attention has been devoted to public domestic debt as a whole, due to the lack of data including marketable and non-makeable liabilities[5].

In retrospective, one can distinguish two branches of studies on the determinants of domestic public debt: one focussing on supply side factors and the other one on demand-side constrains.

The first branch of the literature investigates government's preferred debt portfolio composition and the cost-risk profile of financial instruments available; it identifies important pros and cons of shifting from external to domestic borrowing. To the extent that internal financing is denominated in local currency, domestic debt reduces the exposure of the debt portfolio to unanticipated movements in the exchange rate (Hausmann, Panizza, and Rigobon, 2006; Bacchiocchi and Missale, 2012) and ensures a higher degree of freedom to use the exchange rate as a stabilization mechanism against external shocks, i.e. it lowers fiscal dominance on the exchange rate policy (IMF and World Bank, 2001; Kumhof and Tanner, 2005). Also, to the extent that domestic debt is owed to resident creditors, it reduces exposure to capital flow reversals (Calvo, 2005). Domestic borrowing can improve the efficiency of the allocation of national savings if mobilized resources are used to fund public investment instead of capital flights or inefficient self-investment by savers (Abbas and Christensen, 2010). The development of the institutional infrastructure for the issuance of domestic public debt often supports the organization and functioning of local financial markets (Arnone and Presbitero, 2010). Other than the advantages of domestic borrowing, the literature explores its disadvantages. Given that many developing countries are unable to issue long-term government securities at a reasonable interest rate, the resulting maturity mismatch can be worse than the currency mismatch associated with foreign debt (Panizza, 2008). Macroeconomic distortions and instability can be induced by an excessive domestic borrowing, including crowding out effects (Hanson, 2007; Panizza, 2008; Abbas and Christensen, 2010; and Arnone and Presbitero, 2010; Mbate, 2013), hyper-inflation episodes and external debt crises (Reinhart and Rogoff, 2011). Distortions in the financial system can also be important, particularly the potentially perverse incentives facing financial institutions that invest in government debt. For instance, banks investing in public debt are more profitable but less efficient, and they are more likely to prefer a short term portfolio allocation and, thus, to build additional vulnerabilities; domestic banks and institutional investors may be induced by moral suasion to absorb excessive public debt (Hauner, 2006; Hanson, 2007; Panizza, 2008; and Arnone and Presbitero, 2010). Narrow investor base and lack of instruments may undermine the ability of domestic debt to supply sufficient long term financing for growth-enhancing investment projects. Domestic debt levels exceeding a certain threshold may pose the risk of triggering domestic debt distress and undermining a country's fiscal and debt sustainability position (Mbate, 2013).

A notable exception in the literature on supply- side factors is the recent study by Mu et al. (2013). They depart from public debt composition and cost-benefit considerations and focus on the determinants of government security market. They look at 36 African countries and show that

[5] The few available studies on LIC government debt (Christensen, 2005; Arnone and Presbitero, 2010; Abbas and Christensen, 2010; Abbas et al., 2010; Panizza, 2008; and Presbitero, 2012) gathered data from multiple sources and are therefore quite heterogeneous in terms of the criteria to distinguish domestic and external debt, the definition of public sector, the type of government liabilities covered, and the treatment of certain financial arrangements (Bua et al., 2014).

government security market capitalization is related to better institutions, interest rate volatility, current and capital account openness.

The second branch of the literature – focusing on demand side factors- has surged in the recent years and has been motivated by the reduced opportunity for LICs to access external borrowing. They maintain that financial constrains in traditional lending economies or policy conditionality restricting non-concessional foreign borrowing imposed by IFIs, have reduced the opportunities for external financing and forced LIC governments to tap local public debt markets (IMF and World Bank, 2001; UNCTAD, 2004; Borensztein, Levy-Yeyati, and Panizza, 2006; Arnone and Presbitero, 2010). Finally, other studies depart from the hypothesis that LIC governments use domestic public debt solely for fiscal deficit financing and argue that internal borrowing helps sterilize foreign exchange inflows from foreign aid or natural resource-based exports (Christensen, 2005; Aiyar, Berg, and Hussain, 2005).

3. Evolution of Domestic Public Debt

In this section we present some stylized facts about the evolution and structure of domestic debt in LICs. The analysis is based on a dataset recently developed by the author covering 21 LICs over the period 1996-2011[6].

In the dataset, domestic debt is defined on the residency basis[7] and it includes all domestic financial liabilities listed in the General Financial Statistics Manual (IMF, 2001) - with the exception of arrears -owed to the Central Government. The dataset contains also information on the structure of domestic public debt allowing for a better understanding of possible risks stemming from it.

As shown in Figure 1 in the Appendix, during the period 1996-2011 the share of domestic debt in public debt portfolio almost tripled, reaching 40 percent of the total public debt. The share of internal debt in the economy increased from 12.3 percent of GDP to 16.2 percent and external debt lowered from 72 percent of GDP to 23 percent, rebalancing public debt portfolio toward domestic debt. Countries that benefitted from HIPCs debt relief Initiative (in the graph, HIPCs) and those that did not (non-HIPCs) both managed to reduce the burden of foreign liabilities; however since the early 2000, HIPCs have started increasing external debt again, while non-HIPCs kept increasing internal financing vis-à-vis external financing.

Despite the smaller share of domestic debt in public debt composition, LICs face a heavier burden stemming from domestic liabilities compared to foreign liabilities. As shown in Figure 2, over the period 1996-2011 the cost of external debt -even including the capital loss due to exchange rate depreciation- has never exceed 4 percent per year, while the nominal cost of domestic borrowing swung from 18 percent per year in 1996 to 8 percent in 2011. As a consequence of the lower borrowing cost of external debt and the reduction of foreign liabilities relative to GDP, the financial burden of external debt dropped below the interest payments on domestic debt. As noted in Bua et al. (2014) even if the nominal cost of internal financing is higher than the one on external debt, since 2003 its real cost is negative, probably encouraging borrowing from local sources.

As for the structure of internal financing, data show that the structure of domestic debt is mainly characterized by short-term financing, securities and dominance of the banking system. The breakdown into HIPCs and non-HIPCs highlights significant differences between the two groups, with HIPCs relying more on Central Bank advances and non-HIPCs making progress in issuing securities and lengthening maturities.

Figure 3 shows, that the main sources of domestic financing in LICs are securities and advances from the Central Bank. On average, since the early 2000s, securities constitute three-quarters of domestic debt whereas Central Bank advances are nearly one-fifth. The breakdown in HIPCs and non-HIPCs reveals that the share of securities is much higher in non-HIPCs and, conversely, the share of Central Bank advances is larger in HIPCs.

As for the maturity structure, Figure 4 highlights that LICs have lengthened their domestic public debt portfolio, with the share of long-term liabilities in the total domestic debt increasing from 52 percent to 67 percent in 1996-2011. Differentiating between HIPCs and non-HIPCs suggests that the overall increase in the share of long-term debt has been driven solely by the latter.

Finally, as shown in Figure 4, the investor base is dominated by the banking system, which holds nearly three-quarters of the domestic liabilities. Within the banking system, the share of commercial banks has increased since the early 2000s. The breakdown into HIPCs and non-HIPCs reveals that

[6] This section is largely draw from Bua, et al. (2014).

[7] The currency basis is used in 5 countries because of their debt recording practices and data constraints.

the formers rely much more on Central Bank lending (e.g., advances) whereas the latter tap commercial banks and other market investors.

Trajectories presented in this section provide a first insight of the evolution of internal financing. The increase of domestic debt showed in Figure 2 and its higher cost vis-à-vis external debt (Figure 3) support our call for better understanding the rationale of its evolution. The breakdown into HIPCs and non-HIPCs also provides some suggestions on its potential determinants. As proposed by Presbitero (2012), the different pattern between HIPCs and non-HIPCs may points toward the role for the institutional and political framework. Non-HIPCs are probably better equipped in term of monetary policies and political stability and yet better able to develop an efficient domestic market at a less volatile pace. On the other hand, HIPCs – probably characterized by shallower financial markets and pressures of fiscal dominance and debt monetization- have increased their domestic debt on the onset of debt relief. In the next section we assess, amongst others, some of these hypothesis.

4. Analytical Framework

Our analysis employs panel data techniques to assess the role of supply and demand factors in determining the volume of domestic debt in LICs. The analysis covers the period 1996-2011 and it includes 21 LICs[8].

(a) Data

Our dependent variables are the share of domestic debt in total public debt and domestic debt as a share of GDP. The two variables enable us to capture two different dimensions of internal borrowing. The first one helps investigate the composition of public debt, while the second one captures the depth of the domestic market.

Domestic debt is defined as debt owed by the Central Government to domestic residents and it covers all financial liabilities (i.e. marketable and non-marketable) described in the GFSM (IMF, 2011) with the exception of arrears. We include both the banking system -comprising commercial banks and the Central Bank- and the non-banking system. It is worth noting, that the inclusion of Central Bank may blur the definition of domestic market given that, in our sample, Central Banks hold mainly non-marketable instruments. To address this shortcoming, in section 6 we run a number of robustness checks and we exclude the Central Bank.

The explanatory variables are drawn from a list of potential candidates proposed by the literature on public debt in Emerging Markets and by the more recent literature on domestic debt in LICs (Aiyar et al., 2005; Arnone and Presbitero, 2010; Diouf and Dufrense, 2012; Mu et al., 2013). For the sake of clarity, we describe the covariates following the dichotomy among demand and supply factors. Summary statistics and description of the variables are provided in Table 2 in Appendix.

Starting from demand side factors, we look at the flow of external resources , proxy by the "Net transfer on external debt"[9] (*ex_nettr*) taken from World Bank's World Development Indicator (WDI). The impact of this variable is ambiguous at priori. One strand of the literature suggests a negative sign and claims that the recent increase in domestic debt in LICs may be driven by financial constrains in traditional lending economies (IMF and World Bank, 2001; UNCTAD, 2004; Borensztein, Levy-Yeyati, and Panizza, 2006; Arnone and Presbitero, 2010). Other studies, on the contrary, suggest a positive relation and maintain that the builds up of domestic debt is motivated by the upsurge of aid inflow and the need to sterilize it (Aiyar et al., 2005). We also test the hypothesis that LICs have tapped the domestic market due to limits imposed by the IFIs on non-concessional borrowing[10]. To this end, we build a dummy variable (*debt_limit*) that takes value 1 if a country is subject to Debt Limit Policy either under IMF programs (DLP) or IDA Non-Concessional Borrowing

[8] See Table 1 in the Appendix. We include almost all countries listed in column "Debt Stock Sample". However due to the lack of data for other covariates included in the regression we drop Rwanda and Myanmar reducing the sample to 19 countries.

[9] Net transfers are net flows (disbursement - principal repayment) minus interest payments during the year; negative transfers show net transfers made by the borrower to the creditor during the year (WDI).

[10] IMF-supported programs in LICs typically include limits on non-concessional external debt. These limits seek to prevent the build-up of unsustainable debt, while allowing for adequate external financing. The main component of these limits is concessionality requirements applying to debt contracted or guaranteed by the official sector (IMF, 2013b). Along the same line, IDA implemented in 2006 an incentive mechanism to avoid countries that benefit from debt relief and grants to higher their risk of debt distress by borrowing non-concessional. According to this mechanism *–Non Concessional Borrowing Policy*- concessionality requirements apply only to external public and publicly guaranteed debt (PPG). Domestic debt –even if non-concessional in nature- is excluded from the policy limits given its importance as instrument to develop domestic capital market (World Bank, 2006).

Policy (NCBP) and 0 otherwise[11]. It is worth reminding that due to the endogeneity of this variable, nothing can be said about its causality[12].

Turning to supply side factors, we start by looking at the stock of debt. Different studies suggest that high levels of indebtedness may give the government an incentive to default on their debt either through inflation, unexpected change in interest rate, explicit taxation, or outright default (Missale and Blanchard, 1994, Leong, 1999, Mehl and Reynaud, 2005). Indeed, we expect lenders to reduce their share of domestic liabilities in presence of a high level of debt. On the other hands, the literature on debt relief suggests a negative relation between the two variables. Different authors point out that high levels of debt may hamper the ability of countries to attract new lenders, suggesting that higher levels of debt may induce governments to raise funding domestically (Bulow, 2002; Arslanalp and Henry, 2004). Recently, Presbitero (2012) finds that in LICs the level of the burden -as approximated by external debt- is negatively correlated with domestic debt, confirming the first hypothesis. We capture the level of the burden with the total debt to GDP ratio (*tot_gdp*)[13].

Then, we want to test the relation between the depth of the financial sector and internal borrowing. The literature on EMs is unanimous on the positive impact of financial development on domestic debt. On the contrary studies on LICs are less conclusive and they identify different results upon different specifications. On the one hand, Guscina (2008) finds that governments in countries with higher levels of M2 over GDP are better able to raise financing needs domestically. Along the same line, Claessens et al. (2007) show that countries with deeper domestic financial system – approximated by bank deposits and stock market capitalization- have larger domestic bond market. Mehl and Reynaud (2005) sharpen this result, and show that financial development underpinned by growing private savings increases potential demand for, and eases issuance of, longer term, local currency instruments. On the other hand, studies on LICs (or which include LICs in their sample) find inconclusive results. Abbas and Christensen (2010) identify a positive relation between private saving and domestic debt, but the relation turns to be not significant when they proxy financial development with a financial depth index[14]. Also supportive of this weak relation, Mu et al. (2013) find that the size of the banking sector is either not correlated or negatively correlated with government securities suggesting that private market development crowds out government securities. We proxy the development of the financial system with the ratio of M2 over GDP (*broadmoney_gdp*) taken from the IMF's World Economic Outlook (WEO).

Then, we control for trade openness. Its sign is ambiguous a priori. On the one hand, open economies may encourage securities market development because international competition will limit the ability of entrenched interests to protect their advantaged position (Rajan and Zingales, 2003). On the other hand, a more open economy might decrease its share of domestic debt due to a more outward orientation which translates in issuing more debt externally (Adelegan and Radzewicz-Bak, 2009). Supporting the first view, Eichengreen and Luengnaruemitchai (2004) find a positive relation between the two variables. Consistently with the second view, Mu et al. (2013) find a negative

[11] Data on IMF programs are recollected from the IMF's MONA Database (http://www.imf.org/external/np/pdr/mona/index.aspx). Data on NCBP are obtained from World Bank's website and staff (http://www.worldbank.org/ida/non-concessional-borrowing.htmland).

[12] A challenge in identifying the impact of IFIs programs on domestic debt is the potential for endogeneity of countries' program participation. IMF and WB programs are usually concluded in times of economic crises or specific needs, therefore the conditions of countries that enter and remain under a program are not the same as for those that abstain. If those conditions differ, difference in the development of domestic debt might depend not only on the program itself but also on the initial conditions. Failure to control for these initial conditions would result in a selection bias problem (Allain et al. 2014).

[13] Total debt is calculated as the sum of Central Government Domestic Debt (author's database) and Central Government External Debt including IMF credits (DRS).

[14] The index was first developed by Huang and Temple (2005) and it summarizes liquid liability of the financial system, private sector credit provided by commercial and other banks and, commercial bank assets as a ratio of total banking system assets.

relation. Finally, Guscina (2008) shows different results upon use of different estimators. We proxy trade openness with the ratio of trade over GDP (*trade*).

Following the literature, we include in our analysis the inflation rate to capture monetary credibility and we test the hypothesis that lower inflation is conducive to deeper domestic debt markets. As shown by Jeanne (2003) when monetary credibility is low, interest rate on domestic currency debt will be higher and countries will borrow more externally. Moreover, if the monetary and fiscal authorities are inflation prone, investors will be averse in lending in local currency. To this regards, the empirical literature is unanimous on the sign of the relation and shows that lower inflation rates are associated with larger domestic markets (Hausman and Panizza, 2003; Burger and Warnock, 2003; Claessens et al, 2007; Mehl and Reynaud, 2005; Guscina, 2008). A notable exception is Presbitero (2012) who, focusing on LICs, highlights a lack of correlation between inflation and the depth of the domestic debt. We proxy monetary credibility with a 5-year moving average of the annual percentage change in the GDP deflator (*inf_ma*), taken for the WDI. We first run the model using the variable at time t, then we control for its possible endogeneity by adding its lagged value (*l.inf_ma*). In order to avoid the results being driven by hyperinflation events, we also approximate monetary credibility with GDP deflator (*gdpdef*) plus a dummy variable that capture inflation episodes (*hyperinf_d*). Additionally we test the hypothesis that inflation volatility impacts domestic debt through interest rate differentials (Jeanne, 2003). To this end, we substitute our proxy of monetary stability with the spread between the interest rate on domestic and external debt (*diff_int*). Finally we interact monetary stability with capital control (*kaopen*) and we test the hypothesis that either smaller capital inflows make it easier for governments to control inflation and yet to guarantee monetary stability or that in countries more financially open bad monetary policies will have an higher impact on domestic debt than in countries with capital control. The rationale being that in countries more open, government will easily turn to external lenders to satisfy their financial needs (the coefficient of the interaction term will be bigger in countries more financially open).

Finally, we test the argument in the public finance literature that the institutional environment may have an important effect on the size of government debt. In this regards, the empirical literature is unanimous in supporting the idea that countries with better policy and institutions are better able to develop domestic market (Burger and Warnock, 2003; Claessens et al, 2007; Guscina, 2008; Mu et al., 2013). Two notable exceptions are Hausmann and Panizza (2003) who downplay the importance of institutional factors in determining domestic currency bond and maintain that only country size matters and Mehl and Reynaud (2005) which do not find any significant relation. Presbitero (2012) brings evidence that amongst LICs, those with weak policies and institutions have increased domestic debt substantially on the onset of debt relief initiatives and have reduced it thereafter; while countries with better policy and institutional environment have increased it at a constant and less volatile pace. Following Presbitero (2012) we proxy policy and institutional environment with the Country Policy and Institutional Assessment (*CPIA*) index calculated by the World Bank and used by World Bank-IMF debt sustainability framework (DSF) to assess public debt sustainability.

(b)Empirical specification

The empirical model we want to estimate can be described by the following equation:

$$y_{it} = \beta X_{it} + u_{it} \quad i = 1.....T, t= 1.....T \quad (1)$$

y_{it} is the measure of domestic debt, X_{it} is a matrix of explanatory variables, β is a vector of parameters to be estimated and u_{it} are the residuals. The panel analysis has to face up two conceptual problems. The first one is caused by omitted time-invariant country characteristics (fixed effects) that might be correlated with the explanatory variables and, the second one is caused by the persistence of the dependent variables. This calls for explicit modeling of dynamic effects. To this end, equation (1) can be reorganized as:

$$y_{it} = \delta y_{it-1} + \beta X_{it} + \alpha_i + \gamma_t + u_{it} \quad (2)$$

y_{it-1} is the lagged dependent variable, α_i are country dummies that capture time invariant country characteristics, γ_t are year dummy variables that capture shocks common across countries in a given year and u_{it} is a residual that is clustered at the country level. To overcome the inconsistency of pooled OLS, Fixed Effect, and First Difference[15] introduced by the presence of fixed unit effects in a dynamic model, we could rely on consistent Instrumental Variables (IV) and Generalized Method of Moments (GMM) estimators.

Given the characteristics of our sample (T=16, N=19, δ large) and the dimension of panel data for which IV and GMM are built for (T small, N large) the choice amongst estimators is not trivial. Without pretending to be exhaustive, here we briefly summarize benefits and shortcomings of three possible candidates to estimate our model : Anderson and Hsiao (1982) (AH), Arellano and Bond (1991) (AB), and Blundell-Bond (1998) (BB). AH suggests two IV estimators that upon transforming the model in first differences to eliminate the unobserved individual heterogeneity, use the lags of the dependent variable, either in difference or in level, as an instrument for the differenced one-time lagged dependent variable. AH suffers from the trade-off between lag length and sample size. Using longer lags in 2SLS increases efficiency but reduces sample size. Arellano and Bond propose a GMM estimator for the first differenced model, which relies on a greater number of instruments, and is more efficient that Anderson and Hsiao. Blundell and Bond observe that for highly persistent data AH and AB might suffer a severe sample bias due to weak instruments[16]. As a solution they propose a GMM which augments differenced GMM by estimating simultaneously in difference and levels, the two equations being distinctly instrumented. However attractive are their asymptotic properties, all these estimators are biased in panel data with a small number of cross-sectional units. In particular AB and BB exacerbate the problem of instruments proliferation as T grows. To this regards, Roodman (2007) stresses that GMM estimators –as compared to IV[17]– need to calculate an optimal weighting matrix whose number of elements to be estimated is quadratic in the number of instruments; therefore they might underperform compared to IV estimators. This is confirmed by the work of Judson and Owen (1997) who, after running a Monte Carlo analysis comparing AB and AH, conclude that with small N the latter outperforms the first.

Given the high persistence of our variable and the relative short period of time taken into consideration we believe that the Blundell and Bond estimator is the most appropriate for our sample.

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[15] It is worth remanding that , differently from OLS and FD that are biased regardless T, the asymptotic bias of the FE estimators goes to 0 as T goes to infinity. Therefore when T is large, dynamic panel bias become insignificant and fixed effect estimator works.

[16] AH and AB perform poorly when δ is large because past levels convey little information about future changes and yet, untransformed lags are weak instruments for transformed variables

[17] Which faces the classical problem of overfitting of endogenous variables.

Following the literature on the determinants of domestic debt, we decide to present the results of more than one estimators and to highlight those that are consistent across methodologies. In this regards, we estimate the model first with the Fixed Effect estimator and then with the GMM.

5. Results

Table 3 and 4 show the main results using as dependent variables the share of domestic in total public debt (Table 3) and the domestic debt relative to GDP (Table 4). Each table reports the estimates with FE and GMM. The first column of each table presents the results of the baseline specification; different controls are added in the subsequent columns. Tables 5 to 11 test the robustness of the results to different specifications.

We check in turn whether the various theories discussed above play a role in explaining public debt composition and the dimension of domestic debt in the economy.

We start by looking at the impact of the net transfer on external debt (*ex_nettr*) on public debt composition using the FE estimator. As shown in Table 3 (column 2), we find a negative relation between the two variables, suggesting that changes in the flow of external resources significantly impact the share of domestic debt in total public debt. This result should be interpret with caution, as the decrease in net transfer may simply reflect a decrease in total debt and yet a change in the domestic debt ratio in the opposite direction. In order to qualify this result, in column (3) and (4) we control for total debt and debt forgiveness, both expressed as a percentage of GDP. The variables have the expected sign. Total debt is significantly and negatively correlated with domestic debt, showing that the reduction of the level of the burden fosters the substitution between external and domestic debt. Debt forgiveness has the same sign. In particular, when we add debt forgiveness to the regression, total debt becomes not significant. These results suggest that the reduction of total debt guaranteed by debt relief modifies portfolios composition, fostering the substitution between domestic and external debt. Finally, in column (5), we control for the limits imposed by the IFIs to countries under IMF programs or IDA Non-Concessional Borrowing Policy and we find that the dummy variable is not significant. This suggests that countries under Debt Limit Policy of the IMF or NCBP of IDA do not show higher level of domestic debt. Given the potential endogeneity of this dummy nothing can be said about its causality. The results are robust to the use of BB estimator.
Then we turn to the impact of these variables on the depth of the domestic debt market. The results are reported in Table 4. Surprisingly we find that the flow of external resources is positively and significantly correlated with the size of domestic debt in the economy and that the coefficient of total debt as percent of GDP is positive and significant, even though the coefficient is very small. Debt forgiveness and debt limits are not significant. These results coupled with those in the previous paragraph show that an increase in net transfers –and hence in financial needs– determines and increase in domestic debt to GDP but a decrease in its ratio over total debt, suggesting that financial needs in LICs are still satisfied mainly through external financing. Once again there is not robust evidence that debt limit policy imposed by IFIs affects domestic debt. Not significant coefficients are found with the BB estimator.

Regarding the development of the financial system we find that the ratio of M2 to GDP (*broadmoney_gdp*) does not impact public debt composition (Table 3 column 1 to 5), but it affects positively and significantly the size of domestic debt in the economy (Table 4, column 1 to 5). This result may point toward a positive relation between financial deepening and demand for domestic instruments (Mehl and Reynaud, 2005; Claessens et al. , 2007; Guscina, 2008), but it may also simply capture an increase of liquidity following the purchase of government instruments by the Central Bank[18]. To disentangle this result, we use alternative specifications and different definitions of the variable. As shown in Table 5 – 8 , when we replace M2 with its lagged value (*L.broadmoney_GDP*) we find that the coefficient is not significant (Column 1). Then, when we replace M2 over GDP with bank credit to the private sector as a fraction of GDP (*bc_gdp*) (column 2) or with private saving as a fraction of GDP (*sav_gdp*) (column 3) the relation turns to be mostly not significant with exception of

[18] The process which links money supply, government debt and the Central Bank is known as monetization, and it consists in a procedure where the government issues debt to finance its deficit and the Central Bank purchases it by printing money. This leave the economy with an increased supply of money.

bank credit which takes a negative sign when we use FE estimator. Differently from the case of EMs, the lack of a positive and unambiguous relation between domestic debt and financial development in LICs is not a novelty (Abbas and Christensen, 2010; Mu et al., 2013). Also, as argued by De Gregorio and Guidotti (1995) broad money and bank credit to the private sector, even if often used as proxies of financial deepening might capture two different dimensions of the financial markets and might be not necessarily related. According to the authors, M2 is mainly related to the ability of the financial system to provide liquidity or a medium of exchange, while the bank credit to the private sector is mainly related to the ability of the financial sector to allocate credit efficiently. Against this background and taking into consideration the lack of significance of the lag of M2, we interpret the positive relation between M2 and domestic debt as a signal of increased liquidity due to the purchase of government instruments by the Central Bank. Also, we doubt that the sole negative relation between bank credit to the private sector and the ratio of domestic debt over total debt suffices to infer that domestic debt crowds out private investment. In fact, when we look at the ratio of domestic debt over GDP, the relation turns not significant.

Turning to economic openness, our baseline specification (Table 3 and 4) shows that trade openness (*trade*) is negatively correlated with both domestic debt as a share of the total and as a share of GDP. However, the coefficient is very small and not always significant. These results are in line with Mu et al. (2013) and support the hypothesis that countries more outward oriented issue more debt externally.

In term of monetary policy, we find that inflation (*inf_ma*) is negatively correlated with domestic debt as a share of total debt, supporting the hypothesis that when monetary credibility is higher, countries tend to switch public debt portfolio composition toward domestic debt. As highlighted by the literature on public debt composition in EMs, the rationale behind this may be manifold. For a lender point of view, price stability may alleviate creditor fears that domestic debt would be inflated away. For a borrower point of view, unpredictable monetary policy increases the real ex post interest rate on domestic debt and the interest rate differential[19] fostering sovereign debt dollarization (Jeanne, 2003). Another interpretation of this result is suggested by Claessens et al. (2007) which suggest that governments with high inflation cover their financing needs through the inflation tax, reducing the need to issue large amounts of debt. The relation between these two variables should be interpret with caution given the potential endogeneity of inflation. In fact, as suggested by Jeanne (2003), and more recently by Reinhart and Rogoff (2011), the causality may run the other way with larger shares of domestic-currency debt incentivizing inflation and leading to hyperinflation episodes. Furthermore, the relation could also be driven by common factors and being attenuated when a measure for the rule of law is added to the regressors (Burger and Warnock, 2003). This said, in Table 5-11, we run a number of robustness tests. Following Jeanne (2003), we start by testing the hypothesis that inflation volatility impacts domestic debt through interest rate differentials. To accomplish this, we substitute our proxy of monetary policy with the spread between the interest rates on domestic and external debt (*diff_int*) (Column 4). The sign of the coefficient remains negative and not significant, confirming the previous results. Second, we try to understand whether using five-year moving average of GDP deflator may blur the results, given that it does not distinguish between moderate and hyper-inflation. To this end, we replace our proxy with GDP deflator (*gdp_def*) and a dummy variable that captures hyperinflation episodes (*hyperinf_d*) [20]. As shown in column 5, the coefficient of the GDP deflator confirms the negative relation between variables. Interestingly, the coefficient of hyperinflation is positively and significantly correlated with domestic debt. Third, we analyze in greater details the possibility of endogeneity of inflation. We deal with this using the lagged value of the variable (column 6) and, as for all the other variables, using the BB estimator, which should account for the endogeneity problem (Table 3). The first option confirms a negative and not significant relation, however, when we control for the potential endogeneity using the BB estimator, the coefficient turns to the wrong sign. Overall these regressions highlight one interesting and robust result: once we

[19] Interest rate differential is defined as the difference between interest rate on domestic and external debt.
[20] The dummy variable takes value 1 is GDP deflator is above 50 and 0 otherwise.

control for hyperinflation episodes, inflation and hyperinflation episodes are significantly and consistently correlated with domestic debt. On the one hand, the negative sign of inflation suggests that when monetary credibility is higher, countries tend to switch toward domestic debt. On the other hand the positive sign of hyperinflation episodes may capture the incentive of the government to reduce the real value of its local currency debt through printing money[21]. This hypothesis is confirmed in Table 10 and 11 where we exclude the Central Bank from our definition of domestic debt and we find that inflation and hyperinflation turn not significant. Finally, following Burger and Warnock (2003), we try to understand whether the inclusion of variables that capture institutional and political quality –potentially highly correlated with monetary stability- blur the results. Indeed, when we exclude CPIA from our FE regression, the coefficient of inflation turns significant (Column 11, 12 and 13). Results are not robust to the use of BB.

We then turn to the impact of monetary policy on the size of domestic debt in the economy and we repeat the same exercise that we performed in the previous paragraph. We first proxy monetary credibility with the inflation rate (Table 4), second we substitute it with the spread between the interest rates on domestic and external debt (Table 7 and 8, column 4), third we replace the 5 years-moving average with the GDP deflator and a dummy variable that captures hyperinflation episodes, fourth we add lagged values of inflation (Table 7 and 8, column 5 and 6), and finally we exclude CPIA (Table 7 and 8, column 11, 12, and 13). The results confirm previous finding and show a significant relation amongst domestic debt, inflation and hyperinflation when we control for the latter.

These results coupled with those on the impact of monetary policy on public debt composition suggest that in presence of monetary stability countries tend to switch toward domestic debt (Hausman and Panizza, 2003; Burger and Warnock, 2003; Claessens et al, 2007; Mehl and Reynaud, 2005; Guscina, 2008). Also an interesting finding is the positive relation between domestic debt and hyperinflation which suggests that governments may have incentives to print money above the signorage-maximizing level in order to reduce the real value of their debt. As we will see in the next chapter, when we exclude the Central Bank from the definition of domestic debt, hyperinflation turns not significant, somehow suggesting that debt hold by the Central Bank may be inflationary.

Before turning to the analysis of political and institutional variables, we inspect the interaction between capital control and monetary policy and their impact on domestic debt. To this end, we augment each regression with a proxy of financial openness (*kaopen*)[22] and its interaction with monetary stability. In Table 5-8, we first, interact capital controls with the inflation rate (*int_kaoinf*), second we interact the capital control variable with the GDP deflator (*int_kaogdpdef*) and we add a dummy variable for hyperinflation episodes (Column 8), third we add a dummy variable for HIPC/MDRI countries which reach the completion point (*d_completions_point*) and finally we substitute the inflation rate with the spread between the interest rates on domestic and external debt (*int_kaodiff*). On the one hand, we expect capital control to be positively correlated with domestic debt as smaller capital inflows should make it easier for governments to control inflation and yet to guarantee monetary stability. On the other hand we expect that in countries more financially open bad

[21] As previously discussed monetization leaves the economy with an increased supply of money. If the money printed exceeds the demand for it, prices will raise up and so will do inflation (Fisher and Easterly, 1990). The literature on government budget has long focused on the real resources that the government can buy with the money printed (seignorage revenues) and also on the limits of this practice. It has been demonstrated that as inflation raises, the demand for money declines and eventually the government's revenue from seignorage reaches a maximum. Recently, Reinhart and Rogoff (2011) has pointed toward the failure of this literature to explain why governments seem to inflate above the seignorage-maximizing rate and have suggested that this choice may be explained by domestic debt and the gain of the government from inflating down its real value.

[22] Data comes from Chinn and Ito (2008). The authors use the IMF's Annual Report on Exchange Restrictions and Regulations to construct a measure of capital controls. We use their data as a de jure measure of financial integration. The Chinn-Ito index is based on dummy variables which codify restrictions on cross-border financial transactions. The minimum number is -1.82 (financially closed), the maximum number is 2.46 (financially open). Hence, financial openness measures are both scaled such that a higher number indicates a more open financial system.

monetary policies will have an higher impact on domestic debt than in countries with capital control. The rationale being that in countries more open, government will easily turn to external lenders to satisfy their financial needs (the coefficient of the interaction term will be bigger in countries more financially open). Table 5 and 6 present the results for the share of domestic in total public debt using FE and GMM respectively. The most robust result is the lack of significance of capital control in all regressions. This may suggest that financial integration does not impact public debt composition. Turning to the interaction terms, we start by looking at column 7 in which we multiply capital control with the inflation rate. Using FE we do not find any significant result, while using GMM the coefficient turns significant and to the wrong sign. The Wald test on the interaction term even worsens the result and suggests that the positive relation between inflation and domestic debt is even higher in countries more financially integrated. To understand this result in the two following columns we first add a dummy for hyperinflation (Column 8) and then we add dummy for debt relief [23] (Column 9). In both cases the sign of inflation turns not significant, suggesting that the positive relation between domestic debt and inflation may have simply captured hyperinflation episodes. Finally, in Column 10 we interact capital controls with the spread between the interest rates on domestic and external debt. Interestingly the Wald test on the interaction term reveals that in countries more financially open the interest rate differential tent to have a higher (negative) impact on domestic debt, suggesting that when the cost of domestic debt is high countries will borrow more externally if capital controls are loose. In Table 7 and 8 we perform the same exercise on the size of domestic debt in the economy and we find similar results.

All in all, the most robust result in the battery of regressions on monetary stability, is the positive correlation between domestic debt and hyperinflation when we include the Central Bank in the definition of domestic debt (the coefficient turns not significant when we exclude it).

Last, we control for political and institutional quality and we find that the CPIA Index is positively and significantly correlated with domestic debt as a share of the total (Table 3). The result, however, is not robust to the inclusion of additional control variables. In particular, when we add total debt and debt forgiveness, the coefficient turns not significant, suggesting that higher CPIA's scores may simply reflect an improved evaluation for countries benefitting from debt relief (yet reducing their reliance on external debt). Also, CPIA may simply capture sound monetary policies and, thus describing the positive relation between monetary stability and domestic debt. To address these concerns we run a number of robustness tests (Table 5-8, Column 11, 12 and 13). First, we try to substitute CPIA with the quality of bureaucracy (*bureaucracyquality*) and the stability of government (*governmentstability*) taken from the ICRG database . Unfortunately the variables reduce considerably the panel data dimension and we do not find any significant result. Second, in line with Hausmann and Panizza (2003) we try to proxy policy and institution with the level of development as measured by the log of per capita GDP (*lngdp_pc*) and the coefficient is again not significant. The BB estimator confirms the result. Turning to the size of domestic debt in the economy, CPIA is again not significant. Results hold across all different specifications. One possible interpretation of the lack of significance of CPIA is suggested by Presbitero (2012) who shows that countries with low CPIA have benefitted from HIPC/MDRI Initiatives and yet have increased substantially domestic debt on the onset of debt relief.

[23] The rationale for including debt relief is that, in our sample, hyperinflation episodes occur mainly at the same time as drop in external debt granted by debt relief.

6. Alternative specifications.

In the previous section, we have presented the results of our baseline model and the robustness to alternative specifications. To further verify the validity of our findings, in this section we undertake a numbers of additional robustness exercises. First, we estimate the model dropping influential observations. Second, we run the regressions on a larger sample of countries. Third, we exclude holdings of the Central Bank from the definition of domestic debt in order to ensure that our original dependent variable is a reasonable approximation of the depth of domestic markets. Since we estimated a very large number of alternative specifications, we do not report all of them in the paper. Results are available upon request.

In the first case, we simply drop Eritrea and we find that results on portfolios composition remain almost unchanged, except for CPIA which turns not significant. When we look at the size of domestic debt in the economy, we find that inflation turns not significant and the magnitude of the coefficient on broadmoney diminishes, remaining in any case positive and significant.

Secondly, we do the same analysis on a larger sample of countries. The original dataset, in fact, allows for a definition of a balanced panel data of 32 countries over the period 2002–2011. Unfortunately, given the lack of data for other covariates included in the regressions, the analysis is run on 25 countries[24]. Results remain almost unchanged, except for trade-openness and broadmoney, which become not significant. Also, as in the previous section, we obtain inconsistent results both on the sign and on the significance of inflation.

Finally, we substitute our proxy of the depth of domestic markets with domestic debt as a share of GDP excluding the holdings of the Central Bank. We find that the results of the baseline specifications remain almost unchanged, except for hyperinflation which turn not significant, and the coefficients of broadmoney and the flow of external resources which slightly diminish. As already discussed in the previous chapter the most interesting result is the lack of significance of hyperinflation when we exclude the Central Bank. This points, amongst other interpretations already discussed, towards the importance of excluding the Central Bank's holdings in the analysis of domestic debt market.

Overall these tests confirm the findings of the previous section, stressing the fragility of some results.

[24] Burundi, Eritrea, Ethiopia, Ghana, Guinea, Haiti, Kenya, Kyrgyz, Madagascar, Malawi, Mali, Mozambique, Nepal, Rwanda, Senegal, Sierra Leone, Solomon Islands, Tajikistan, Tanzania, Togo, Uganda, Union de Comoros, Vietnam, Yemen, Zambia.

7. Conclusions

In this paper we investigate the rationale for the increase in domestic debt using a newly developed database covering 21 LICs over the period 1996-2011. To the best of our knowledge, this is the first paper that studies the determinants of public debt composition in LICs and the size of domestic debt in the economy.

Relying on GMM and FE estimators, the key findings of the paper are that only a small number of factors explain the ability of countries to issue domestic debt. Also, the fragility of some results highlights that the rationale for the increase of domestic debt in LICs is not as clear as in EMs.

Starting from demand-side factors, we find that the fiscal space granted by debt relief has naturally favored the substitution of public debt portfolios toward domestic debt but it probably did not suffice on its own to foster domestic debt development. We also find that financial needs in LICs are probably still satisfied mainly through external financing. We draw our conclusions from two set of results. First we see that an increase in net transfers –and hence in financial needs– determines and increase in domestic debt to GDP but a decrease in its ratio over total debt, suggesting that LICs still finance their debt mainly through foreign borrowing. Second we find that total debt or the reduction of external debt granted by debt relief foster the substitution in public debt portfolio but they do not seem to determine the size of domestic market, suggesting that the reduction of the burden granted by debt relief did not suffice on its own to develop domestic debt.

Looking at supply side constrains, we find that internal financing is positively correlated with the share of liquidity in the economy and with hyperinflation episodes and it is negatively correlated with trade openness and moderate inflation. Also we do not find evidence that financial development and quality of policy and institutions are correlated with domestic debt.

We interpret the significant correlation between domestic debt, liquidity in circulation and hyperinflation has a warning signal of the tendency of governments to inflate the debt away. As recently suggested by Reinhart and Rogoff (2011), the domestic debt and the gain of the government from inflating down its real value may explain why governments seem to print money above the seignorage-maximizing rate. The negative correlation with moderate inflation and trade confirms previous finding and suggests that in presence of monetary stability countries tend to switch toward domestic debt (Hausman and Panizza, 2003; Burger and Warnock, 2003; Claessens et al, 2007; Mehl and Reynaud, 2005; Guscina, 2008), while countries more outward oriented issue more debt externally (Adelegan et al. 2009; Mu et al. , 2013). The lack of significance of financial development is in line with the results of Mu et al. (2013) and Abbas and Christensen (2010) who find either a negative or a lack of correlation between the two variables. One possible interpretation of these results is that domestic debt in LICs is still mainly dominated by central banks - which hold primarily non-marketable instruments- and by commercial banks - which may be induced by moral suasion to absorb excessive public debt -Panizza (2008). Being this true, financial development would not play an important role in spurring domestic debt. The absence of a positive relation between domestic debt and the quality of policies and institutions confirms the results of Hausmann and Panizza (2003) and Mehl and Reynaud (2005) who both downplay the role of institutional factors in determining domestic debt in EMs.

These results seem to suggest that domestic debt development in LICs is still at an early stage and the rational for its increase is not as clear as in EMs. From a policy perspective, the significant correlation between domestic debt, hyperinflation and liquidity in circulation raises the specter of domestic default and may suggest the need for governments to develop specific domestic debt management policies.

