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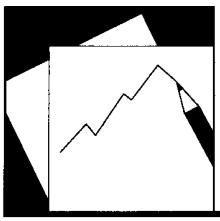

IMF Working Paper

Estimating Demand for IMF Financing by Low-Income Countries in Response to Shocks

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Finance Department

Estimating Demand for IMF Financing by Low-Income Countries in Response to Shocks

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Abstract

This paper estimates factors affecting demand for Fund financing by Low-Income Countries (LICs) in response to policy and exogenous shocks. Various economic variables, including reserve coverage, current account balance to GDP, real GDP growth, macroeconomic stability, and terms of trade shocks are found to be significant determinants of Fund financing. Moreover, global conditions, including changes in real oil and non-oil commodity prices and world trade, are also significant. Therefore, the demand for Fund financing by LICs is likely to be cyclical in response to common shocks with its intensity depending on the severity and persistence of adverse shocks.

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Contents Page

Figures

I. INTRODUCTION

Since late 2007, the global environment has become very challenging for developed and developing countries alike, and low-income countries (LICs) are no exception. LICs have been buffeted by a set of exogenous shocks. First, the surge in food and fuel prices in 2007−08 worsened balance of payments positions of a large number of LICs. Then the global financial crisis, hitting first advanced economies and emerging market countries, has started to take its toll on the external stability of LICs. The repercussions of these developments have already been apparent in the changing pattern of Fund financing to LICs. Demand for financing in response to policy[1] as well as exogenous shocks under augmentations of the Poverty Reduction and Growth Facility (PRGF) arrangement, Stand-by (SBA) arrangements and Exogenous Shocks Facility (ESF)[2] was subdued during the most part of this decade until 2008. While only twenty-seven such arrangements were approved over 2000–07, the number shot up to seventeen in 2008 alone.[3] Moreover, many arrangements have already been approved or are already in the pipeline for 2009. This recent surge in demand motivated this study to look into factors explaining demand for Fund financing by LICs in response to external as well as policy shocks. This paper aims at providing a systematic framework to help identify vulnerable countries that are likely to need Fund assistance, and also to assess resilience of LICs to common as well as country-specific exogenous shocks.

Motivated by this objective, this paper essentially explores determinants of a subset of Fund arrangements with LICs that has not yet been studied. Despite the vast literature on determinants of IMF arrangements, two comprehensive surveys by Steinwand and Stone (2008), and Bird (2007) conclude that existing models are far from definitive. Bird argues that the empirical evidence so far may imply that important determining variables may still have been omitted, or there is no one overall explanation of IMF arrangements. Therefore, examining more homogenous subsets of arrangements is a promising area of research. So far only Bird and Rowlands (2009) have looked into determinants of Fund arrangements with LICs, albeit without much success in improving the model specification.

Compared to previous studies, the empirical approach of this paper proves to improve the model specification significantly. The econometric model fits well and remains resilient through a battery of robustness checks. A wider range of economic variables are found to be significant determinants of approval of Fund arrangements with LICs, including reserve

[1] Throughout the paper, policy shocks refer to domestic policy slippages.
[2] This LIC facility, created in 2006 and reformed in late 2008, addresses financing needs arising from exogenous shocks and not used until 2008.
[3] The reported numbers include 66 LICs out of 78 PRGF-eligible countries. Small island economies that became PRGF-eligible based on an exception to the GNI per capita operational cut-off are excluded. PRGF augmentations for natural disasters are also excluded. Some PRGF arrangements addressing policy and/or exogenous shocks are included. Further explanation is presented in section IV.

coverage, current account balance to GDP, real GDP growth, macroeconomic stability indicator and terms of trade shocks. Moreover, no study has yet explored the effects of global conditions on demand for Fund arrangements by LICs. This paper looks into this issue and finds that the change in real oil and non-oil commodity prices, and the cyclical component of world trade are significant determinants of Fund arrangements with LICs. Therefore, the demand for Fund resources by LICs is likely to be cyclical in response to global conditions with its intensity depending on the severity and persistence of adverse exogenous shocks.

Two important innovations, relative to empirical approaches of previous research, may explain the improvement in the model specification. First, a specific subset of Fund arrangements are examined, i.e., approval of arrangements addressing immediate balance of payments needs of LICs in response to shocks. As the economic circumstances leading up to signing of such arrangements are likely to be more homogenous, the model specification is expected to improve. Various subsets of this group are studied as well, including arrangements explicitly addressing exogenous shocks and sub-samples of LICs with high export concentration in non-oil commodities. Second, this study uses observable "supply constraints" that would preclude a member's access to Fund financing to refine "normal episodes," i.e., periods without Fund financing for shocks. This approach certainly helps distinguish the effects of economic factors on demand for Fund arrangements.

A brief discussion of why the economic circumstances leading up to signing of such arrangements are likely to be more homogenous is warranted.

LICs share some common economic characteristics. In general, LICs are more exposed to terms of trade shocks owing to their narrow export base concentrated in primary commodities, historically prone to macroeconomic policy slippages and have no/limited market access, thereby more dependent on official financing and foreign aid. As such, their balance of payments needs are more likely to originate from the current account and they are more likely to resort to multilateral creditors, including the Fund, given their limited financing options. Moreover, LICs usually need to have a seal of approval for their policies from the Fund to access foreign aid and obtain debt rescheduling. For these countries, the Fund involvement is widely a politically accepted notion, which largely removes/reduces political barriers of entering into a Fund arrangement. Finally, unlike emerging market countries, they do not pose a systemic or contagion risk owing to their much smaller weight in global GDP and limited financial flows.