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Appendix

Table 1: List of countries

Country name	Income Group	Region (i)	Lending category	Debt Relief	Main data source	Debt Stock Sample	Debt Structure Sample
Burundi	LIC	AFR	IDA	HIPC	Website	x	x
Benin	LIC	AFR	IDA	HIPC	IMF		
Burkina Faso	LIC	AFR	IDA	HIPC	PRMED		
Bangladesh	LIC	SA	IDA		IMF		
CAR	LIC	AFR	IDA	HIPC	IFS (v)		
Comoros	LIC	AFR	IDA	HIPC	IFS (vi)	x	
Eritrea	LIC	AFR	IDA	HIPC	IFS (vii)	x	
Ethiopia	LIC	AFR	IDA	HIPC	PRMED	x	x
Ghana	LMIC	AFR	IDA	HIPC	Website	x	x
Guinea	LIC	AFR	IDA	HIPC	IMF	x	x
The Gambia	LIC	AFR	IDA	HIPC	Website		
Guinea Bissau	LIC	AFR	IDA	HIPC	IMF	x	x
Haiti	LIC	LAC	IDA	HIPC	PRMED	x	x
Kenya	LIC	AFR	IDA		Website	x	x
Kyrgyz	LIC	ECA	IDA		IMF	x	x
Cambodia	LIC	EAP	IDA		IFS	x	
Lao PDR	LMIC	EAP	IDA		IMF		
Liberia	LIC	AFR	IDA	HIPC	PRMED		
Madagascar	LIC	AFR	IDA	HIPC	IMF		
Mali	LIC	AFR	IDA	HIPC	IMF		
Myanmar	LIC	EAP	IDA		IFS	x	
Mozambique	LIC	AFR	IDA	HIPC	PRMED		
Mauritania	LIC	AFR	IDA	HIPC	PRMED		
Malawi	LIC	AFR	IDA	HIPC	PRMED	x	x
Niger	LIC	AFR	IDA	HIPC	PRMED		
Nepal	LIC	SA	IDA		Website	x	x
Rwanda	LIC	AFR	IDA	HIPC	Website	x	x
Senegal	LMIC	AFR	IDA	HIPC	IMF		
Solomon Islands	LMIC	EAP	IDA		Website	x	x
Sierra Leone	LIC	AFR	IDA	HIPC	Website	x	x
Chad	LIC	AFR	IDA	HIPC	IMF		
Togo	LIC	AFR	IDA	HIPC	IFS	x	
Tajikistan	LIC	ECA	IDA		IMF		
Tanzania	LIC	AFR	IDA	HIPC	PRMED	x	x
Uganda	LIC	AFR	IDA	HIPC	IMF	x	
Vietnam	LMIC	EAP	Blend		IMF		
Yemen	LMIC	MNA	IDA		IMF	x	x
Congo, Dem.	LIC	AFR	IDA	HIPC	IMF		
Zambia	LMIC	AFR	IDA	HIPC	PRMED		
Zimbabwe	LIC	AFR	Blend		Web-IMF		

(i) Africa Region (AFR), East Asia & Pacific Region (EAP), Europe & Central Africa Region (ECA), Latin America & Caribbean (LAC), Middle East and North Africa Region (MNA), South Asia
(ii) Domestic debt corresponds to Central Government, with the exception of Lao PDR (General Government), Niger (Public Sector), and Congo DCR (General Government).

(iii) Domestic debt includes all financial liabilities defined by the GFSM (IMF, 2001), with the exception of Benin, Kenya, Kyrgyz, and Mauritania, whose definition includes only securities. For Benin and Mauritania, there are no data available for other liabilities. For
(iv) Domestic debt is defined on a residency basis, with exception of Kenya, Nepal, Rwanda, Solomon Islands, and Yemen, where the currency basis is used because of their debt

(v) Banking system is the only holder of domestic debt.

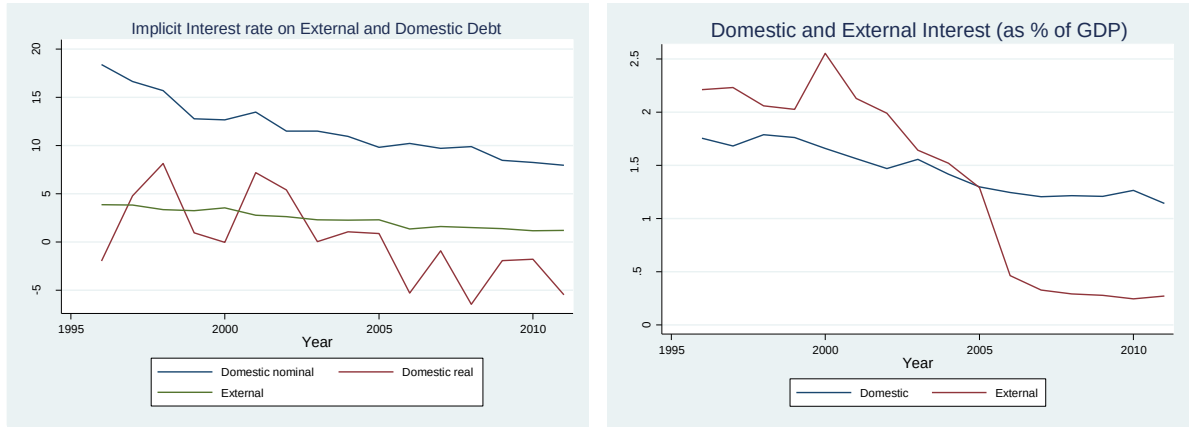
(vi) There is no domestic market. Central Bank is the only holder of domestic debt.

(vii) Banking system is the only holder of domestic debt.

Figure 1: Domestic and External Debt (percentage, weighted average)

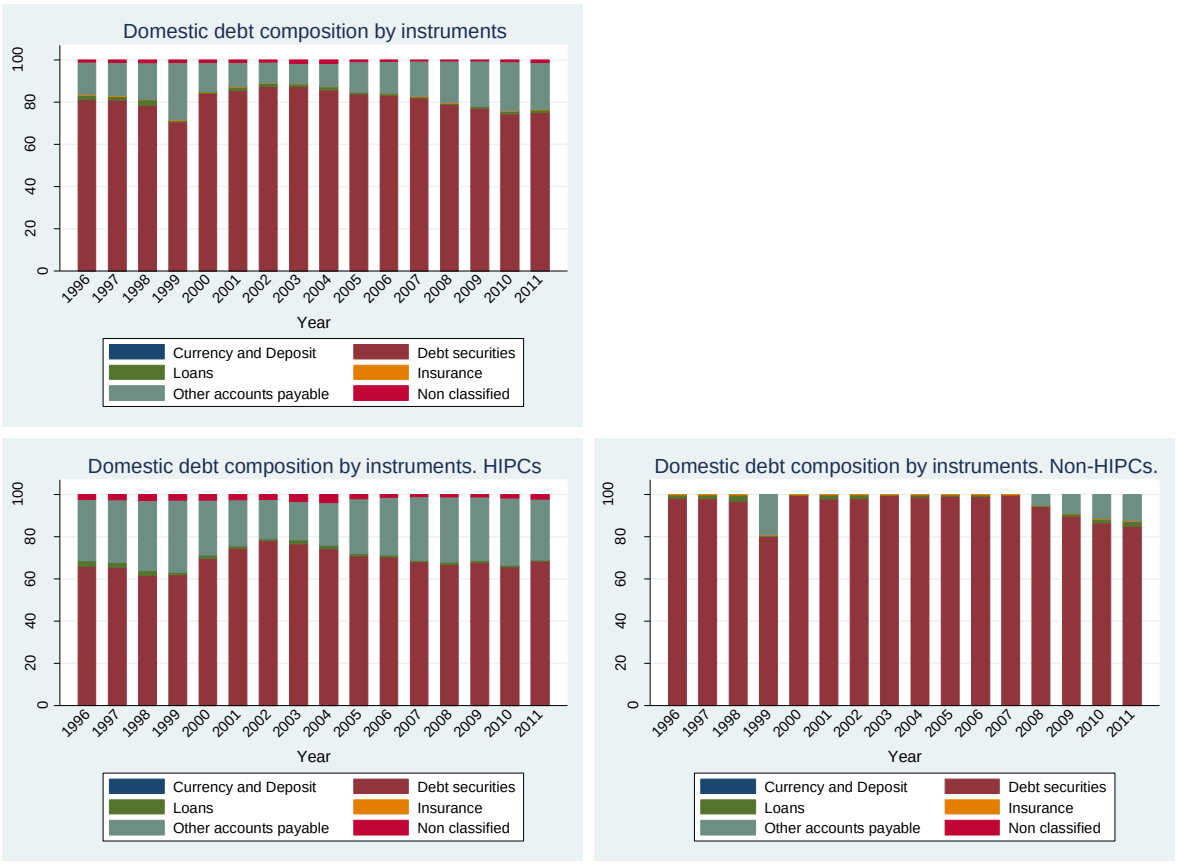
Source: Bua, et al. (2014)

Figure 2: Cost of Domestic and External Borrowing (percentage, weighted average)



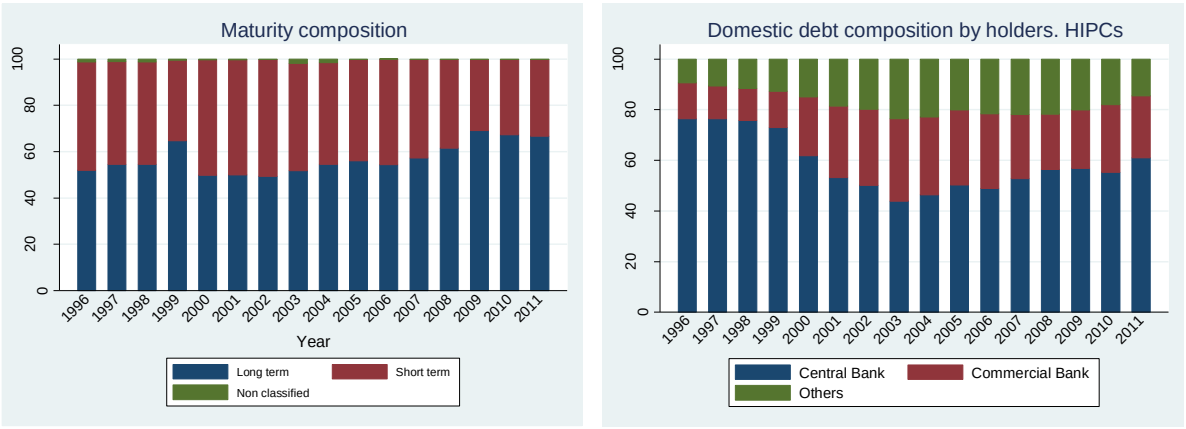
Source: Bua, et al. (2014)

Figure 3: Domestic debt by type of instruments (percentage, weighted average)



Source: Bua, et al. (2014)

Figure 4: Domestic Debt by maturity and holders (percentage, weighted average)



Source: Bua, et al. (2014)

Table 2: Summary statistics

Variable	Label	Description	Mean	Std. Dev.	Min	Max	Obs.	Sourcce
dd_tot	Domestic Debt (as % total public debt) (i)		0,266	0,240	0,010	0,998	334	AC (ii)
dd_gdp	Domestic Debt (as % GDP) (i)		0,166	0,196	0,006	1,246	334	AC (ii)
broadmoney_gdp	M2 (as % of GDP)		0,319	0,238	0,090	1,628	329	WEO
inf_ma	Inflation	5 years moving average GDP deflator	0,119	0,078	-0,005	0,419	313	WDI
cpia	CPIA		3,117	0,489	1,825	4,100	320	World Bank
trade	Trade (% of GDP)	Sum of exports and imports of goods and services	0,620	0,271	0,004	1,446	315	WDI
ex_nettr	Net transfers on external debt (as % of GDP)	Net flows minus interest payments during the year	0,017	0,025	-0,045	0,142	334	WDI
tot_gdp	Total Debt (% of GDP)	CG Domestic Debt plus CG External Debt including IMF credits (DRS)	0,814	0,597	0,156	4,253	334	AC (ii), WDI
dfor_gdp	Debt forgiveness or reduction (as % of GDP)	Change in debt stock due to debt forgiveness	-0,025	0,093	-0,803	0,000	336	WDI
debt_limit	IMF's DLP and/or IDA's NCBP	Takes value 1 if the country is subject to IMF's DLP or IDA's NCBP	0,699	0,459	0,000	1,000	336	Mona
bc_gdp	Bank credit to the private sector (as % of GDP)		0,116	0,077	0,009	0,456	264	WDI
sav_gdp	Private saving (as % of GDP)		0,135	0,089	-0,064	0,473	315	WDI
diff_int	Interest rate differencial	Difference between domestic and external interest rate	0,079	0,070	-0,017	0,398	284	AC (ii)
gdpdef	GDP deflator		11,478	11,100	-8,708	80,750	311	WDI
hyperinf_d	Hyperinflation	Takes value 1 if GDP deflator is bigger than 50	0,012	0,109	0,000	1,000	336	AC (ii)
lngdp_pc	Log GDP per capita		10,539	2,235	6,504	14,638	329	WDI
bureaucracyquality	Burocracy	Government's ability to govern without drastic changes in policy	1,310	0,765	0,000	3,000	192	ICRG
governmentstability	Governance	Government’s ability to carry out its program(s), and to stay in office	8,719	1,651	4,000	12,000	192	ICRG

(i) Domestic debt is defined as debt owed by Central Government to domestic residents and it covers all financial liabilities (i.e. marketable and non-marketable) included in the GFSM (2011) with the exception of arrears.
(ii) Author calculation

Table 3. Determinants of domestic debt as percent of total public debt

	Fixed effect					Blundell & Bond				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
VARIABLES	dd_tot	dd_tot	dd_tot	dd_tot	dd_tot	dd_tot	dd_tot	dd_tot	dd_tot	dd_tot
L.dd_tot	0.803***	0.816***	0.726***	0.866***	0.786***	0.964***	0.958***	0.899***	1.050***	0.923***
	(0.044)	(0.049)	(0.047)	(0.038)	(0.042)	(0.087)	(0.080)	(0.083)	(0.073)	(0.083)
broadmoney_gdp	0.051	0.047	0.118	0.041	0.055	0.062	0.061	0.008	-0.001	0.049
	(0.048)	(0.050)	(0.076)	(0.066)	(0.049)	(0.082)	(0.092)	(0.106)	(0.054)	(0.075)
inf_ma	-0.129*	-0.112	-0.074	-0.046	-0.135**	0.149	0.234	0.117	0.145	0.127
	(0.062)	(0.067)	(0.050)	(0.041)	(0.063)	(0.145)	(0.172)	(0.117)	(0.086)	(0.121)
cpia	0.022*	0.026*	0.005	0.009	0.026**	0.030	0.029	-0.008	0.006	0.023
	(0.012)	(0.013)	(0.013)	(0.010)	(0.011)	(0.020)	(0.022)	(0.028)	(0.022)	(0.023)
trade	-0.055*	-0.051*	-0.046*	-0.046**	-0.065**	-0.087	-0.077	-0.061	-0.027	-0.113*
	(0.027)	(0.026)	(0.027)	(0.018)	(0.026)	(0.059)	(0.057)	(0.052)	(0.048)	(0.061)
ex_nettr		-0.265*	-0.079	-0.207*			-0.703**	-0.591	-0.700*	
		(0.145)	(0.141)	(0.113)			(0.289)	(0.411)	(0.336)	
tot_gdp			-0.080***	-0.018				-0.050*	-0.008	
			(0.025)	(0.023)				(0.028)	(0.026)	
dfor_gdp				-0.326***					-0.318***	
				(0.079)					(0.084)	
debt_limit					-0.015					-0.025
					(0.012)					(0.019)
Constant	0.037	0.019	0.108**	0.026	0.048	-0.056	-0.062	0.127	-0.015	0.031
	(0.051)	(0.060)	(0.049)	(0.037)	(0.049)	(0.101)	(0.071)	(0.099)	(0.078)	(0.102)
Observations	267	265	264	264	267	267	265	264	264	267
R-squared	0.803	0.804	0.819	0.864	0.805					
Number of country_id	19	19	19	19	19	19	19	19	19	19
Arellano-Bond test for AR(2)						0.165	0.0445	0.110	0.908	0.160
Hansen test						1	1	1	1	1

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Arellano-Bond test for AR(2): test for autocorrelation in first difference. Null hypothesis of no autocorrelation (see Arellano –Bond, 1991)

Hansen test for the validity of instruments: test the null hypothesis that the instruments as a group are exogenous. In a model containing a very large set of excluded instrument such a test may have very little power.

Table 4. Determinants of domestic debt as percent of GDP

	Fixed effect					Blundell & Bond				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
VARIABLES	dd_gdp	dd_gdp	dd_gdp	dd_gdp	dd_gdp	dd_gdp	dd_gdp	dd_gdp	dd_gdp	dd_gdp
L.dd_gdp	0.498***	0.563***	0.543***	0.542***	0.502***	0.538	0.561**	0.503*	0.510*	0.517
	(0.118)	(0.080)	(0.095)	(0.096)	(0.117)	(0.357)	(0.211)	(0.265)	(0.257)	(0.368)
broadmoney_gdp	0.380*	0.260**	0.238**	0.237**	0.383**	0.515**	0.300*	0.394**	0.385**	0.549**
	(0.184)	(0.098)	(0.096)	(0.096)	(0.180)	(0.188)	(0.170)	(0.161)	(0.170)	(0.202)
inf_ma	-0.059	-0.062	-0.076	-0.076	-0.063	0.110	0.059	0.063	0.045	0.117
	(0.044)	(0.047)	(0.048)	(0.050)	(0.042)	(0.140)	(0.092)	(0.129)	(0.105)	(0.154)
cpia	-0.002	-0.015	-0.009	-0.009	0.001	0.009	-0.002	0.048	0.038	0.025
	(0.011)	(0.010)	(0.009)	(0.009)	(0.010)	(0.044)	(0.022)	(0.041)	(0.036)	(0.035)
trade	-0.047	-0.057	-0.061*	-0.061*	-0.053	0.066	-0.072	-0.178	-0.156	0.056
	(0.037)	(0.034)	(0.031)	(0.031)	(0.038)	(0.087)	(0.100)	(0.129)	(0.126)	(0.096)
ex_nettr		0.287*	0.262	0.263			0.350	0.313	0.297	
		(0.158)	(0.158)	(0.160)			(0.267)	(0.243)	(0.239)	
tot_gdp			0.030*	0.031				0.070	0.054	
			(0.017)	(0.019)				(0.045)	(0.045)	
dfor_gdp				-0.005					0.045	
				(0.027)					(0.030)	
debt_limit					-0.010					0.032
					(0.008)					(0.032)
Constant	-0.027	0.051	0.028	0.028	0.000	-0.214	-0.007	-0.151	-0.122	-0.299*
	(0.039)	(0.034)	(0.026)	(0.026)	(0.028)	(0.184)	(0.099)	(0.104)	(0.103)	(0.165)
Observations	268	266	265	265	268	268	266	265	265	268
R-squared	0.628	0.716	0.726	0.726	0.631					
Number of country_id	19	19	19	19	19	19	19	19	19	19
Arellano-Bond test for AR(2)						0.682	0.324	0.358	0.427	0.443
Hansen test						1	1	1	1	1

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Arellano-Bond test for AR(2): test for autocorrelation in first difference. Null hypothesis of no autocorrelation (see Arellano –Bond, 1991).

Hansen test for the validity of instruments: test the null hypothesis that the instruments as a group are exogenous. In a model containing a very large set of excluded instrument such a test may have very little power.

Table 5. Determinants of domestic debt as percent of total public debt. Alternative specifications.

Fixed effect

VARIABLES	(1) dd_tot	(2) dd_tot	(3) dd_tot	(4) dd_tot	(5) dd_tot	(6) dd_tot	(7) dd_tot	(8) dd_tot	(9) dd_tot	(10) dd_tot	(11) dd_tot	(12) dd_tot	(13) dd_tot
L.dd_tot	0.813***	0.812***	0.772***	0.793***	0.832***	0.814***	0.809***	0.827***	0.748***	0.790***	0.812***	0.661***	0.667***
	(0.051)	(0.050)	(0.042)	(0.057)	(0.046)	(0.048)	(0.050)	(0.048)	(0.043)	(0.057)	(0.053)	(0.126)	(0.088)
broadmoney_gdp				0.039	0.053	0.040	0.041	0.044	0.061	0.045	0.035	0.122*	0.113
				(0.064)	(0.054)	(0.053)	(0.040)	(0.041)	(0.056)	(0.047)	(0.047)	(0.066)	(0.075)
inf_ma	-0.116	-0.031	-0.104				-0.071				-0.125**	-0.123*	-0.124*
	(0.068)	(0.125)	(0.073)				(0.109)				(0.059)	(0.062)	(0.065)
cpia	0.026*	0.009	0.028*	0.028**	0.021*	0.027*	0.023*	0.019	0.000	0.025*			
	(0.013)	(0.014)	(0.015)	(0.013)	(0.011)	(0.013)	(0.012)	(0.011)	(0.012)	(0.013)			
trade	-0.054	-0.043	-0.049	-0.050	-0.035	-0.051*	-0.045	-0.027	-0.009	-0.049	-0.040	-0.131**	-0.133**
	(0.034)	(0.034)	(0.037)	(0.029)	(0.024)	(0.026)	(0.034)	(0.031)	(0.032)	(0.035)	(0.034)	(0.054)	(0.058)
ex_nettr	-0.299*	-0.356**	-0.301*	-0.372*	-0.223	-0.283*	-0.324**	-0.262*	-0.268*	-0.404**	-0.177	-0.441*	-0.463*
	(0.146)	(0.129)	(0.159)	(0.182)	(0.153)	(0.144)	(0.134)	(0.126)	(0.147)	(0.145)	(0.145)	(0.220)	(0.236)
L.broadmoney_gdp	0.074												
	(0.081)												
bc_gdp		-0.361***											
		(0.087)											
sav_gdp			0.012										
			(0.044)										
diff_int				-0.142						-0.195*			
				(0.101)						(0.106)			
gdpdef					-0.001*			-0.001	-0.000				
					(0.000)			(0.000)	(0.000)				
hyperinf_d					0.179**			0.157**	0.143**				
					(0.067)			(0.065)	(0.053)				
L.inf_ma						-0.086							
						(0.075)							
kaopen							0.001	0.001	-0.005	0.002			
							(0.013)	(0.012)	(0.008)	(0.010)			
int_kaoinf							-0.017						
							(0.079)						
int_kaodiff										-0.085			
										(0.070)			
int_kaogdpdef								-0.000	-0.000				
								(0.000)	(0.000)				
d_completion_point									0.070***				
									(0.019)				
lngdp_pc											0.001		
											(0.034)		
bureaucracyquality												0.012	
												(0.071)	
governmentstability													-0.002
													(0.003)
Constant	0.013	0.079	0.042	0.006	0.014	0.021	0.007	0.002	0.045	0.017	0.099	0.205**	0.138**
	(0.061)	(0.055)	(0.061)	(0.052)	(0.053)	(0.059)	(0.047)	(0.042)	(0.038)	(0.047)	(0.336)	(0.086)	(0.057)
Observations	262	208	250	256	265	264	247	247	247	244	271	157	157
R-squared	0.801	0.823	0.810	0.800	0.814	0.804	0.795	0.808	0.833	0.801	0.802	0.844	0.844
Number of country_id	19	18	18	19	19	19	19	19	19	19	20	12	12
Robust standard errors in parentheses													
*** p<0.01, ** p<0.05, * p<0.1													
Interaction term							-0,088	0	0	-0,28			
Wald test (Prob > F)							0.6046	0.1879	0,2235	0.0797			

Table 6. Determinants of domestic debt as percent of total public debt. Alternative specifications.

Blundell & Bond

VARIABLES	(1) dd_tot	(2) dd_tot	(3) dd_tot	(4) dd_tot	(5) dd_tot	(6) dd_tot	(7) dd_tot	(8) dd_tot	(9) dd_tot	(10) dd_tot	(11) dd_tot	(12) dd_tot	(13) dd_tot
L.dd_tot	0.985***	0.957***	1.051***	0.993***	0.972***	0.992***	0.983***	0.984***	0.919***	0.800***	0.978***	0.961***	1.038***
	(0.095)	(0.091)	(0.051)	(0.058)	(0.059)	(0.072)	(0.047)	(0.065)	(0.069)	(0.069)	(0.056)	(0.117)	(0.122)
broadmoney_gdp				0.078	-0.021	0.042	-0.024	0.061	0.051	0.114**	0.124	0.218	0.309
				(0.076)	(0.073)	(0.070)	(0.042)	(0.073)	(0.046)	(0.041)	(0.112)	(0.205)	(0.288)
inf_ma	0.269	0.125	0.344				0.177	0.296***				0.284	0.283
	(0.182)	(0.129)	(0.198)				(0.137)	(0.097)				(0.238)	(0.211)
cpia	0.052**	0.012	0.032	0.022	0.017	0.034		0.030	0.031	0.028	0.022		
	(0.020)	(0.018)	(0.019)	(0.026)	(0.018)	(0.021)		(0.024)	(0.024)	(0.019)	(0.026)		
trade	-0.023	-0.021	-0.057	-0.115*	-0.070**	-0.068	-0.078	-0.041	-0.035	-0.045	-0.040	-0.054	-0.077
	(0.054)	(0.078)	(0.053)	(0.065)	(0.031)	(0.043)	(0.055)	(0.073)	(0.055)	(0.052)	(0.070)	(0.192)	(0.163)
ex_nettr	-0.936**	-0.785**	-0.882*	-0.822**	-0.613*	-0.802**	-0.697*	-0.798*	-0.619*	-0.589**	-0.803**	-0.694*	-1.019**
	(0.393)	(0.359)	(0.423)	(0.372)	(0.305)	(0.345)	(0.339)	(0.417)	(0.353)	(0.267)	(0.356)	(0.329)	(0.446)
L.broadmoney_gdp	0.095												
	(0.082)												
bc_gdp		-0.120											
		(0.116)											
sav_gdp			0.034										
			(0.100)										
diff_int				-0.150							0.012		
				(0.152)							(0.146)		
gdpdef					0.000				0.000	0.000			
					(0.001)				(0.001)	(0.001)			
hyperinf_d					0.164*				0.170*	0.134			
					(0.081)				(0.084)	(0.080)			
L.inf_ma						0.205							
						(0.122)							
kaopen								-0.013	0.001	0.001	0.004		
								(0.013)	(0.006)	(0.008)	(0.009)		
int_kaoinf								0.130					
								(0.090)					
int_kaodiff											0.056		
											(0.100)		
int_kaogdpdef									0.000	0.000			
									(0.000)	(0.000)			
d_completion_point										0.058**			
										(0.026)			
lngdp_pc							-0.012						
							(0.015)						
bureaucracyquality												0.020	
												(0.032)	
governmentstability													-0.001
													(0.007)
Constant	-0.186*	0.039	-0.094	0.024	0.023	-0.077	0.198	-0.090	-0.042	-0.033	-0.057	-0.067	-0.048
	(0.096)	(0.123)	(0.118)	(0.073)	(0.057)	(0.069)	(0.197)	(0.087)	(0.076)	(0.050)	(0.085)	(0.178)	(0.098)
Observations	262	208	250	256	265	264	271	247	247	247	244	157	157
Number of country_id	19	18	18	19	19	19	20	19	19	19	19	12	12
Arellano-Bond test for A	0.162	0.255	0.132	0.0587	0.0797	0.0963	0.0970	0.0706	0.0541	0.0334	0.0784	0.0599	0.0772
Hansen test	1	1	1	1	1	1	1	1	1	1	1	1	1
Robust standard errors in parentheses													
*** p<0.01, ** p<0.05, * p<0.1													
Interaction term								0,426	0	0	0,068		
Wald test (Prob > F)								0.0024	0.8732	0,6727	0.7186		

Table 7. Determinants of domestic debt as percent of GDP Alternative specifications.

Fixed effect

VARIABLES	(1) dd_gdp	(2) dd_gdp	(3) dd_gdp	(4) dd_gdp	(5) dd_gdp	(6) dd_gdp	(7) dd_gdp	(8) dd_gdp	(9) dd_gdp	(10) dd_gdp	(11) dd_gdp	(12) dd_gdp	(13) dd_gdp
L.dd_gdp	0.579***	0.594***	0.644***	0.517***	0.560***	0.562***	0.576***	0.496***	0.452***	0.534***	0.534***	0.535***	0.536***
	(0.057)	(0.081)	(0.056)	(0.085)	(0.080)	(0.083)	(0.070)	(0.114)	(0.118)	(0.113)	(0.113)	(0.067)	(0.084)
broadmoney_gdp				0.316***	0.286***	0.256**	0.249***	0.224**	0.295***	0.196**	0.195**	0.260**	0.283**
				(0.106)	(0.097)	(0.099)	(0.087)	(0.083)	(0.093)	(0.078)	(0.078)	(0.095)	(0.110)
inf_ma	-0.082	-0.045	-0.060				-0.049	-0.019				-0.060	-0.062
	(0.089)	(0.038)	(0.069)				(0.044)	(0.064)				(0.052)	(0.056)
cpia	0.001	-0.016	-0.013	-0.018	-0.019*	-0.014		-0.017*	-0.019	-0.016	-0.016		
	(0.011)	(0.009)	(0.011)	(0.011)	(0.010)	(0.010)		(0.010)	(0.012)	(0.009)	(0.010)		
trade	0.055	0.005	-0.023	-0.061	-0.052	-0.056	-0.055	-0.030	-0.032	-0.020	-0.021	-0.060	-0.034
	(0.044)	(0.016)	(0.029)	(0.037)	(0.035)	(0.034)	(0.034)	(0.024)	(0.028)	(0.024)	(0.024)	(0.041)	(0.029)
ex_nettr		0.083	0.139	0.206	0.256	0.261	0.246*	0.195	0.096	0.205	0.207	0.074	0.095
		(0.089)	(0.173)	(0.144)	(0.148)	(0.164)	(0.142)	(0.129)	(0.104)	(0.133)	(0.133)	(0.151)	(0.167)
L.broadmoney_gdp	-0.138												
	(0.161)												
bc_gdp		-0.096											
		(0.111)											
sav_gdp			-0.013										
			(0.029)										
diff_int				-0.060	-0.040				-0.156*				
				(0.054)	(0.059)				(0.075)				
gdpdef					-0.001***					-0.001***	-0.001***		
					(0.000)					(0.000)	(0.000)		
hyperinf_d					0.059*					0.060*	0.060*		
					(0.030)					(0.032)	(0.032)		
L.inf_ma						-0.021							
						(0.058)							
kaopen								-0.010	-0.001	-0.008	-0.008		
								(0.009)	(0.011)	(0.010)	(0.010)		
int_kaoinf								0.024					
								(0.037)					
int_kaodiff									-0.085				
									(0.075)				
int_kaogdpdef										0.000	0.000		
										(0.000)	(0.000)		
d_completion_point											-0.002		
											(0.009)		
int_kaocpia													
int_kaobroad													
lngdp_pc							-0.027						
							(0.025)						
bureaucracyquality												-0.048	
												(0.045)	
governmentstability													-0.003
													(0.003)
Constant	0.084	0.097**	0.127**	0.059**	0.067***	0.046	0.282	0.081*	0.078*	0.069**	0.068**	0.080	0.047
	(0.052)	(0.034)	(0.054)	(0.027)	(0.021)	(0.036)	(0.261)	(0.044)	(0.038)	(0.028)	(0.028)	(0.085)	(0.040)
Observations	264	210	250	256	255	265	272	248	244	248	248	159	159
R-squared	0.416	0.542	0.674	0.723	0.736	0.714	0.713	0.626	0.644	0.641	0.641	0.588	0.584
Number of country_id	19	18	18	19	19	19	20	19	19	19	19	12	12
Robust standard errors in parentheses													
*** p<0.01, ** p<0.05, * p<0.1													
Interaction term								0,005	-0,241	-0,001	-0,001		
Wald test (Prob > F)								0.9510	0.1132	0.0087	0,006		

Table 8. Determinants of domestic debt as percent of GDP Alternative specifications.

Blundell & Bond

VARIABLES	(1) dd_gdp	(2) dd_gdp	(3) dd_gdp	(4) dd_gdp	(5) dd_gdp	(6) dd_gdp	(7) dd_gdp	(8) dd_gdp	(9) dd_gdp	(10) dd_gdp	(11) dd_gdp	(12) dd_gdp	(13) dd_gdp
L.dd_gdp	1.123***	0.869***	1.004***	0.503**	0.586**	0.552**	0.570***	0.683***	0.630***	0.757***	0.754***	0.760***	0.861***
	(0.139)	(0.103)	(0.075)	(0.195)	(0.242)	(0.210)	(0.169)	(0.155)	(0.176)	(0.161)	(0.163)	(0.220)	(0.224)
broadmoney_gdp				0.337*	0.343**	0.344**	0.271	0.222	0.257	0.205*	0.214*	0.369*	0.379
				(0.174)	(0.148)	(0.147)	(0.174)	(0.132)	(0.151)	(0.116)	(0.115)	(0.195)	(0.261)
inf_ma	0.093	0.011	0.003				-0.025	0.135**				-0.023	0.075
	(0.182)	(0.056)	(0.103)				(0.092)	(0.058)				(0.094)	(0.132)
cpia	0.027	-0.013	0.039	-0.015	0.010	0.008		0.012	-0.005	0.022	0.020		
	(0.034)	(0.021)	(0.025)	(0.020)	(0.025)	(0.024)		(0.023)	(0.022)	(0.024)	(0.027)		
trade	0.148	-0.000	0.073	-0.101	-0.038	-0.058	-0.070	-0.029	-0.017	0.027	0.039	-0.054	-0.056
	(0.091)	(0.037)	(0.062)	(0.075)	(0.114)	(0.104)	(0.085)	(0.077)	(0.080)	(0.075)	(0.074)	(0.052)	(0.047)
ex_nettr		0.022	0.216	0.191	0.206	0.165	0.222	0.218	0.230	0.113	0.043	0.243	0.216
		(0.132)	(0.307)	(0.187)	(0.217)	(0.259)	(0.220)	(0.211)	(0.189)	(0.186)	(0.169)	(0.224)	(0.287)
L.broadmoney_gdp	0.084												
	(0.124)												
bc_gdp		-0.015											
		(0.072)											
sav_gdp			0.046										
			(0.062)										
diff_int				-0.127					0.016				
				(0.087)					(0.133)				
gdpdef					-0.000					-0.001*	-0.001		
					(0.001)					(0.000)	(0.000)		
hyperinf_d					0.021					0.072**	0.070**		
					(0.040)					(0.029)	(0.030)		
L.inf_ma						0.035							
						(0.096)							
kaopen								-0.012*	-0.018	-0.013	-0.012		
								(0.006)	(0.012)	(0.009)	(0.009)		
int_kaoinf								0.052					
								(0.054)					
int_kaodiff									0.130				
									(0.112)				
int_kaogdpdef										0.000	0.000		
										(0.000)	(0.000)		
d_completion_point											0.008		
											(0.015)		
int_kaocpia													
int_kaobroad													
lngdp_pc							-0.007						
							(0.011)						
bureaucracyquality												0.045*	
												(0.023)	
governmentstability													-0.001
													(0.003)
Constant	-0.204*	0.069	-0.202*	0.076	-0.076	-0.058	0.085	-0.069	-0.017	-0.124	-0.134	-0.141	-0.101
	(0.103)	(0.078)	(0.104)	(0.061)	(0.125)	(0.117)	(0.116)	(0.069)	(0.071)	(0.079)	(0.084)	(0.085)	(0.121)
Observations	264	210	250	256	266	265	272	248	244	248	248	159	159
Number of country_id	19	18	18	19	19	19	20	19	19	19	19	12	12
Arellano-Bond test for A	0.678	0.323	0.528	0.351	0.296	0.281	0.231	0.467	0.346	0.120	0.114	0.568	0.754
Hansen test	1	1	1	1	1	1	1	1	1	1	1	1	1
Robust standard errors in parentheses													
*** p<0.01, ** p<0.05, * p<0.1													
Interaction term								0,187	0,146	-0,001	-0,001		
Wald test (Prob > F)								0.0189	0.5322	0.6924	0,794		

Table 9. Determinants of domestic debt as percent of GDP Excluding Central Bank.

	Fixed effect					Blundell & Bond				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
VARIABLES	dd_gdp_ncb	dd_gdp_ncb	dd_gdp_ncb	dd_gdp_ncb	dd_gdp_ncb	dd_gdp_ncb	dd_gdp_ncb	dd_gdp_ncb	dd_gdp_ncb	dd_gdp_ncb
L.dd_gdp_ncb	0.610***	0.601***	0.580***	0.578***	0.610***	0.734***	0.616***	0.604*	0.603*	0.675***
	(0.083)	(0.084)	(0.103)	(0.107)	(0.084)	(0.145)	(0.176)	(0.318)	(0.312)	(0.17)
broadmoney_gdp	0.157*	0.149*	0.137*	0.136*	0.157*	0.205***	0.174**	0.185*	0.187*	0.235***
	(0.086)	(0.079)	(0.076)	(0.075)	(0.086)	(0.054)	(0.077)	(0.093)	(0.092)	(0.064)
inf_ma	-0.033	-0.043	-0.04	-0.039	-0.032	0	0.02	-0.013	-0.032	0.052
	(0.047)	(0.051)	(0.045)	(0.045)	(0.05)	(0.133)	(0.135)	(0.117)	(0.124)	(0.159)
cpia	0.012	0.006	0.01	0.01	0.012	0.022	0.024	0.085	0.081	0.034
	(0.009)	(0.007)	(0.01)	(0.009)	(0.009)	(0.02)	(0.015)	(0.073)	(0.066)	(0.021)
trade	0.001	-0.004	-0.008	-0.008	0.002	0.072	0.029	-0.134	-0.124	0.051
	(0.022)	(0.024)	(0.023)	(0.024)	(0.021)	(0.051)	(0.032)	(0.114)	(0.102)	(0.042)
ex_nettr		0.196*	0.184	0.185			0.132	0.074	0.083	
		(0.099)	(0.106)	(0.108)			(0.169)	(0.178)	(0.172)	
tot_gdp			0.02	0.02				0.088	0.083	
			(0.015)	(0.016)				(0.073)	(0.07)	
dfor_gdp				-0.005					-0.004	
				(0.012)					(0.03)	
debt_limit					0.001					0.033
					(0.005)					(0.027)
Constant	-0.063	-0.038	-0.044	-0.044	-0.056	-0.151**	-0.136**	-0.259	-0.249	-0.204**
	(0.037)	(0.028)	(0.033)	(0.033)	(0.039)	(0.064)	(0.048)	(0.189)	(0.175)	(0.096)
Observations	244	242	241	241	244	244	242	241	241	244
R-squared	0.654	0.666	0.672	0.672	0.654					
Number of country_id	18	18	18	18	18	18	18	18	18	18
Arellano-Bond test for AR(2)						0.406	0.907	0.885	0.9	0.46
Hansen test						1	1	1	1	1

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Arellano-Bond test for AR(2): test for autocorrelation in first difference. Null hypothesis of no autocorrelation (see Arellano –Bond, 1991).

Hansen test for the validity of instruments: test the null hypothesis that the instruments as a group are exogenous. In a model containing a very large set of excluded instrument such a test may have very little power.

Table 10. Determinants of domestic debt as percent of GDP Excluding Central Bank. Alternative specifications

Fixed effect

VARIABLES	(1) dd_gdp_ncb	(2) dd_gdp_ncb	(3) dd_gdp_ncb	(4) dd_gdp_ncb	(5) dd_gdp_ncb	(6) dd_gdp_ncb	(7) dd_gdp_ncb	(8) dd_gdp_ncb	(9) dd_gdp_ncb	(10) dd_gdp_ncb	(11) dd_gdp_ncb	(12) dd_gdp_ncb	(13) dd_gdp_ncb
L.dd_gdp_ncb	0.532***	0.728***	0.629***	0.555***	0.564***	0.602***	0.595***	0.380***	0.341**	0.391***	0.394***	0.613***	0.685***
	(0.058)	(0.067)	(0.027)	(0.091)	(0.089)	(0.080)	(0.081)	(0.130)	(0.143)	(0.124)	(0.127)	(0.096)	(0.079)
broadmoney_gdp				0.193**	0.189**	0.145*	0.154*	0.143**	0.193**	0.131*	0.126*	0,076	0,103
				(0.080)	(0.082)	(0.076)	(0.075)	(0.066)	(0.071)	(0.066)	(0.066)	(0.046)	(0.064)
inf_ma	-0,051	-0,036	-0,04				-0,053	-0.054				-0,025	-0,037
	(0.075)	(0.048)	(0.063)				(0.052)	(0.049)				(0.063)	(0.069)
cpia	0,006	-0,001	0,003	0,005	0,004	0,006		0.000	-0.000	0.002	0.004		
	(0.007)	(0.005)	(0.008)	(0.005)	(0.005)	(0.006)		(0.006)	(0.006)	(0.005)	(0.005)		
trade	0.059*	0.019**	0,015	-0,011	-0,011	-0,004	-0,005	0.012	0.006	0.015	0.013	-0,046	-0,005
	(0.029)	(0.009)	(0.010)	(0.027)	(0.027)	(0.025)	(0.023)	(0.015)	(0.020)	(0.016)	(0.015)	(0.031)	(0.024)
ex_nettr		0,093	0,07	0.172**	0.188*	0,191	0.213**	0.141	0.069	0.104	0.110	0.153*	0.175**
		(0.075)	(0.069)	(0.08)	(0.09)	(0.111)	(0.101)	(0.083)	(0.097)	(0.087)	(0.087)	(0.072)	(0.075)
L.broadmoney_gdp	-0,119												
	(0.096)												
bc_gdp		-0,063											
		(0.058)											
sav_gdp			0,002										
			(0.03)										
diff_int				0,044	0,06				-0.070				
				(0.058)	(0.062)				(0.070)				
gdpdef					-0.000*					-0.000	-0.000		
					(0)					(0.000)	(0.000)		
hyperinf_d					-0,006					0.003	0.005		
					(0.01)					(0.023)	(0.023)		
L.inf_ma						-0,036							
						(0.067)							
kaopen								0.007	0.018	0.007	0.008		
								(0.009)	(0.014)	(0.008)	(0.008)		
int_kaoinf								0.031					
								(0.035)					
int_kaodiff									-0.089				
									(0.063)				
int_kaogdpdef										0.000	0.000		
										(0.000)	(0.000)		
d_completion_point											-0.007		
											(0.007)		
int_kaocpia													
int_kaobroad													
lngdp_pc							0,013						
							(0.015)						
bureaucracyquality												-0.064*	
												(0.029)	
governmentstability													-0,002
													(0.002)
Constant	0,037	0,014	0,022	-0.048*	-0,043	-0,037	-0,153	0.004	-0.003	-0.005	-0.003	0.123*	0,007
	(0.026)	(0.016)	(0.025)	(0.027)	(0.028)	(0.026)	(0.151)	(0.023)	(0.024)	(0.013)	(0.012)	(0.057)	(0.018)
Observations	241	190	227	232	231	241	248	226	222	226	226	134	134
R-squared	0,442	0,628	0,625	0,669	0,673	0,666	0,665	0.481	0.494	0.480	0.483	0,706	0,679
Number of country_id	18	17	17	18	18	18	19	18	18	18	18	11	11
Robust standard errors in parentheses													
*** p<0.01, ** p<0.05, * p<0.1													
Interaction term								-0,023	-0,159	0	0		
Wald test (Prob > F)								0,4729	0,2041	0,8232	0,8612		

Table 11. Determinants of domestic debt as percent of GDP Excluding Central Bank. Alternative specifications

Blundell & Bond

VARIABLES	(1) dd_gdp_ncb	(2) dd_gdp_ncb	(3) dd_gdp_ncb	(4) dd_gdp_ncb	(5) dd_gdp_ncb	(6) dd_gdp_ncb	(7) dd_gdp_ncb	(8) dd_gdp_ncb	(9) dd_gdp_ncb	(10) dd_gdp_ncb	(11) dd_gdp_ncb	(12) dd_gdp_ncb	(13) dd_gdp_ncb
L.dd_gdp_ncb	0.501***	0.904***	0.932***	0.530***	0.652***	0.609***	0.629***	0.718***	0.617***	0.744***	0.648**	0.969***	0.962***
	(0.145)	(0.108)	(0.031)	(0.180)	(0.186)	(0.145)	(0.108)	(0.132)	(0.203)	(0.158)	(0.262)	(0.129)	(0.125)
broadmoney_gdp				0.218**	0.217***	0.200***	0,112	0.111	0.178	0.135*	0.209**	0,088	0,104
				(0.095)	(0.062)	(0.063)	(0.068)	(0.067)	(0.108)	(0.064)	(0.098)	(0.082)	(0.083)
inf_ma	-0,047	0,048	-0,049				-0,026	-0.065				-0,032	0,064
	(0.206)	(0.074)	(0.124)				(0.121)	(0.116)				(0.099)	(0.121)
cpia	0.052**	0,007	0,026	0,015	0.033*	0.028*		0.027	0.022	0.036*	0.033*		
	(0.019)	(0.013)	(0.023)	(0.01)	(0.018)	(0.016)		(0.021)	(0.018)	(0.020)	(0.019)		
trade	0,077	0,003	0,022	-0,016	0,058	0,037	0,034	-0.007	-0.028	0.010	0.020	0,015	0,005
	(0.058)	(0.031)	(0.036)	(0.024)	(0.036)	(0.035)	(0.052)	(0.040)	(0.055)	(0.044)	(0.046)	(0.032)	(0.038)
ex_nettr		0,097	0,154	0,009	0,009	0,05	0,132	0.214*	0.098	0.101	0.093	0,24	0.300**
		(0.136)	(0.163)	(0.177)	(0.212)	(0.164)	(0.119)	(0.117)	(0.138)	(0.141)	(0.153)	(0.146)	(0.123)
L.broadmoney_gdp	0.286***												
	(0.073)												
bc_gdp		-0,016											
		(0.054)											
sav_gdp			0,12										
			(0.108)										
diff_int				0,243					0.143				
				(0.278)					(0.137)				
gdpdef					-0,001					-0.000	-0.000		
					0					(0.000)	(0.000)		
hyperinf_d					0,021					0.030	0.027		
					(0.019)					(0.038)	(0.027)		
L.inf_ma						-0,017							
						(0.133)							
kaopen								-0.001	0.000	-0.011	-0.012		
								(0.007)	(0.008)	(0.009)	(0.008)		
int_kaoinf								-0.053					
								(0.072)					
int_kaodiff									-0.083				
									(0.129)				
int_kaogdpdef										0.000	0.000		
										(0.000)	(0.000)		
d_completion_point											-0.005		
											(0.014)		
int_kaocpia													
int_kaobroad													
lngdp_pc							-0,011						
							(0.011)						
bureaucracyquality												0,004	
												(0.01)	
governmentstability													-0,003
													(0.002)
Constant	-0.224***	-0,026	-0,095	-0.097*	-0.195***	-0.141***	0,082	-0.083*	-0.097*	-0.130**	-0.138***	-0,034	-0,013
	(0.053)	(0.04)	(0.058)	(0.055)	(0.054)	(0.042)	(0.11)	(0.043)	(0.052)	(0.046)	(0.047)	(0.028)	(0.031)
Observations	241	190	227	232	242	241	248	226	222	226	226	134	134
Number of country_id	18	17	17	18	18	18	19	18	18	18	18	11	11
Arellano-Bond test for AR(2)	0,779	0,711	0,29	0,502	0,409	0,803	0,903	0.986	0.813	0.697	0.762	0,197	0,147
Hansen test	1	1	1	1	1	1	1	1	1	1	1	1	1
Robust standard errors in parentheses													
*** p<0.01, ** p<0.05, * p<0.1													
Interaction term								-0,118	0,06	0	0		
Wald test (Prob > F)								0,431	0,6956	0,8311	0,7746		

Chapter 3

The impact of IMF's debt limit policy on borrowing behavior[1]

Giovanna Bua
Università degli Studi di Milano

Abstract

This paper uses the propensity matching score approach to assess the impact of the IMF's debt limits policy (DLP) on borrowing behavior in countries eligible to borrow from its concessional lending window. The paper finds that countries under the DLP borrow significantly higher amounts of concessional resources. However, there is no evidence that the DLP significantly impacts the level of non-concessional borrowing nor the terms of such borrowing. This result is confirmed by the heterogeneity analysis, suggesting that the level of development, rather than concessionality requirements, is the key driver of non-concessional borrowing

JEL Codes: F33, F34, F35, F53, O1
Keywords: Concessionality; debt; debt limits policy; IMF programs; propensity score matching.

[1] The impact of IMF's debt limit policy on borrowing behavior", is a previous version of the IMF Working Paper 2014/176, "A Constrained Choice? Impact of Concessionality Requirements on Borrowing Behavior (joint with Calixte Ahokpossi and Laurence Allain)

1. Introduction

As always when a financial crisis occurs and policy responses are adapted, questions arise about the effectiveness of those strategies. The long lasting debt crisis in highly indebt poor countries and the arrival of debt forgiveness –mainly through the Highly Indebt Poor Countries Initiative (HIPCs) and Multilateral Debt Relief Initiative (MDRI)[2] - reawaken the debate over the effectiveness of debt relief and its efficiency compared to other forms of developmental assistance to poor and indebted countries.

The literature has traditionally recognized two main channels under which debt relief spurs growth and investment. The first one is the reduction of debt service payment (Cohen, 1993) and the second one is the reduction of the stock of debt below the level that disincentive investment (Krugman 1988, Sachs 1989).

Evidence from the HIPC/MDRI Initiative provides new insight into these channels and suggests additional benefits and challenges. On the one hand, recent studies claim that one possible advantages of debt relief vis-à-vis other forms of assistance is to create market access to private capital market. To this regards, Bulow (2002) has highlighted as crucial test of debt relief the importance of successfully restoring positive net resource transfers to countries where international lending is profitable; along the same line Arslanalp and Henry (2004) have shown that Brady deals succeeded in stimulating investment and growth principally because of the new flow of lending to the private sector. On the other hand, some IFIs have raised concern about possible disadvantages of debt relief, warning against the risks that some countries will use the fiscal space guaranteed by the initiative to restart borrowing excessively or to borrow at non- concessional term (World Bank, 2006, IDA and IMF, 2006). In this regards, countries have adopted, on their own or through various international commitments (IMF conditionality, regional convergence criteria, engagement with other multilateral institutions), some rules to guide their borrowing behavior and ultimately to avoid the buildup of unsustainable debt. These two views are somehow contradictory: worries about lending, in fact, appear to clash with the idea that debt relief paves the way for new capital inflows producing rising asset prices, increased investment and faster growth (Arslanalp and Henry, 2004).

It is a moot point whether constraints on borrowing behavior harm the ability of low income countries (LICs) to access growth enhancing lending or whether the lack of basic infrastructure that form the basis for profitable economic activity would harm it regardless.

Given this backdrop, in this paper, we assess effectiveness of the IMF's debt limits policy (DLP) on borrowing behavior in countries eligible to its concessional lending window (Poverty Reduction and Growth Trust – or PRGT).[3]

The IMF's debt limits policy is a set of rules that guide borrowing policy in countries with an economic program supported by a Fund arrangement. A key feature of the policy is that it distinguishes loans based on concessionality, i.e., the level of their grant element.[4] Under the DLP, while access to nonconcessional borrowing is limited, access to highly concessional borrowing is

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[2] Debt Relief in Highly Indebted Poor Countries started in 1988 with the *Toronto term* and the forgiveness of a third of bilateral debt. The Initiative was followed by three consecutive actions and the forgiveness of 90 percent of bilateral debt. As these reductions were seen as insufficient, donors decided to include multilateral agencies. Multilateral forgiveness began with the HIPC Initiative in 1996 and it continued with the approval of the MDRI in 2005. The HIPC Initiative entailed coordinated action by multilateral organizations and governments to reduce to sustainable levels the external debt burdens of the most heavily indebted poor countries. The MDRI goes further by providing full debt relief to free up additional resources to help these countries reach the MDGs (IMF, 2013a).

[3] PRGT is a trust fund that provides concessional resources for poor countries with limited access to international markets.

[4] The grant element is the difference between the face value of the loan and its present value relative to the face value. Up to October 2013, to calculate the grant element, the IMF used a variable discount rate that is linked to the commercial interest reference rate (CIRR). Now, it uses a discount rate linked to the level of economic activity in LICs. Concessional loans are those for which the grant element is higher than a certain threshold. The IMF uses a 35% threshold.

unconstrained. In principle, as long as concessional resources are available, countries can rapidly accumulate new debt. The terms of concessional borrowing are very favorable and alleviate the debt burden, but a high amount of concessional debt can also compromise debt sustainability (IMF 2013b). In this regard, we intend to investigate the impact of DLP on the level on new borrowing as well as on the terms of borrowing in order to understand whether IMF's conditionality harms the ability of LICs to access growth enhancing lending. To answer these questions, we focus on PRGT-eligible countries because the policy uniformly applied to this group of countries.

We proxy DLP with the participation in IMF program for muliple reasons. First, DLP does not apply to countries as a stand-alone policy, but as part of an IMF program. Second, DLP applies in all IMF programs with LICs (hence our focus on PRGT eligible countries). Third, even though Fund programs encompass a variety of other measures (fiscal, monetary, financial, etc), DLP is the only one that affects the terms of borrowing; it also affects, in conjunction with fiscal policy, the amount borrowed through limits on nonconcessional borrowing.

Same preliminary evidence is depicted in Figure 1, 2 and 3 in Appendix 1. Figure 1 shows the evolution of public and publicly guaranteed (PPG) external debt disbursement and suggest that on average PRGT-eligible countries tend to supply their financial needs with concessional loans vis-à-vis non-concessional loans. Also the box-plot in Figure 1 suggests that LICs are quite heterogeneous with regard to reliance on non-concessional financing and small economies seem to receive larger amount. Figure 2 reveals that in countries under DLP the level of concessional borrowing (as % of GDP) is on average higher that in countries that are not under the policy, while the level of non-concessional borrowing (as % of GDP) is similar in both groups. Figure 3 shows that grant element and financial terms are on average higher in countries under DLP. These figures provides first insight into the effectiveness of DLP. On the one hand, higher level of concessional borrowing and better financial terms in countries under the policy suggest a positive impact of DLP on borrowing behavior; on the other hand, the limited reliance on non-concessional borrowing in both groups may indicate that macroeconomic and institutional instability in LICs discourage non-concessional type of lenders.

A challenge in identifying the impact of DLP on LICs is the potential for endogeneity of IMF's program participation. IMF programs are usually concluded in times of economic crises, therefore the conditions of countries that enter and remain under agreement are not the same as for those that abstain. If those conditions differ, difference in borrowing behavior might depend not only on the program (DLP) itself but also on these initial conditions. Failure to control for these initial conditions would result in a selection bias problem. The literature on the impact of IMF program has used various methods to deal with the selection problems, from early before–after studies (Reichmann and Stillson, 1978; Connors, 1979; Pastor, 1987, Killick, 1995) to more recent works which use Heckman's (1979) methodology (i.e. Przeworski and Vreeland, 2000), the instrumental variables approach (Barro and Lee, 2005; Easterly, 2005; and Nsouli, Mourmouras, Atoian, 2005), or the method of matching (Atoyan and Conway, 2006; Hardoy, 2003; Bal Gunduz et al., 2013).[5]
To address the self-selection problem of being under an IMF program, we use the statistical technique known as "propensity score matching"[6] (PSM). In addition to examining the overall effect of DLP on

[5] All these approaches present pros and cons -relative to the specific context- that should be carefully ponder by the analyst. The matching is a consistent estimator of casual parameters under the hypothesis of "selection on observables" (see Cerulli, 2012; Przeworski & Limongi, 1996), hence it results in unbiased estimates only if the decision to enter IMF programs can be accounted by the selection procedure (Przeworski & Limongi,1996). Nonetheless, it is generally preferred to other estimators as it does not require the identification of any specific parametric relation between the dependent variables and the regressors. On the contrary, the Heckman Selection Model (1979) is suitable –other than under selection of observable- also under "selection on unobservable", but it depends implicitly on auxiliary restrictions such as the distribution of the unobservable. Finally the challenge with the Instrumental Variable (IV) approach, even if suitable for both selection of observable and unobservable without assuming any distributional hypothesis, is in finding variables that affect the probability of program participation but do not affect the outcome variables other than through their impact on participation.

[6] Propensity score matching was first proposed by Rosenbaum and Rubin (1983) and it has been used –with increasing interest- in many non randomized studies (e.g. Dehejia and Wahba, 1999; Hong & Yu, 2008; Ye & Kaskutas, 2009; Wyse,

borrowing behavior, we also investigate whether there is any heterogeneity in its impact, which is whether the treatment varies across members of the population. To this end, we explore the following sources of heterogeneity: IDA-status, level of development, infrastructure gap, projection growth and total debt. To the best of our knowledge, our paper is the first study that uses propensity score matching to analyze the impact of DLP on borrowing behavior.

We find that the level of concessional borrowing is significantly higher in countries under the DLP, suggesting that the presence of an IMF program could play a catalytic role in attracting more concessional resources. We do not find evidence that the DLP significantly impacts the level of non-concessional borrowing (private or otherwise), suggesting that LICs have not been able to attract significant amounts of non-concessional financing, irrespective of the policy constraint. The results also indicate that the terms of borrowing on new loan commitments are not significantly affected by concessionality requirements under the DLP. Finally, the heterogeneity analysis (conducted for robustness check) confirms that terms of borrowing as well as the level of non-concessional borrowing are not affected by the DLP, but are affected by the level of development

The rest of the study is organized as follow. Section 2 describes our dataset and the methodology. In section 3, we estimate the average treatment effect of DLP on the treated group, employing a variety of propensity score matching methods. In section 4, we explore the heterogeneity feature of the treatment effect utilizing control function regression approach. Section 5 offers our conclusion.

Keesler, and Schneider, 2008; Staff et al. , 2008). In the macroeconomics literature, it has been recently used, to study the effects of the inflation targeting arrangement on macroeconomic performances (see Lin and Ye, 2009; Lin, 2010), the effects of fiscal rules on fiscal behavior in developing countries (Tapsoba, 2012), the economic impacts of foreign capital flows (see Chari, Chen, and Dominguez, 2012) and the impact of different strategies to respond to crisis (Forbes et al. , 2013). Amongst the studies on the impact of IMF Fund-supported program, Propensity score matching has been recently used by Atoyan and Conway (2006) Hardoy (2003), Hutchison (2004), and Bal Gunduz et al., (2013).

2. Method and data

(a) Data

Our analysis assesses the hypothesis that countries' borrowing behavior is impacted by their involvement with the IMF, through its DLP. Our dataset consists of 70 countries that were PRGT-eligible throughout the sample period 1986 – 2011[7] (countries are listed in Table 1 in Appendix 2). Most of the data are drawn from the World Bank's World Development Indicator and the IMF's World Economic Outlook. Following Barro and Lee (2005) and Jorra (2012), we arrange all the data in five-year frequencies; hence our panel covers 70 countries over the five-year periods 1986-91, 1992-96, 1997-01, 2002-06, 2007-11. Amongst the 70 countries, 57 countries benefited from IDA-only lending and 13 received a mix of IDA and IBRD lending[8] Also, 39 countries in the sample benefitted from the HIPC initiative. The focus on PRGT-eligible countries- based on income level and related economic and financial vulnerabilities - helps create a homogeneous sample and yet it ensures that the control group provides a good counterfactual for the treatment group.

The dependent variable is a dummy variable that takes the value one if a country is under IMF program for at least three years in a five years window.[9] This variable is taken from Bal Gunduz et al. (2013). The qualifying programs are all IMF financial arrangements available to PRGT-eligible countries: primarily the ECF and its predecessors (PRGT, ESAF, SAF), but also the Stand-By-Arrangements (SBA), the Exogenous Shock Facility (ESF), the Standby Credit Facility (SCF), and the Policy Support Instruments (PSI). The focus on this specific sample helps address some of the concerns raised by the literature on IMF's engagement. As pointed out by Steinwand and Stone (2008), the heterogeneity of IMF's program weakens the ability of identifying a satisfactory selection model of participation in IMF programs.

We assess borrowing behaviors in the presence of the debt limits policy by looking at external public debt along three different dimensions. For each dimension we use different groups of variables:

i) Size of borrowing, which is proxied by the total amount of public and publicly guaranteed (PPG) loan commitment and disbursement as a share of *GDP*. We also look at the sources of PPG debt flows by breaking them down into concessional[10] versus non-concessional loans, official (bilateral and multilateral) loans versus private loans. Finally, we look at the largest source of borrowing for most low income countries (IDA loans)[11];

ii) *Composition of borrowing*, which is proxied by the share of external disbursement –breakdown into sources of financing- as a share of total external disbursement. As before, we look at concessional versus non-concessional, bilateral, multilateral and IDA;

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[7] A country is PRGT-eligible, if: (i) its annual per capita income is below the operational IDA cut-off ; and (ii) the sovereign does not have capacity to access international financial markets on a durable and substantial basis (IMF, 2013c).

[8] As for 2011.

[9] Alternatively, we define the treatment as "being under DLP and/or IDA Non Concessional Borrowing Policy" (NCBP), in order to include the debt limits imposed by IDA since 2006. The variable is proxied by a dummy variable that takes value one if a country is under IMF program and/or IDA NCBP for at least three years in a five years window". The two variables overlap almost perfectly, hence no difference is found in the results.

[10] The definition of concessionality in the data available differs from the debt limit policy definition. WDI defines concessional debt as loans with an original grant element of 25 calculated discounting future service payments at 10 percent, while in the current debt limit policy the concessionality ceiling is based on 35 percent grant element cut off and it is based on CIRRs discount rate; hence data should be interpret with caution.

[11] In the current Debt Limit Policy the concessionality ceiling applies to PPG External Debt Commitments. Therefore, we would ideally use as dependent variable the breakdown of PPG External Debt *Commitments*. However, given the lack of data on concessional/non concessional dichotomy for External Debt Commitments, we use 5 year period average of External Debt *Disbursement*, which we expect being a good proxy of 5 year average of External Debt *Commitments*.

iii) *Terms of borrowing*, which is proxied by the average grace period, the average interest rate, the average maturity, and the average grant element[12] on new external debt commitments. Data are draw from the World Bank's Debt Reporting System (DRS).

Summary statistics and description of the variables are provided from Table 2 to Table 5 in Appendix 2. As depicted in Figure 2 and 3 (see Appendix 1), countries under DLP shows on average a higher level of disbursement on concessional PPG External Debt (as % of GDP), higher grant element and in general better average financial term. This seems to give a first insight on a positive impact of DLP on borrowing behavior. We do not observe any difference in the level of non-concessional borrowing (as % of GDP). In the next section we assess more formally whether those differences hold once we address the self-selection problem of the IMF-engagement.

[12] Data on average grant element available in the WB's DRS are derived by discounting future service payments at 10 percent. In order to provide figures closer to the IMF' grant element calculator – based on CIRRs discount rate- we derived the average grant element using 5% discount rate. Our estimates are based on the average financial terms provided by WDI and assuming constant future repayments.

(b) Method

The objective of our analysis is to evaluate the treatment effect of DLP in PRGT-eligible countries on their borrowing behavior. A simple approach would be to compare flow of external debt for countries under the DLP against that of countries not subject to the DLP. However, this approach would yield biased results, as participation in IMF program (and therefore being subject to the DLP) is endogenous and depends on many factors (Bal Gunduz et al. 2013). To account for this endogeneity, we consider the participation in an IMF program as a *treatment* and we refer to countries that have been under IMF program as *treated group* and to the non-program as the *control group*. Then, the average *treatment effect* for the treated (ATT; Imbens, 2004) [13] is given by

$$ATT = E\,[\,Y_{I1}|D_I = 1] - E\,[\,Y_{I0}|D_I = 1] \qquad (1)$$

Where D is the dummy variable that identifies a country as "being under the Debt Limits Policy". Y_{I1} is the value of the outcome variable when country i is "under the Debt Limits Policy" and Y_{I0} if it is not. $[\,Y_{I0}|D_I = 1]$ is the outcome value that would have been observed if the country i was not subject to the DLP, and $[Y_{I1}|D_I = 1]$ is the outcome value actually observed for the same country (subject to DLP).

Unfortunately, the counterfactual impact of the treatment - $[\,Y_{I0}|D_I = 1]$ – is not observed, therefore one has to choose a proper substitute for it in order to estimate an unbiased ATT. To this end, we use a statistical technique known as "propensity score matching" (PSM). It consists of finding in a large group of non-participants individuals who are similar to the participants in all relevant characteristics X and pair them. Then, differences in outcomes between the control group and the participants can be attributed to the treatment (DLP in our case). The key assumptions that need to be met to apply PSM are: i) conditional independence assumption (CIA); and ii) common support.

The first condition requires the selection into treatment to be driven only by factors that the researcher can observe. Under this assumption equation (1) becomes:

$$ATT = E\,[\,Y_{I1}|D_I = 1, |X_i\,] - E\,[\,Y_{I0}|D_I = 0|X_i] \qquad (2)$$

Where $E\,[\,Y_{I0}|D_I = 1]$ has been replaced by $E\,[\,Y_{I0}|D_I = 0|X_i]$ which is observable.

Since, conditioning on a high number of covariates in X might be complicated (the so called "curse of dimensionality"), Rosenbaum and Rubin (1983) suggest matching on probability score i.e. the probability of participating in a program given observed characteristics X instead of matching on X. The second assumption requires that every subject has a non-zero probability to receive either treatment. Rosenbaum and Rubin (1983) demonstrate that under those two assumptions treatment assignment is strongly ignorable and conditioning on propensity score can be used to obtain unbiased average treatment effect estimates and equation (2) can be written as follow:

$$ATT = E\,[\,Y_{I1}|D_I = 1, |p(X_i)] - E\,[\,Y_{I0}|D_I = 0|p(X_i)] \qquad (3)$$

Yet, propensity score matching entails forming matched sets of treated and untreated subjects who share a similar value of propensity score (Rosenbaum and Rubin, 1983) , once a matched sample has been formed, the treatment effect can be directly estimated by comparing outcomes between treated and untreated subject in the matched sample.

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[13] A related measure of treatment effect is the ATE at the population level (Imbens, 2004), that is the average treatment effect of moving an entire population from untreated to treated. Applied researchers should decide whether ATT or ATE are of greater interest for their research. ATT might be more appropriate when estimating the impact of a structured program with potentially high barriers to participate. In contrast, when testing the effect of wide spread treatment (i.e. brochures given to patients) ATE might be of greater interest.

The methodology involves two steps: the first one is the estimation of the propensity scores, i.e. the probability that a country would have agreed to an IMF stabilization program ex-ante, regardless of what they ultimately decided to do. In the second one, the *propensity scores* are used to match countries that had an IMF program with similar countries (propensity-wise) that did not have an IMF program. This process of "balancing" program and non-program observations by propensity scores controls for systematic differences between the two groups prior the decision whether to participate in a Fund program. [14]

The results of the propensity score matching should be interpret with care. The reliability of the PSM results depends on whether or not the conditions for the application of the PSM methodology are met. As we previously described, PSM relies on two main assumptions: i) Conditional Independence Assumption (CIA); and ii) Common support. The first one requires the selection into treatment to be driven only by factors that the researcher can observe; hence it implies that omitting important variables can seriously increase bias in resulting estimates. In order to credibly justify the CIA, it is important to first discuss whether the available empirical evidence casts doubts on its plausibility; and then to identify a selection model broadly accepted by the literature. In other words, a model – which properly identifies the likelihood of being under an IMF program, - is *conditio sine qua non* for the correct use of PSM. The second assumption –the common support- ensures that countries with the same characteristics X have the same positive probability of being both participants and nonparticipants (Heckman, Lalonde, and Smith, 1999).

[14] The literature proposes different type of estimators to match treated and untreated observations. In this paper we present the result for the *radius matching* and the *kernel matching* because they guaranteed the best balancing for all relevant confounders (as proved by the Absolute Standardized Bias).

3. Estimating average treatment effect

(a) Estimating the propensity scores

We estimate the propensity score by using a probit model with the probability of being under IMF program/DLP as dependent variable. As independent variables, we use economic and political variables that capture both demand and supply factors and that have been broadly identified by the literature as predictors of participation in IMF programs[15]. Our estimation is broadly similar to the one by Bal Gunduz et al. (2013).

In general, we assume that i) countries turn to the IMF when their economies are in turmoil and that ii) the IMF lending policy in LICs is responding to the degree of their external imbalance, their macroeconomic conditions, their size and institutional weights. Given this backdrop, we expect Fund assistance to be more likely in countries with weak macroeconomic conditions, feeble structural characteristics and state institutions, and tighter link with the IMF.

Starting from the countries' macroeconomic conditions, in line with the major evidence in the literature[16], we find that a shortage of official reserves significantly increases the likelihood of entering a program agreement with the Fund. As regard bilateral aid, we do not find any significant correlation with the dependent variable. The expected sign is ambiguous a priori. According to Dreher, Sturm and Vreeland (2009), when the availability of bilateral aid is lower, the pressure to draw on multilateral resources is stronger. Supporting this view Bal Gunduz et al. (2013) find a negative significant relation between the likelihood of an IMF program and aid. On the other hands, Alesina and Dollar (2000) maintain that bilateral foreign assistance is widely used by donors as foreign policy instrument responding to their strategic interests in the recipient countries and can be expected to have a catalytic effect on IMF lending. Our results do not help distinguish between these competing theories. Finally, in line with Bal Gunduz et at. (2013) we don't find evidence that weak trading partner growth impacts the likelihood of being under an IMF program.

Consistently with the literature[17] we find that the probability of being under an IMF-program is higher in poorer countries and is lower in countries that benefit from higher resource rents (Bal Gunduz et al., 2013). We also find that countries with high level of inflation were slightly less likely to sign an IMF-program. This result, which might be difficult to justify, is partially in line with the literature that find different results upon using different samples and periods. In particular, Pop-Eleches (2008) finds a negative relation for Latin America in the period 1990-2001; Biglaiser and DeRouen Jr. (2010) do not find any significant result and Presbitero and Zazzaro (2010) find a positive and significant relation.

The structural characteristics of a country also contribute to explain the likelihood that the country would have an IMF program. As expected, landlocked resource-scarce countries have a higher probability of being under an IMF program (Bal Gunduz et al., 2013). We also control for the possibility that the IMF rewards more globalized countries, either because of their closeness to the "*Washington Consensus*" prescription or because they are more prone to suffer from spillover effect of a crises. In line with Presbitero and Zazzaro (2010) and Bal Gunduz et al. (2013) we do not find evidence of a significant relation.

Institutional characteristics are shown to increase the probability of being under an IMF program. We find that the World Bank's Country Policy and Institutional Assessment (*CPIA*) is positively and

[15] E.g. Barro and Lee, 2005; Bird & Rowlands, 2007; Broz and Hawes, 2006; Brune et al., 2004; Dreher, 2006; Edward, 2005; Bal Gunduz et al., 2013; Presbitero and Zazzaro, 2010; Przeworsk & Vreeland, 2000; Vreeland, 2003). A detailed description of our variables and the source of information can be found in Table 2 in Appendix 1.

[16] Cornelius, 1987; Knight and Santaella, 1997; Vreeland, 2003; Barro and Lee, 2005; Sturm, Berger and De Haan, 2005.

[17] Joyce, 1992; Garuda, 2000; Dreher and Vaubel, 2004; Barro and Lee, 2005; Sturm, Berger and De Haan, 2005; Eichengreen, et al., 2006.

significantly correlated with the dependent variable, while being a democracy is not significantly correlated with the dependent variable. The sign of this relation is not conclusive in the literature. In particular democracy might impact the dependent variable either way. Autocratic governments are, in fact, less concerned with the popularity of their economic policy decisions and therefore may be more likely to ask for IMF support, but are also less interested in using IMF assistance to spur macroeconomic adjustment programs. Supporting the negative relation, Bird et al. (2004) find that countries with weak state institutions are more likely to borrow from the IMF repeatedly, while Jensen (2004) and Nooruddin and Simmons (2006) do not find any significant relation.

Finally, one of the most robust finding that emerges from the literature on the determinants of IMF lending is that program initiation is significantly drawn by a country's political and economic links with IMF influential shareholders. To capture the country's relationship with the IMF, we include the country's size and its IMF quota, which might increase the likelihood of the Fund to intervene (Barro and Lee, 2005; Bal Gunduz et al., 2013; Stone, 2008). We find a positive but not significant relation. This result might be explained by the peculiarity of our sample, composed by countries whose size does not significantly differ.

Table 6 reports the probit estimates of the propensity score using DLP as dependent variables[18]. Column (1) displays our preferred model. In the following columns we add further controls on the baseline specification. Table 7 reports the probit estimates using an alternative dependent variable (being under a Fund program, or being under the World Bank's Nonconcessional Borrowing Policy). The results remain almost identical to those of Table 6.

[18] It is important to point out that our objective here is not to build a statistical model explaining IMF participation in the best possible way, but to mimic a controlled experiment in the best possible way. To do so, -while selecting the variables- we give much attention to the implementation rules proposed by the literature (Caliendo and Kopeining, 2007; Persson, 2001). In particular, according to the CIA, the PSM produces bias estimates if variable that affect simultaneously the assignment process and the outcome variables are omitted. By the same token, as pointed out by Persson (2001) omitting variables that affect only the assignment process, but not the outcome variables, have little influence on the results. Secondly, only variables that are unaffected by the participation (or its anticipation) should be included in the model. To ensure this we include variables either calculated at the beginning of the 5-year period or fixed over time.

(b) Matching method and results

Before applying the matching methods, we make sure that the common support assumption is met. To this end, we implement the minimum-maximum criterion, by excluding all observations in the control group whose propensity score is smaller than the minimum and larger than the maximum in the treated group.

We used the results of the propensity scores estimated above to match countries under the DLP with countries in the control group using two methodologies. First, the radius matching which matches each country under the DLP with control countries within a certain radius (we used R=0.05 and R=0.1). Second, the kernel matching, which matches each country under the DLP with all control countries weighted proportionally to their closeness to the DLP country[19]. As the matching estimator presents no analytical variance, we compute standard errors by bootstrapping (see Dehejia and Wahba, 1999). We looked at three sets of debt indicators: the volume of borrowing (disbursement and commitment), the composition of borrowing (disbursement) and its financial terms (interest rate, maturity, grace period and grant element).

Table 8 reports the estimated average treatment effect on the treated (ATTs) on all the outcome variables. The results are broadly consistent across matching methods. They indicate that, on average, the level of concessional borrowing (disbursement and commitment) is significantly higher in countries under the DLP as compared to what would have happen in its absence, while the ATT on the level of non-concessional borrowing is not significant. We find that the higher level of concessional borrowing in countries under DLP is essentially driven by multilateral and bilateral donors, whereas the level of borrowing granted by private creditors is not statistically different in the two groups. Turning to the composition of external debt disbursement, we do not find any significant results. However, the signs of the coefficients suggest that depending on the treatment status countries rely on different debt portfolio composition favoring concessional lending vis-à-vis non-concessional lending if they are under the policy. Finally we find that the ATT on average grant element, average interest rate, average maturity and average grace period is not significant. However, as the composition of external debt disbursement is found to be not significant, no difference should be found in the average grant element of the two groups[20].

In sum, we do not find evidence that DLP significantly impacts the level of non-concessional borrowing and the terms of borrowing on new commitment, suggesting that LICs are not able to attract non-concessional type of lenders irrespective of the policy constraint. Also we find that the level of concessional borrowing is significantly higher in countries under DLP (as % of GDP) suggesting that, if available, PRGT-eligible countries tend to supply their financial needs through concessional borrowing. The higher level of concessional-type of lenders in countries under DLP should be interpreted with caution, as the literature is not unanimous on its rational. Bird and Rowlands (2007a) suggest that IMF programmes crowd in lending at favorable terms; more recently Kinda and Le Manchec (2012) postulate that higher level of donor assistance in countries under IMF programmes may be simply reflecting the fact that most of the factors that affect the likelihood of being under the DLP (GDP per capita, size of the country, etc) also affect donors' allocation. Finally, we find that DLP does not exert a significant effect on private creditors lending, suggesting that the policy does not discourage private creditors. Even if beyond the scope of this analysis, this result is in line with previous studies on the catalytic effect of the IMF-programmes on private lending, which

[19] We retained the radius matching and the kernel matching because they guaranteed the best balancing for all relevant confounders (as proved by the Absolute Standardized Bias). As pointed out by Heckman, Ichimura and Todd (1997), asymptotically, all PSM estimators should yield the same results but in small sample the choice of the matching algorithm can be important. Pragmatically we should choose the matching method that guarantees the best balancing on the X variables -and hence the highest bias reduction-.

[20] Grant element is calculated for all public and publicly guaranteed external debt as the difference between (commitment) present value and the discounted present value of its contractual debt service divided by the (commitment) present value. If the debt composition is similar no difference should be found in the average grant element of different countries.

indicate that countries with weak fundamentals do not experience catalysis (Mody and Saravia, 2003; Bordo et al., 2004; Bird and Rowlands, 2007b).

4. Heterogeneity

The Average Treatment effect estimated above could still mask some heterogeneity[21] due to countries specific features. To this regards, in this section we explore five possible sources of heterogeneity: i) IDA status (IDA-only countries most likely have a different borrowing behavior than other countries); ii) level of development (richer countries have larger access to non-concessional financing); iii) country's infrastructure gap (countries with large infrastructure gap tend to borrow at any cost to close the gap); iv) growth prospect (the better the growth prospect the more incline the country is to borrow at any cost); and v) total debt as % of GDP (higher level of the burden may discourage non-concessional type of lenders.). Following Lin and Ye (2009) and Tapsoba (2012) we apply control function regression approach[22] and run a simple OLS within the common support previously identified. The regression is defined as follows:

$$Y_{it} = \alpha + \beta DLP_{it} + \gamma Pscore_{it} + \theta X_{it} + \omega DLP_{it} * X_{it} + \varepsilon_{it}$$

Our dependent variables are the average grant element and the average non-concessional borrowing (as % of GDP). We focus on the average grant element vis-à-vis other terms of borrowing as it is a continuous variable that summarizes interest, maturity and grace period. DLP_{it} is the dummy variable indicating whether country *i* was subject to the DLP at time *t*, $Pscore_{it}$ is the propensity score estimated in our selection model, X_{it} are the possible sources of heterogeneity, and finally the interaction term. The parameter ω captures the difference of the treatment impact due to X_{it}.

Table 9 presents the regression estimates using average grant element as dependent variable. The results confirm the finding of the previous section: after controlling for the likelihood of being under the DLP, there is no significant difference between the DLP countries and the control group (Table 9, column 1 and 2). When we control for IDA status,[23] we observe that IDA and DLP have significant impact on average grant element (Table 9, column 3). This confirms the assumption put forward in the PSM section that the presence of IDA only countries in both the treated and the control groups appear to blur the impact of the DLP. In particular, when we control for IDA, the coefficient of DLP suggests that in non-IDA countries the DLP positively impacts the average grant element (12.622), while a Wald test on the interaction term reveals that the DLP does not significantly impact the grant element in IDA only-countries.

This result should be interpret with care. IDA status in fact is defined as GNI per capita below an established threshold; only few countries in our sample are above this threshold and their GNI per capita vary largely. To the extent that the level of development impacts negatively the probability of being under an IMF program, the DLP might simply proxies the better financing terms granted to poorer countries. To overcome this problem we substitute IDA-countries with GNI per capita and we find that the impact of DLP disappears. In addition we find that the level of development is negative correlated with the grant element (Table 9 column 4) suggesting that more developed countries receive less favorable financing terms.

One of the most frequent complaints from Low Income Countries that are subject the Fund's DLP is that the policy is very restrictive because given the limited amount of concessional borrowing

[21] In this paper we refer to heterogeneity as "how the effect of treatment varies across members of the population". As pointed out by Jann (2010), a basic paradigm of the literature on casual models is that there can be individual heterogeneity in treatment effects. Surprisingly, however, not much attention is usually paid to the explicit analysis of the heterogeneity of treatment effects in applied studies. In fact because all statistical quantities of interest can be computed only at the group level, the researcher necessarily "ignores" within-group individual level heterogeneity (Xie et al, 2012).

[22] Amongst other methodologies for program evaluation, Wooldrige (2002) suggests the use an OLS regression that includes the propensity score as control variable in the outcome regression. One of the main backdrops of this estimator is that the variation in the first-stage probit estimates is ignored when computing the standard error of the treatment effect.

[23] IDA is a dummy variable that takes the value one if the country is IDA-only at the beginning of the five- year period and zero otherwise.

available to them, they are constrained in their ability to invest in public infrastructure. We postulate that countries with higher infrastructure gaps would tend borrowing more on non-concessional terms, so as to close their infrastructure gap. We proxy infrastructure by the number of telephone line per 100 people (av5_*i_TLPPLP*)[24] and we find that the coefficient is negative and significant, suggesting a positive relation between infrastructure gap and average grant element[25]. This could be because infrastructure gap is highly correlated with GDP per capita, which is a key determinant of concessional resources allocation.

We also explored whether improving growth prospect affect borrowing behavior (*av5_PROJGR*). If a country's growth prospects are better than previously expected for any reason (discovery of natural resources or ambitious new investment plan) the debt burden may not worsen by a limited increase in non-concessional borrowing. As a result, one would expect improving growth prospects to result in worsening borrowing terms. We proxy improving growth prospect, by a variable that compared different vintages of WEO projections and we do not find any significant results[26].

Finally we test whether higher debt burden may discourage non-concessional type of lenders. In particular we explore the hypothesis that total debt as percent of GDP (*av5_TDPPG_GDP*) is positive correlated with average grant element. We do not find any evidence of such relation.

Columns (8) and (9) display new results that repeat earlier regression, but using values at the beginning of the 5-year period for potentially endogenous variables. We find that above conclusions are unaltered.

Table 10 presents the estimations using average non-concessional borrowing (as % of GDP) as dependent variable. The results reinforce those of the previous section. After controlling for the likelihood of being under the DLP, there is no significant difference between the DLP countries and the control group (column (1) and (2)).

When we control for IDA status, we observe that IDA has a significant impact on non-concessional borrowing (Table 10, column (3)), confirming the hypothesis that, as long as available, LICs tend to supply their financial needs through concessional borrowing. The coefficient of DLP and its interaction with IDA dummy (*IDA_INT*) are not significant, suggesting that DLP does not impact the level of non-concessional borrowing irrespective of IDA-status classification. In column (4) we analyze the heterogeneity of the treatment effect across different levels of development. GNI per capita is found to be positively and significantly correlated with non-concessional borrowing (as % of GDP) while DLP is not. This confirms previous evidence and may indicate that countries turn to larger level of non-concessional borrowing when their economies growth rather than in absence of borrowing constraint.

Columns (5) to (7) use respectively infrastructure gap, prospect growth and total debt as source of heterogeneity. Column (8) and (9) repeat the same regressions, but using values at the beginning of the 5-year period for potentially endogenous variables. The results confirm those of the previous table and suggest that the impact of DLP is not significant and it does not vary across different members of the population. The significance of the infrastructure gap, as proxied by the number of telephone line per 100 people (Column (8)), is also in line with previous findings and reinforces the hypothesis that higher level of development attract non-concessional type of lenders.

[24] 5-year period average.

[25] We tried a better proxy (infrastructure gap as measured by roads paved as a percent of total roads), but because of limited coverage of the variable, our sample size was significantly reduced, rendering the results questionable.

[26] To measure improvement in growth prospects, we calculate the growth rate of 5-years average GDP projections taken from WEO.

5. Conclusion

In this paper, we analyze the effectiveness of the IMF's debt limits policy (DLP) on borrowing behavior in countries eligible to IMF's concessional lending. We aim to shed some light into the discussion on debt relief effectiveness on to the ability of LICs to access growth enhancing lending without harming sustainability. To the best of our knowledge, this paper is the first paper that analyzes the impact of DLP on borrowing behavior using propensity score matching to address the self-selection problem of being under IMF program.