Nevertheless, the LIC-only specification in Bird and Rowlands (2009) has little success in improving the model specification. Therefore, working with a LIC-only sample does not seem to be the answer by itself. It is important to look closely at different types of balance of

payments needs addressed by various Fund arrangements available to LIC members.[4] SBAs deal with immediate balance of payments needs arising from policy and/or external shocks.[5] Moreover, the Compensatory Financing Facility (CFF) and PRGF augmentations also address immediate balance of payments needs specifically arising from external shocks.[6] On the other hand, for SAF/ ESAF/ PRGF arrangements, a member must be experiencing a "protracted balance of payments problem" that needs to be addressed over medium-term structural reforms.[7] Furthermore, arrangements under Extended Fund Facility (EFF) support medium-term programs to correct structural imbalances in production, trade, and prices.[8] Substantially different economic circumstances leading up to different types of balance of payments needs under various Fund arrangements might be partly responsible for mixed results in the empirical literature.

This paper focuses only on arrangements addressing immediate balance of payments needs of LICs in response to shocks. These arrangements are SBAs, PRGF augmentations and CFFs. Precautionary SBAs and SBAs/PRGF augmentations addressing natural disasters are excluded, considering the lack of immediate balance of payments need for the former and different nature of the shock for the latter. Finally, some SAF/ ESAF /PRGF arrangements are included if they address immediate balance of payments needs. This approach is substantially different from previous studies which included either only SBAs/EFFs—the precautionary ones as well in most cases, or also added SAF/ ESAF /PRGF arrangements.[9] Moreover, CFFs and PRGF augmentations were invariably excluded.

Finally, this study aims at identifying economic determinants of Fund arrangements. Nevertheless, in order to isolate effects of economic determinants, supply constraints by the Fund must be properly accounted for. Previous studies included a range of political variables to capture supply-side factors with mixed results. A few studies modeling supply and demand separately encountered specification problems. This study follows a different route

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[4] Bird and Rowlands (2007) examine empirically the economic and political circumstances associated with the use of different IMF facilities and include SBAs, EFFs and PRGFs in their analysis. For SBAs and EFFs, they find that although initially these facilities were used in different economic circumstances, since the mid 1980s these differences have largely disappeared. This period also corresponded to LICs migrating away from EFF to SAF/ESAF/PRGF. They report, however, some differences between concessionary (PRGF) and nonconcessionary facilities (SBA and EFF) beyond the income levels of countries using them.

[5] On approval of SBA arrangements, for purposes of determining access to Fund resources, the Fund takes into consideration the present, prospective and, in the case of precautionary arrangements, the potential need that may arise during the period of the arrangement. However, when a purchase is requested there should be an actual balance of payments need.

[6] The CFF provides financing for members that are experiencing an immediate balance of payments need resulting from a temporary shortfall in export earnings or excess cereal import costs or both.

[7] The Fund has provided concessional financing under these facilities to its eligible members. Structural Adjustment Facility (SAF) was established in 1986 and replaced by Enhanced Structural Adjustment Facility (ESAF) in 1987. In 1999, ESAF was renamed as Poverty Reduction and Growth Facility (PRGF).

[8] EFF was established in 1974 as a vehicle for longer-term external financing for members undertaking needed structural economic reforms.

[9] Cerutti (2007) is a notable exception excluding precautionary arrangements.

by taking into account factors affecting the Fund's evaluation of member's capacity to repay the Fund—a primary concern when granting access, in identification of normal episodes.

There are observable circumstances under which a member's access to Fund resources may be constrained by the Fund. Members must cooperate with the Fund in implementing adjustment policies leading to a viable balance of payments position by the time obligations begin to fall due. The Fund would deny access to its resources if the member (i) incurred overdue financial obligations to the Fund; (ii) had interruption in its current program; (iii) lacked the technical capacity/willingness to implement Upper Credit Tranche quality adjustment programs; and (iv) incurred significant arrears to bilateral and multilateral creditors and lacked a cooperative framework to address these arrears.[10] Therefore, episodes with these characteristics are removed from the normal episodes. This approach is likely to improve the model specification by better distinguishing the effects of economic factors on demand for Fund arrangements.

The paper is organized as follows: Section II briefly summarizes the literature on determinants of IMF arrangements; Section III illustrates some stylized facts on LIC landscape against the background of Fund financing; Section IV presents potential economic determinants of participation in Fund arrangements with reference to previous empirical findings; Section V reviews the empirical methodology; Section VI presents the results followed by robustness analysis presented in section VII; Finally, main conclusions are discussed in section VIII.

II. Literature Review

Numerous empirical studies have looked into determinants of participation in, or approval of IMF arrangements (see Bird, 2007, and Steinwand and Stone, 2008 for comprehensive surveys). This body of research is partly motivated by efforts to counter selection bias to properly account for various effects of IMF lending.[11] Approval of a Fund program essentially reflects the outcome of the joint decision of national authorities to request Fund financing and of the Fund to provide that support. While a few studies differentiate these decisions and model them separately,[12] in practice it is hard to find appropriate identifying

[10] The Fund may have either no involvement or Staff Monitored Programs (SMPs)/Emergency Post Conflict Assistance (EPCA) with these countries.

[11] Steinwand and Stone (2008) explains that since countries typically call upon the IMF in reaction to economic crises, the sample of countries under IMF programs is systematically different from the overall population. Statistical analyses that do not correct for this self-selection are in danger of producing biased results. Therefore, researchers increasingly use a variety of models with two equations: the first capturing the program participation and the second modeling the effect of interest.

[12] Knight and Santaella (1997), Przeworski and Vreeland (2000 and 2002), Vreeland (2003) and Stone (2008) use a bivariate probit model with partial observability which models the dependent variable as the product of two dichotomous decisions: one made by the country and the other by the IMF. When there is a Fund arrangement both of these decisions are revealed. However, when there is no Fund arrangement, it is not observable whether the country, the Fund, or both have rejected a program.

restrictions.[13] Similarly to the vast empirical literature, this study estimates a single-equation probability model that could be considered as a reduced-form estimate of the decisions made separately by the member and by the Fund.