We do not find evidence that the DLP significantly impacts either the level of non-concessional borrowing or the terms of such borrowing (interest rate, grace period, maturity and grant element). This suggests that LICs do not accumulate non-concessional loans more rapidly when not subject to the DLP. We also show that the DLP does not exert a significant effect on private creditors lending, suggesting that the policy does not discourage private creditors, perhaps because poor countries are not able to attract private lenders in the first place. Even if beyond the scope of this analysis, this result, which is in line with previous studies on the catalytic effect of the IMF programs on private lending, indicates that countries with weak fundamentals do not experience catalysis.

Finally the heterogeneity analysis suggests that countries turn to higher levels of non-concessional borrowing as their economies grow richer, not because of the absence of constraints on borrowing under the DLP. From a policy perspective, our results suggest that the absence of the concessionality requirements under the Fund's debt limits policy is unlikely to result in a major shift in financing toward non-concessional borrowing, especially in the poorest low-income countries.

Our findings have several implications for the current discussions on debt relief and its effectiveness in stimulating private capital flows. Our study suggests that, regardless borrowing constraints, least developed countries are not able to attract non-concessional type of lenders and, if available, they tend to supply their financial needs through concessional borrowing. In line with Arslanalp and Henry (2004), we postulate that highly indebt poor countries may lack the basic infrastructure that form the basis for profitable economic activity and hence debt relief may not be able to stimulate investment and growth through private foreign capital.

In term of policy implication, this paper suggest that DLP does not impact borrowing behavior in PRGT-eligible countries. This is particularly important in the current context, where LICs face decreasing foreign aid relative to development financing needs and government must seeks for additional financing. Our study suggests that the level of development, rather than DLP, influences the ability to access non-concessional type of lenders.

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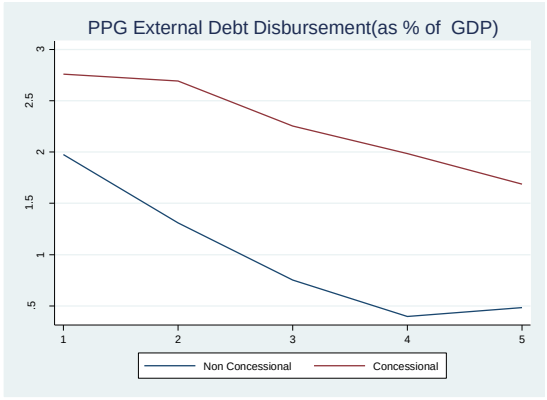
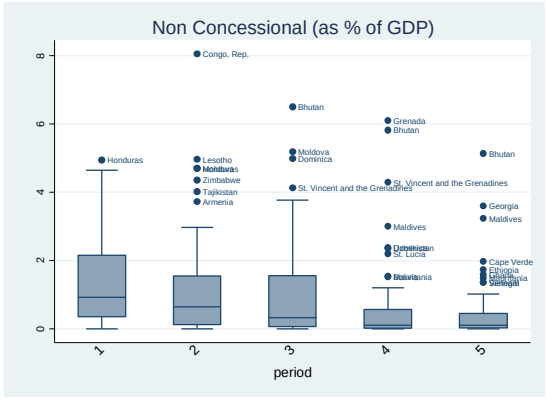
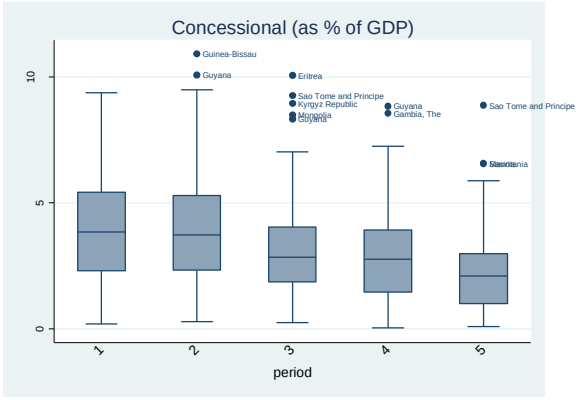
Appendix 1

Figure 1: PPG External Debt disbursement (percentage of GDP, weighted average)

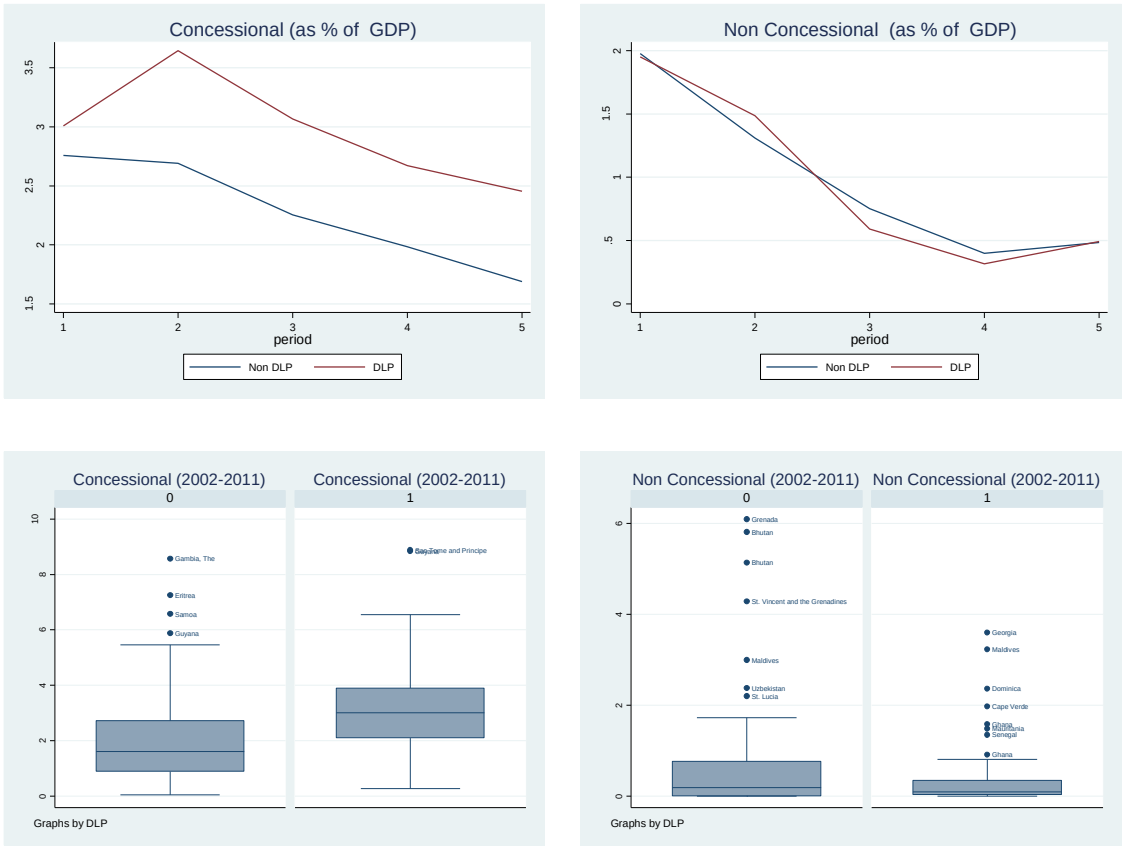






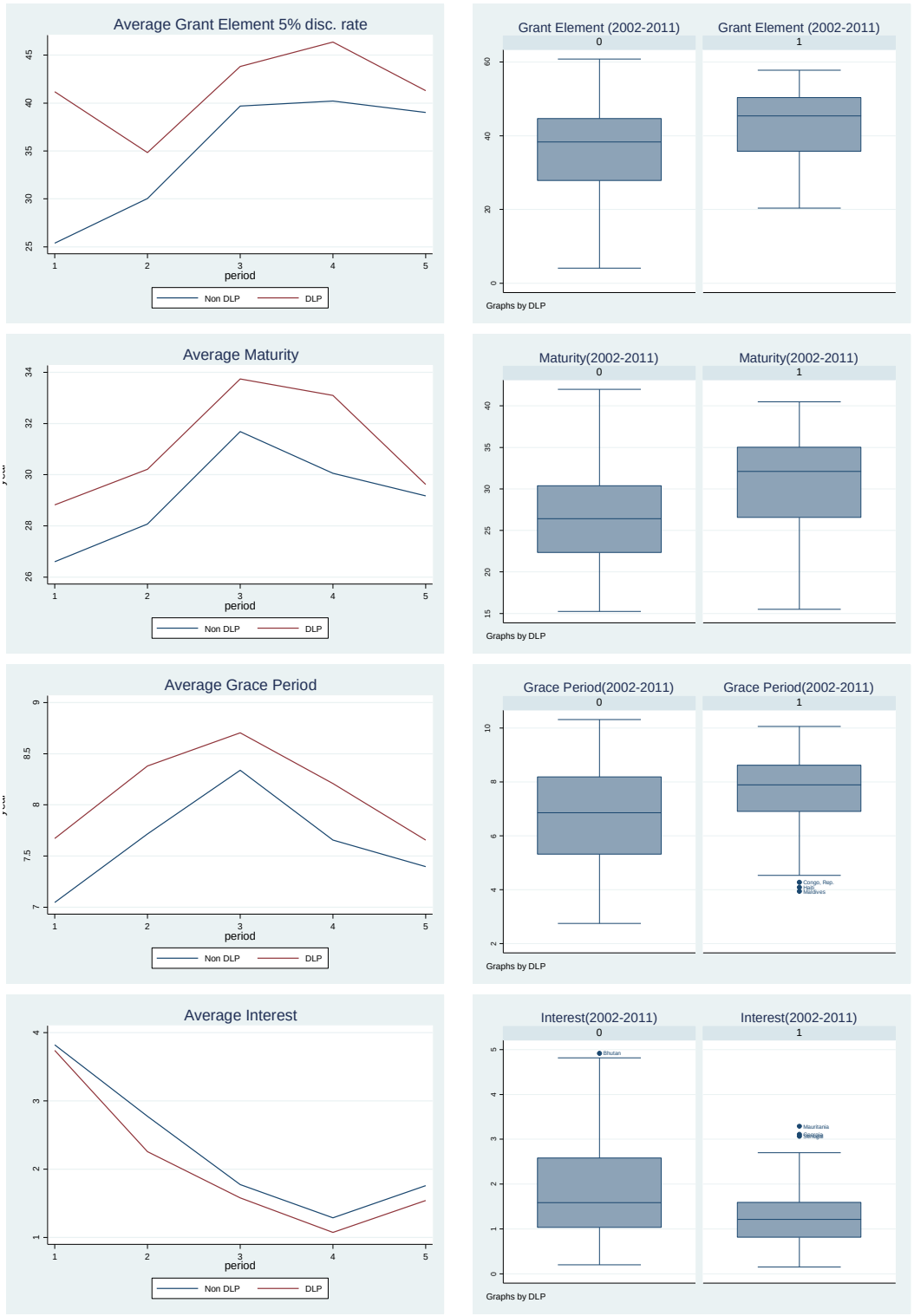
The panel covers 70 countries over the five-year periods 1986-91, 1992-96, 1997-01, 2002-06, 2007-11.

Figure 2: PPG External Debt Disbursement by DLP (percentage of GDP, weighted average)



The panel covers 70 countries over the five-year periods 1986-91, 1992-96, 1997-01, 2002-06, 2007-11.

Figure 3: Average financial terms



The panel covers 70 countries over the five-year periods 1986-91, 1992-96, 1997-01, 2002-06, 2007-11.

Appendix 2

Table 1: List of countries

List of countries

Country	Region	IDA	HIPC	Country	Region	IDA	HIPC
Afghanistan, I. S. of	South Asia	1	1	Madagascar	Sub-Saharan Africa	1	1
Armenia	Europe & Central Asia	0	0	Malawi	Sub-Saharan Africa	1	1
Bangladesh	South Asia	1	0	Maldives	South Asia	1	0
Benin	Sub-Saharan Africa	1	1	Mali	Sub-Saharan Africa	1	1
Bhutan	South Asia	1	0	Mauritania	Sub-Saharan Africa	1	1
Bolivia	Latin America & Caribbean	0	1	Moldova	Europe & Central Asia	1	0
Burkina Faso	Sub-Saharan Africa	1	1	Mongolia	East Asia & Pacific	0	0
Burundi	Sub-Saharan Africa	1	1	Mozambique	Sub-Saharan Africa	1	1
Cambodia	East Asia & Pacific	1	0	Myanmar	East Asia & Pacific	1	0
Cameroon	Sub-Saharan Africa	1	1	Nepal	South Asia	1	0
Cape Verde	Sub-Saharan Africa	0	0	Nicaragua	Latin America & Caribbean	1	1
Central African Republic	Sub-Saharan Africa	1	1	Niger	Sub-Saharan Africa	1	1
Chad	Sub-Saharan Africa	1	1	Nigeria	Sub-Saharan Africa	1	0
Comoros	Sub-Saharan Africa	1	1	Papua New Guinea	East Asia & Pacific	0	0
Congo, Democratic Republic of	Sub-Saharan Africa	1	1	Rwanda	Sub-Saharan Africa	1	1
Congo, Republic Of	Sub-Saharan Africa	1	1	Samoa	East Asia & Pacific	1	0
Cote d'Ivoire	Sub-Saharan Africa	1	1	Sao Tome & Principe	Sub-Saharan Africa	1	1
Djibouti	Middle East & North Africa	1	0	Senegal	Sub-Saharan Africa	1	1
Dominica	Latin America & Caribbean	0	0	Sierra Leone	Sub-Saharan Africa	1	1
Eritrea	Sub-Saharan Africa	1	1	Solomon Islands	East Asia & Pacific	1	0
Ethiopia	Sub-Saharan Africa	1	1	Somalia	Sub-Saharan Africa	1	1
Gambia	Sub-Saharan Africa	1	1	St. Lucia	Latin America & Caribbean	0	0
Georgia	Europe & Central Asia	0	0	St. Vincent and the Grenadines	Latin America & Caribbean	0	0
Ghana	Sub-Saharan Africa	1	1	Sudan	Sub-Saharan Africa	1	1
Grenada	Latin America & Caribbean	0	0	Tajikistan	Europe & Central Asia	1	0
Guinea	Sub-Saharan Africa	1	1	Tanzania	Sub-Saharan Africa	1	1
Guinea-Bissau	Sub-Saharan Africa	1	1	Togo	Sub-Saharan Africa	1	1
Guyana	Latin America & Caribbean	1	1	Tonga	East Asia & Pacific	1	0
Haiti	Latin America & Caribbean	1	1	Uganda	Sub-Saharan Africa	1	1
Honduras	Latin America & Caribbean	1	1	Uzbekistan	Europe & Central Asia	0	0
Kenya	Sub-Saharan Africa	1	0	Vanuatu	East Asia & Pacific	1	0
Kyrgyz Republic	Europe & Central Asia	1	0	Vietnam	East Asia & Pacific	0	0
Lao People Dem. Rep.	East Asia & Pacific	1	0	Yemen, Republic Of	Middle East & North Africa	1	0
Lesotho	Sub-Saharan Africa	1	0	Zambia	Sub-Saharan Africa	1	1
Liberia	Sub-Saharan Africa	1	1	Zimbabwe	Sub-Saharan Africa	0	0

Table 2: Description of the variables

Outcome variables		
Variables	**Description**	**Source**
Size of borrowing		
COMMEXP_GDP	Commitments PPG (as % of GDP)	WDI
COMMIDA_GDP	Commitments PPG IDA (as % of GDP)	WDI
COMMPR_GDP	Commitments PPG Private Creditors (as % of GDP)	WDI
DPPG_GDP	Disbursements PPG (as % of GDP)	WDI
DPPGCON_GDP	Disbursements PPG concessional external debt (PPG) (as % of GDP)	WDI
DPPGNOCON_GDP	Disbursements PPG non concessional external debt(PPG) (as % of GDP)	WDI
DPPGIDA_GDP	Disbursements PPG IDA (as % of GDP)	WDI
DPPGBIL_GDP	Disbursements PPG bilateral (as % of GDP)	WDI
DPPGMUL_GDPP	Disbursements PPG multilateral (as % of GDP)	WDI
DPRV_GDP	Disbursements PPG Private Creditors (as % of GDP)	WDI
Composition of borrowing		
DPPGIDA_DPPG	Disbursements PPG IDA (as % of TOT. DISB.PPG)	WDI
DPPGBIL_DPPG	Disbursements PPG bilateral (as % of TOT. DISB.)	WDI
DPPGMUL_DPPG	Disbursements PPG multilateral (as % of TOT. DISB.)	WDI
DPPGCON_DPPG	Disbursements PPG concessional external debt (as % of TOT. DISB.)	WDI
DPPGNOCON_DPPG	Disbursements PPG non concessional external debt (as % of TOT. DISB.)	WDI
Term of borrowing		
GRCPERCO	Average grace period on new external debt commitments (years)	WDI
GRCELCO	Average grant element on new external debt commitments (%)	WDI
GRCELCO_5	Average grant element on new external debt commitments' based on 5% discount rate	WDI
GRCELC~10	Average grant element on new external debt commitments' based on 10% discount rate	Author calculation
INTCOM	Average interest on new external debt commitments (%)	WDI
MTR	Average maturity on new external debt commitments' private (years)	WDI

Table 2: Description of the variables

Selection model

Variables	Description	Source
Dependent variable		
DLP	Countries subjected to Debt Limit Policy : the dummy takes value one if the country is under IMF program for at least three years in a five years window	Bal Gunduz et al., (2013)
DLPNCBP	Country subjected to Debt Limit Policy and/or IDA Non Concessional Borrowing Policy (NCBP)", in order to include the debt limits imposed by IDA since 2006. The dummy takes value one if a country is under IMF program and/or IDA NCBP for at least three years in a five years window	IMF
Geographic and institutional characteristics		
politicalglobalization	Globalization index	KOF Institute
landlocked	1 if landlocked	CEPII
democracy	Dummy variable takes value 1 if the regime qualifies as democratic.	Cheibub, J. A., Gandhi J., and Vreeland J.R. (2010)
cpia	World Bank's CPIA Index measures the quality of policies and institutions in the country	IMF
External demand conditions		
grostar	Trading partner real GDP growth	WEO
Country's relation with the Fund		
quota_gdp	Logarithm of the IMF quota	IMF
SIZE	Logarithm of GDP (constant 2005 PPP)	WDI
Initial macroeconomic buffer		
AIDGDPI	Initial aid/GDP (at the beginning of each five years period)	WDI
RESIN	Initial reserves in months of import (at the beginning of each five-years period)	VE-LIC database
Country income and macroeconomic conditions		
INFLCPI	Infation, average consumer prices (annual percent change)	WEO
GNIPC	Logarithm of GNI per capita (current US$)	WDI
resource_rents	Resource Rent as a share of GDP	WDI
CURRACC	Current account deficit	WDI
TDPPG_GDP	Total Public Debt PPG (as % of GDP)	WDI
GDPGR	Gross domestic product, constant prices (annual percent change)	WDI

Heterogeneity analysis

Variables	Description	Source
IDA	Dummy variable which takes value 1 if the country is IDA only (time variant) BEGINNING OF 5 YEARS PERIOD	IMF
i_TLPPLP	Telephone lines per 100 people BEGINNING OF 5 YEARS PERIOD	WDI
PROJGR	Growth rate of GDP projection BEGINNING OF 5 YEARS PERIOD	WEO
TDPPG_GDP	Total Public Debt PPG (as % of GDP) BEGINNING OF 5 YEARS PERIOD	WDI
av5_i_TLPPLP	Telephone lines per 100 people (five years average)	WDI
av5_PROJGR	Growth rate of GDP projection (five years average)	WEO
av5_TDPPG_GDP	Total Public Debt PPG (as % of GDP)	WDI

Table 3: Summary statistics

Outcome variables						
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs.**	**Countries**
av5_COMMEXP_GDP	5.319	3.866	0.000	25.926	319	68
av5_COMMIDA_GDP	1.584	1.504	0.000	7.195	296	68
av5_COMMPR_GDP	0.433	1.019	0.000	7.847	322	68
av5_DPPG_GDP	4.279	2.693	0.040	13.066	323	69
av5_DPPGCON_GDP	3.324	2.230	0.040	10.924	323	69
av5_DPPGNOCON_GDP	0.923	1.360	0.000	8.050	323	69
av5_DPPGIDA_GDP	1.339	1.185	0.000	5.576	327	69
av5_DPPGBIL_GDP	1.070	1.115	0.000	6.644	325	69
av5_DPPGMUL_GDP	2.791	1.871	0.005	8.881	322	69
av5_DPRV_GDP	0.320	0.623	0.000	3.521	325	69
av5_DPPGIDA_DPPG	32.670	21.454	0.000	77.774	333	70
av5_DPPGBIL_DPPG	23.457	17.514	0.000	74.983	331	70
av5_DPPGMUL_DPPG	70.004	21.993	10.831	100.000	331	70
av5_DPPGCON_DPPG	82.955	19.957	23.100	100.000	330	70
av5_DPPGNOCON_DPPG	17.054	19.953	0.000	76.900	330	70
av5_GRCPERCO	7.654	1.799	2.335	10.892	324	70
av5_GRCELCO	60.672	14.482	17.040	81.000	324	70
av5_GRCELCO_10	63.707	13.482	23.334	82.722	310	67
av5_GRCELCO_5	36.855	15.286	-9.809	60.800	310	67
av5_INTCOM	1.991	1.317	0.150	7.156	321	70
av5_MTR	29.404	7.126	10.070	42.285	325	70
All outcome variables are 5 years period average						

Selection model						
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs.**	**Countries**
politicalglobalization	44.605	16.895	13.804	84.551	323	68
landlocked	0.353	0.479	0.000	1.000	340	68
democracy	0.342	0.475	0.000	1.000	342	70
grostar	4.085	1.849	-0.655	9.468	337	68
quota_gdp	4.051	2.805	0.571	15.882	309	67
AIDGDPI	12.776	9.803	0.574	50.360	306	67
RESIN	3.419	2.368	0.033	13.336	302	66
INFLCPI	11.772	18.820	-6.243	165.707	276	67
GNIPC	6.236	0.784	4.868	8.470	307	69
resource_rents	7.241	9.580	0.000	56.217	313	67
SIZE	21.411	1.282	18.978	24.597	311	66
cpia	3.094	0.715	1.000	4.630	319	70
CURRACC	-7.278	8.557	-42.894	11.990	267	67
av5_CURRACC	-7.595	7.725	-35.374	9.220	285	68
TDPPG_GDP	88.051	68.558	17.311	492.711	295	67
av5_TDPPG_GDP	87.624	71.699	18.042	524.142	310	67
GDPGR	3.434	5.971	-29.100	21.713	255	66
av5_GDPGR	3.488	3.516	-13.560	12.074	318	66
IDA	0.797	0.403	0.000	1.000	350	70
All indipendent variables are calculated at the beginning of 5 years period, unless otherwise indicated						

Heterogeneity analysis						
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs.**	**Countries**
IDA	0.797	0.403	0.000	1.000	350	70
GNIPC	6.236	0.784	4.868	8.470	307	69
i_TLPPLP	3.262	5.318	0.100	27.100	332	69
PROJGR	19.830	53.978	-26.976	377.568	255	70
TDPPG_GDP	88.051	68.558	17.311	492.711	295	67
av5_i_TLPPLP	3.593	5.738	0.080	28.420	334	69
av5_PROJGR	24.977	56.738	-21.550	373.687	311	70
av5_TDPPG_GDP	87.624	71.699	18.042	524.142	310	67

Table 4: Summary statistics by DLP

Outcome variables															
	DLP = 0					DLP = 1					DLP = .				
Variable	Mean	Std.	Min	Max	Obs.	Mean	Std.	Min	Max	Obs.	Mean	Std.	Min	Max	Obs.
av5_COMMEXP_GDP	5.027	4.095	0.000	25.926	186	5.779	3.518	0.194	22.248	127	4.612	3.018	1.049	9.320	6
av5_COMMIDA_GDP	1.200	1.443	0.000	7.195	189	1.987	1.479	0.000	6.214	127	1.333	2.005	0.000	5.143	6
av5_COMMPR_GDP	0.505	1.117	0.000	7.847	189	0.347	0.873	0.000	6.652	127	0.011	0.026	0.000	0.064	6
av5_DPPG_GDP	4.125	2.849	0.040	13.066	189	4.532	2.477	0.263	11.668	128	3.712	1.808	2.347	6.284	6
av5_DPPGCON_GDP	2.979	2.248	0.040	10.924	189	3.829	2.131	0.192	10.087	128	3.421	2.000	1.952	6.261	6
av5_DPPGNOCON_GDP	1.092	1.516	0.000	8.050	189	0.702	1.082	0.000	5.176	128	0.291	0.317	0.000	0.789	6
av5_DPPGIDA_GDP	1.136	1.219	0.000	5.576	193	1.660	1.049	0.000	4.657	128	0.997	1.453	0.000	3.892	6
av5_DPPGBIL_GDP	1.095	1.108	0.000	5.087	191	1.022	1.085	0.000	6.644	128	1.308	1.966	0.000	5.223	6
av5_DPPGMUL_GDP	2.527	1.906	0.005	8.881	189	3.203	1.768	0.075	8.712	127	2.383	1.526	0.490	5.098	6
av5_DPRV_GDP	0.373	0.699	0.000	3.521	191	0.256	0.495	0.000	2.653	128	0.021	0.032	0.000	0.064	6
av5_DPPGIDA_DPPG	27.984	21.190	0.000	77.160	199	40.410	19.537	0.000	77.774	127	25.447	24.016	0.000	65.126	7
av5_DPPGBIL_DPPG	25.974	18.661	0.000	74.980	196	19.777	14.234	0.000	65.194	128	20.283	27.524	0.000	74.983	7
av5_DPPGMUL_DPPG	66.096	23.460	10.831	100.000	196	75.488	17.818	20.106	100.000	128	79.145	27.535	23.960	100.000	7
av5_DPPGCON_DPPG	79.212	22.245	23.100	100.000	196	88.290	14.635	33.679	100.000	127	90.993	11.092	74.811	100.000	7
av5_DPPGNOCON_DPPG	20.805	22.236	0.000	76.900	196	11.710	14.635	0.000	66.321	127	9.007	11.092	0.000	25.189	7
av5_GRCPERCO	7.362	1.947	2.335	10.566	191	8.099	1.409	3.930	10.892	127	7.542	2.594	3.660	9.667	6
av5_GRCELCO	57.369	15.751	17.040	81.000	191	65.652	10.550	18.268	79.718	127	60.401	16.432	41.093	77.000	6
av5_GRCELCO_10	60.390	14.708	23.334	81.467	185	68.616	9.552	23.361	82.722	125	.	.	.	.	0
av5_GRCELCO_5	33.136	16.745	-9.809	60.800	185	42.358	10.724	7.633	60.622	125	.	.	.	.	0
av5_INTCOM	2.289	1.449	0.200	6.174	189	1.551	0.953	0.150	7.156	126	1.854	1.048	0.333	3.077	6
av5_MTR	27.850	7.425	10.070	42.285	192	31.767	5.692	15.506	41.288	127	29.106	11.547	12.137	39.233	6

Table 5: Summary statistics by DLP

Selection model

	DLP = 0					DLP = 1					DLP = .				
Variable	**Mean**	**Std.**	**Min**	**Max**	**Obs.**	**Mean**	**Std.**	**Min**	**Max**	**Obs.**	**Mean**	**Std.**	**Min**	**Max**	**Obs.**
politicalglobalization	41.109	16.414	13.804	84.551	197	50.072	16.231	20.955	84.121	126	.	.	.	.	0
landlocked	0.283	0.452	0.000	1.000	212	0.469	0.501	0.000	1.000	128	.	.	.	.	0
democracy	0.328	0.471	0.000	1.000	204	0.391	0.490	0.000	1.000	128	0.000	0.000	0.000	0.000	10.000
grostar	4.062	1.890	-0.655	9.468	209	4.122	1.787	-0.135	8.140	128	.	.	.	.	0
quota_gdp	4.004	2.826	0.571	15.595	182	4.118	2.785	0.814	15.882	127	.	.	.	.	0
AIDGDPI	11.803	10.503	0.574	50.360	180	14.167	8.555	1.821	48.809	126	.	.	.	.	0
RESIN	3.268	2.583	0.033	13.336	176	3.630	2.021	0.087	9.668	126	.	.	.	.	0
INFLCPI	13.827	23.546	-4.476	165.707	154	9.305	9.747	-6.243	45.485	117	6.200	3.137	2.125	10.365	5
GNIPC	6.357	0.782	4.942	8.470	174	6.031	0.717	4.868	8.345	127	7.055	1.054	5.075	7.959	6
resource_rents	8.462	11.185	0.000	56.217	186	5.453	6.177	0.000	35.092	127	.	.	.	.	0
SIZE	21.292	1.409	18.978	24.597	184	21.621	1.015	19.277	24.298	125	19.122	0.003	19.121	19.124	2
cpia	2.985	0.773	1.000	4.630	186	3.292	0.531	1.453	4.380	126	2.443	1.058	1.000	3.500	7
av5_CURRACC	-7.487	8.292	-34.738	9.220	161	-7.650	6.974	-35.374	6.673	122	-12.938	1.742	-14.170	-11.707	2
CURRACC	-7.148	9.058	-42.894	11.990	146	-7.411	8.003	-37.621	8.713	119	-8.870	3.422	-11.289	-6.450	2
av5_TDPPG_GDP	93.200	80.627	18.820	460.740	181	81.349	56.811	18.042	524.142	124	41.394	6.764	31.300	49.967	5
TDPPG_GDP	91.222	79.647	18.293	492.711	168	85.627	50.512	17.311	296.212	122	40.675	4.980	32.124	44.625	5
av5_GDPGR	2.687	4.001	-13.560	11.864	189	4.778	2.144	-0.020	12.074	124	1.786	0.819	0.720	2.688	5
GDPGR	2.688	6.666	-29.100	17.926	143	4.555	4.787	-12.674	21.713	108	-0.150	3.097	-4.138	3.416	4
IDA	0.759	0.428	0.000	1.000	212	0.844	0.365	0.000	1.000	128	1.000	0.000	1.000	1.000	10.000

Heterogeneity analysis

	DLP = 0					DLP = 1					DLP = .				
Variable	**Mean**	**Std.**	**Min**	**Max**	**Obs.**	**Mean**	**Std.**	**Min**	**Max**	**Obs.**	**Mean**	**Std.**	**Min**	**Max**	**Obs.**
IDA	0.759	0.428	0.000	1.000	212	0.844	0.365	0.000	1.000	128	1.000	0.000	1.000	1.000	10.000
i_TLPPLP	3.569	5.758	0.100	27.100	203	2.589	4.281	0.100	20.320	119	5.044	6.644	0.220	20.570	10.000
PROJGR	21.812	53.996	-26.716	320.722	142	18.158	55.702	-26.976	377.568	106	4.937	11.320	-10.171	26.395	7
TDPPG_GDP	91.222	79.647	18.293	492.711	168	85.627	50.512	17.311	296.212	122	40.675	4.980	32.124	44.625	5
av5_i_TLPPLP	3.793	5.926	0.130	28.420	202	3.037	5.087	0.080	27.380	122	6.353	8.498	0.230	26.766	10.000
av5_PROJGR	21.262	51.070	-21.550	331.783	188	32.305	66.088	-13.262	373.687	115	6.944	11.745	-1.930	35.005	8
av5_TDPPG_GDP	93.200	80.627	18.820	460.740	181	81.349	56.811	18.042	524.142	124	41.394	6.764	31.300	49.967	5

Table 6: Selection model

Dependent variable : Debt Limit Policy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
landlocked	0.512**	0.502**	0.508**	0.486**	0.469**	0.531**	0.497**	0.477**	0.758***
	(0.228)	(0.236)	(0.239)	(0.233)	(0.233)	(0.233)	(0.247)	(0.235)	(0.199)
politicalglobalization	-0.002	-0.002	0.000	-0.002	0.001	-0.004	-0.003	-0.001	0.005
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
democracy	0.134	0.096	0.045	0.155	0.118	0.167	0.064	0.090	0.068
	(0.218)	(0.234)	(0.237)	(0.221)	(0.219)	(0.221)	(0.233)	(0.228)	(0.221)
grostar	0.033	0.015	0.015	0.036	0.006	0.041	0.058	0.034	0.011
	(0.061)	(0.064)	(0.064)	(0.062)	(0.063)	(0.063)	(0.067)	(0.062)	(0.058)
quota_gdp	0.037	0.059	0.059	0.038	0.043	0.040	0.047	0.042	0.021
	(0.051)	(0.051)	(0.052)	(0.051)	(0.052)	(0.052)	(0.056)	(0.052)	(0.049)
AIDGDPI	0.024	0.022	0.021	0.022	0.018	0.024	0.026	0.023	0.046***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)	(0.018)	(0.016)	(0.013)
RESIN	-0.113**			-0.122**	-0.101*	-0.120**	-0.091*	-0.110**	-0.072
	(0.050)			(0.052)	(0.052)	(0.052)	(0.053)	(0.050)	(0.047)
INFLCPI	-0.018**	-0.015	-0.011	-0.017**	-0.016*	-0.018**	-0.018**	-0.018**	-0.016**
	(0.008)	(0.011)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.007)
GNIPC	-0.510***	-0.527***	-0.475**	-0.564***	-0.526***	-0.514**	-0.434**	-0.575***	
	(0.197)	(0.204)	(0.204)	(0.203)	(0.201)	(0.203)	(0.215)	(0.222)	
resource_rents	-0.037**	-0.046**	-0.044**	-0.038**	-0.035**	-0.038**	-0.040**	-0.039**	-0.039***
	(0.015)	(0.018)	(0.018)	(0.016)	(0.015)	(0.016)	(0.017)	(0.015)	(0.015)
SIZE	0.149	0.244*	0.187	0.124	0.083	0.147	0.208	0.138	0.276**
	(0.129)	(0.134)	(0.134)	(0.132)	(0.132)	(0.132)	(0.148)	(0.131)	(0.113)
cpia	0.538***	0.405**	0.470**	0.554***	0.495**	0.550***	0.523**	0.519***	
	(0.194)	(0.197)	(0.200)	(0.197)	(0.199)	(0.198)	(0.245)	(0.196)	
av5_CURRACC		-0.030							
		(0.020)							
CURRACC			-0.016						
			(0.015)						
av5_TDPPG_GDP				0.000					
				(0.003)					
av5_GDPGR					0.091**				
					(0.042)				
TDPPG_GDP						0.001			
						(0.002)			
GDPGR							-0.024		
							(0.026)		
IDA								-0.226	0.056
								(0.357)	(0.283)
Constant	-2.279	-4.175	-3.478	-1.399	-0.891	-2.225	-4.229	-1.421	-6.932***
	-3,438	-3,6	-3,586	-3,555	-3,502	-3,563	-3,876	-3,702	-2,408
Observations	226	212	205	223	223	221	195	226	232
Pseudo R-squared	0,248	0,251	0,244	0,246	0,267	0,244	0,238	0,249	0,202
N	226	212	205	223	223	221	195	226	232

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Selection model

Dependent variable : Debt Limit Policy and IDA-Non Concessional Borrowing Policy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
landlocked	0.430*	0.483**	0.492**	0.403*	0.394*	0.443*	0.411	0.401*	0.702***
	(0.231)	(0.235)	(0.239)	(0.236)	(0.236)	(0.236)	(0.251)	(0.238)	(0.201)
politicalglobalization	-0.003	-0.002	-0.001	-0.003	-0.000	-0.004	-0.005	-0.002	0.004
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
democracy	0.148	0.085	0.033	0.161	0.121	0.176	0.069	0.112	0.079
	(0.222)	(0.234)	(0.237)	(0.225)	(0.223)	(0.226)	(0.239)	(0.233)	(0.224)
grostar	0.026	0.005	0.006	0.029	0.002	0.035	0.055	0.027	0.004
	(0.062)	(0.064)	(0.064)	(0.063)	(0.063)	(0.064)	(0.068)	(0.063)	(0.058)
quota_gdp	0.045	0.061	0.061	0.047	0.050	0.050	0.057	0.049	0.027
	(0.052)	(0.051)	(0.052)	(0.052)	(0.053)	(0.052)	(0.057)	(0.052)	(0.049)
AIDGDPI	0.028*	0.022	0.021	0.026	0.023	0.029	0.031*	0.027*	0.051***
	(0.016)	(0.016)	(0.016)	(0.017)	(0.016)	(0.018)	(0.018)	(0.016)	(0.013)
RESIN	-0.135**			-0.143***	-0.125**	-0.140***	-0.116**	-0.132**	-0.089*
	(0.052)			(0.054)	(0.054)	(0.054)	(0.055)	(0.052)	(0.048)
INFLCPI	-0.020**	-0.015	-0.012	-0.019**	-0.019*	-0.020**	-0.021**	-0.020**	-0.018**
	(0.009)	(0.011)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.007)
GNIPC	-0.555***	-0.500**	-0.452**	-0.604***	-0.569***	-0.554***	-0.480**	-0.608***	
	(0.202)	(0.203)	(0.204)	(0.207)	(0.205)	(0.207)	(0.221)	(0.227)	
resource_rents	-0.037**	-0.047***	-0.044**	-0.036**	-0.034**	-0.037**	-0.040**	-0.038**	-0.038**
	(0.015)	(0.018)	(0.018)	(0.016)	(0.015)	(0.016)	(0.017)	(0.016)	(0.015)
SIZE	0.175	0.265**	0.211	0.150	0.113	0.175	0.245	0.165	0.310***
	(0.131)	(0.134)	(0.134)	(0.133)	(0.134)	(0.134)	(0.151)	(0.133)	(0.114)
cpia	0.560***	0.361*	0.419**	0.572***	0.524***	0.566***	0.570**	0.544***	
	(0.197)	(0.196)	(0.198)	(0.200)	(0.202)	(0.201)	(0.253)	(0.199)	
av5_CURRACC		-0.025							
		(0.020)							
CURRACC			-0.014						
			(0.015)						
av5_TDPPG_GDP				-0.000					
				(0.003)					
av5_GDPGR					0.082*				
					(0.042)				
TDPPG_GDP						0.000			
						(0.002)			
GDPGR							-0.033		
							(0.027)		
IDA								-0.185	0.114
								(0.361)	(0.285)
Constant	-2.529	-4.521	-3.874	-1.677	-1.233	-2.546	-4.794	-1.822	-7.654***
	-3.486	-3.601	-3.588	-3.601	-3.545	-3.611	-3.955	-3.756	-2.437
Observations	226	212	205	223	223	221	195	226	232
Pseudo R-squared	0.271	0.247	0.240	0.268	0.288	0.266	0.265	0.272	0.220
N	226	212	205	223	223	221	195	226	232
Standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

Table 8: Propensity score matching

Variable	Description	Radius matching								Kernel matching			
		r=0.05				r=0.1							
		ATT	BSSE	z	P> |z|	ATT	BSSE	z	P> |z|	ATT	BSSE	z	P> |z|
DPPG_GDP	Disbursements PPG (as % of GDP)	0.7728728	0.3865643	2	0.046	0.5967261	0.3859173	1.55	0.122	0.7848913	0.389036	2.02	0.044
DPPGCON_GDP	Disbursements PPG concessional external debt (as % of GDP)	0.7241765	0.3302592	2.19	0.028	0.5936713	0.3382845	1.75	0.079	0.7133179	0.329694	2.16	0.03
DPPGNOCON_GDP	Disbursements PPG non concessional external debt (as % of GDP)	0.0488692	0.1606924	0.3	0.761	0.0032322	0.1614627	0.02	0.984	0.0717271	0.159068	0.45	0.652
DPPGIDA_GDP	Disbursements PPG IDA (as % of GDP)	0.3228747	0.1889911	1.71	0.088	0.3114287	0.1810039	1.72	0.085	0.3115159	0.180228	1.73	0.084
DPPGBIL_GDP	Disbursements PPG bilateral (as % of GDP)	0.2123053	0.1275779	1.66	0.096	0.1695951	0.1190846	1.42	0.154	0.2255069	0.125289	1.8	0.072
DPPGMUL_GDP	Disbursements PPG multilateral (as % of GDP)	0.6000248	0.3208987	1.87	0.062	0.4769695	0.3321076	1.44	0.151	0.5876777	0.304546	1.93	0.054
DPRV_GDP	Disbursements PPG Private Creditors (as % of GDP)	-0.0392666	0.0931214	-0.42	0.673	-0.0574947	0.0879635	-0.65	0.513	-0.0280096	0.102481	-0.27	0.785
DPPGIDA_DPPG	Disbursements PPG IDA (as % of TOT. DISB.)	3.518317	3.409974	1.03	0.302	4.491444	3.461008	1.3	0.194	3.086319	3.576274	0.86	0.388
DPPGBIL_DPPG	Disbursements PPG bilateral(as % of TOT. DISB.)	-1.172665	2.781734	-0.42	0.673	-1.051942	2.575596	-0.41	0.683	-0.8694812	2.522231	-0.34	0.73
DPPGMUL_DPPG	Disbursements PPG multilateral(as % of TOT. DISB.)	1.558769	3.091106	0.5	0.614	1.709736	2.969438	0.58	0.565	1.058155	3.170461	0.33	0.739
DPPGCON_DPPG	Disbursements PPG concessional external debt (as % of TOT. DISB.)	0.8580167	2.346067	0.37	0.715	1.115517	2.263488	0.49	0.622	0.4616413	2.471818	0.19	0.852
DPPGNOCON_DPPG	Disbursements PPG non concessional external debt (as % of TOT. DISB.PPG)	-1.057798	2.17438	-0.49	0.627	-1.212577	2.293875	-0.53	0.597	-0.6718606	2.397672	-0.28	0.779
COMMEXPPG_GDP	Commitments PPG (as % of GDP)	1.564012	0.5355725	2.92	0.003	1.389821	0.5496944	2.53	0.011	1.599904	0.531238	3.01	0.003
COMMIDA_GDP	Commitments PPG IDA (as % of GDP)	0.5156829	0.256106	2.01	0.044	0.4701947	0.2622312	1.79	0.073	0.5115893	0.252089	2.03	0.042
COMMPR_GDP	Commitments PPG Private Creditors (as % of GDP)	0.0807619	0.1223185	0.66	0.509	0.066098	0.1301578	0.51	0.612	0.0887437	0.963739	0.09	0.927
GRCPERCO	Average grace period on new external debt commitments (years)	0.2472801	0.2585576	0.96	0.339	0.1467935	0.2422197	0.61	0.544	0.220743	0.268367	0.82	0.411
GRCELCO	Average grant element on new external debt commitments (%)	0.767176	1.725642	0.44	0.657	0.921721	1.585463	0.58	0.561	0.4830635	1.660823	0.29	0.771
GRCELCO_10	Average grant element on new external debt commitments (%) _10% discount rate	0.5803368	1.723532	0.34	0.736	1.084716	1.376388	0.79	0.431	0.2431072	1.614115	0.15	0.88
GRCELCO_5	Average grant element on new external debt commitments (%) _5% discount rate	0.677487	2.01422	0.34	0.737	1.536049	1.904662	0.81	0.42	0.2425376	2.129002	0.11	0.909
INTCOM	Average interest on new external debt commitments (%)	-0.1141979	0.2840498	-0.4	0.688	-0.176609	0.1381793	-1.28	0.201	-0.1205812	0.148988	-0.81	0.418
MTR	Average maturity on new external debt commitments' (years)	0.7311327	0.9677089	0.76	0.45	0.9699715	0.9108252	1.06	0.287	0.5437776	0.932593	0.58	0.56

Notes: An Epanechnikov kernel is used for kernel regression matching. Bootstrapped standard errors are reported in parentheses. They are based on 500 replications of the data.

Table 9: Heterogeneity analysis

Dependent variable : Average grant element (5% discount rate)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ps		21.665***	15.529***	10.291**	18.986***	20.948***	23.283***	19.199***	22.483***
		-4.704	-3.975	-4.191	-4.72	-4.771	-4.934	-4.775	-4.873
DLP	7.643***	2.87	12.622**	-8.121	3.077	2.116	2.827	2.332	2.716
	-2.404	-1.843	-5.384	-12.879	-2.106	-2.041	-3.417	-2.089	-3.321
IDA			18.791***						
			-4.737						
IDA_INT			-11.026*						
			-5.525						
GNIPC				-8.387***					
				-1.844					
GNIPC_INT				1.718					
				-2.112					
av5_i_TLPPLP					-0.488*				
					-0.265				
av5_i_TLPPLP_INT					-0.06				
					-0.338				
av5_PROJGR						0.004			
						-0.023			
av5_PROJGR_INT						0.044*			
						-0.026			
av5_TDPPG_GDP							0.045		
							-0.037		
av5_TDPPG_GDP_INT							-0.003		
							-0.042		
i_TLPPLP								-0.748***	
								-0.228	
i_TLPPLP_INT								0.211	
								-0.323	
TDPPG_GDP									0.034
									-0.036
TDPPG_GDP_INT									-0.003
									-0.037
Constant	35.849***	27.040***	14.587***	85.514***	30.590***	26.960***	22.987***	30.941***	24.147***
	-2.283	-3.658	-4.42	-12.045	-3.876	-3.697	-4.474	-3.903	-4.662
Observations	190	190	190	190	180	176	187	180	186
R-squared	0.07	0.171	0.311	0.314	0.198	0.199	0.191	0.236	0.182

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Heterogeneity analysis

Dependent variable : Average non concessional borrowing (as % of GDP)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ps		-1.975***	-1.425***	-1.240**	-1.510***	-1.779***	-2.052***	-1.555***	-2.101***
		-0.519	-0.473	-0.511	-0.52	-0.487	-0.543	-0.525	-0.545
DLP	-0.407*	0.028	-0.889	1.262	-0.019	-0.057	0.431	0.069	0.519
	-0.221	-0.207	-0.553	-1.678	-0.223	-0.209	-0.363	-0.219	-0.384
IDA			-1.695***						
			-0.449						
IDA_INT			1.040*						
			-0.555						
GNIPC				0.578**					
				-0.249					
GNIPC_INT				-0.195					
				-0.279					
av5_i_TLPPLP					0.035				
					-0.027				
av5_i_TLPPLP_INT					0.025				
					-0.041				
av5_PROJGR						-0.002			
						-0.001			
av5_PROJGR_INT						0			
						-0.002			
av5_TDPPG_GDP							0.004		
							-0.004		
av5_TDPPG_GDP_INT							-0.005		
							-0.004		
i_TLPPLP								0.067**	
								-0.026	
i_TLPPLP_INT								-0.005	
								-0.044	
TDPPG_GDP									0.004
									-0.004
TDPPG_GDP_INT									-0.006
									-0.004
Constant	1.042***	1.845***	2.971***	-2.166	1.409***	1.804***	1.566***	1.366***	1.642***
	-0.203	-0.368	-0.455	-1.586	-0.371	-0.368	-0.444	-0.378	-0.446
Observations	190	190	190	190	180	176	187	180	186
R-squared	0.025	0.134	0.277	0.211	0.147	0.15	0.142	0.196	0.144
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

Chapter 4

US monetary policy and gross capital flows in Emerging Markets

Giovanna Bua
Università Statale di Milano

Abstract

Using a two-countries recursive vector autoregressions (VAR), we study the dynamic relations between the US monetary policy, market volatility, gross capital flows and credit. We focus on six Emerging Markets that have recently experienced an upsurge in capital inflows (South Africa, Peru, Philippines, Indonesia, Turkey, Brazil) and we look, first, at the impact of the Federal Fund Rate (FFR) on total gross capital inflows; second, we look at whether shocks in U.S. monetary policy have a different impact on different type of flows; and finally we study the impact on US long interest rate on the breakdown of gross capital flows and credit to the private sector. The results bring evidence that restrictive monetary policy increases market risk aversion and decreases gross capital flows and credit. Also the analysis on gross flows breakdown suggests that the results are mainly driven by portfolio investments, suggesting that debt and equity flows may act as transmission mechanism of the monetary policy in EMs. Finally, we show that shocks in the long term interest rate – that we interpret as shocks to the term premium - do not impact portfolio investments, suggesting the investment decisions are mainly affected by the policy rate imposed by the FED.

JEL Codes: F32, F33, F34

Keywords: monetary policy, risk-taking channel, gross capital flows, Emerging Markets

1. Introduction

The financial crisis and the boom that preceded it have renewed attention on the global factors that drive financial conditions worldwide. Low interest rates maintained by central banks in Advanced Economies (AEs) have led to an animate discussion on cross-border monetary policy spillovers and the possible transmission channels.

Borio and Zhu (2012) forged the term "risk-taking channel" of monetary policy to identify the impact of monetary policy on the willingness of market participants to take on risk exposures [1]. Bekaert et al. (2013) first provided empirical evidence of this relation and proved that lax monetary policy lowers risk aversion and uncertainty in the financial market, bearing potential risks for the real economy.

In the wake of the financial crisis, most of the studies aimed at gauge the impact of U.S. monetary policy on financial conditions, have focused on Advanced Economies (AEs) and the dynamic relation between policy rate chosen by the Federal Reserve, risk aversion of the financial market and some measure of the financial cycle (Altunbas et al., 2012; Borio and Disyatat, 2011; Bruno and Shin, 2014, 2014b; Rey, 2013). They have brought attention to the role of U.S. Federal Fund Rate (FFR) in determining bank's decisions on how much exposure to take on and have concluded that monetary policy affects the economy through greater risk taking by the banking sector.

The recent increase in international debt securities in Emerging Markets (EMs), however, has cast doubt on models that point only to the banking sector as transmission channel of global liquidity and have suggested that future spillovers may involve alternative mechanisms such market or debt securities (Bruno and Shin, 2014). In this regards, McCauley et al., (2014) and Turner, (2013) have noted that portfolio investments –as compared to banking flows- may not react to FFR, but they may react to long term interest rate irrespective of the policy rate imposed by the FED. If this was true, global flows could not be directly attribute to U.S. monetary policy (McCauley et al., 2014; Turner, 2013; Bruno and Shin, 2014).

In this paper we inspect this transmission channel in EMs. In particular we try to understand whether different type of flows (foreign direct investment, portfolio investments, other inflows) react differently to short term interest rate shocks. We also try to identify whether portfolio investments react to long term rate shocks irrespective of the policy rate imposed by the FED. In line with the literature we include an additional measure of global liquidity in receiving country in order to identify potential co-movements in the financial cycle.

We move from the hypothesis that cross bank lending are closely tied to the policy rate chosen by the central bank, while portfolio investments movements may be not attributable to it. The first mechanism hinges on the model developed by Bruno and Shin (2014) in which global banks finance cross-border lending in the US dollar money market funds and therefore a fall in the US dollar risk-free rate accelerates their flows to local banks and credit in recipient economies[2]. The second hypothesis, which has been resumed by McCauley et al. (2014) and Turner (2013) in the post-crisis

[1] Before them other studies already pointed to the potential link between loose monetary policy and excessive risk-taking in financial markets (Rajan, 2006; Adrian and Shin, 2008). In particular, Rajan (2006) suggested that in time of lax monetary policy, investment managers have a tendency to engage in risky and illiquid securities in order to earn excess return in a low interest rate environment. Also, he mainteined that their behavior may result from the particular structure of managerial compensation contracts. Managers are evaluated vis-à-vis their peers and by pursuing strategies similar to others they can ensure that they do not under perform. Adrian and Shin (2008) suggested that monetary policy induces excess leverage.

[2] In the model developed by Bruno and Shin (2014b) local banks borrow in US dollars from global banks. In turn, global banks finance cross-border lending to regional banks by tapping US dollar money market funds in financial centers. In this setting, when the US dollar risk-free rate interest rate falls, the spread between the local lending rate and the U.S. dollar funding rate increases. The resulting lower dollar funding costs leads to an acceleration of bank capital flows and more permissive credit conditions in recipient economies.

period, stressed the importance of long-term dollar rate vis-à-vis short term rate as a driver of portfolio investments[3].

There is of course a voluminous literature on monetary policy transmission channels, on the determinants of capital inflows and on credit boom in EMs, however few main considerations motivate us to revisit this topic.

First, in the aftermath of the financial crisis, most of the studies aimed at gauge the transmission channel of loose financial conditions across borders have been dedicated to the banking sector of Advanced Economies and to the co-movement of the financial cycle across border. They have highlighted the highly synchronized nature of financial cycle amongst different counties and the tight co-movements of debt flows and credit grow that accompany it (Rey, 2013); also, they have stressed the primary role of the banking leverage in explaining co-movements in financial conditions (Altunbas et al., 2012; Borio and Disyatat, 2011; Bruno and Shin, 2014, 2014b; Rey, 2013). The attention dedicated to the banking system has been justified by the important role played by European banks in channeling US dollar liquidity worldwide before the crisis (Shin, 2013).

Following the sharp increase of international debt securities in EMs in the first half of 2009, few authors (IMF, 2011; Bruno and Shin, 2014; Shin, 2013; Turner, 2013; McCauley, Upper and Villar, 2013) have shifted their attention from bank lending to portfolio investments, suggesting that indicators of vulnerability that are based only on international bank credit expansion may not fully capture financial system risks. They have argued that the increase in bond portfolio may have been stimulated by long term interest rate in center economies irrespective of the policy rate imposed by the FED, suggesting that global flows would not be directly attributable to U.S. monetary policy (McCauley et al., 2014; Turner, 2013).

In an economic environment where shocks in financial centers are rapidly transmitted worldwide[4], we believe it is crucial for policymakers to identify future drivers of global liquidity in order to inform the debate about the appropriate policy response to promote global financial stability.

Second, the recent crisis has demonstrated that increasing financial integration and sharp market driven movements may have reduced the control of the Central Bank on long term interest rate raising the need to understand its impact on financial vulnerabilities. According to theory, other things being equal, increasing short-term interest rates are accompanied by a rise in longer-term yields to the extent that further rises in short-term rates are expected. This simple relationship has long been supported by data and a rise in the Federal Funds rate would have increased the yield on ten-year U.S. Treasury notes. However, the correlation between short and long term rates is by no means perfect; the central bank can influence but cannot precisely determine the long-term rate. This has become more evident starting from June 2004, when long-term interest rates have trended lower even if Federal Reserve has raised the level of the target federal funds rate[5] (Greenspan, 2005). Figure A1 in the Appendix 1 shows how this relationship has drastically changed over time[6].

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[3] The rationale behind this is that portfolio investors are more likely to substitute out at the long end of the yield curve. Turner (2013) provides evidence that movements in the real long-term interest rate in major AEs have been recently mirrored in similar movements in the EMs. He shows that flattering of the yield curve in the most EMs can encourage firms, government and households to lengthen the maturity of their local currency debt. Yet a reduction of long term rate in center economies may translate in an increase in EMs corporates and public bonds through a drop in the financing cost.

[4] This mechanism is amplified in countries with less flexible exchange rate where, as recently demonstrated by Magud et al. (2012) the impact of capital flows on credit grows is higher.

[5] Alan Greenspan (2005) famously characterized this period of rising short-term rates and unchanged long-term rates as a "conundrum."

[6] Weise and Hardisty H. (2006) provide a detailed description of how changes in the federal funds rate have been associated with strong movements in the ten-year bond rate till 2003. They report that the 372 basis point increase in the federal funds rate from 1987:1-1989:1 was associated with a 211 basis point increase in the ten-year rate; the 300 point increase from 1993:4-1995:1 was associated with a 143 basis point increase in the ten-year rate, and the 185 point increase from 1998:4-

Third, the financial crisis and the recent literature on global liquidity have raised attention on the potential risks of gross financial flows, challenging the early literature on capital flows determinants which focused on net inflows. Their choice was justified by the situation in the mid-1990s in EMs in which net capital inflows roughly mirrored gross inflows so that capital outflows of domestic investors could often be ignored (Forbes and Warnock, 2012). Most recently, however, gross capital flows and its volatility have increased, surpassing the size and in most case the volatility of net capital flows (Broner et al., 2013), making the distinction between gross inflows and gross outflows more relevant[7]. Few recent studies argued that, despite both type of flows can lead to macroeconomic and financial vulnerabilities, gross flows may be more relevant for financial stability (Johnson, 2009; BIS, 2011; IMF, 2011; Borio and Disyatat, 2011; Obsfeld, 2012). In this regards, the literature on credit boom have recently found that while shifting the focus from net to gross flows, the latter become good predictor of credit boom gone bust and that its probability is higher when surges are driven by large increase in Other Inflows and, to a lesser extent, by portfolio investments. FDI are found to mitigate the probability of credit boom followed by banking crisis Calderon and Kubota (2012)[8] .

Because of the reasons indicated above, we believe that it is important to revisit the link between U.S. short and long interest rates, capital flows and credit to the private sector, shifting the attention from net flows to gross flows.

We build on the recent works by Bruno and Shin (2014) and Rey (2013) in which they use a Vector Autoregressive model (VARs) to study the cross border spillovers of monetary policy on global financial conditions (they focus on BIS reporting countries and, AEs and EMs respectively). They find that an expansionary shock to US monetary policy decreases the VIX Index[9] - which measures risk aversion in the financial market - and increases bank leverage (Bruno and Shin, 2014; Rey, 2013) , gross credit flows and global domestic credit (Rey, 2013). Their interpretation of the result suggests that funding cost affects bank's decisions on how much exposure to take on, therefore monetary policy affects the economy through greater risk taking by the banking sector.

Like them, we study the dynamic links between the US monetary policy shocks, capital flows and credit creation. In addition, we look at whether shocks on long and short interest rates have different impacts on gross flows composition and credit to the private sector. Differently from them , we focus on EMs[10] and we look at a single country rather than on total flows in the economy.

In order to examine this dynamic relationship we conduct a two-countries recursive vector autoregressions (VAR) for six Middle Income Countries (South Africa, Peru, Philippines, Indonesia, Turkey, Brazil) from 1990q1 to 2012q4. The choice of the sample is guided by the concern about the

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2000:2 was associated with a 145 point increase in the ten-year rate. By contrast, from 2003:4 to 2005:4 the federal funds rate increased by 316 basis points, while the ten-year rate rose a mere 20 basis points.

[7] Broner et al. (2013) provide evidence that starting in the 2000s, gross capital flows and their volatility have increased, while net capital flows have remained relatively stable. The BIS report on global liquidity (2011) shows that during booms, the cross-border components supporting credit expansion grow faster than the credit granted by banks located in the country, suggesting that international credit can amplify booms in recipient economies (BIS, 2011). In the same vein, Bruno and Shin (2014) show that international banking system was a very substantial proportion of total cross-border debt flows and it played a major role in the expansion of domestic lending. Also, Rey (2013) documents the rapid increase in credit flows relative to FDI and portfolio equity flows.

[8] They focus on 22 industrial economies and 48 emerging market for the period 1975 to 2010.

[9] The VIX index measures the "risk neutral" expected stock market variance for the US S&P 500 Index. It entails a measure of uncertainty and one of risk aversion.

[10] There is no single agreed-upon definition of emerging markets and the list of countries classified as emerging economies differs according to the institutions . Emerging market economies are generally identified as those economies in the low- to middle-income category that are advancing rapidly and are integrating with global capital and product markets. In our sample we followed the definition provided by the IMF and we considered emerging markets those "developing countries that have liberalized their financial systems to promote capital flows with nonresidents and are broadly accessible to foreign investors."

recent upsurge in portfolio capital inflows in EMs and yet the need to identify policy response to promote global financial stability (IMF, 2011; Bruno and Shin, 2014; Shin, 2013; Turner, 2013; McCauley, Upper and Villar, 2013). Their selection was based on different considerations including: i) countries receiving big capital inflows ; ii) geographic diversity ; iii) relatively large size.; iv) similar exchange rate regime.

The main findings of our paper are as follows. We find that a restrictive monetary policy raises risk aversion in the stock market and lowers gross capital flows and credit to the private sector. Also we find that a shock in the VXO leads to a decline in gross flows and credit, with the effect on credit lasting longer than the one on gross flows. The analysis of the breakdown of gross flows suggests that for most of the countries in our sample the negative impact of the FFR and the VXO to gross flows is driven by portfolio investments. Finally we find that shocks in the long term interest rate – that we interpret as shocks to the term premium - do not have a significant impact on the VXO Index and gross flows dynamics.

These findings confirm our initial hypothesis that market and debt security can play a role as transmission channel of global liquidity in EMs; with regards to our initial conjecture, however, we do not find that portfolio investments react to long term interest rate, suggesting that portfolio investment decisions are mainly affected by the policy rate imposed by the FED.

Also our investigation suggests to revisit the interpretation of the risk-taking channel. Our findings are in line with most of the literature of global liquidity and capital flows determinants. Consistently with the studies of Bekaert et al. (2014), Rey (2013) and Bruno and Shin (2014), we show that FFR impacts the VXO (Bekaert et al., 2014; Rey, 2013; Bruno and Shin, 2014) , gross flows (Rey, 2013) and credit to the private sector. Also we find that VXO impacts gross flows and credit (Rey, 2013). However, given the structure of our VAR -in which VXO is ordered after FFR and hence its orthogonal to its shocks- we cannot interpret the impact of the VXO to gross flows and credit as the transmission channel of the monetary policy, for that shocks in the VXO are purged from those in the FFR.

The rest of the study is organized as follow. Section 2 reviews the literature. In section 3 we provides some stylized facts on gross capital inflows in EMs. In section 4, we describe the data and the methodology we use. Section 5 discusses the robustness checks and alternative specifications. Section 6 offers our conclusions.

2. Literature review

In the aftermath of the financial crisis many observers have single out the role of balance of payments imbalances as a key factors contributing to the global turmoil. Part of the discussion have focused on current account and saving-investment imbalances (*global saving glut thesis*)[11], while another part has pointed to the role of the financial account and the potential risks of gross capital flows (*excess elasticity thesis*). Our paper moves from this second strand of the literature and adds to the studies on the international transmission channel of U.S. monetary policy.

The key hypothesis of the *excess elasticity theory* is that the roots of the financial crisis can be traced to a global credit and asset price boom on the back of aggressive risk. It conjectures that the main macroeconomic cause of the financial crisis is not the excess saving but the excess elasticity of the monetary and financial regimes in place (Taylor 2007, 2009; Borio and White 2003; Goodhart et al. 2010; Borio, 2008; Borio and Disyatat, 2010; Christiano et al. 2010).[12]

Scholars and policy makers supporting this view, points to the importance of the Federal Reserve's pattern of providing liquidity for the global financial cycle (BIS, 2011). In this vein, Borio and Zhu (2012) coined the term "risk-taking channel" of monetary policy to denote the impact of monetary policy on the willingness of market participants to take on risk exposures, thereby influencing financial conditions and ultimately influencing real economic decisions. Digging into this hypothesis, Bekaert et al. (2013) finds that a loose monetary policy reduces risk aversion in the financial market.

Most of the studies aimed at gauge the transmission channel of loose financial conditions across border, focus mainly on banking sector and advanced economies. Along this lines, Bruno and Shin (2014b) develop a theoretical model which identifies the bank leverage as the prime determinant of the international transmission channel through banking sector capital flows and highlights the role of currency appreciation in spurring higher leverage in the banking system. Empirically , they study the role of the cross border lending in the banking sector as potential operator of the risk-taking channel (Bruno and Shin, 2014). They find that expansionary shock to US monetary policy, lowers risk aversion and increases cross-border banking flows through higher leverage of international banks. Similarly, Rey (2013) finds that when Federal Funds rate goes down, measured risk falls and European banks' leverage, gross credit flows and global domestic credit rise.

Many of the core elements of these analysis are by no means new. They stand at the cross-road between studies on monetary policy transmission channel, capital flows determinants and international spillovers of credit flows (credit boom)[13].

The literature on capital inflows developed in the early 1990s with the resurgence of international financing to developing countries and have traditionally focused on net capital flows and EMs. Seminal papers by Calvo, Leiderman and Reinhart (1996) and Fernandez Ariaz et al. (1995) distinguished the global "push" factors from the country-specific "pull" factors, and emphasized the

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[11] This view points at the surge of *net capital inflows* as a key determinants of credit boom in deficit countries. According to this theory an excess of saving over investment in several EMs have fueled the credit booms and risk-taking in the biggest advanced deficit countries by putting significant downward pressure on world interest rates and/or by simply financing the booms in deficit countries. Perhaps the best known of these explanations is Bernanke's (2005) global saving glut thesis. In his thesis he argued that the excess of ex-ante global savings over investment centered in Asia and oil-exporting economies led to both downward pressure on global real interest rates and the widening of global imbalances. A variant of the savings glut story is that of Caballero, Farhi and Gourinchas (2008) in which the coexistence of global imbalances and low interest rates stems not from a savings glut so much as from a shortage of financial assets. According to this theory, following the Asian financial crisis in 1997-98, these economies' capacity to generate financial assets had diminished, with the consequence that Asian central banks stepped in to provide a financial intermediary role whereby domestic savings were exported. It is further argued that the US is uniquely placed to supply these financial assets given its large and mature capital markets and the reserve currency status of the dollar.

[12] For a similar conclusion, which plays down the role of global imbalances, see Truman (2009) and Shin (2009).

[13] For a recent survey of monetary policy transmission channel see Boivin, Kiley and Mishkin (2010).

importance of external push factors in explaining capital flows to EMs. Taylor and Sarno (1997) found that global and country-specific factors to be equally important. Recently, the dramatic increase in gross capital flows have posed a challenge to this traditional approach where financial flows are seen only as the counterpart to the current account[14] and has paved the way for new studies on the determinants of gross capital inflows.

In this regards, Byrne et al. (2011) have found that U.S. long term rates is a crucial determinant of gross capital flows in developing countries[15]. Along the same line, the IMF (2011) has identified that loose monetary policy in AEs, global risks and EMs' growth are also key determinants of gross inflows. Forbes (2010), focusing exclusively on inflows in the US, have found that the financial development of the investing countries is the most significant drivers of foreign investments[16]. Finally, Forbes and Warnock (2012) looking at a large sample of countries that includes both advanced and emerging economies, have stressed the prominent association of global risks and capital flows. This correlation disappears when they look at net flows. Interestingly, their results do not support the widespread presumption that changes in global liquidity or interest rates in a major economy, such as the United States, drive surges in capital flows.

The volume of studies on the spillovers effect of international capital flows is also huge. They have traditionally focused on macroeconomic vulnerabilities stemming from net capital inflows[17]. Recently, however, most studies have shifted their attention to the impact of gross flows (Johnson, 2009; BIS, 2011; IMF, 2011; Borio and Disyatat, 2011; Obsfeld, 2012; Turner, 2013) and have underlined that rising gross inflows can exacerbate credit expansions, create distortion in asset prices – i.e. bubbles in stock and housing prices, volatility of long-term rate– and increase vulnerabilities associated to currency and maturity mismatches.

In this paper we are particularly interested in the impact of capital flows on credit expansion. As it is well known credit booms can be driven by many factors, however in EMs they seem to be associated mostly with large capital inflows. Evidences that net inflows of private capital may help generate credit booms are obtained by Mendoza and Terrones (2008), the IMF (2011b) and Ostry et al.,(2011) [18]. More recently Furceri, Guichard and Rusticelli (2011) and Calderon and Kubota (2012) have found that also gross capital inflows and credit growth are positively and significantly correlated. They have also showed that this positive effect is larger if the shocks can be attributed to debt inflows vis-à-vis equity flows.

[14] The BIS report on global liquidity (2011), Borio and Disyatat (2011), and Forbes and Wornock (2012) provide a detail reasoning for this shift. More in general Milesi-Ferretti (2009) and Obstfeld (2010) discuss the importance of focusing on the whole balance sheet.

[15] Defined as Equity issuance, Bond issuance and Syndicated Banks.

[16] Counties with less developed financial market invest a larger share of their portfolio in the US.

[17] See Calvo, Leiderman and Reinhart (1996) and Fernandez Ariaz et al. (1995) for early studies on current account imbalances.

[18] See Magud, Reinhart and Vesperoni (2012) for a recent analysis of the impact of exchange rate flexibility on credit markets during period of large capital inflows.

3. Stylized facts on capital inflows in middle income countries

Our study is driven by the concern about the recent upsurge in portfolio capital inflows in EMs. This section briefly summarizes episodes of capital inflows boom in Middle Income Countries from the Nineties and provides some stylized facts on gross capital flows composition. We highlight the significant change before and after the financial crisis.

Figure 1 (left panel) shows the evolution of Gross and Net Capital Inflows in a sample of 40 Middle Income Countries (MIC)[19] in 1990q1-2012q4 and it identifies (right panel) the number of countries that experience a surge in capital inflows in each period[20].

The figure summarily captures the history of capital inflows over the past 15 years in Emerging Markets and it highlights three main upsurge episodes. The Nineties were characterized by a wave of financial liberalization, low interest rate and positive growth performance, which led to a strong increase in external indebtedness in developing countries. This incredible upsurge in capital inflows meant the end of the external credit rationing for Latin America[21], however it led to a long sequence of regional crises. It started with the tequila crisis in 1993 and it was then followed by South-East Asia in 1997-1998 , Russia 1998, Brazil 1999, Pakistan, Ukraine, Argentina 2002, Uruguay, Turkey, and Ecuador.

Between 2004 and 2008 the international financial market increased appetite for risk and hit developing countries with a new wave of capital inflows. The policy reaction in receiving countries was to intervene in the FX market[22] in order to either reduce nominal exchange rate volatility (Aizenman and Lee, 2007) or to preserve an undervalued real exchange rate (Dooley et al., 2009). Whatever the reasons, developing countries proved resilient to the global crisis and after a sharp slowdown in the late 2008, capital inflows rebounded again in the first half of 2009 reaching- in net term- new high, in only two quarters. Gross capital flows have yet to hit they pre-crisis volume, but its amount has been on the raised reaching at the end of 2012 US$ 720 billion.

Figure 1 also brings evidence of the growing importance of gross inflows vis-à-vis net inflows. As suggested by Forbes and Warnock (2012) until the mid-1990s net capital inflows roughly mirrored gross inflows, however starting from mid-2000s gross capital flows have increased, surpassing the size and in most case the volatility of net capital flows (Broner et al., 2013), making the distinction between gross inflows and gross outflows more relevant.

[19] The data availability is quite heterogeneous across countries and over time. Hence, in order to conduct meaningful descriptive analysis and comparisons across periods, we keep only countries with quarterly data on capital flows for at least 15 years. We exclude China given its large dimension. In Appendix 1 we show the evolution of Gross and Net flows pulling all information available (all MICs, excluding China. Figure A2) and the relative size of our sample respect to it (Figure A3).

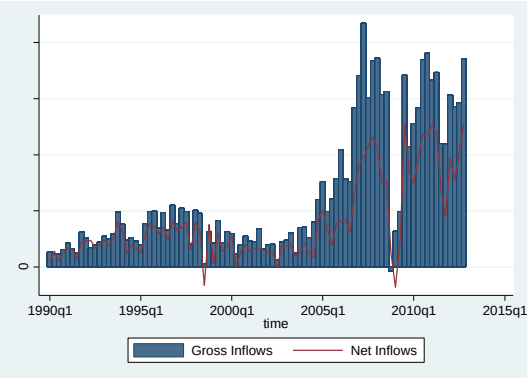
[20] Following the IMF (2011), a surge is defined as an event in which inflows exceed its long run trend by one standard deviation and it is big in magnitude (larger of 1.5 percent of annual GDP). The country specific trend is calculated by applying an H-P filter with a smoothing parameter of 1600 for quarterly gross inflows data.

[21] Mexico, Argentina Brazil and Chile became the main recipients of foreign capital, but Colombia, Peru and other countries also received significant volumes.

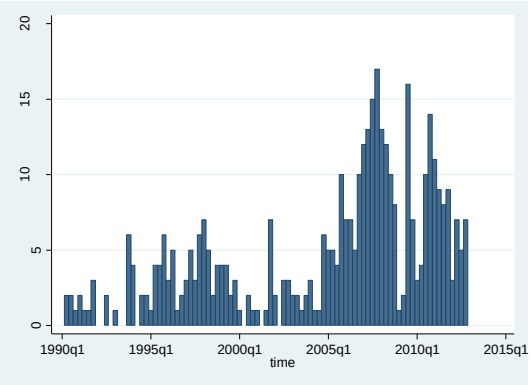
[22] The process of reserve accumulation, however, was not homogenous across countries. Between 2004 and 2008, Brazil quadrupled its stock of FX reserves, Peru more than tripled it.

Figure 1

Gross and Net Capital Inflows (in millions of US$)



Surge of Gross Capital Inflows

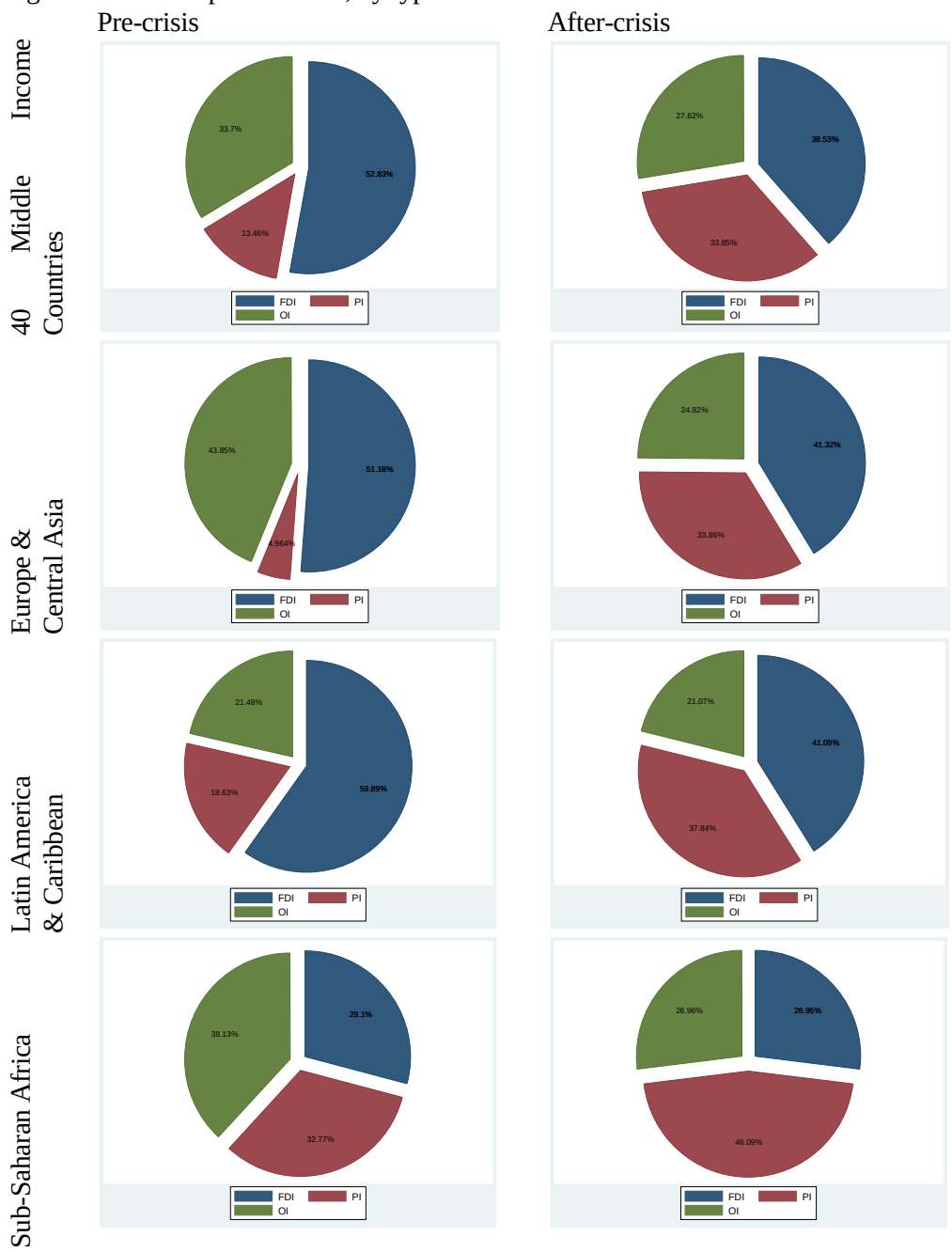


Sample: 40 MICs.

The composition of inflows also changed over time. During the second half of the Nineties capital inflows were mainly in the form of foreign direct investment (FDI) and portfolio investment (PI), while other inflows (OI) accounted only for a small portion of the total. During the pre-crisis period the situation almost reversed, with OI more than doubled from about 16 percent in the previous wave to around 33 percent. Probably, the most striking change in the aftermath of the financial crisis is the sharp increase in PI. Figure 2 highlights the composition of gross capital inflows before and after the crisis[23] in all EMs and some selected geographic area (which change seems noteworthy).

[23] The two graphs capture periods in which a large number of countries experience a surge in capital inflows. The pre-crisis refers to the time span 2005q4-2008q4 and the after-crisis to 2009q3-2012q4.

Figure 2: Gross Capital Inflows, by type of flows



4. Method and data

(a) Data

To accomplish our exercise, we gathered quarterly[24] data for 6 countries (South Africa, Peru, Philippines, Indonesia, Turkey, Brazil) from 1990q1 to 2012q4. Their selection was based on different considerations including: i) countries receiving big capital inflows ; ii) geographic diversity ; iii) relatively large size.; iv) similar exchange rate regime.

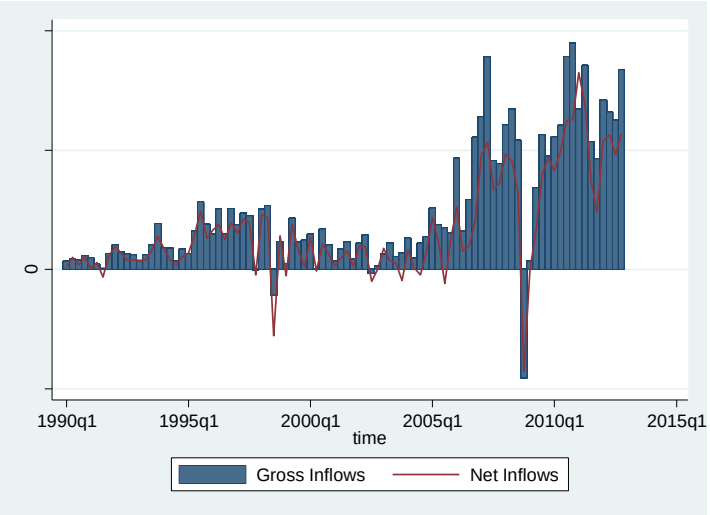
As for the first point, we selected only countries that have had capital upsurges in the aftermath of the financial crisis. According to the definition of capital upsurge given in the previous paragraph, South Africa experienced a surge in capital inflows for 5 quarters after the financial crisis, Turkey and Indonesia for 3 and Brazil, Peru and the Philippines for 2. In terms of geographic location, 1 country is in Sub-Sahara Africa, 2 in East Asia and Pacific, 1 in Europe and Central Asia, 2 in Latin America and the Caribbean. Countries are those with largest real GDP amongst MICs. All countries have had a floating exchange rate during the period considered[25].

Gross flows directed to these countries accounted for almost 40 percent of total inflows directed to MICs after the financial crisis. The volume of gross flows in absolute term overtook pre-crisis levels in most of the countries (Peru, Philippines, Indonesia and Brazil) and it reached new high as % of GDP in Indonesia. Figure 3 shows the evolution of gross and net capital inflows in millions of US$. The composition of gross flows has been skewed toward portfolio investments. As highlighted by the IMF (2011) in Indonesia, Peru and Turkey the trend has been driven mainly by foreign investors' holdings of government securities; while flows to the corporate sector may have been limited in Peru and Indonesia due to the underdeveloped corporate bond market. South Africa and Brazil also experienced a sizable flows in local currency bond market, even if in Brazil the most virtuous trend is to be attributed to equity investments. Brazil and Peru also received a sizable flows of FDI which may have been attracted by the stronger outlook for commodity prices.

[24] Following Rothenberg and Warnock (2011), Forbes and Warnock (2012), and Calderon and Kubota (2012), we argue that they dynamics of surges and stops in capital flows as well as expansions and contractions of credit along the business cycle are better captured with quarterly data.

[25] They range from 3 to 4 in the coarse classifications developed by Ilzetzki, Reinhart and Rogoff (2008).

Figure 3: Gross and Net Capital Inflows (in millions of US$)



Sample: 6 countries (South Africa, Peru, Philippines, Indonesia, Turkey, Brazil)

Time series were obtained from International Monetary Fund's *International Financial Statistics* and *Balance of Payment Statistics*, Haver Analytics databases, World Bank's World Development Indicators (WDI), Federal Reserve Board and Chicago Board Option Exchange and the U.S. Department of Commerce and Reinhart and Rogoff coarse classification (2004). These series are domestic credit to the private sector, gross capital inflows, consumer price index, real GDP growth , short and long term U.S. interest rate, VXO Index, exchange rate regime, US GDP and US GDP deflator.

Our measure of credit is defined as domestic bank and other financial institutions credit to the domestic private sector (LNCRQR). We collect data on gross capital inflows (ICAPFL) and its breakdown -foreign direct investment (IFDI), portfolio investments (IPF) and other investment liability flows (IOTHF)- from the IMF's Balance of Payment Statistics[26]. Economic performance in an economy is measured by the growth rate of real GDP. Quarterly data of real GDP in local currency (GDPGRSM) is obtained from Haver Analytic. For the international interest rates, we use respectively the Effective Federal Fund Rates (FFR) -at the end of the period- taken from the Federal Reserve Board and the 10 years U.S. Government Bond Interest rate taken from the IMF's International Financial Statistics (USBOND). The exchange rate regime is taken from Reinhart and Rogoff (2004) *de-facto* exchange rate regime classification updated by Ilzetzky, Reinhart and Rogoff (2009). This index goes from 1 to 6, and higher values indicate a more flexible exchange rate arrangement. Global risk aversion is proxied by the VXO index —a measure of implied volatility computed using 30-day S&P 100 index at-the-money options. Higher values of the VXO indicate rising global risk aversion. Finally US GDP (USGDPGR) and US GDP (USGDPDEFGR) deflator are obtained from the Bureau of Economic Analysis of the U.S. Department of Commerce.

[26] Gross capital inflows is equal to non-residents' purchase minus sales of domestic assets.

(b) Method

Our empirical investigation consists of two-countries recursive vector autoregressions (VAR) examining the dynamic relationship between US long and short interest rate, risk aversion and uncertainty, gross flows and credit to the private sector in six selected MICs.

We build on the recent works of Bruno and Shin (2014) and Rey (2013) in which they study the cross border spillovers of monetary policy on global financial conditions. Bruno and Shin (2014) frame the argument by asking how monetary policy influences cross border banking flows. They perform a VAR analysis in which they include Fed Funds target rate, U.S. banking leverage, BIS banking flows[27], VIX and US dollar exchange rate. They find that a monetary policy shock rises the VIX and lowers banking leverage and cross banking flows. Their interpretation suggests that funding cost affects decisions on how much exposure to take on, therefore monetary policy affects the economy through greater risk taking by the banking sector. Rey (2013) conducts a similar analysis for a sample of AEs and EMs and looks at the impact of monetary policy shocks on the VIX, credit creation, leverage and credit flows. She performs a recursive VAR analysis in which she includes: US GDP, US GDP deflator, global credit, global credit inflows, European banks leverage, Fed Funds target rate and the VIX. She finds that when Federal Funds rate goes down, the VIX falls (mirroring a lower measured risk), and European banks' leverage, gross credit flows and global domestic credit rise.