Early research emphasized the economic determinants.[14] While some consensus emerged on the significance of low levels of reserve holdings, previous participation in Fund programs and low levels of income, evidence was at best mixed on a range of others, including external debt burdens, terms of trade shocks, current account balance, fiscal deficits, monetary expansion, and inflation. Moreover, the within sample and out-of-sample predictive capacity of the models has been limited.

The low predictive power of these models led researchers to include political variables that would affect the "supply" side of programs, such as the size of governments, quota at the IMF and various instruments for "U.S. and European influence" such as the United Nations (UN) voting record, United Nations Security Council (UNSC) membership, share of professional staff at the Fund, U.S. commercial interests, and military aid. Evidence is again mixed in various studies: some find a role for "U.S. influence" but limited to the Fund's nonconcessional lending, others suggest that U.S. influence has an impact on other aspects of the Fund lending rather than participation, or approval, such as the size of loans, nature of structural conditionality, and record of program implementation.[15] Some studies have looked into political variables that could affect program participation through the demand side. For example, if the number of veto players in the political system increases, governments are more likely to turn to the Fund to "tip the balance."[16] Evidence on the significance of these factors is again mixed. Although some individual political factors appear to be significant, including these variables does not significantly improve the predictive power (Bird and Rowlands, 2001). Based on extreme bounds analysis, Sturm, Berger, and de Haan (2005) report that mostly economic variables are robustly related to the IMF lending, while most political variables that have been put forward in previous studies are not significant. Steinwand and Stone (2008), on the other hand, argue that the usefulness of such analysis is limited since randomly chosen, instead of theoretically guided, model specifications are compared, which could introduce omitted variable bias.

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[13] For example, Przeworski and Vreeland (2000) impose the restrictions that a member's balance of payments deficit or political regime only enters the Fund's decision while not affecting the member's decision. On the other hand, its level of reserves, budget deficit, and debt service influence the member's decision while not affecting the Fund's decision. Moreover, Knight and Santaella (1997) find that reduced-form model predicts the approval of a financial arrangement more accurately compared to the bi-variate model.

[14] Joyce (1992), Conway (1994), Santaella (1996), Knight and Santaella (1997).

[15] Andersen et. al. (2003), Barro and Lee (2005), Oatley and Yackee (2004), Dreher, Sturm and Vreeland (2006), Dreher and Jensen (2007) and Stone (2002, 2004)

[16] Measured as the sum of the chief executive, each house of the legislature, and the coalition parties forming the government.

Steinwand and Stone (2008) emphasize that the variety of models used to explain participation in IMF programs and the plethora of contradictory results they produce indicates that existing models are far from definitive. Therefore, they urge caution in rushing to judgment about the effects of IMF lending as the results of analysis that correct for selection effects are only as good as the selection models. There is little consensus in the literature on which variables really matter, as the results for particular variables are often mixed. Bird (2007) points out that the empirical evidence so far may imply that important determining variables may still have been omitted or that there is no one overall explanation of IMF arrangements. Rather certain things are important in some cases but not in others, such that their significance effectively cancels out in large sample studies. Furthermore, he highlights that as yet no study has attempted to test empirically the subsets of country cases distinguishing the traditional current account crisis, capital account crisis, and low-income countries.

Recently only a handful of studies have attempted to disaggregate the analysis of participation in Fund arrangements by examining sub-samples of countries. Ghosh et. al. (2007) report on a sample composed of middle income countries (MICs) that an IMF-supported program is more likely the higher the country's external debt, the lower its reserve coverage of imports, the greater the fiscal and external adjustment it undertakes, the higher its inflation rate, and the higher (lower) the oil prices for oil importers (exporters). Similarly, Cerutti (2007) examines participation in IMF programs by emerging market economies excluding precautionary arrangements. He finds net international reserves, GDP growth, current account, inflation, and world GDP growth to be the most significant determinants of participation. Bird and Rowlands (2009) estimate the same "conventional" model of the probability of signing a Fund arrangement on sub-samples composed only of LICs, MICs, and capital account crisis countries. While they find significant differences between the specifications for LICs and MICs, the LIC specification turns out even weaker than the specification for the mixed sample that motivated their disaggregated approach in the first place. Only three variables are found to be significantly related to participation in Fund arrangements in LICs: the presence of previous Fund arrangements, high inflation, and the rescheduling of debt in the current year.[17] They report weaker explanatory power vis-à-vis MICs.

A relevant strand of literature is the prolonged use of IMF resources exploring reasons behind repeated participation in Fund arrangements while also looking into differences among country groups. Bird, Hussain, and Joyce (2004) find that repeated participation was associated with lower levels of international reserves, larger current account deficits, larger

[17] Reserve-to-import ratio and real exchange rate depreciation are weakly significant. The variables that are insignificant included GDP growth, current account balance to GDP, debt-service-to-exports ratio, public external debt to GDP ratio, exchange rate regime, as well as changes in some of these variables.

debt service ratios, lower per capita income, lower investment rates, and weaker governance. Joyce (2005) reports that duration of program "spell" is independent of previous spell length or the number of spells. However, the duration is extended for countries with lower income, exports concentrated in primary goods, landlocked geographic status, and autocratic regimes. According to the findings of the Independent Evaluation Office (2002), prolonged use is associated with lower levels of international reserves and higher debt service ratios while results are driven entirely by PRGF-eligible countries. Conway (2005) reports that the duration of IMF program "spells" is reduced significantly by prior participation in IMF programs for PRGF-ineligible countries. However, repeated participation increases significantly by prior participation for PRGF-eligible countries. Overall, this limited literature suggests that factors affecting the underlying weakness of the current account and other features of LICs seem to be especially significant in repeated use of Fund resources.