Like them, we study the dynamic links between the US monetary policy shocks, risk aversion and uncertainty , capital flows and credit creation. In addition, we split the total gross flows into its main components (FDI, PI , OI) and we look at the impact of short U.S. interest rate on each of them. Also we augment our VAR with US long term interest rate, in order to detect whether shocks on long and short interest rates have different impacts on gross flows composition and credit. Differently from the literature on global liquidity, we focus on financial variables in single countries.

To avoid that omitted variables may overestimate the effect of US interest rate on capital inflows and of capital inflows on the credit to the private sector, we enrich the VAR model proposed by Rey (2013) with country specific characteristics. Following recent studies on gross capital inflows and credit growth[28], we augment the list of VAR variables by adding real GDP growth and by selecting countries that have had a similar exchange rate regime during the entire period considered. To avoid that past values of country specific variables impact the FFR, we also impose some restrictions on the parameter and we set the coefficients of GDPGRSM, LNCRQR and ICAPFL (or its breakdown) equal to zero in the FFR equation[29].

[27] As measured by the growth (log difference) in cross-border loans of BIS reporting banks on banking sector counterparties

[28] Most of the literature on capital inflows has traditionally focused on net flows and has emphasized the importance of both push and pull factors in determining capital flows. Most recently, some authors have shifted their attention to gross flows and have stressed the importance of push factors vis-à-vis pull factors while moving the focus from net to gross flows (Forbes and Warnock, 2012). In particular a recent study by the IMF (2011) have identified as main determinants of gross capital inflows in LICs and MICs the VIX and the U.S. interest rate – as push factors- and real GDP growth - as country specific pull factor. By the same token the literature on the determinants of credit boom has been mainly focused on net flows. Mangud et al. (2012) have stressed the importance of net capital inflows and the exchange rate regime in determining the level of credit to GDP (bank credit grows more rapidly in economies with less flexible exchange rate regimes). More recently, Calderon and Kubota (2012) looking at the relation between gross flows and credit boom have remarked their relevance and have stressed the importance of accounting for other likely determinants of credit boom to avoid overestimating the relation. Such variables are real GDP growth and overvalued assets prices and build-up of leverage. Their results reinforce our choice to include real GDP growth in our model. Also, to account for possible differences stemming from exchange rate regime, we select countries that have had a floating exchange rate during the entire period considered.

[29] In the presence of parameter restrictions on a VAR, OLS is no longer efficient. Therefore we use a SUR - Seemly Unrelated Regression – to estimate the model.

In order to identify monetary policy shocks we impose a triangular Cholesky decomposition[30]. Following Rey (2013) we include US GDP and the GDP deflator as set of information to which the monetary policy reacts and, the Federal Fund rate as the main instrument of US monetary policy. Differently from her, we base our VAR on the assumption that each country is a small open economy, therefore we impose exogeneity of US GDP and GDP deflator, meaning that each correlation between US and the country analyzed is assumed to be unidirectional, going from the US to the small country.

For each country we run three VARs. First, we look at the impact of FFR on total gross capital inflows, in order to make sure our results are in line with the literature. Second, we slit gross flows into their main components (FDI, PI and OI) and we look at whether shocks in U.S. monetary policy have a different impact on different type of flows. Then we augment the VAR with US long term interest rate and we look at its impact first on gross flows composition and credit.

[30] This restrictions imply that the first variable cannot respond to contemporaneous shocks (within the quarter) of any other variables, while the second variable is affected by the contemporaneous shock to the first one, but not any others, etc. Thus, slower moving variables are better candidates to be ordered before fast moving variables.

(Var 1)

In the first VAR we include 5 endogenous variables and 2 exogenous variables (in this order): Fed Funds target rate (FFR), VXO (VXO), real GDP growth (GDPGRSM) credit to the private sector (LNCRQR) , gross capital inflows (ICAPFL). LNCRQR and VXO are in log. ICAPFL is in millions of US$. US GDP growth (USGDPGR) and US GDP deflator growth (USGDPDEFGR) are included as exogenous variables.

The order we impose implies that Fed Funds target rate does not react to contemporaneous shocks of any other variables[31], while Gross flows can respond within the same quarter to any variables (and it is therefore ordered last). VXO is order second and it can react only to contemporaneous shocks of FFR. Real GDP growth is ordered after VXO. Credit is our "penultimate" variable, implying that if there were a shock in gross flows, credit would take a quarter to react. As previously discussed, we also set the coefficients of GDPGRSM, LNCRQR and ICAPFL equal to zero in the FFR equation.

Some of the variables display a possibility of non-stationary behavior. Nevertheless, we estimate the system with 3 lags and all variables in level. In the choice of the appropriate number of lags we opted for a parsimonious VAR specification, but at the same time characterized by estimated residuals with good white-noise properties[32].

Appendix 2 Figures 1 to 6 present the impulse response functions for the five variables recursive VAR with 95 percent confidence bands for each country. Intervals are bootstrapped and based on 500 replications. Figures are organized so that the columns of the matrix indicate the variable whose shock we are following and the rows of the matrix indicate the variable whose response we are tracking. Each cell of the tables graphs the impulse responses over 20 quarters to a one-standard-deviation variable shock. Figure 4, in the main text, groups the key panels for the narrative. For each country we present in the first column the response of gross capital flows and credit to the private sector to a shock in the FFR. In the third and fourth column we show how the two variables react to a shock in the VXO. At the top of the graph we present the response of the VXO to a shock in the FFR only for Brazil. For expositional proposes we do not present the same figure for the entire sample for its variation differs only modestly from one country to another (see Appendix 2 for detailed results).

In the first place, we are interested in the impact of Federal Fund rate on gross capital inflows (ICAPFL) and on credit to the private sector (LNCRQR). We expect that when the Federal Fund rate goes up, gross flows and domestic credit fall. As shown in Figure 4, we find that a restrictive monetary policy shock has a negative impact on the two variables from about the 12th quarter (results are not significant for South Africa and Turkey, and partially for Peru; although they turn significant using 68% confidence interval)[33]. This is in line with most of the literature on global liquidity and capital flows determinants and it confirms the negative relation identified for by Rey (2013), also for Emerging Markets.

Following the recent literature on risk-taking channel we then look at the impact of FFR on the VXO and at the impact of the VXO on gross flows and credit. We expect that a shocks in the Federal Fund rises the VXO (spreads are large and measured risk is high) and a shocks in the VXO lowers gross flows and credit to the private sector. Figure 4 confirms our expectations and shows that a tighter monetary policy raises the VXO Index from around the 5th quarter. Also we find that an increase in the VXO leads to a decline in gross flows lasting for about 3 quarters and to a decline of credit lasting

[31] The Fed Funds target rate reflects the periodic decision making process at the Federal Reserve and the slowly evolving implementation of monetary policy.

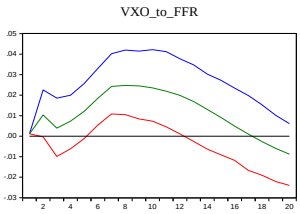
[32] LM test shows that the multivariate version of Lagrange multiplier test suggests that for most of the countries just a lag order of one is sufficient to get uncorrelated VAR residuals. Nevertheless, we opted for a specification with three lags, which guarantees residuals with better white-noise properties.

[33] Note that such interval bounds are common in VAR analysis literature. See for example Bekaert et al. (2013) and Christiano et al. (1996b).Results are available upon request.

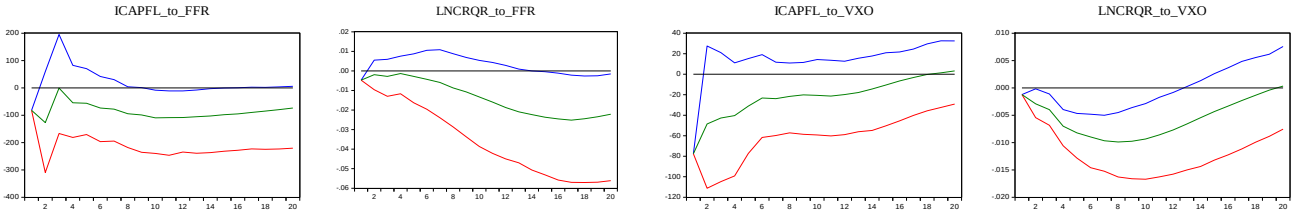
for about 13 quarters (except for South Africa and Turkey were the impact lasts for a shorter period). The first set of results corroborates the findings in Bekaert et al. (2013), Rey (2013) and Bruno and Shin (2014) who show that FFR shock has a positive effect on the VIX Index starting between the 4th and 9th period and has a negative effect on gross flows after 12 quarters (Rey, 2013). The second set of results are consistent with Rey (2013) and Bruno and Shin (2014) who find a negative impact of the VIX on cross-border lending (Rey, 2013; and Bruno and Shin, 2014) and global domestic credit (Rey, 2013). Their interpretation of the results suggest that monetary policy affects economic variables through greater risk taking by the banking sector, as denoted by the increase in the VIX and a decrease in the bank leverage.

In line with their analysis, our results suggest that FFR impacts the VXO, gross flows and credit to the private sector. We also find that VXO impacts gross flows and credit. Given the structure of our VAR (in which VXO is ordered after FFR, hence it is orthogonal to its shocks), however, we caution against interpreting these results as risk-taking channel mechanism, because that the impact of shocks in VXO cannot be attribute to U.S. monetary policy.

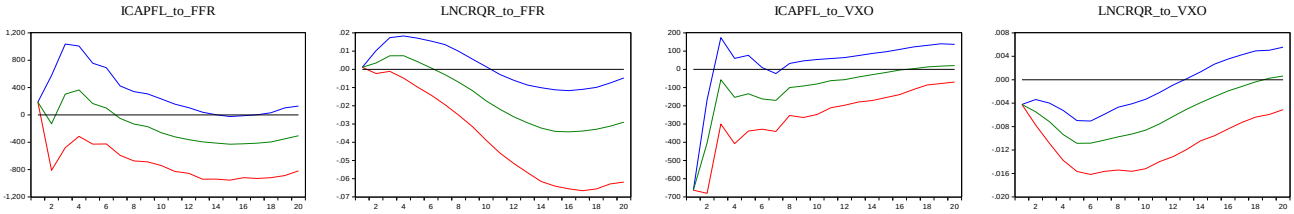
Figure 4: Main results



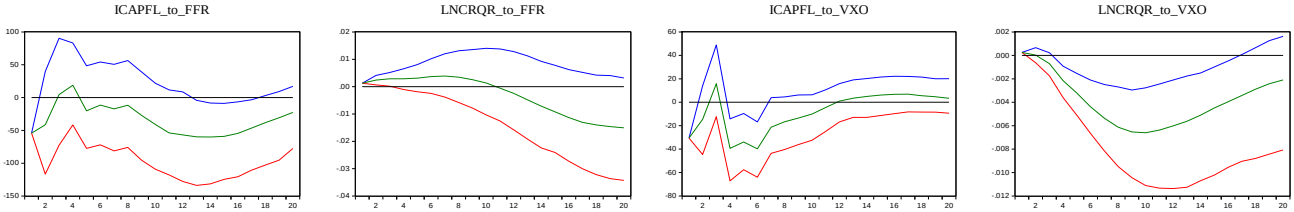
Indonesia



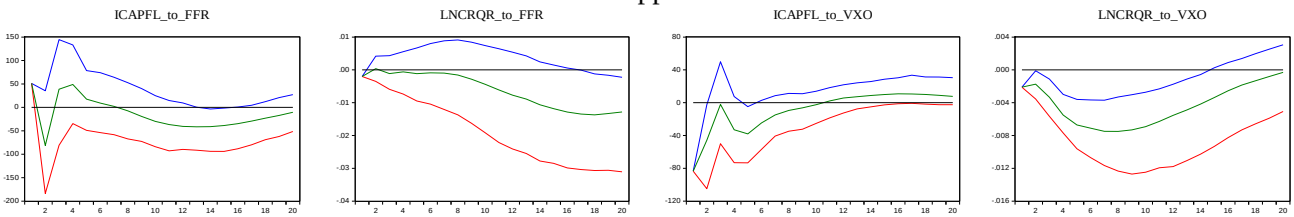
Brazil



Peru

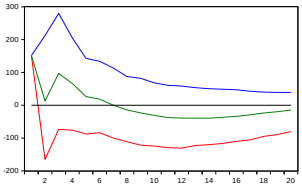


Philippines

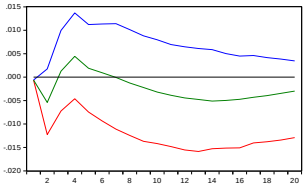


South Africa

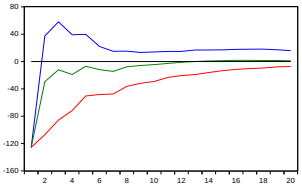
ICAPFL_to_FFR



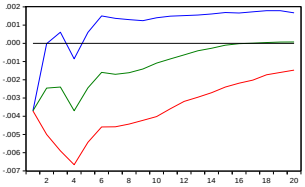
LNCRQR_to_FFR



ICAPFL_to_VXO

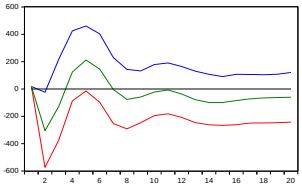


LNCRQR_to_VXO

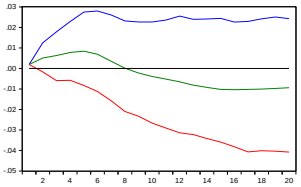


Turkey

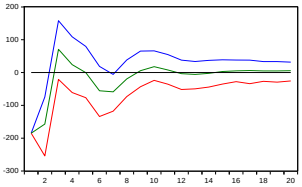
ICAPFL_to_FFR



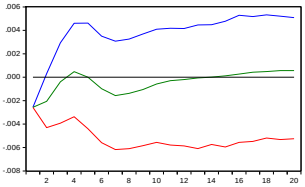
LNCRQR_to_FFR



ICAPFL_to_VXO



LNCRQR_to_VXO



Var (2)

We now turn to our second VAR in which we study how short U.S. interest rate impacts different type of capital inflows and interacts with credit in the economy.

We split gross flows down into its components and we include 7 endogenous variables and 2 exogenous variables (in this order): Fed Funds target rate (FFR), VXO (VXO), real GDP growth (GDPGRSM) credit to the private sector (LNCRQR) , foreign direct investment (IFDI), other inflows (IOTHF) and portfolio investments (IPF). LNCRQR and VXO are in log. IFDI, IOTHF and IPF are in millions of US$. US GDP growth (USGDPGR) and US GDP deflator growth (USGDPDEFGR) are included as exogenous variables.

As before, the order we impose implies that Fed Funds target rate does not react to contemporaneous shocks of any other variables, while Gross flows' breakdown can respond within the same quarter to any variables (and it is therefore ordered last). The other variables are ordered as before. Since we are first and foremost interested in the impact of the shocks on the three type of flows but we are not interested in interrelation amongst them, we do not assume any specific direction of their relations[34]. However in order to make sure the ordering does not influence our results we test different identification restrictions and the loglikelihood remains unchanged. As before, we also set the coefficients of GDPGRSM, LNCRQR and IFDI, IOTHF and IPF equal to zero in the FFR equation.

Figure 5 groups the key panels for the narrative. In the first row, for each country, we present the impact of a shock in the FFR to foreign direct investment, other inflows, portfolio investments and Credit. In the second row we show the responses to a shock in the VXO. As before, we present at the top of the graph the response of the VXO to a shock in the FFR for Brazil. Figure 7 to 12 in the Appendix 2 present detailed results.

We start by looking at the impact of Federal Fund rate on gross capital inflows breakdown (IFDI, IOTHF, IPF) and credit to the private sector (LNCRQR). We find that for most of the countries a shock in the FFR reduces portfolio investments after about 12 quarter, but it does not impact other inflows and foreign direct investment (with exception of Indonesia and Peru for which we find that FFR has a negative impact on foreign direct investments after 12 quarter)[35]. Also we find that a shock in FFR reduces credit after about 12 quarter. This results suggest that for most of the countries in our sample the negative impact of the FFR to gross flows is driven by portfolio investments. Results on foreign direct investments are in line with our expectations, however we conjecture that the lack of significance of the FFR in affecting other inflows, may be due to the variety of flows that are grouped under this account[36]. Figure A6 in Appendix 1 shows that the official sector component, e.g. IMF lending, – that may not react to global factors - is a relevant component of other inflows for a few countries.

Then we turn to the impact of FFR to the VXO and of the VXO to gross flows and credit. As expected, results on the VXO remain unchanged and so do those on the credit to the private sector. A

[34] The literature is not conclusive on the direction of the relations amongst capital flows. With regards to the relation amongst FDI and portfolio investments, for example, some authors maintain that portfolio investments enters the economy before FDI and, if they maintain certain level of consistency, they can contribute to the stabilization of the host economy and eventually to attract FDI (Reinhart and Rogoff, 2009) . On the other hands, some authors suggest that FDI enter the economy at first and contributes to the stability of the economic environment, enhancing more suitable economic environment for the entry of FPI (Erzurumlu et al., 2014).

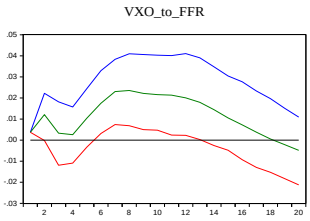
[35] Results are weaker than in the previous VAR, however they turn significant using 68% confidence interval.

[36] Other inflows includes: i)other equity; ii) currency and deposit; iii) loans (including use of IMF credit and loans from the IMF); non -life insurance technical reserves, life insurance and annuities entitlements, and provisions for calls under standardized guarantees; iv)trade credit and advances; v) other account receivable/payable; and vi) SDR allocation (SDR holding are included in reserve assets).

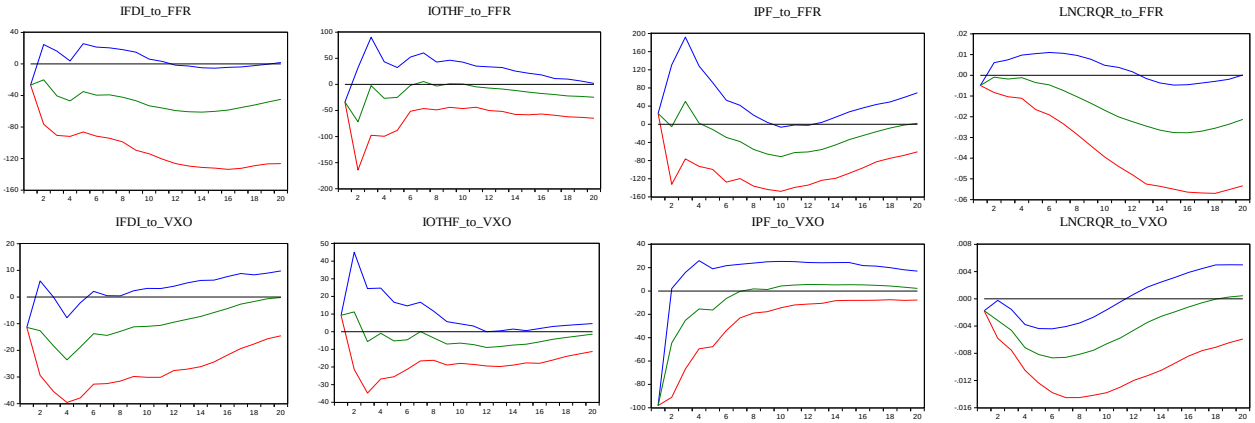
shock in the FFR raises the VXO and a shock in the VXO reduces credit (results are not significant only for Turkey and South Africa). As for the impact of the VXO to different type of capital flows, we find that for most of the countries a shock in the VXO reduces portfolio investments in the first quarter, but it does not impact other inflows and foreign direct investments (with exception of Brazil and Philippines for which we find a negative impact of VXO to other inflows).

These results seem to suggest that shocks in monetary policy and in the VXO affect gross flows mainly through portfolio investments. Even though the weak response of foreign direct investments was expected, we conjecture that the lack of significance of the FFR and the VXO in affecting other inflows, may be due to the variety of flows that are grouped under this account.

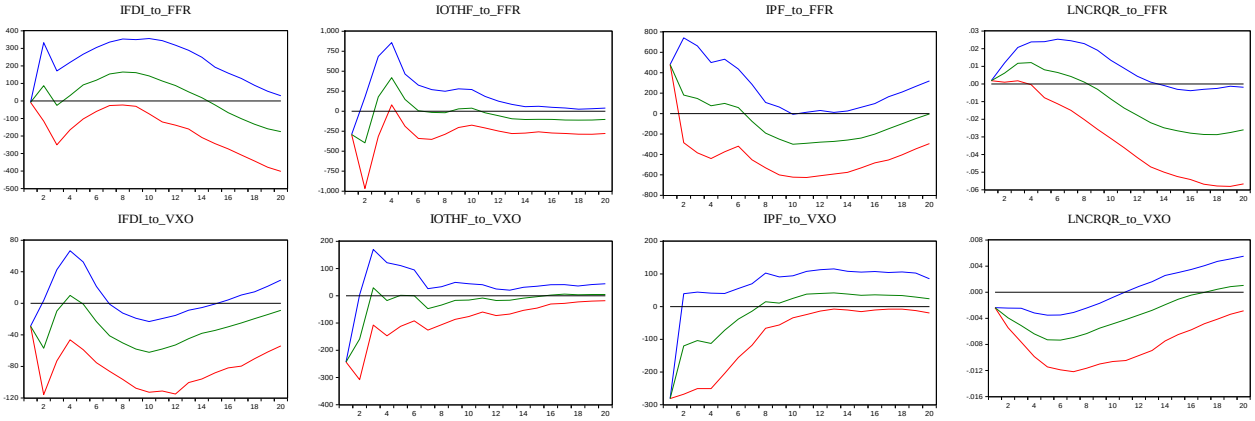
Figure 5: Main results. Gross flows decomposition



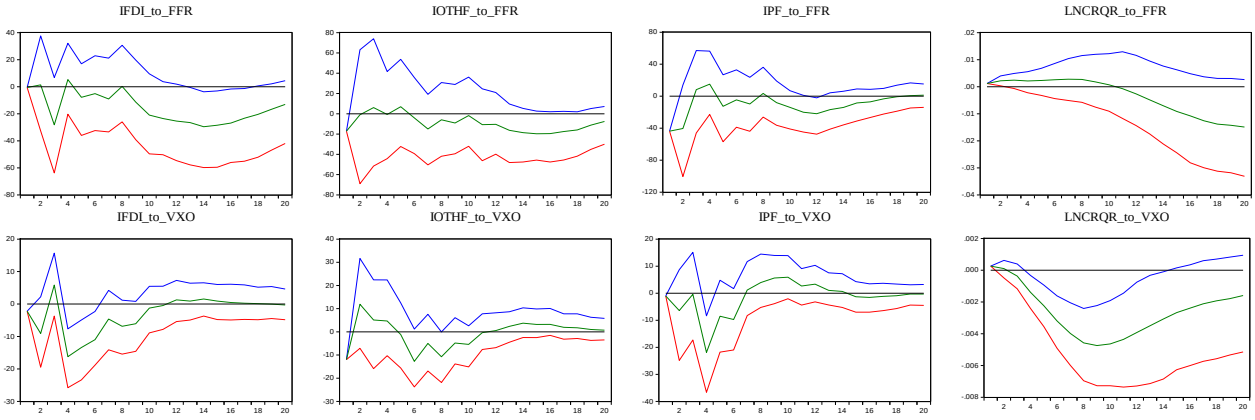
Indonesia



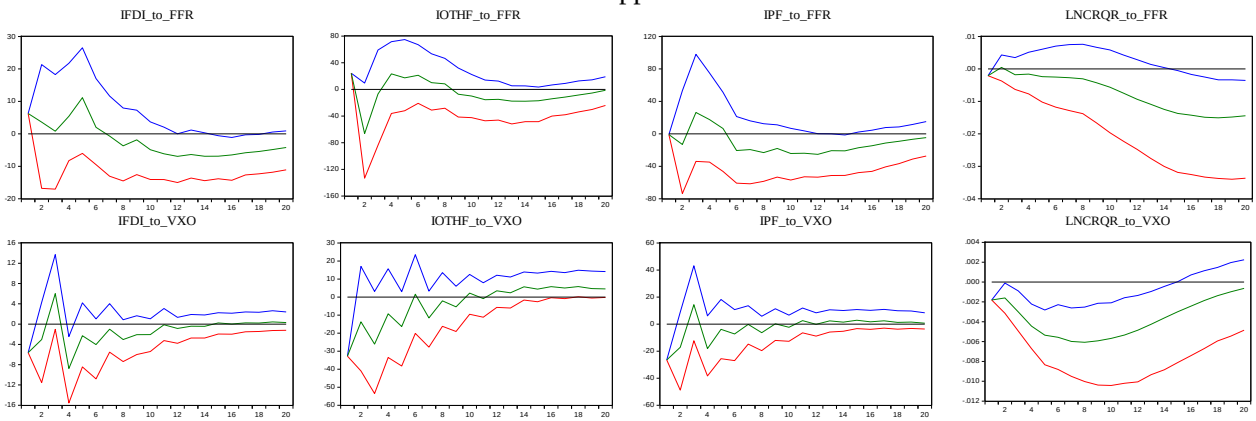
Brazil



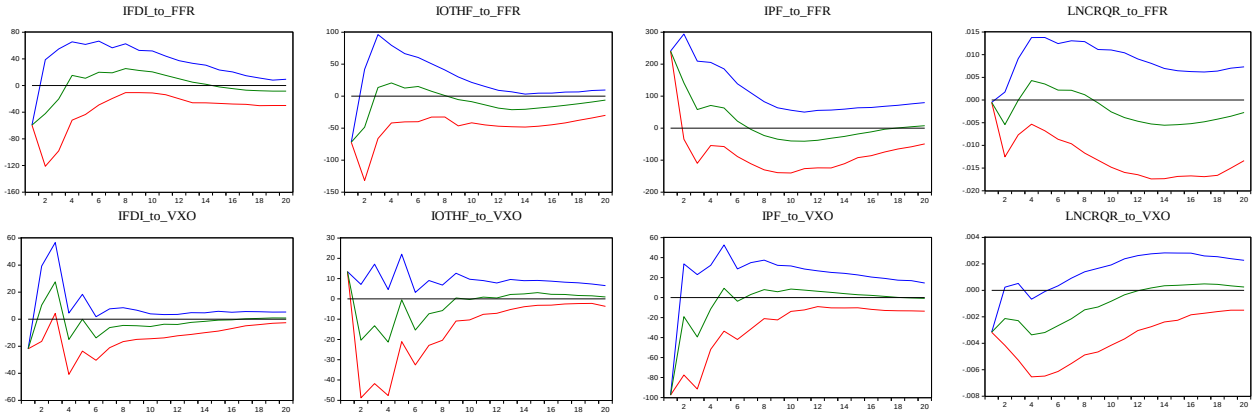
Peru



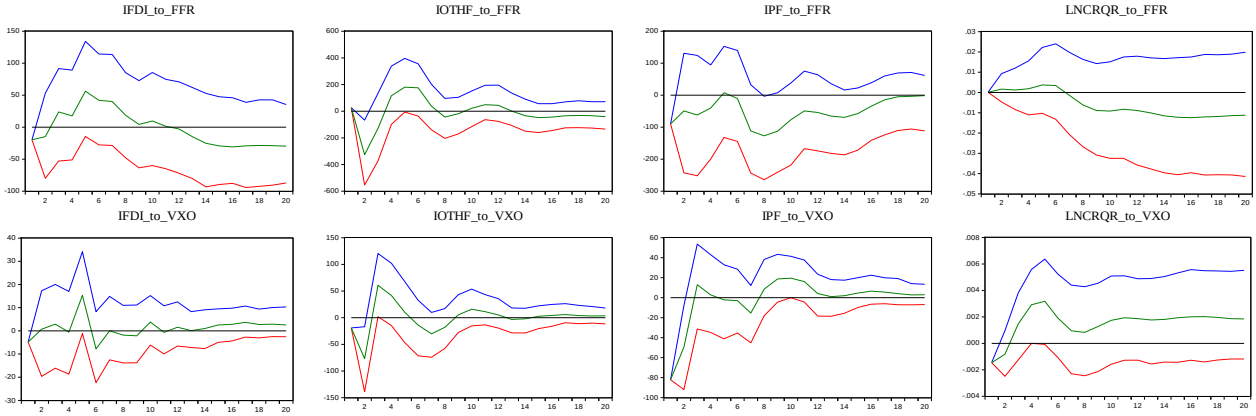
Philippines



South Africa



Turkey



(Var 3)

In our third VAR we try to detect whether shocks of long and short interest rates have different impacts on gross flows composition and credit to the private sector. To this end, we augment our VAR with U.S. long term rate.

We include 8 endogenous variables and 2 exogenous variables (in this order): Fed Funds target rate (FFR), US long term rate (USBOND), VXO (VXO), real GDP growth (GDPGRSM) credit to the private sector (LNCRQR) , foreign direct investment (IFDI), other inflows (IOTHF) and portfolio investments (IPF). LNCRQR and VXO are in log. IFDI, IOTHF and IPF are in millions of US$. US GDP growth (USGDPGR) and US GDP deflator growth (USGDPDEFGR) are included as exogenous variables.

The structure of the VAR implies that shocks in U.S. long interest rate are changes in the U.S. Treasury Bond yield orthogonal to monetary policy shocks. We interpret such changes as shocks in the term premium. The yield of nominal Treasury security is the sum of the compounded expected future short term rate over the maturity of the bond plus a term premium to compensate investors for the uncertainty return on holding the bond. To interpret the meaning of long term shocks in our VAR we refer to the study by Favero and Giavazzi (2008) in which they look at the determinants of long term rate in the Euro Area. They suggest that long term rate reacts both to financial and macroeconomic shocks. They classify financial shocks as: i) deviation from the systematic response of the Central Bank from macro variables (*monetary shocks*) and ii) shocks in term premia (*non-monetary shocks*). Macroeconomic shocks are identified with inflation and output gap. Given this taxonomy, shocks in the long term rate in our VAR are shocks in the term premium.

Figure 6 groups the key panels for the narrative. In the first row, for each country, we present the impact of a shock in the USBOND to foreign direct investment, other inflows, portfolio investments and credit to the private sector. In the second row we show the responses to a shock in the VXO. As before at the top of the graph we show the impact of the VXO to a shock in the FFR. Figure 13 to 18 in the Appendix 2 present detailed results.

As before we first check the impact of shocks in monetary policy to gross flows and credit to the private sector and we find that results are similar to those in our second VAR (although mostly not significant). This confirms that including the long term interest rate in a VAR model designed to estimate the transmission mechanism, diminishes the impact of monetary shocks on the variables of interest (Bagliano and Favero, 1998). Results are reported in Appendix 2.

Then, we turn to the analysis of long term rate shock,. As expected, foreign direct investments do not react to it. Other inflows decrease in South Africa and Brazil, while portfolio investments is not significant in any country but Brazil, where a shock in the long rate causes an increase in portfolio investments in the first quarter. Results are not cross cut, however they might suggest that in most of the cases portfolio investments do not react to unexpected variations in the term premium. If they do – as in the case of Brazil – the impact is positive.

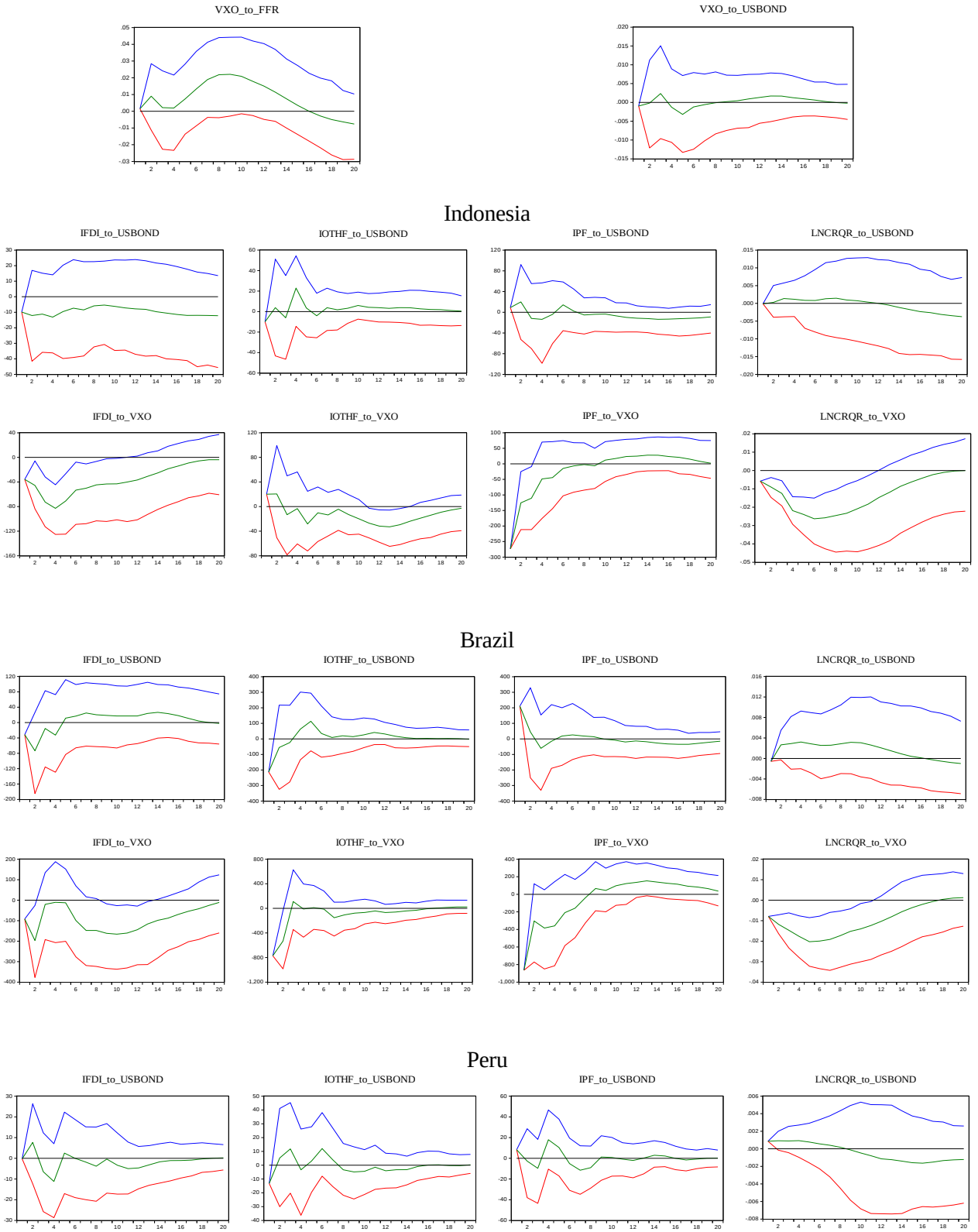
Finally, once again, we inspect the relation between U.S. interest rates, market volatility, gross flows and credit. We first check the response of the VXO to a shock in the FFR and in the long-term rate and we find that the VXO reacts to the FFR, but it does not respond to the long term interest rate. This results provide further strength to the hypothesis that monetary policy shocks impact market risk perception, and also that the inclusion of long term rate in a model designed to inspect the transmission mechanism weakens the results (Figure 6).

Secondly, we turn to the impact of VXO to different type of capital flows and credit. It is worth noting that the interpretation of the shocks now is slightly different. In fact, given the order of our variables (FFR, USBOND, VXO) we have purged shocks of the VXO from monetary policy shocks and long term interest rate shocks. Results remain almost unchanged, even if their magnitude

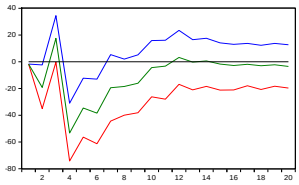
increases for most of the countries . We still find that the VXO has negative impact on portfolio investments in all countries and it has a negative impact on other inflows in Brazil, Philippines and Turkey (which was not significant in the previous model) . Finally we find that a shock in the VXO lowers credit to the private sector for at least 10 quarters (with exception of South Africa and Turkey in which the impact dies out around the 6^{th} and 2^{nd} quarter respectively).

All in all, these results seem to suggest that gross capital flows - and in particular portfolio investments –respond to shocks in the FFR and in the VXO. Contrarily to our initial conjecture, however, we do not find that portfolio investments react to long term interest rate, maybe suggesting that portfolio investment decisions are mainly affected by the policy rate imposed by the FED.

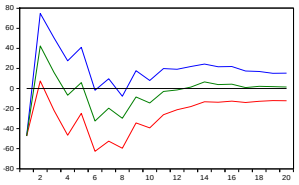
Figure 6: Main results. Gross flows decomposition



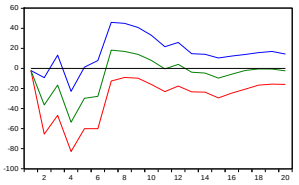
IFDI_to_VXO



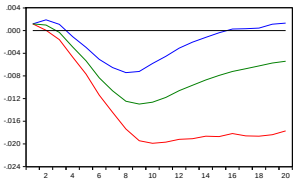
IOTHF_to_VXO



IPF_to_VXO

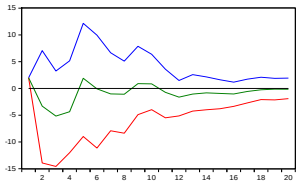


LNCRQR_to_VXO



Philippines

IFDI_to_USBOND



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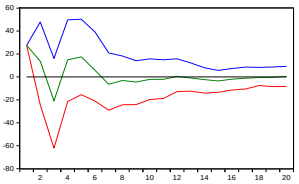

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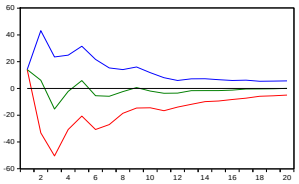

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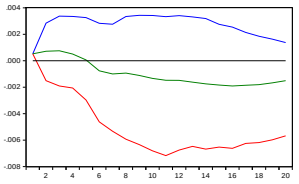

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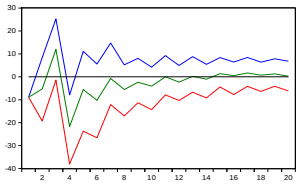

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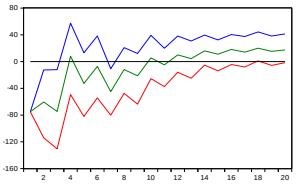

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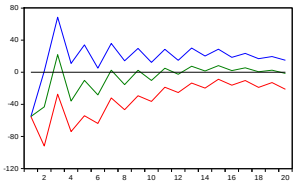
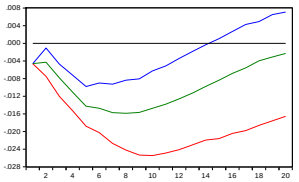
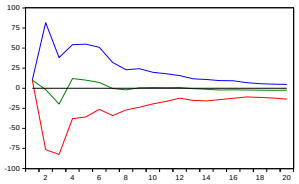


LNCRQR_to_VXO



South Africa

IFDI_to_USBOND



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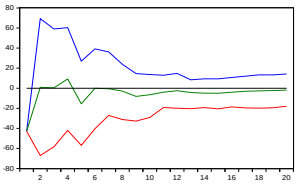

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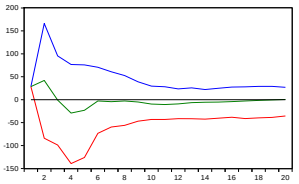

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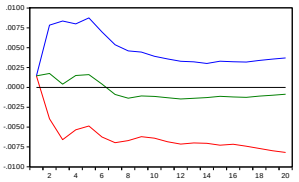

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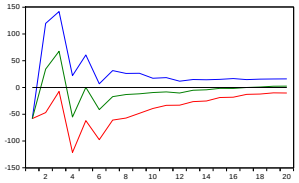

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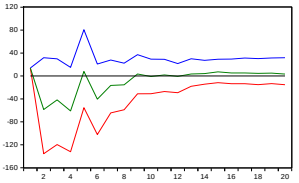

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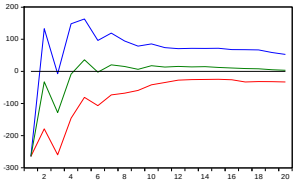

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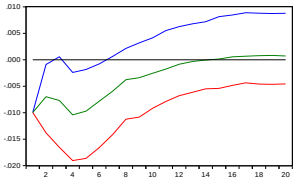
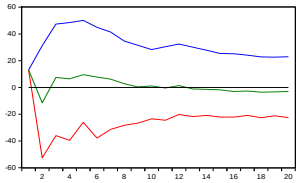


Turkey

IFDI_to_USBOND



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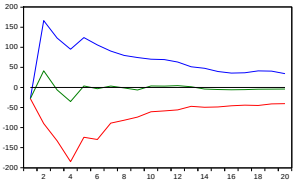

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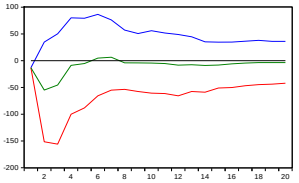

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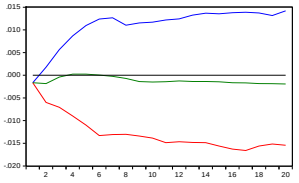

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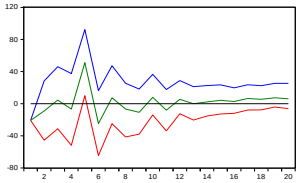

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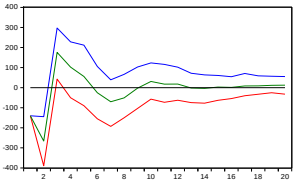

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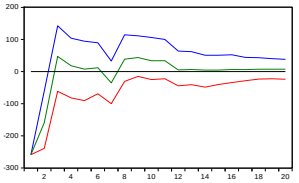

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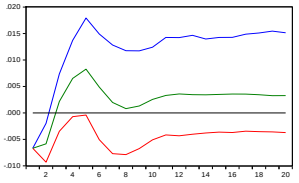

5. Robustness check

Our exercise suggests that shocks in the FFR and in the VXO are important for gross flows dynamics and credit to the private sector. To validate our results, we conduct a series of robustness checks.