Research on the empirical link between global economic conditions and IMF financing is limited. Only Elekdag (2008) explicitly examines effects of global conditions on the probability of approval of a stand-by (SBA) arrangement using a mixed sample of LICs and MICs. He finds significant effects from oil prices, world interest rates, and a measure of the global business cycle.

The current study contributes to the existing literature in three areas: First, it looks into a specific subset of Fund arrangements differentiated by both country group, i.e., LICs, and the type of balance of payments need. As the economic circumstances leading up to signing of such arrangements are likely to be more homogenous the model specification is expected to improve. Second, it takes into account observable "supply-side" constraints that would preclude a member's access to Fund financing in identifying normal episodes, which would further distinguish the effects of economic factors on demand for Fund arrangements. Third, it explicitly examines effects of an extensive set of global economic conditions on demand for Fund financing by LICs in response to shocks.

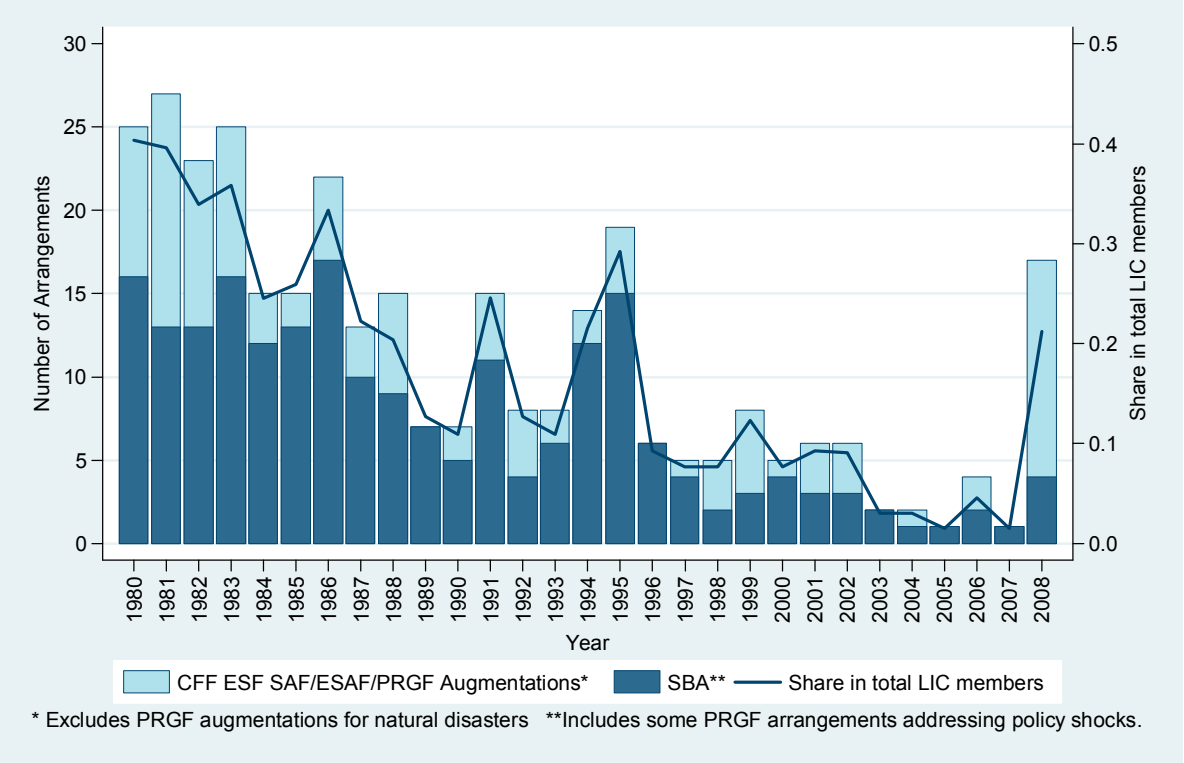
III. Stylized Facts on LIC Landscape and Fund Financing

The number of Fund arrangements approved in response to immediate balance of payments needs exhibited considerable variation over 1980–2008 (Figure 1).[18] In the early 80s, such financing to LICs shot up to about twenty-five arrangements annually. The financing difficulties were widespread—40 percent of the LIC membership requested Fund assistance. Although more subdued than the first episode, financing reached about 30 percent of the membership in the mid 90s, partly on account of financing to transition economies. On the

[18] Sixty-six LICs are included which constitute the Fund's LIC membership excluding countries that became PRGF-eligible based on the exception for small island economies. The reported share in the Fund's LIC membership takes into account the change in the number of members in this group from 52 in 1980 to 66 in 2002.

other hand, demand for Fund assistance was subdued during 1996–2007. On average nearly six arrangements per year were approved during 1996–2002, and demand plummeted further to two arrangements per year during 2003–07. Finally, the number of arrangements picked up sharply in 2008 to seventeen, reaching one fifth the LIC membership.

Figure 1. Fund Financing to LICs for Policy and/or Exogenous Shocks (1980–2008)



Source: IMF Arrangements database and author's calculations.

One plausible explanation for this kind of clustering of the Fund assistance, or of its absence, might be common external shocks to LICs. It would be insightful to look into the episodes in the early 80s and 2008 given both the sheer scale of Fund financing and the visibly significant number of arrangements addressing exogenous shocks.[19] The episode in the early 80s coincided with less developed countries (LDC) debt crisis, prior to which global conditions turned very unfavorable to LICs. Oil prices rose almost for a decade after the first oil shock in 1973–74 and reached their peak following the second oil shock in 1979. The world recession of 1974–75 set off a significant decline in non-oil commodity prices. Combined with widespread macroeconomic mismanagement, these large and persistent adverse shocks led to severe balance of payments problems and LICs increasingly resorted to external borrowing to close their widening financing gaps. Against this background, LIC

[19] For the episode in the 80s, CFFs and SBAs were approved in parallel for many members.

borrowing from the Fund had already surged during 1974–79 through the Oil Facility,[20] SBAs, CFFs, and concessional financing from the Trust Fund.[21] Finally, the LIC debt crisis fully developed by the early 80s. Official creditors responded by comprehensive debt rescheduling and multilateral agencies, including the Fund and the multilateral development banks, provided new lending which substituted for dwindling commercial credit to LICs. The episode in 2008 coincided with the aftermath of, first, the food and fuel price shock, and then the onset of the global economic crisis. IMF Board papers (2009a and 2009b) note that the crisis has significantly impacted LICs through reduced demand for their exports, lower FDI, and reduced remittances. As a result, average LIC growth has weakened sharply from pre-crisis rates of 5–7 percent to 2.4 percent forecasted for 2009.

Adverse external conditions prior to these high demand periods seem to justify the common shocks argument. However, subdued demand over an extended period as well as the overall trend decline in arrangements addressing policy shocks, except for the peculiar episode in the mid 90s, might also be attributed to some permanent improvements in the LIC landscape. Let's turn to this issue.

Since 1980 several favorable developments have led to subdued demand. Figure 2 presents the median versus 75th (25th) percentile, marking the worst quartile of various key economic indicators over 1980–2007. Overall, growth picked up. Nevertheless, the worst quartile of LIC growth, at about 3 percent, compares quite unfavorably to the median growth reaching about 5½ percent. During this period macroeconomic policies dramatically improved and fairly converged. Inflation came down to single digits, fiscal deficits were sharply reduced—a correction reaching 6 percent of GDP for the worst quartile, and the era of massive parallel market premiums ended with the removal of exchange restrictions and the unification of exchange rates in most countries. Moreover, LICs boosted their reserve coverage from severely low levels and became better positioned to absorb adverse shocks, nevertheless the worst quartile remained below three months of imports.

Despite these favorable developments, current account sustainability is a challenge and external vulnerabilities remain. Current account balances did not improve much and stayed volatile. Furthermore, the worst quartile of the deficit remained about 10 percent of GDP. LICs experienced high and persistent volatility in their terms of trade. The worst terms of trade shocks occurred in the early 80s and the early 90s, with a cumulative three year loss close to 30 percent for the worst quartile and also a quite significant median loss of about 10 percent. After the early 90s, negative shocks were milder and relatively short-lived. With respect to the financing of the external deficit, net resource transfers to LICs remained

[20] Established to assist members to meet the impact of oil price shock on their balances of payments. The first oil facility provided financing for the period of June–December 1974 and the second for the period of April 1975–March 1976.

[21] Established in 1976 to provide concessional balance of payments assistance to LICs and terminated in 1981.

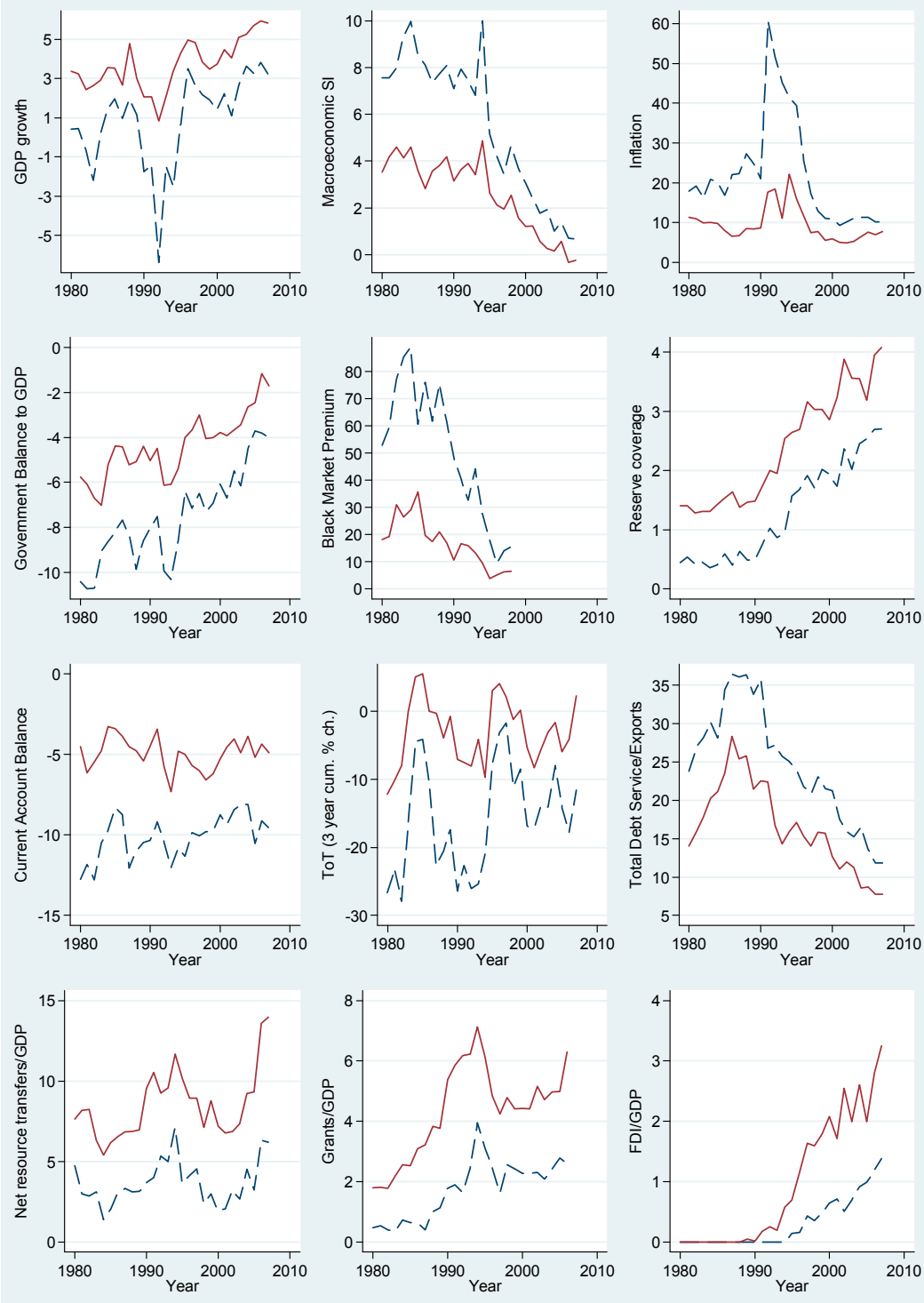
broadly stable until recently, but its composition improved with higher shares of grants and the FDI. However, the gap between the worst quartile and the median remained substantial. Finally, LICs achieved great strides in external debt sustainability after repeated debt reschedulings and through the Heavily Indebted Poor Countries (HIPC) initiative and the Multilateral Debt Relief Initiative (MDRI). Median total debt service to exports ratio came down sharply from close to 30 percent to less than 10 percent, and the decline was even steeper for the worst quartile.