First, we run our models taking gross inflows (ICPLF) in differences and our findings remain unchanged.

Second, we test for structural breaks. As suggested by different authors, the crisis period presents special challenges in the VAR estimation, especially because the post-crisis period is associated with the Fed Funds rate pressed against the zero lower bound. In such a situation the impact of uncertainty shocks (measured by the VXO) might be substantially more pronounced Caggiano et al. (2014) and Federal Reserve may increasingly use unconventional instruments and communication to manipulate market interest rates, reducing the ability of Federal Fund rates to capture monetary policy shocks (Gertler and Karadi ,2013) As shown by Bruno and Shin (2014) and Bekaert et al. (2013) using a sample that encompasses the zero lower bound period shows weaker VAR impulse responses and many of the impulse response function associated with shifts in the Federal Funds target rate fail to show significant effects. We run our VARs on the sample 1990q1–2007q4, however excluding the crisis period does not strength our results. On the contrary we find that for most of the countries the impact of FFR on the VXO turn not significant at 95% confidence interval. We also test whether our model is affected by a structural break at the beginning of the so called conundrum period. The log likelihood ratio test reject this hypothesis that parameters differ before and after 2004.

Third, we test the sensitivity of our VAR to alternative orderings of the variables. The order we impose implies that the VXO does not react to contemporaneous shocks of any variables but the FFR and, Gross flows can respond within the same quarter to any variables. To check the extent to which these assumptions may affect our results, we order uncertainty last in our vector, i.e FFR, GDPGRSM, LNCRQR, ICAPLF and VXO. This alternative replicates more closely the ordering proposed by Rey (2013) and it implies that VXO reacts to contemporaneous shocks of any other variables. Results remain almost unchanged but the response of gross flows to the VXO becomes weaker.

Fourth, we check whether our model may return spurious results due to the lack of relevant information for modeling the interactions among the variables. We check the robustness of our results by including the nominal exchange rate taken in log (*exrt*)[37] . Despite we choose countries with a floating exchange rate most of them have not had a passive role in the determination of the nominal exchange rate. Intervention in the FX market has been common practice (Frankel et al., 2010). As it is well known, in the absence of intervention, capital inflows should lead to a nominal appreciation dampening and possibly reversing the impact of the foreign interest rate shock. This outcome is desiderable if domestic macroeconomic conditions are such that policy makers seek to avoid stimulating aggregate demand (Fernandez-Arias et al., 1995). Including the exchange rate in our VAR does not change our main results. However it is interesting to note that the exchange rate reacts positively (nominal depreciation) to a shock in the VXO and negatively (nominal appreciation) to a shocks in gross capital inflows and credit. Results are significant for all countries.

[37] Exchange rate refers to local currency unit relative to the U.S. dollar, thus an increase of the variable corresponds to local currency depreciation.

6. Conclusions

In this paper we study the dynamic links between U.S. monetary policy shocks, risk aversion and uncertainty , capital flows and credit creation in EMs. In particular we try to understand whether different type of flows (foreign direct investment, portfolio investments and other inflows) react differently to short term interest rate shocks. We also try to identify whether portfolio investments react to long term rate shocks irrespective of the policy rate imposed by the FED.

To this end we focus on six Middle Income Countries (South Africa, Peru, Philippines, Indonesia, Turkey, Brazil) that have recently experienced an upsurge in capital inflows. For each country we run three VARs and we look, first, at the impact of FFR on total gross capital inflows; second, we look at whether shocks in U.S. monetary policy have a different impact on different type of flows; and finally we augment the VAR with US long term interest rate and we look at its impact on gross capital flows breakdown and credit to the private sector.

We find that a restrictive monetary policy lowers gross capital flows and credit to the private sector after about 12 quarters and that it raises risk aversion in the stock market after about 5 quarters. Also we find that a shocks in the VXO leads to a decline in gross flows and credit, with the effect on credit lasting longer than the one on capital flows. The analysis of the gross flows' breakdown suggests that for most of the countries in our sample the negative impact of the FFR and the VXO to gross flows is driven by portfolio investments. Finally we find that shocks in the long term interest rate – that we interpret as shocks to the term premium - do not have a significant impact either on the VXO Index or gross capital flows.

Our main contribution to the literature is to highlight the role of portfolio investments as transmission channel of monetary policy shocks. Our results confirm the initial hypothesis that market and debt securities can play a role in transmitting global liquidity towards EMs. Also, with regards to our initial conjecture, we do not find evidence that portfolio investments react to long term interest rate, suggesting that portfolio investment decisions are mainly affected by the policy rate imposed by the FED.

Also our investigation suggests to revisit the interpretation of the risk-taking channel. Our findings are in line with most of the literature of global liquidity and capital flows determinants. Consistently with the studies of Bekaert et al. (2014), Rey (2013) and Bruno and Shin (2014), we show that FFR impacts the VXO (Bekaert et al., 2014; Rey, 2013; Bruno and Shin, 2014) , gross flows (Rey, 2013) and credit to the private sector. Also we find that VXO impacts gross flows and credit (Rey, 2013). Their interpretation of the results suggest that funding cost affects bank's decisions on how much exposure to take on, therefore monetary policy affects the economy through greater risk taking by the banking sector. Given the structure of our VAR, however, -in which VXO is ordered after FFR and hence its orthogonal to its shocks- we cannot interpret the impact of the VXO to gross flows and credit as the transmission channel of the monetary policy, for that shocks in the VXO are purged from those in the FFR.

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Appendix 1

Figure A1 : U.S. short and long interest rate

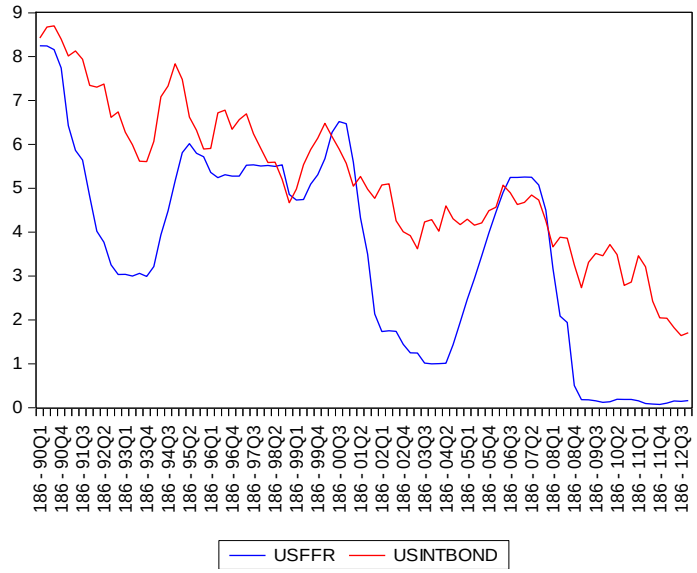
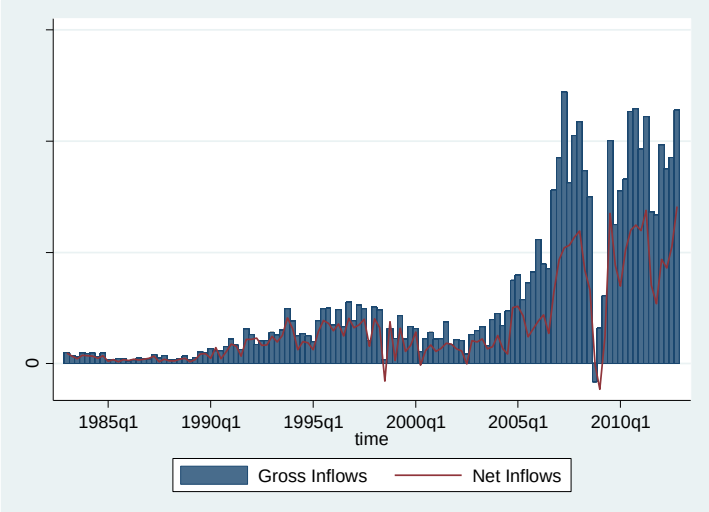
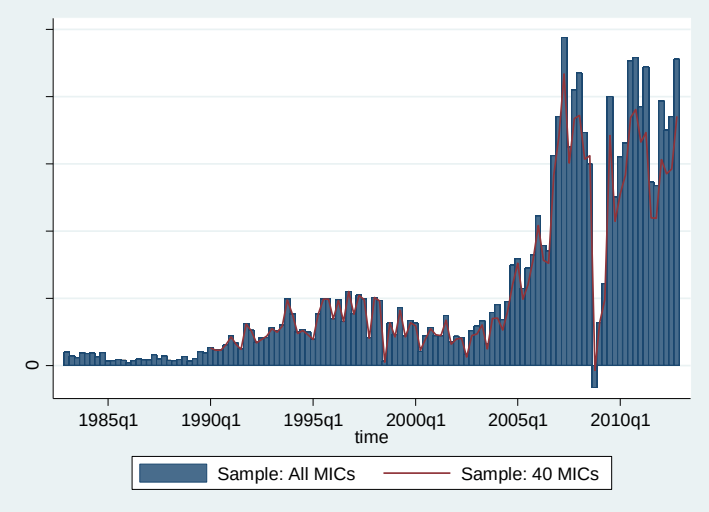


Figure A2 : Gross and Net Capital Inflows (in millions of US$)



Sample: 72 MICs (All MICs excluding China).

Figure A3: Gross Capital Inflows in different samples (in millions of US$)



Sample: 72 MICs (All MICs excluding China) and 40 MICs.

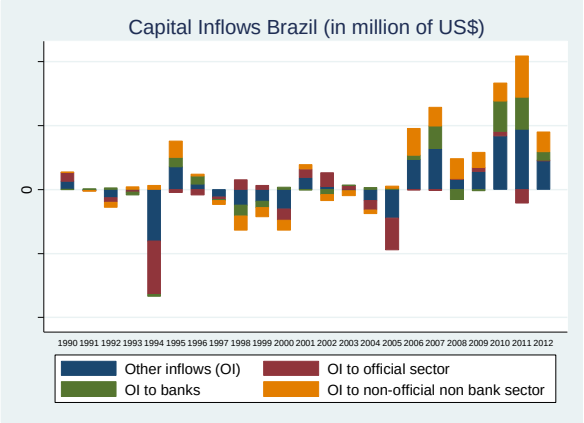
Table A4: Description of the variables

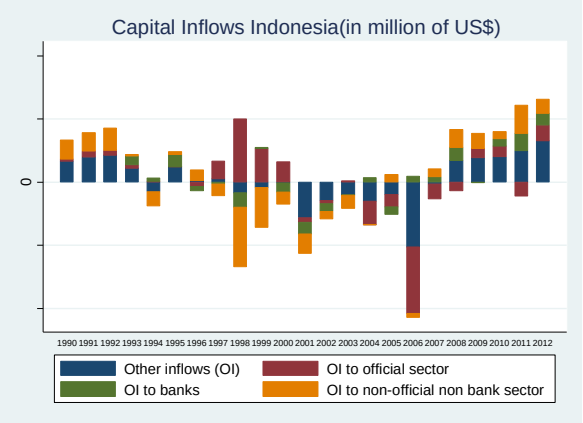
Variable	Abbreviation	Description	Sources
Financial vulenrabilities			
Credit to private sector (real term)	LNCRQR	Log of domestic bank and other financial institutions claims on the private sector	IFS. Line 22d & 42D..ZF
Trasmission channel			
Total inflows	ICAPFL	Total inflows (US$ dollar)	IMF BOP. Line ICAPFL
FDI inflows	IFDI	FDI inflows (US$ dollar)	IMF BOP. Line IFDI
Portfolio inflows	IPF	Cross border transactions and positions involving debt or equity securities , other than those included in the direct investment and reserve assets (US$ dollar)	IMF BOP. Line IPF
Other inflows	IOTHF	Other inflows. It includes: i)other equity; ii) currency and deposit; iii) loans (including use of IMF credit and loans from the IMF); non -life insurance technical reserves, life insurance and annuities entitlements, and provisions for calls under standardized guarantees; iv)trade credit and advances; v) other account receivable/payable; and vi) SDR allocation (SDR holding are included in reserve assets) (US$ dollar)	IMF BOP. Line IOTHF
Global factors			
Short term interest rate	FFR	Effective Federal Fund Rates, End of Period (% p. a.)	Federal Reserve Board; Selected Interest Rates, release H.15
Real long term interest rate	USBOND	10 year bond yield deflated ex post by the annual US Consumer Price Index Consumer Price inflation	IFS
VXO	VXO	Log of implied volatility computed using 30-day S&P 100 index at-the-money options.	Chicago Board Option Exchange
Yield spread	yldspr	10 years US bond - 3 months US Treasury Bill	Author calculation
Pull factors			
Real GDP growth	GDPGRSM	Real GDP growth	Haver Analytics
Other variables			
Rate of inflation	CPI	Percentage change of CPI	IFS
Flexibility of the exchange rate regime	EXREG	Coarse classification	Ilzetzky, Reinhart and Rogoff (2009). http://personal.lse.ac.uk/ilzetzki/IRRBack.htm
Nominal exchange rate	exrt	National currency per US$	IFS
U.S. GDP	USGDP	U.S. GDP	Bureau of Economic Analysis of the U.S. Department of Commerce.
U.S. GDP deflator	GDPDEF	U.S. GDP deflator	Bureau of Economic Analysis of the U.S. Department of Commerce.
Growth of U.S. GDP	USGDPGR	Log of US GDP growth	Author calculation
Growth of U.S. GDP deflator	USGDPDEFGR	US GDP deflator growth	Author calculation

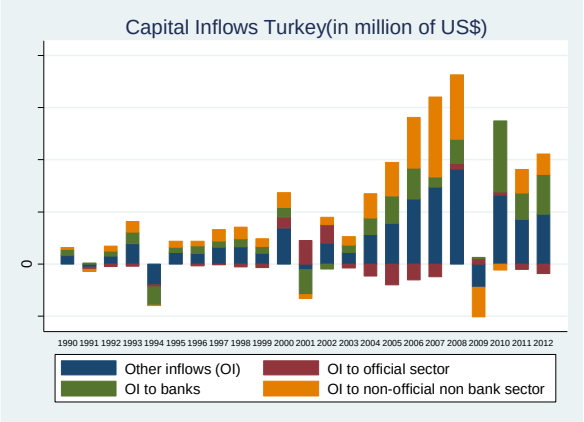
Table A5: Correlation table

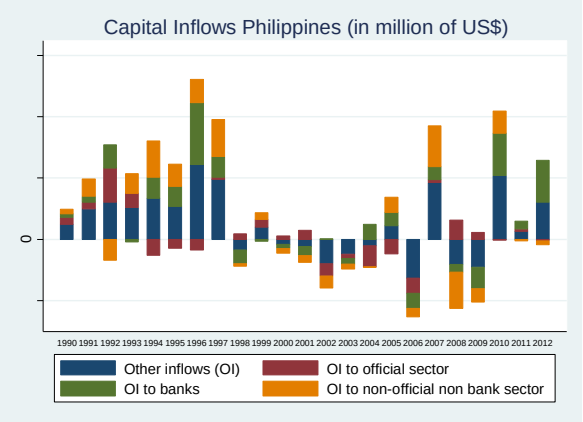
		1	2	3	4	5	6	7	8	9	10	11	12
USGDP	1	1											
		552											
GDPDEF	2	0.9717*	1										
		552	552										
ffr	3	-0.6358*	-0.7089*	1									
		552	552	552									
usbond	4	-0.8977*	-0.9205*	0.8262*	1								
		552	552	552	552								
yldspr	5	-0.0645	0.0348	-0.6643*	-0.1347*	1							
		552	552	552	552	552							
vxo	6	0.2060*	0.1900*	-0.1866*	-0.2508*	0.0484	1						
		552	552	552	552	552	552						
gdpgrsm	7	0.1522*	0.1588*	-0.0518	-0.0648	-0.0073	-0.2646*	1					
		528	528	528	528	528	528	528					
icapfl	8	0.3479*	0.3972*	-0.2262*	-0.3249*	-0.0255	-0.1485*	0.1160*	1				
		548	548	548	548	548	548	528	548				
iothf	9	0.1950*	0.2242*	-0.0972*	-0.1716*	-0.0409	-0.1079*	0.1483*	0.6491*	1			
		548	548	548	548	548	548	528	548	548			
ifdi	10	0.3733*	0.4084*	-0.2443*	-0.3634*	-0.0419	0.0659	-0.0013	0.7482*	0.2736*	1		
		548	548	548	548	548	548	528	548	548	548		
ipf	11	0.1697*	0.2069*	-0.1386*	-0.1557*	0.0277	-0.2418*	0.0817	0.6759*	0.0443	0.3349*	1	
		548	548	548	548	548	548	528	548	548	548	548	
lncrqr	12	0.4306*	0.4655*	-0.3059*	-0.4242*	-0.0208	0.0624	-0.0223	0.5566*	0.2219*	0.5765*	0.3773*	1
		552	552	552	552	552	552	528	548	548	548	548	552