IV. Potential Economic Determinants of Participation in IMF Arrangements

This study looks into determinants of participation in Fund arrangements addressing policy and/or exogenous shocks. The conceptual framework identifying the set of potential explanatory variables would be closely related to the notion of balance of payments sustainability. Bird and Rowlands (2006), in reference to Milesi-Ferretti and Razin (1996), explain this notion as follows: A country's balance of payments becomes unsustainable under circumstances where current policies cannot be continued into the indefinite future and a drastic policy shift becomes required. Sustainability of the current account deficit depends not only on the size of the deficit and factors influencing it but also on the country's willingness to borrow and the willingness of the creditors to lend. In the context of a traditional current account crisis, a country is likely to shift to unsustainability owing to developments increasing its current account deficit without an equal increase in its ability to finance it. Unsustainability may also arise from a decline in a country's ability to finance a given current account deficit because of a loss of creditworthiness. In these cases, unsustainability originates from factors affecting capital flows and triggers capital account crises.

Within this framework, this section outlines expected relationships between approval of Fund arrangements and various economic variables. It presents variables already included in previous studies, in reference to empirical evidence thus far, as well as new variables tested in this study. For details on previous empirical evidence, please refer to a summary of studies since 1990 in Sturm, Berger and Haan (2005).

Figure 2. Low Income Countries: Selected Economic Indicators (1980–2007)[22]



[22] Macroeconomic SI is a composite indicator of macroeconomic stability comprised of inflation, government deficit, change in reserves, nominal depreciation and parallel market premium. A decrease indicates improvement in macroeconomic stability. Further explained in section III.

International reserve coverage in months of imports. Countries with less reserve coverage relative to imports will not be able to meet their immediate balance of payments needs through reduction in reserves, therefore, they are more likely to request Fund credit. On the supply side, by definition Fund resources are made available to a country to meet its financing need related to its reserve position or developments in its reserve position.[23] Therefore, this is an important indicator variable for the Fund to signal a "need" for balance of payments support. This variable is invariably included in previous studies and found to be significant.

Real GDP growth. Additional financing may ease the burden of policy adjustment on already weak and faltering growth. Therefore, authorities of a country experiencing relatively weak growth and limited access to alternative financing are more likely to request Fund credit. Empirical evidence on significance of this variable is mixed.

Debt Service to exports. A heavy debt burden relative to debt servicing capacity increases a country's need for external finance. On the other hand, it may also raise concern for a country's capacity to repay the Fund, an important consideration affecting the "supply" side of Fund assistance. The results for this variable are mixed.

Current account balance to GDP. The fundamental condition underlying use of Fund resources is that a member country must have a balance of payments need. A high current account deficit could increase the likelihood of a country requesting Fund assistance. However, various studies did not find this variable significant and overall results are mixed at best. One reason that may render this variable insignificant could be the heterogonous samples mixing traditional current account crises as well as capital account crises. Another reason arises in the context of event identification. In various studies precautionary SBAs and/or SAF/ESAF/PRGF arrangements are included in the event set. Nevertheless, these arrangements do not require a present or prospective balance of payments need at the time of the approval, rather a "potential" need for the former and "a protracted balance of payments problem" for the latter.[24] Similarly, omitting CFFs and PRGF augmentations, which address actual balance of payments need in response to exogenous shocks, from the financing events would wrongly classify periods with such financing as "normal" episodes. These misclassifications of events potentially weaken the significance of the current account variable.

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[23] The condition of need is, however, only one of a number of conditions governing a member's use of the Fund's resources therefore existence of a need in itself does not entitle the member to use the Fund's resources.
[24] On approval of SBA and EFF arrangements, for purposes of determining access to Fund resources, the Fund takes into consideration the present, prospective and, in the case of precautionary arrangements, the potential need that may arise during the period of the arrangement. However, when a purchase is requested there should be an actual balance of payments need. For SAF/ESAF/PRGF arrangements a member must be experiencing a "protracted balance of payments problem" as a condition for approval of an arrangement.

Income per capita. Low income countries typically do not have market access, therefore, they are more dependent on bilateral and multilateral official flows as well as foreign aid. Moreover, official creditors tend to require a Fund program for policy adjustment as a precondition for disbursing new loans or providing debt relief. Finally, LICs turn to the Fund not only for financing but also for technical assistance to formulate of stabilization policies. Most studies found significant negative effect from this variable. That finding could be driven by a heterogonous sample including low income as well as middle income and emerging market economies.

Change in terms of trade. Obviously negative shocks to commodity terms of trade would deteriorate balance of payments position.[25] LICs' dependence on commodity exports brings about significant and persistent volatility in their terms of trade. Oil prices would be another important source of volatility for importers and exporters alike. Results are mixed, ranging from negative effect to no effect, in previous studies. This study tries some alternative measures of terms of trade shocks as well, including overall terms of trade losses scaled by GDP.

U.S. real interest rate. Increase in real international interest rates indicates tighter global liquidity conditions and increases debt servicing costs. Previous studies include LIBOR/real U.S. interest rate and some report positive effects while others could not find significant effect.

Paris Club (PC) dummy. A Fund program subject to upper credit tranche (UCT) conditionality has usually been a pre-requisite for a PC debt rescheduling.[26] To capture this effect this study uses a dummy variable taking the value of 1 if a PC rescheduling takes place in the current or the following year, and zero otherwise. Bird and Rowlands (2003) found significant positive effect from imminent rescheduling.

Election dummy. New governments may be more likely to request an IMF arrangement, resulting in an increase in the likelihood of a Fund arrangement after election years. Similarly, governments may be reluctant to request a Fund arrangement with upcoming elections. To test for these effects, this study constructs two versions of an election dummy: lagged version taking the value of 1 if there is an election in the previous year and zero

[25] Commodity terms of trade here is defined as the price of exports relative to the price of imports.

[26] A member-country can freely draw up to 25 percent of its quota to address its balance of payments need. To draw on more than 25 percent, i.e.,in upper credit tranches, requires a Fund program with specific program-related conditions refferred to as UCT conditionality. Conditionality is intended to ensure that Fund resources are provided to members to assist them in resolving their balance of payments problems in a manner that is consistent with the Fund's Articles. It also establishes adequate safeguards for the temporary use of the Fund's resources.

otherwise; and a version showing upcoming elections next year. Some studies found this variable significant.[27]

Other Variables Tested in this Study

A composite indicator for macroeconomic stability. Previous studies separately include inflation, growth rate of nominal exchange rate, and budget deficit to GDP as indicators of macroeconomic stability with mixed results. In order to assess the macroeconomic policy stance based on a comprehensive set of complementary indicators, this study prefers to use a variant of the composite indicator introduced by Jaramillo and Sancak (2009) (see Box 1). The formula for the indicator is given by:

$$mitot_{it} = \frac{\ln(\frac{cpi_{it}}{cpi_{it-1}})}{\sigma_{\Delta\ln(cpi)}} + \frac{\ln(\frac{xr_{it}}{xr_{it-1}})}{\sigma_{\Delta\ln(xr)}} - \frac{\frac{res_{it}-res_{it-1}}{mgs_{t-1}}}{\sigma_{\Delta res/mgs_{t-1}}} - \frac{\frac{gbal_{it}}{gdp_{it}}}{\sigma_{gbal/gdp}} + \frac{\ln(1+blackpr_{it})}{\sigma_{\Delta\ln(xr)}}$$

where *mitot* is the macroeconomic stability index for country *i* at time *t*, *cpi* is the consumer price index, *xr* is the exchange rate of national currency to U.S. dollar (increase indicates a nominal depreciation), *res* is the stock of international reserves, *mgs* is the imports of goods and services, g*bal* is the government balance, *gdp* is the nominal GDP, *blackpr* is the black market premium, and σ is the standard deviation of each variable. Weights are inverse of standard deviation for each component for all countries over the full sample after removing the outliers.[28] Higher levels of *mitot* indicate increased macroeconomic instability.

These policy indicators would obviously be affected by domestic policy slippages. Furthermore, exogenous shocks could also affect these indicators. For example, a sharp decline in the price of a major commodity export could lead to a higher budget deficit, lower reserves, and/or a depreciation in exchange rate. Although the exogenous shock itself will have first-round effects on these endogenous policy indicators, government policy can influence adjustment to the shock and minimize its destabilizing impact over the medium-term. When faced with increased macroeconomic instability resulting from domestic policy slippages and/or exogenous shocks, governments are more likely to turn to the Fund to ease the required macroeconomic adjustment.

Net resource transfers to GDP. A country is more likely to turn to the Fund when creditors become unwilling to finance its current account deficit or rollover its debt if they are concerned about the country's repayment ability. For LICs the resource envelope is determined not only by creditor resources but also by donor assistance. This study uses net

[27] Przeworski and Vreeland (2000) and Dreher, Sturm and Vreeland (2006).
[28] Observations above the 95th percentile for inflation and depreciation, above the 97.5th percentile or below the 2.5th percentile for the change in reserve coverage and below 5th percentile for government balance to GDP are considered as outliers.

Box 1. Why A Composite Indicator for Macroeconomic Stability?

Jaramillo and Sancak (2009) proposes a composite indicator of inflation, the fiscal balance, growth rate of nominal exchange rate and changes in international reserves. They argue that a combined indicator, advocated also by Fischer (1993) and Sahay and Goyal (2006), is considered to be more appropriate because any variable taken in isolation provides only partial information.