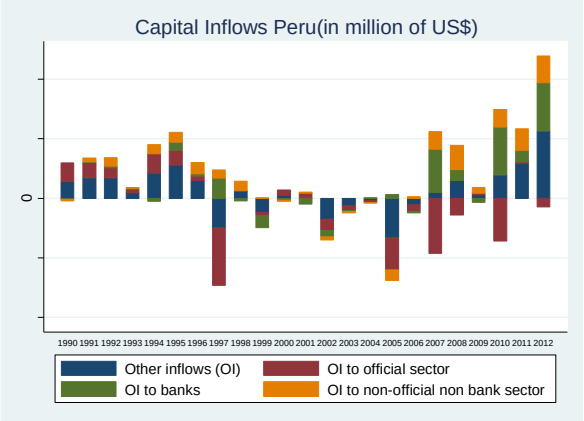
Table A6: Other inflows breakdown

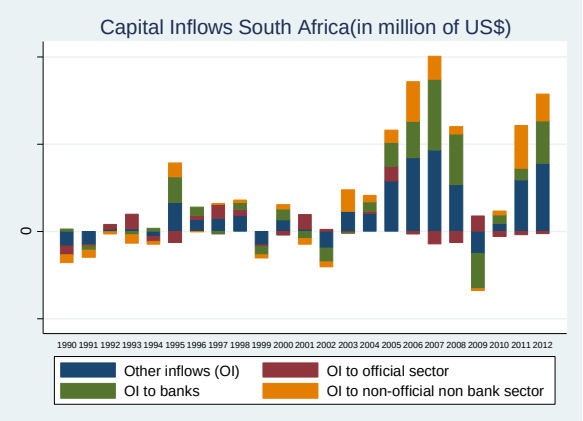












APPENDIX 2. Results

Table 1. VAR(1). Indonesia

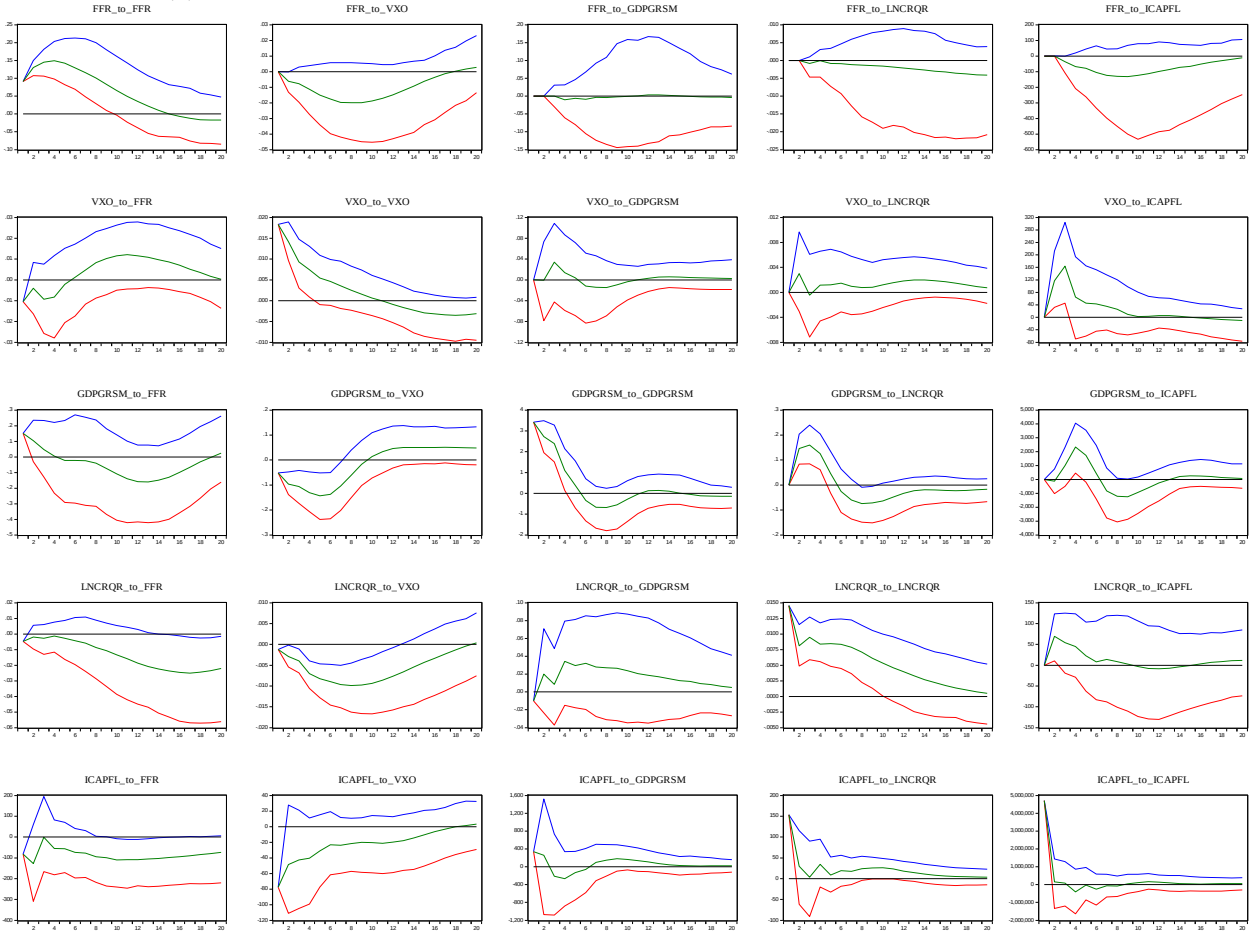


Table 2. VAR(1). Brazil

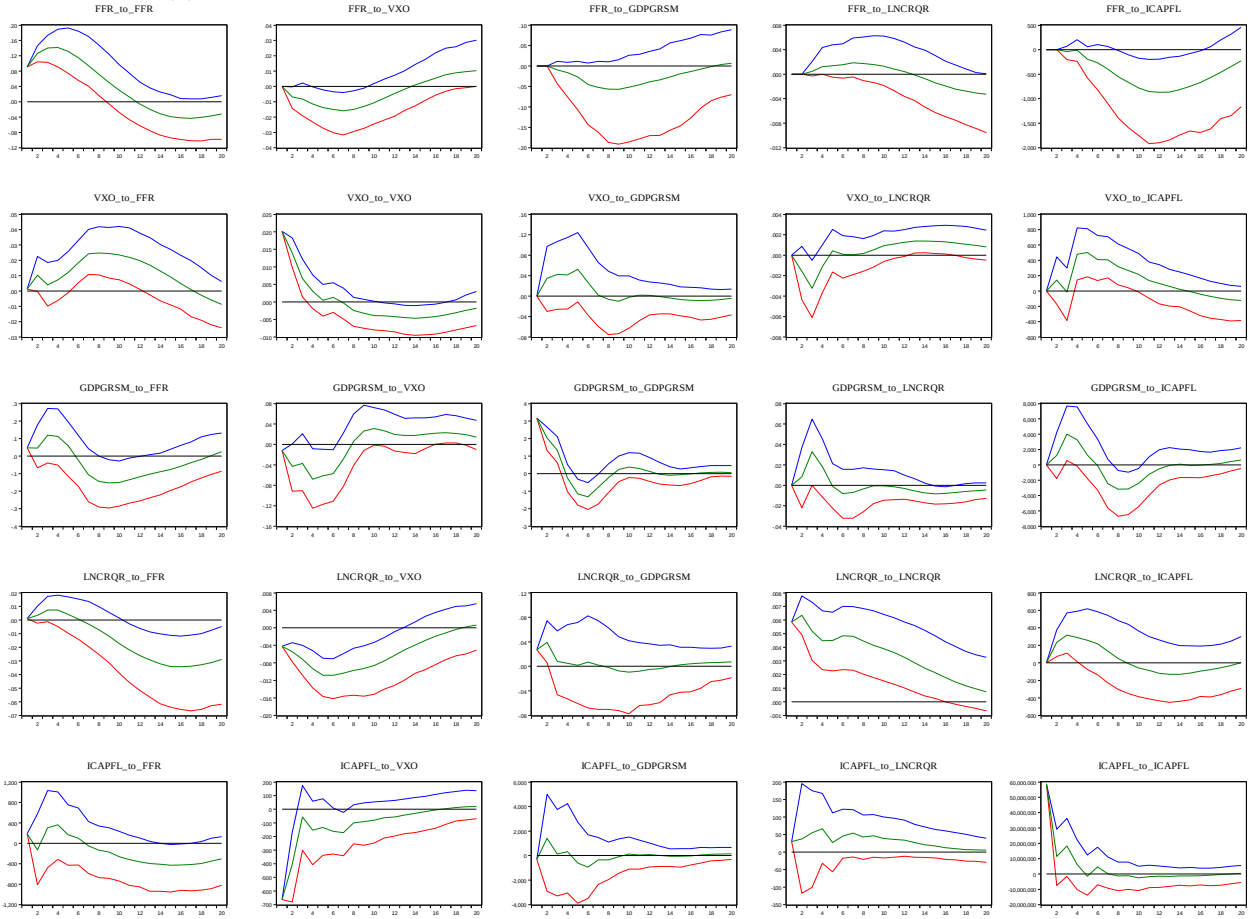


Table 3. VAR(1). Peru

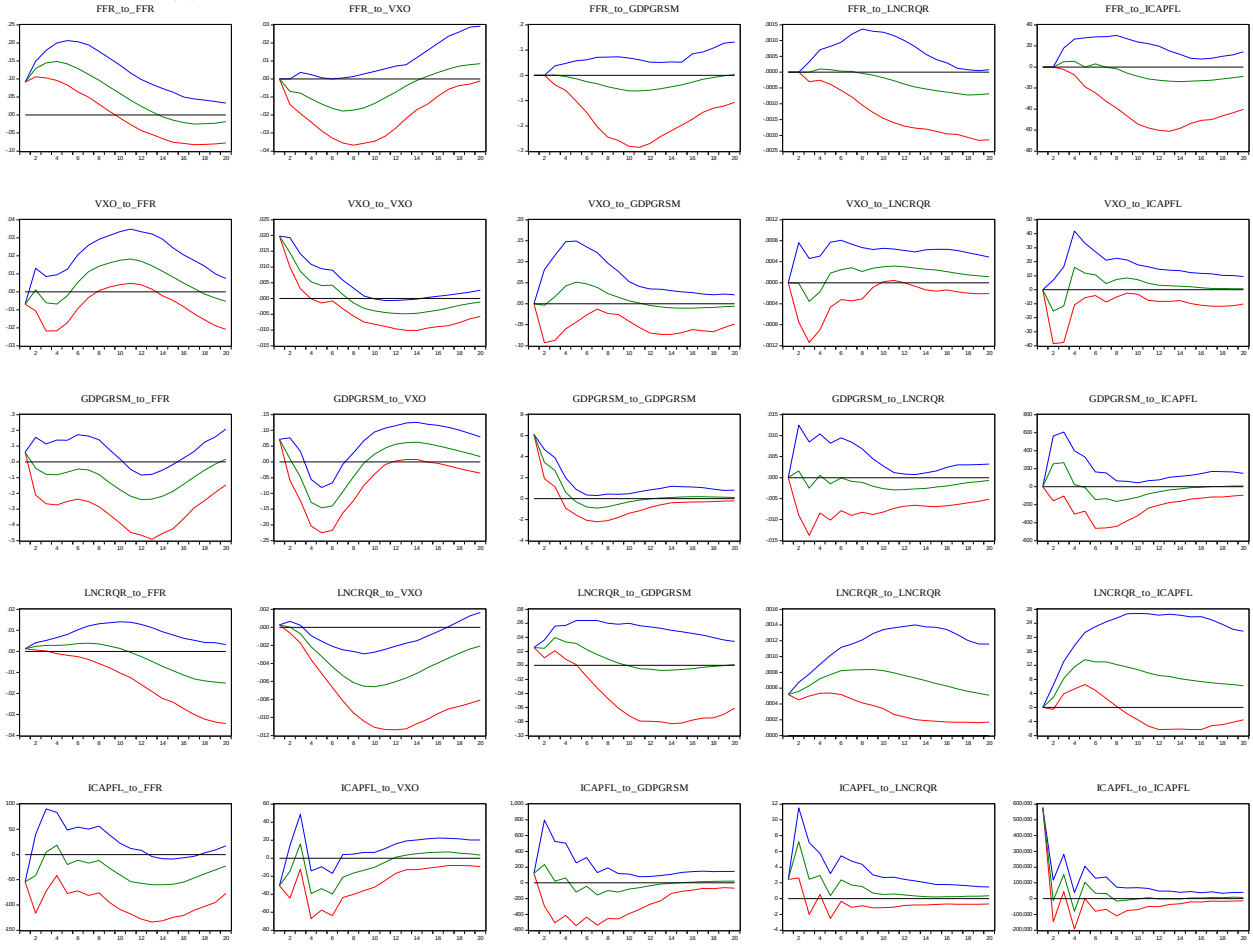


Table 4. VAR(1). Philippines

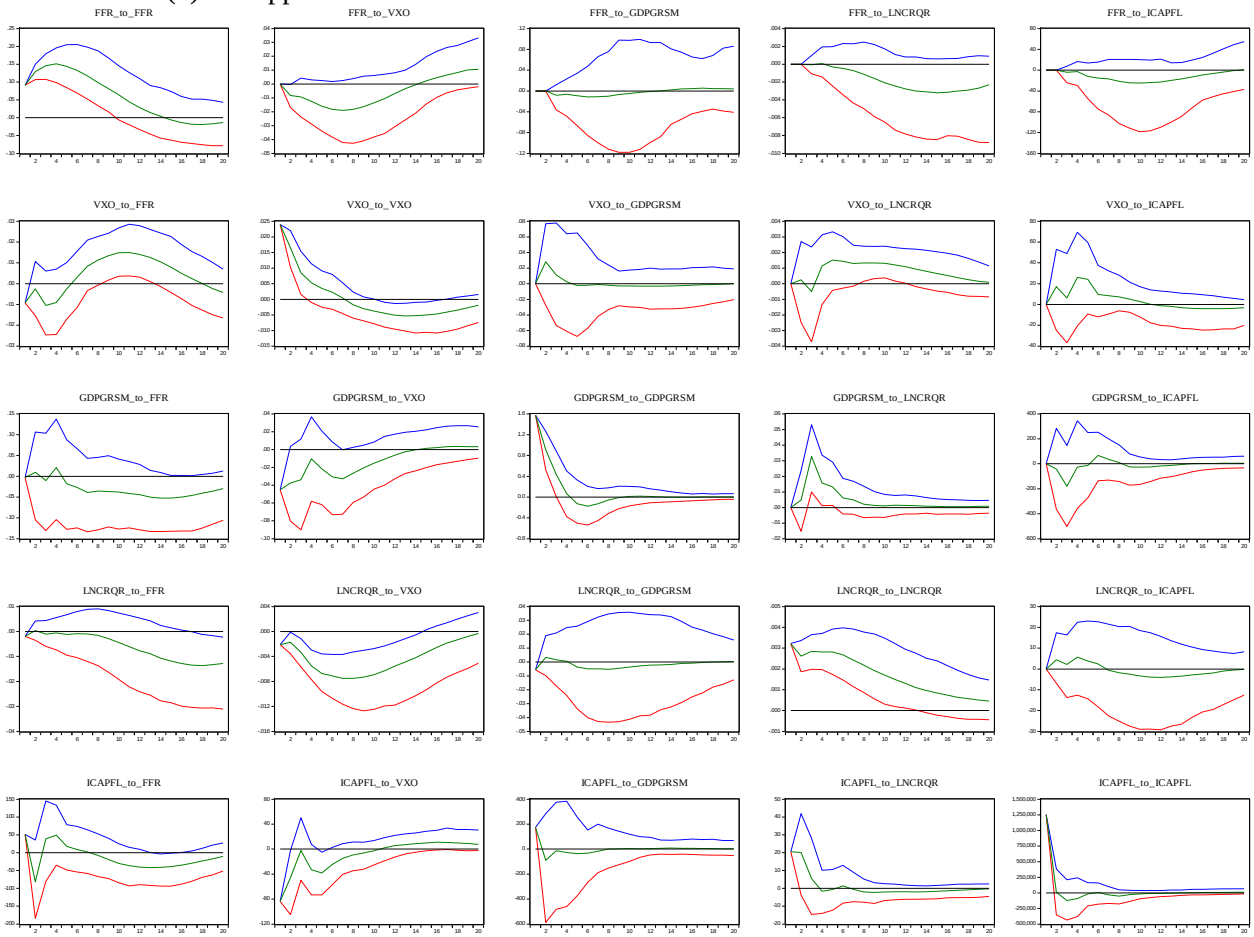


Table 5. VAR(1). South Africa

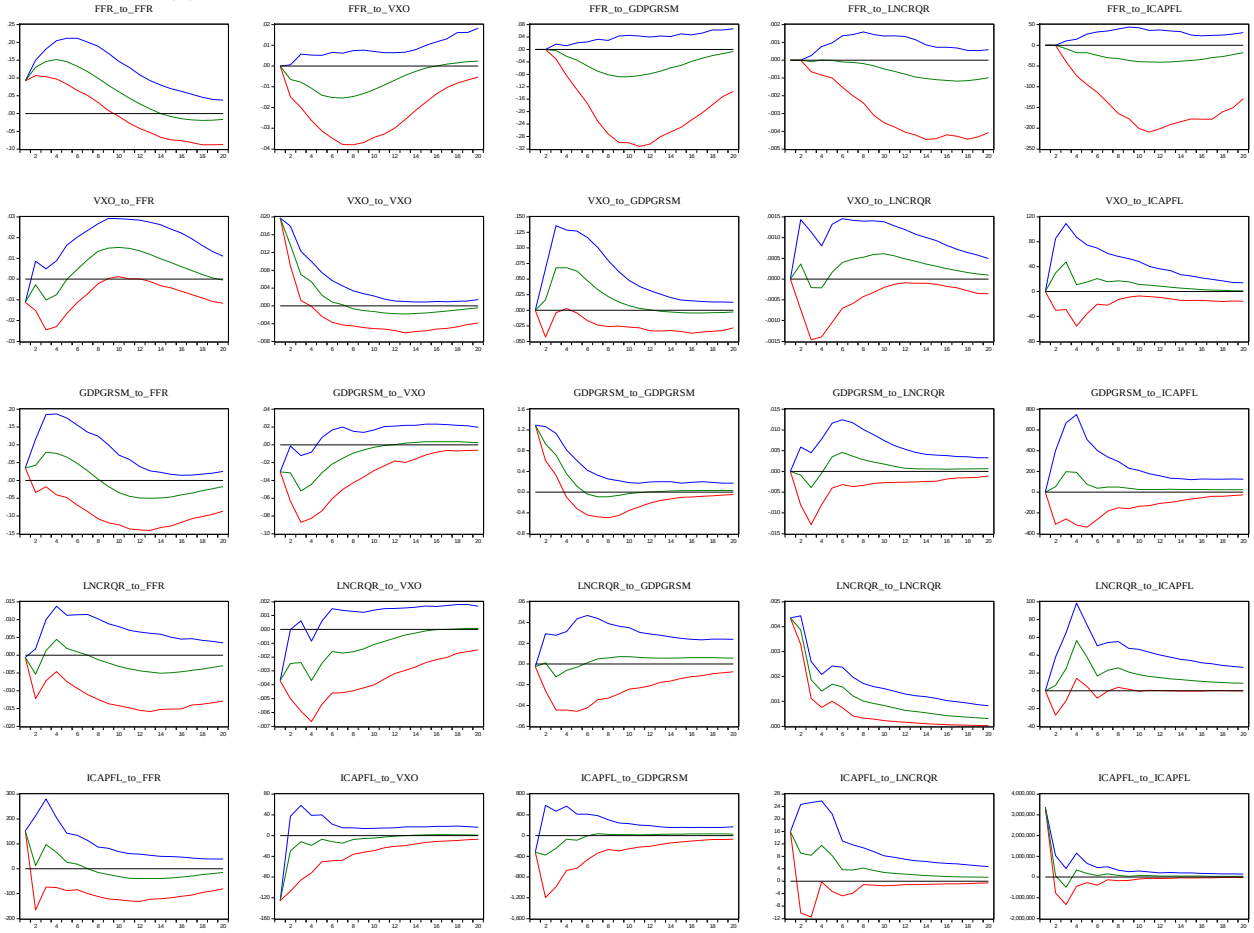


Table 6. VAR(1). Turkey

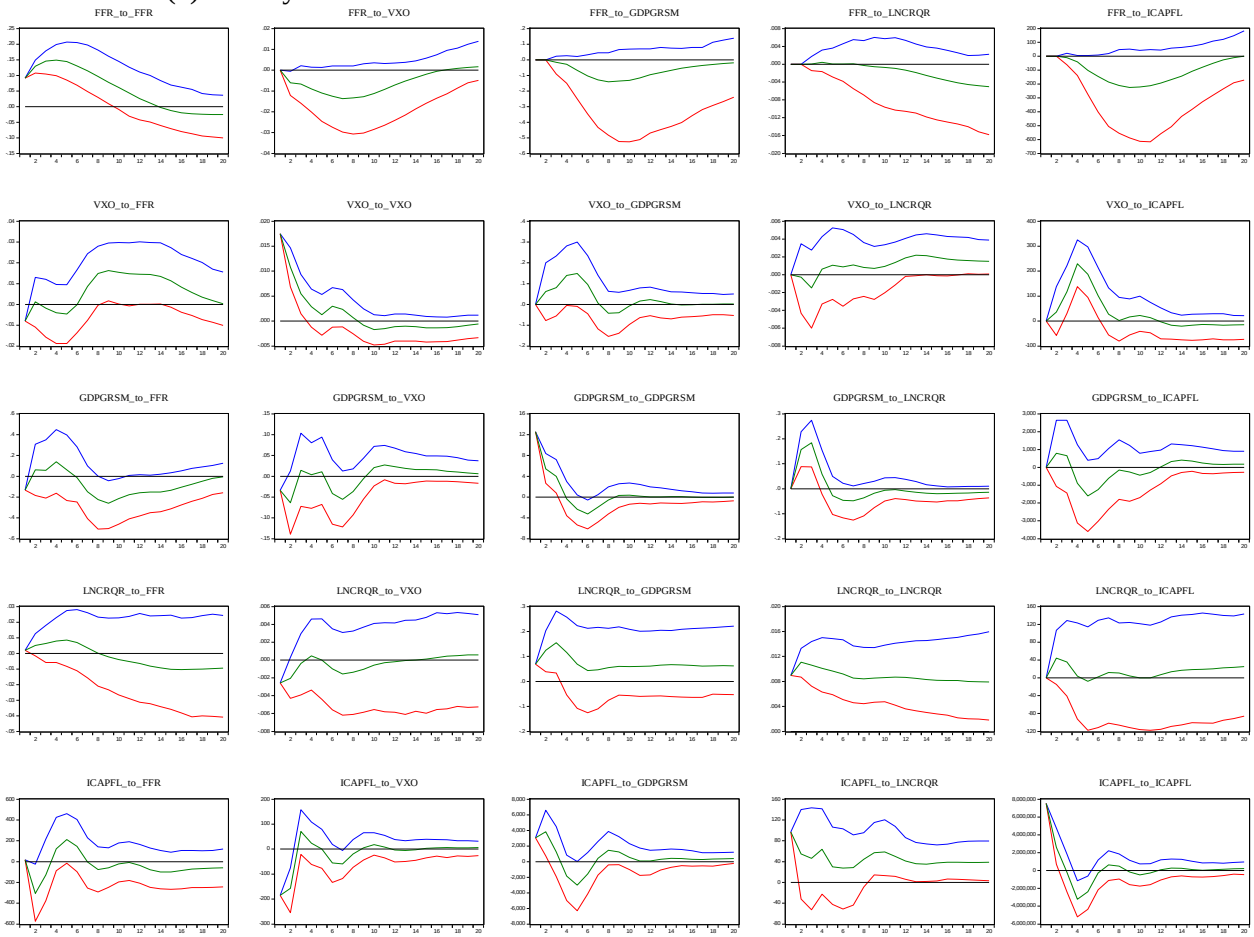


Table 7. VAR(2). Indonesia

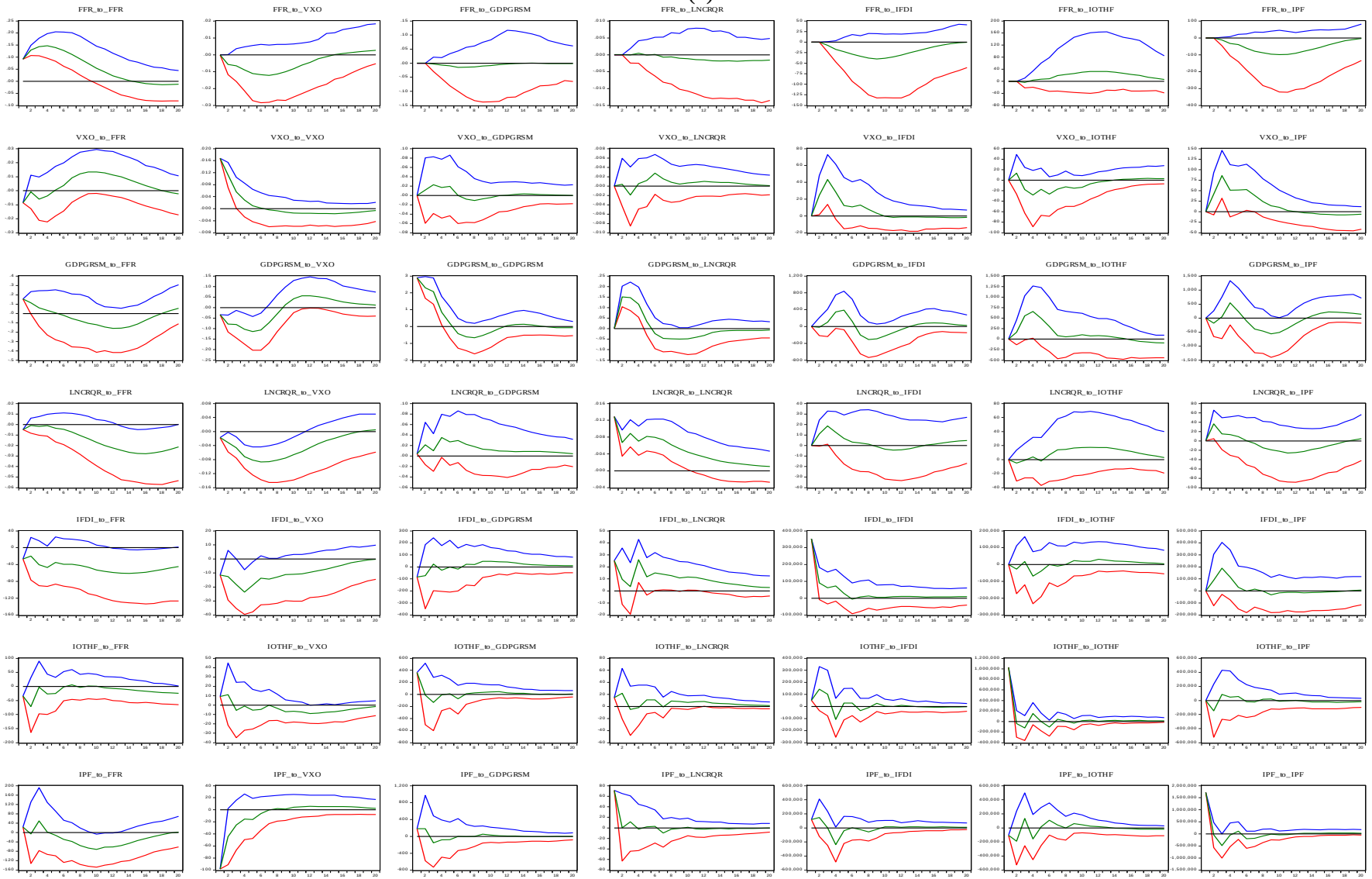


Table 8. VAR(2). Brazil

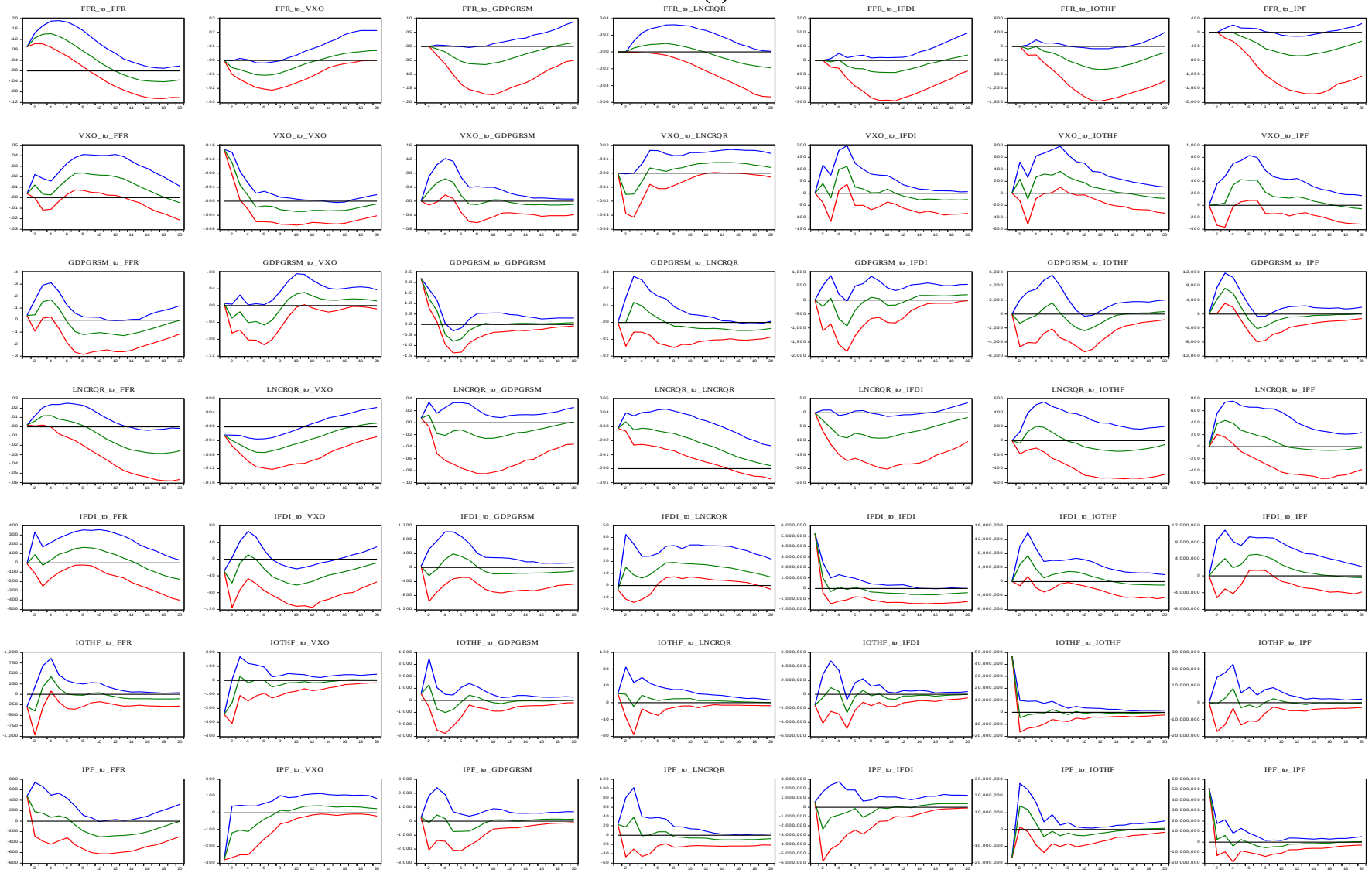


Table 9. VAR(2). Peru

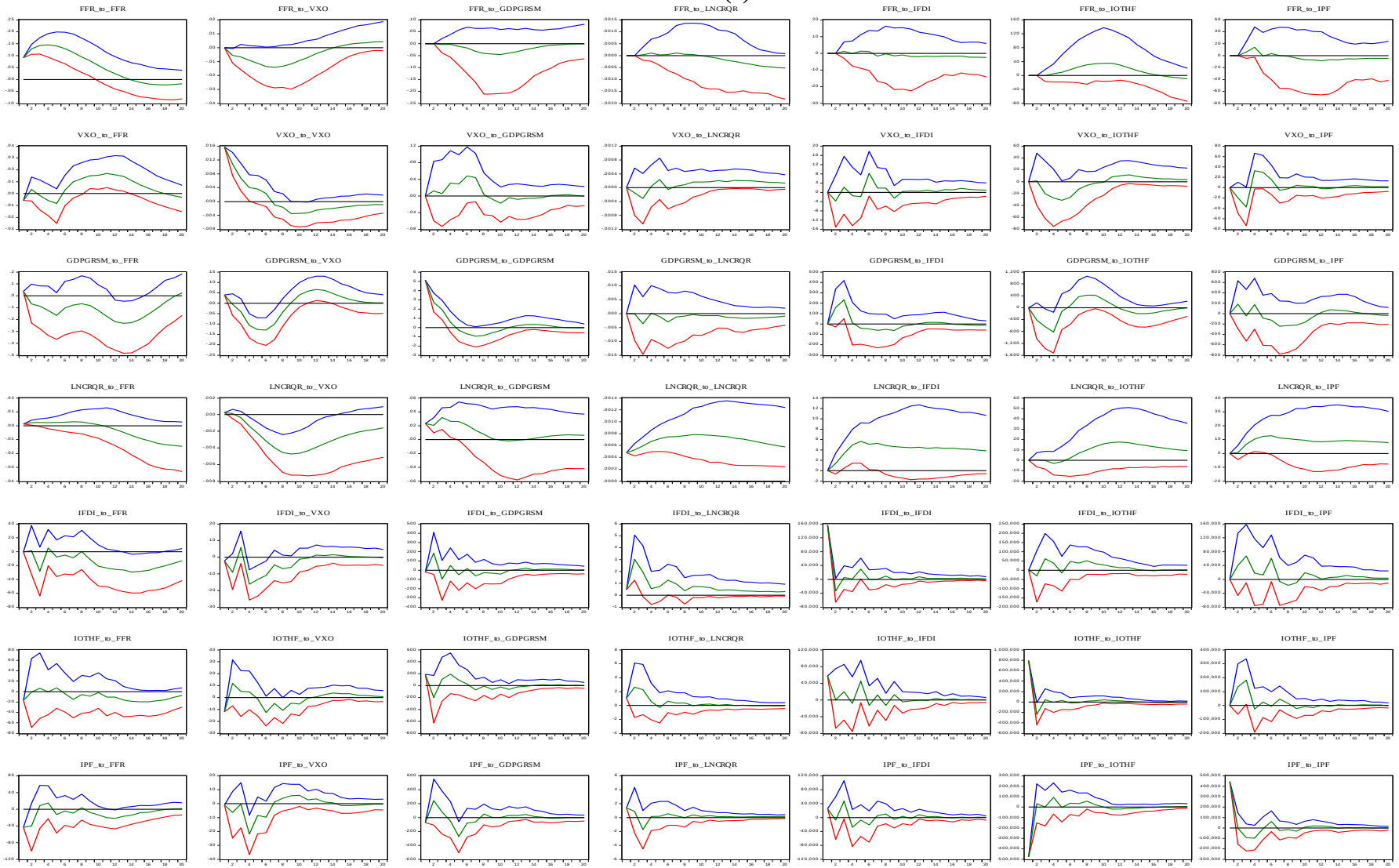


Table 10. VAR(2). Philippines

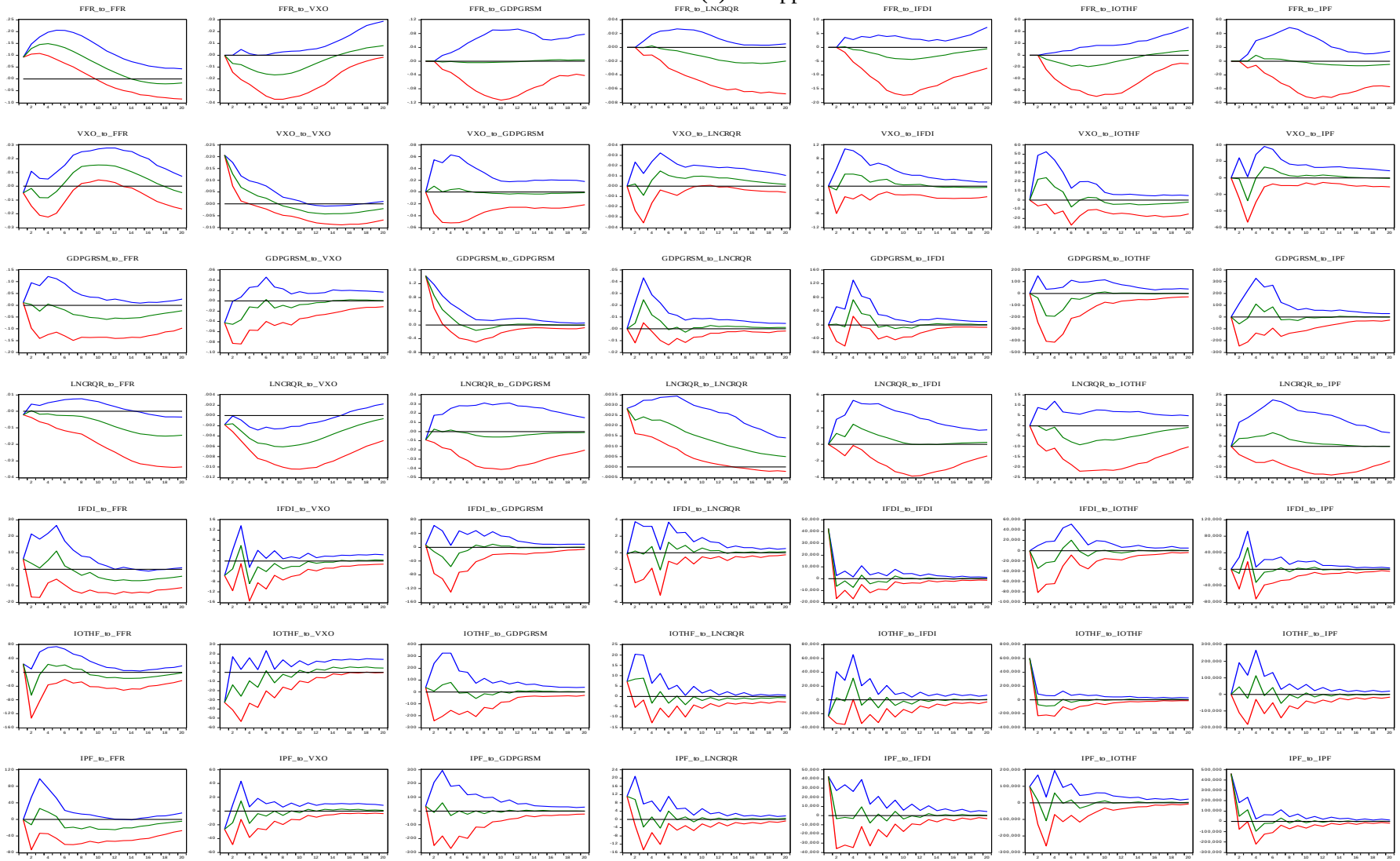


Table 11. VAR(2). South Africa

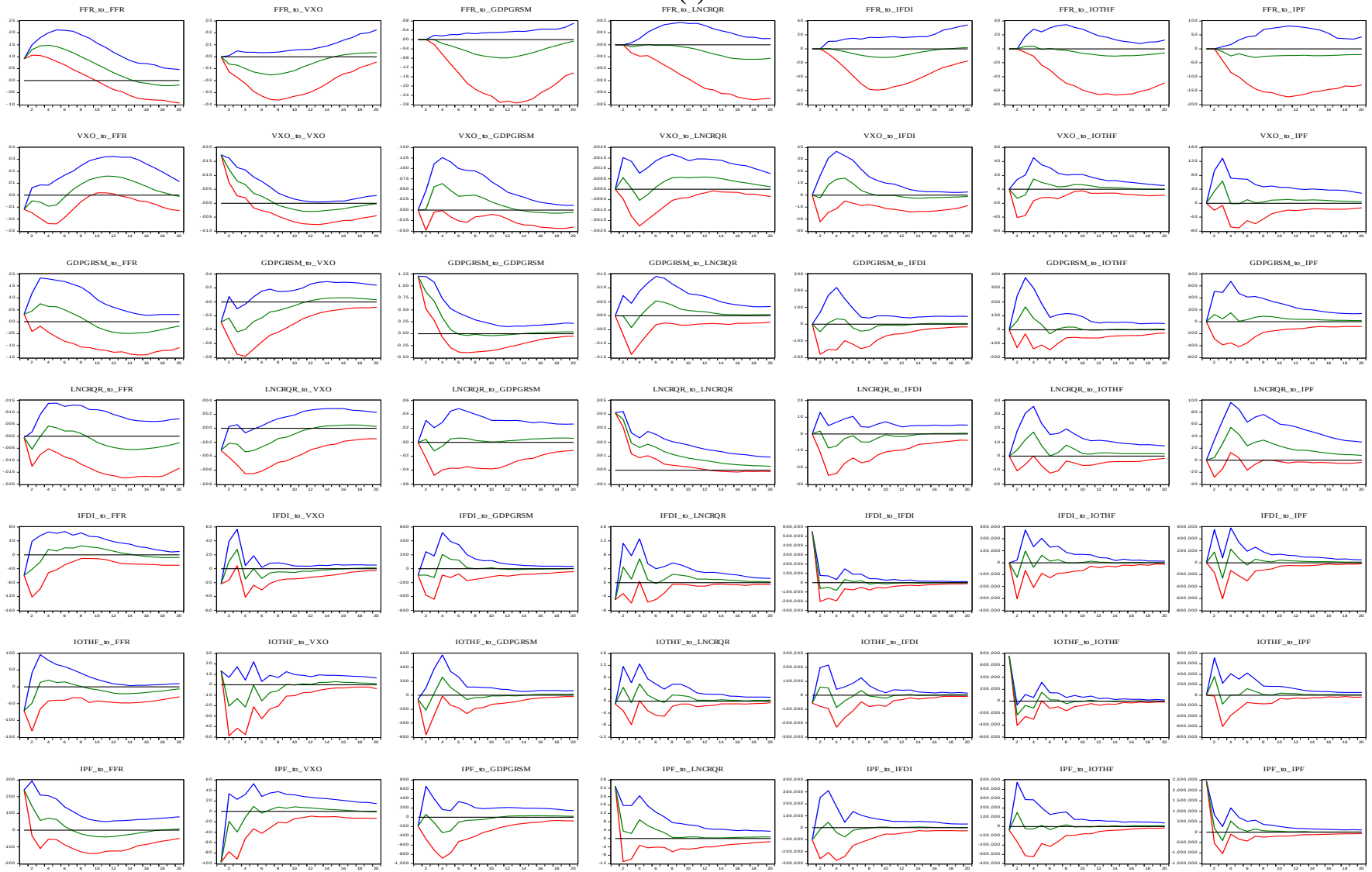


Table 12. VAR(2). Turkey

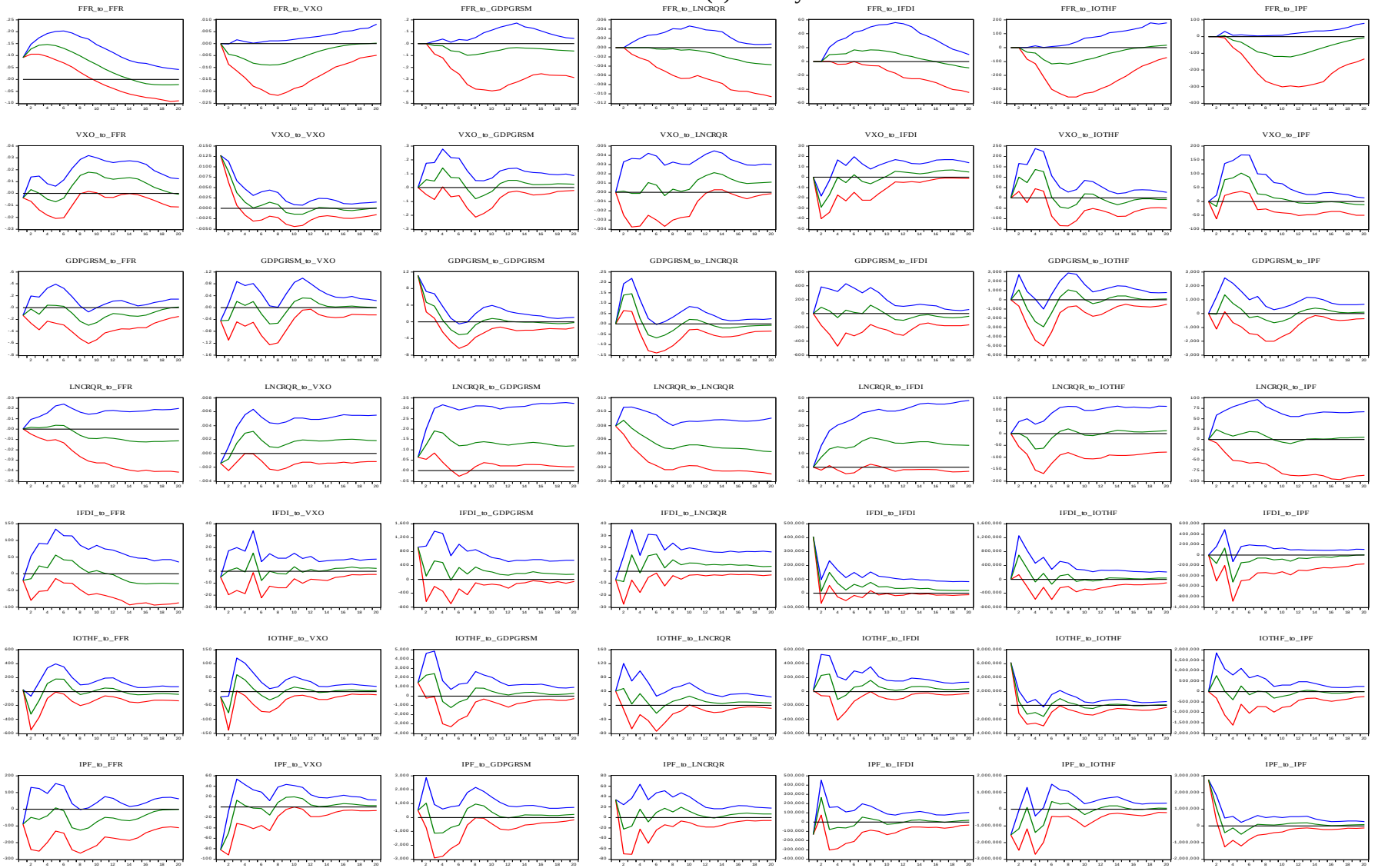


Table 13. VAR(3). Indonesia

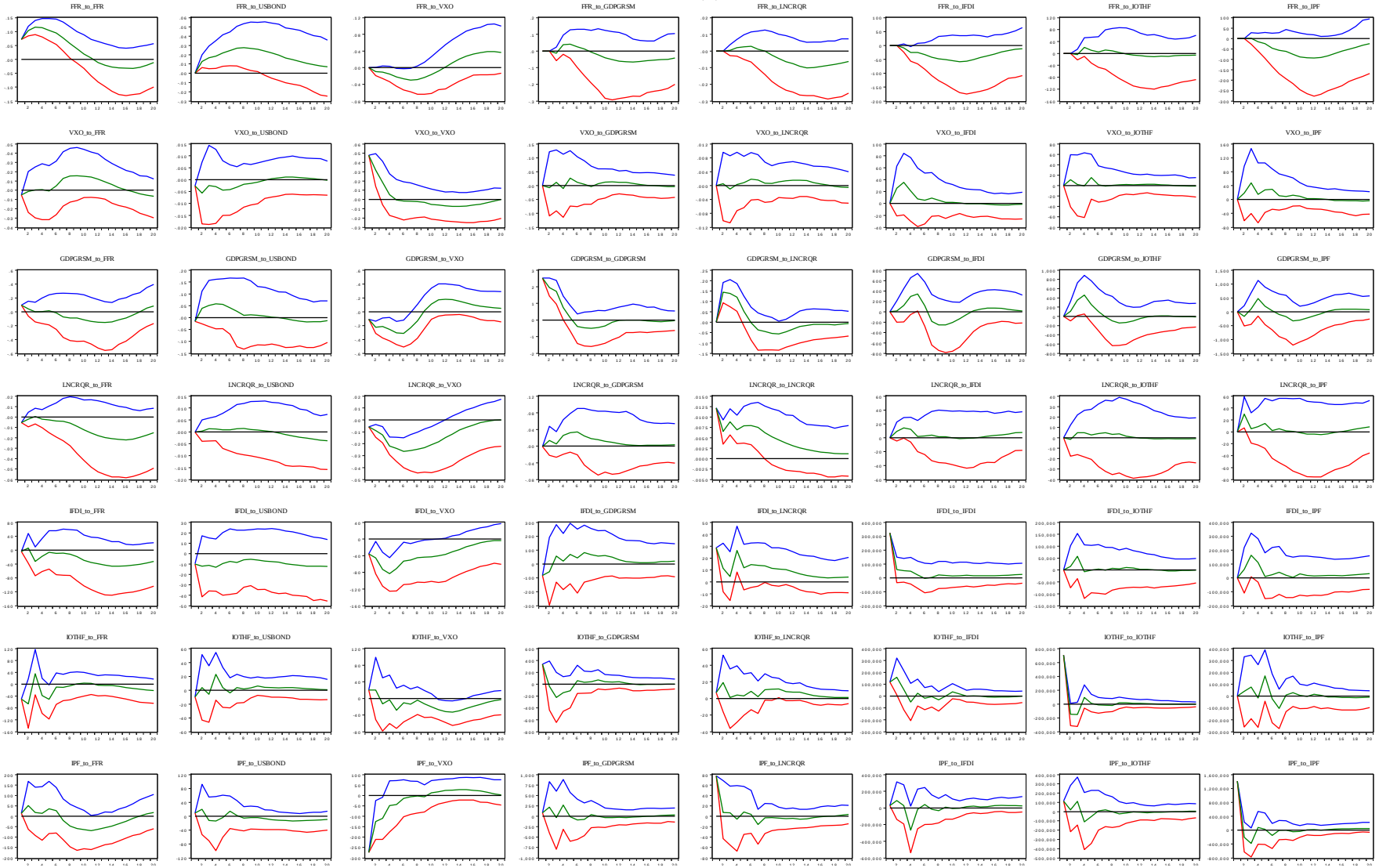


Table 14. VAR(3). Brazil

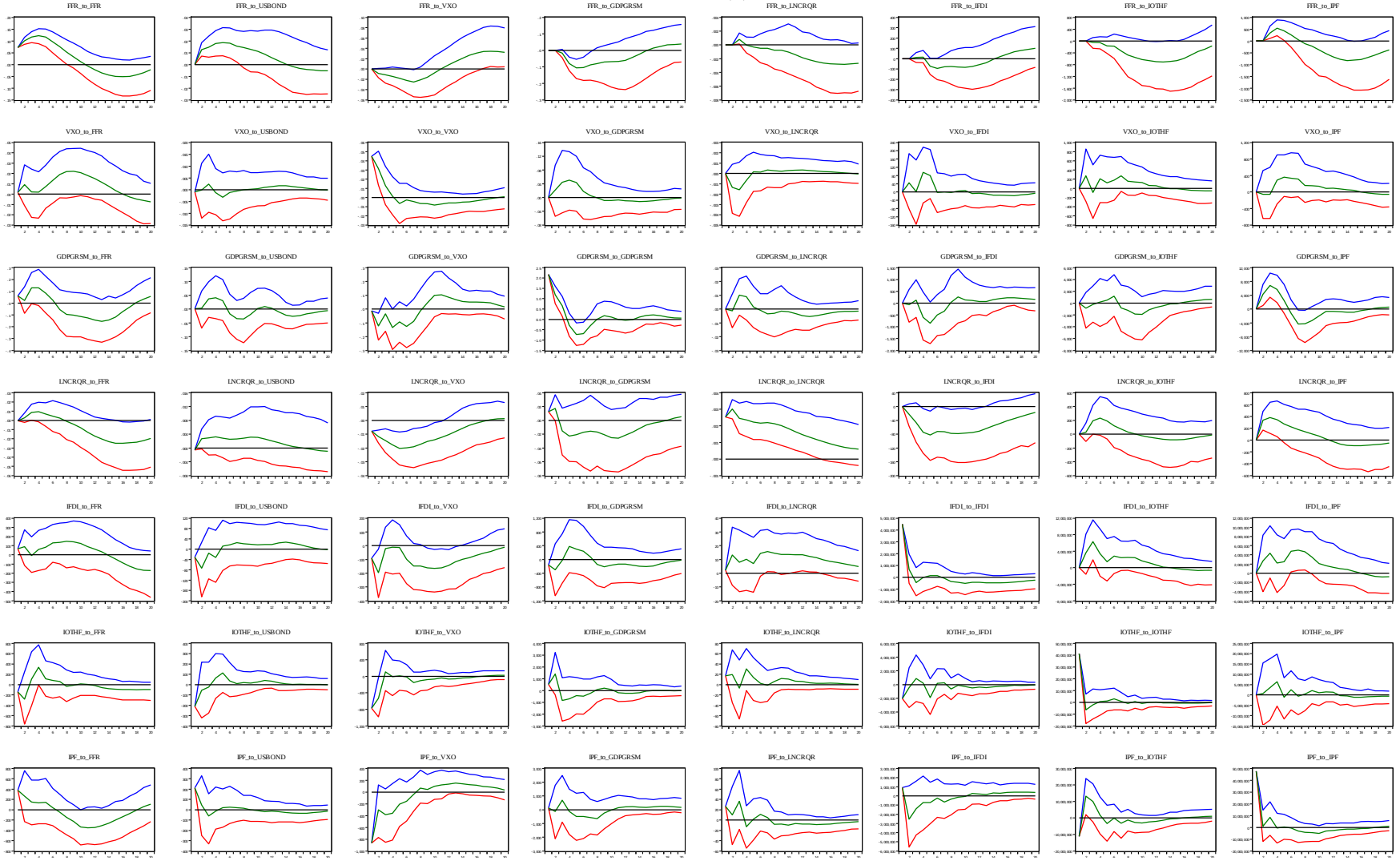


Table 15. VAR(3). Peru

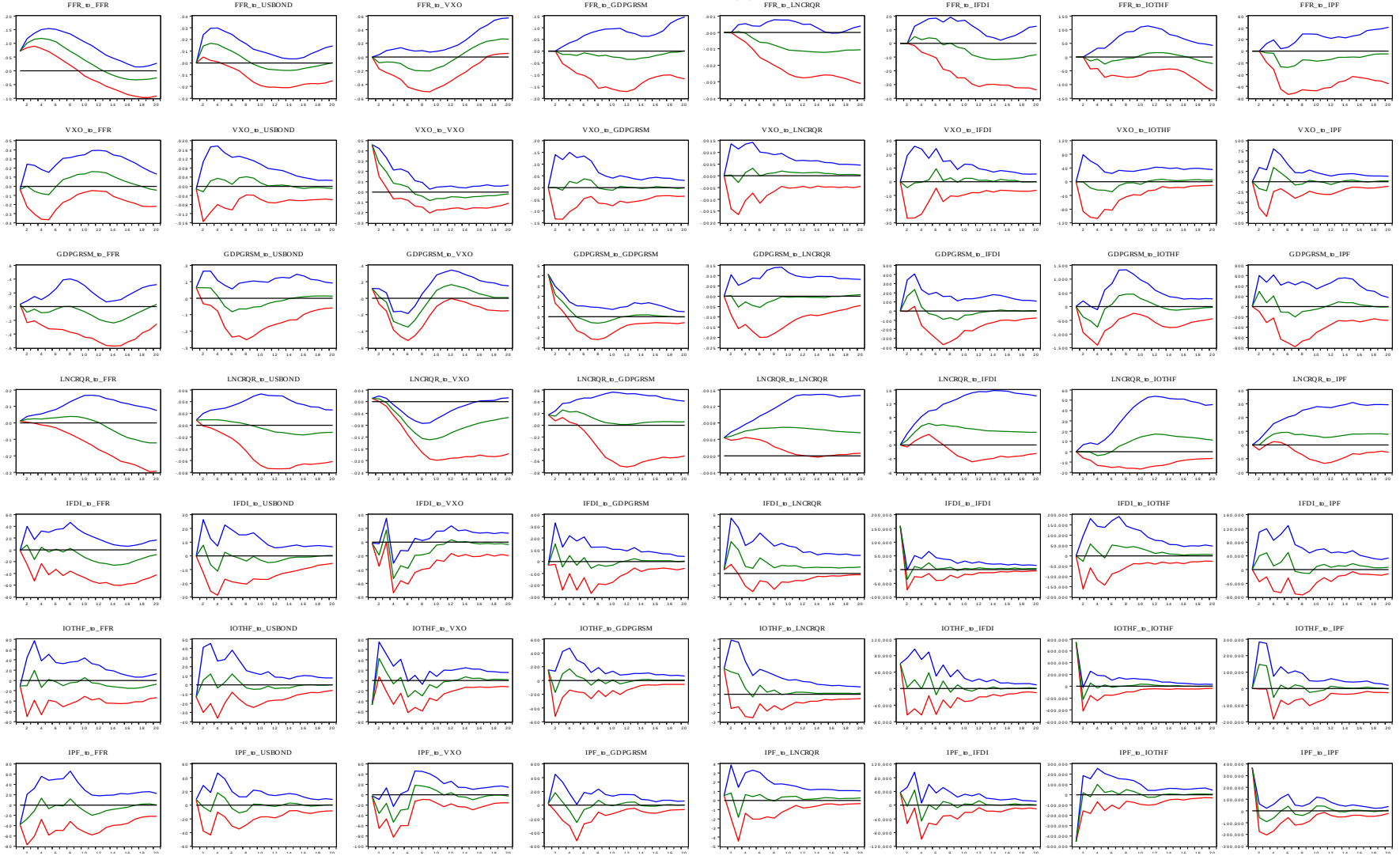


Table 16. VAR(3). Philippines

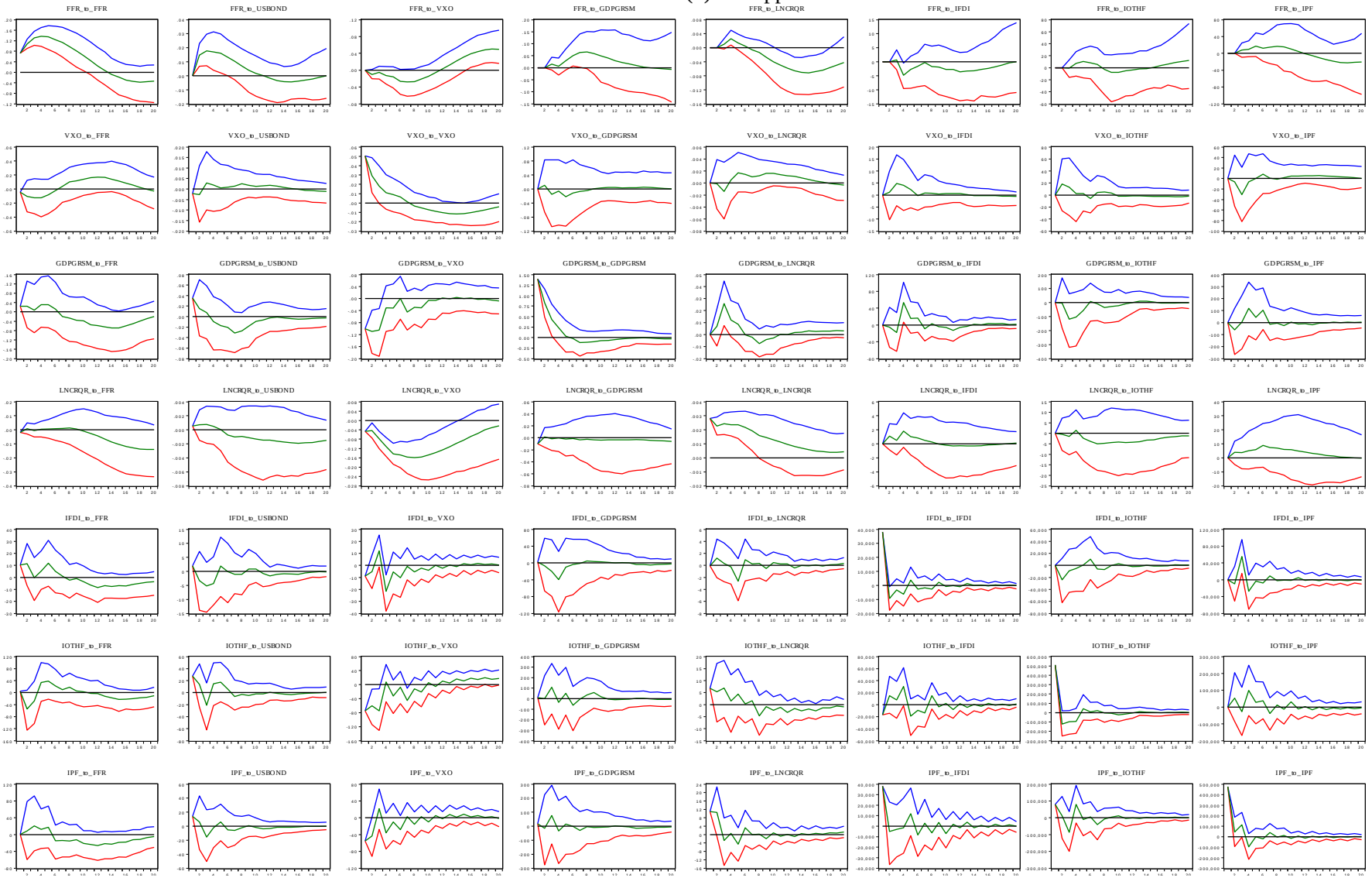


Table 17. VAR(3). South Africa

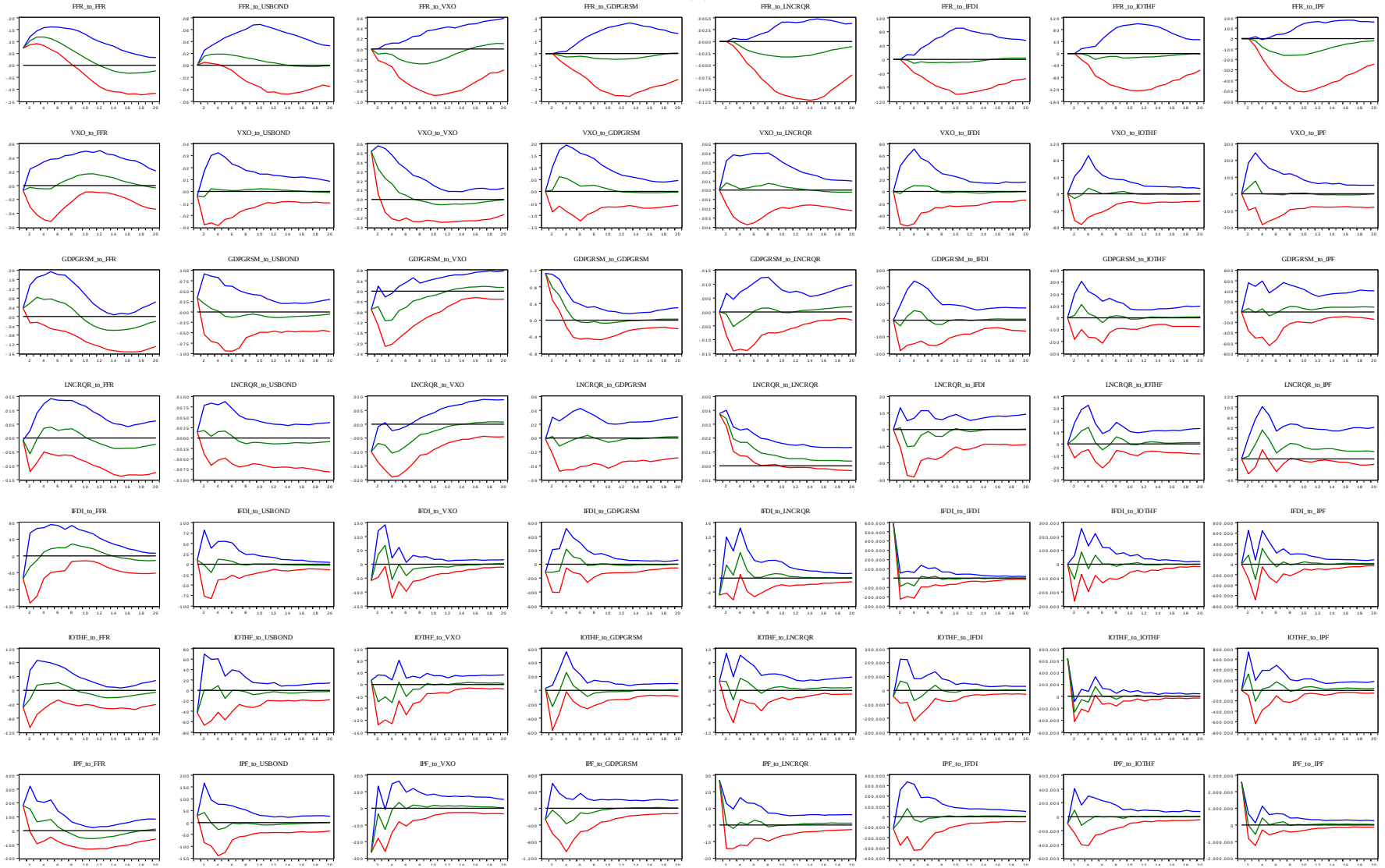


Table 18. VAR(3). Turkey