Inflation should, in principle, be the most obvious indicator of macroeconomic instability. However, in many developing countries controlled and/or fixed prices were common practices until recently, and prices of utilities remain heavily regulated. Moreover, Fischer (1993) argues that countries may for a long time succeed in maintaining low and stable inflation through policies that are not ultimately sustainable. Direct price controls are likely to lead to higher fiscal deficits owing to higher subsidies to state agencies incurring losses. Therefore, fiscal deficit is a good indicator of unsustainable policies. However, problems in measuring the true fiscal deficit in low income countries—inadequate coverage of the public sector and quasi-fiscal deficits—may render fiscal deficit less useful. Exchange rate developments, both in the official and the parallel market, and reserve losses are more likely to reflect underlying macroeconomic problems despite measurement issues. If exchange rate is fixed, then efforts to defend the parity would lead to loss of international reserves.

This study makes two modifications to Jaramillo and Sancak (2009) index. First, the black market premium is added as a separate component of the index, inspired by Fischer (1993). The authorities may ration the foreign currency to prevent further reserve losses. Black market premium is a good indicator of distorted or controlled market for exchange rate and it is more likely to reflect the underlying fiscal position. Satyanath and Subramanian (2004) find that, as a market based measure, the change in the nominal parallel market exchange rate is a better measure of nominal macroeconomic instability compared to inflation since it responds more clearly to underlying macroeconomic conditions. It is not feasible to rely exclusively on black market premium for two reasons. First, the short dataset for this variable would constrain the estimation, and would not be conducive to the intended forecasting framework. Second, while the existence of a substantial premium indicates an overvalued exchange rate and unsustainable policies, the absence of a premium does not guarantee sustainable policies. As such, the forecaster must make an assessment based on other macroeconomic variables. Finally, reserves are scaled by lagged value of imports of goods and services, rather than by base money as in the original index, to assure comparability across countries.

resource transfers, as defined in the World Bank's Global Development Finance (GDF) database, to capture the effect of overall country specific resource availability:

$$nrt = D - P - I + short + fdi - profit + port + grant$$

Where *nrt* is net resource transfers; *D* is disbursements on long-term debt and IMF purchases/loans; *P* is repayments on long-term debt and IMF repurchases; *I* is total interest payments; *short* is the change in short-term debt; *fdi* is the foreign direct investment; *profit* is fdi profit remittances; *port* is portfolio investment flows; and *grant* is official grants excluding technical cooperation.[29]

[29] This series is available in the World Bank's GDF only 1985 onwards.

This variable reflects combined and complementary factors of the debt service burden, creditors' willingness to finance the balance of payments need, and donor inflows that may offset financial outflows. Individual effects of these components are also tested.

Real export growth. LICs with a narrow export base concentrated on a few primary commodities are exposed to more frequent real quantity shocks that may put pressure on balance of payments sustainability.

Global variables

This study examines the effects of a variety of global variables to capture time-specific effects arising from common external shocks. Although a few studies included a measure of world interest rates, only Elekdag (2008) explicitly looked into effects of global economic conditions—represented by global business cycle, real oil prices, and world interest rates, on probability of approval of SBAs in a mixed sample of LICs and MICs.

Global demand. The cyclical components of World GDP and real World trade are used as indicators of global demand conditions.

Change in real non-oil commodity prices. LICs are major exporters of non-oil primary commodities, therefore a global decline in real non-oil commodity prices is likely to exert a common adverse terms of trade shock. This paper is the only study examining the role of non-oil commodity prices in demand for Fund financing.

Change in real oil prices. The balance of payments positions of net oil importing LICs are adversely affected by a rise in real oil prices. Although dependence on oil may vary widely by country and over time, given its likely prominent effect on balance of payments it is an important common shock. This variable is interacted with a dummy variable taking the value of one for oil importers. To address the above mentioned heterogeneity in oil dependence, country specific time series of oil imports to GDP are also used.

V. METHODOLOGY

A. Identification of the Dependent Variable: Approval of IMF Arrangements

The dependent variable is a panel dummy variable, taking the value of one if a new Fund arrangement is approved, and zero otherwise, indicating a normal episode. The set of arrangements include those addressing an immediate balance of payments need arising from policy and/or exogenous shocks. SBAs, SAF/ESAF/PRGF augmentations, CFFs and some SAF/ESAF/PRGF arrangements addressing immediate balance of payments needs are included. Over the sample period of 1980–2004, 235 financing events and 297 normal episodes are identified.

Moreover, a variant of this dependent variable is constructed to examine the conditions leading to approval of arrangements explicitly addressing exogenous shocks. In this case, only SAF/ESAF/PRGF augmentations and CFFs are included in financing events. These arrangements do not necessarily represent purely exogenous shocks, nevertheless, they are valuable tools for capturing the presence of exogenous shocks.[30] Over the estimation sample, 91 such financing events are identified. Modeling demand for this more homogenous subset of financing events triggered by exogenous shocks is likely to provide further insights into the role of global conditions in demand for Fund financing.

Let's turn to the technical aspects of identifying financing events. The dependent variable takes the value of one for the year of approval of an SBA, a PRGF augmentation or a CFF. As discussed earlier, several refinements are made to this basic set as follows:
(i) precautionary SBAs and SBAs/PRGF augmentations addressing natural disasters are excluded, and (ii) some SAF/ ESAF /PRGF arrangements are added if they address immediate balance of payments needs arising from policy shocks. In order to systematically determine the latter cases, this study relied heavily on program interruptions preceding SAF/ESAF/PRGF arrangements.[31] Similar to the Mecagni (1999) definition, a delay of more than six months in completing a review owing to noncompliance with macro performance criteria is taken as an interruption, often accompanied by undrawn balances. For first time SAF/ESAF/PRGF arrangements, these cases are identified by narratives in relevant staff reports. Presence of an immediate balance of payments need would be indicated by a drastic shift in macroeconomic policies to address a financing gap under these programs.

Normal episodes are identified as the initial year of two successive years with no Fund financing for shocks when the member is eligible to access Fund resources. Therefore, countries are included only after they became Fund members. Furthermore, members with overdue obligations to the Fund are ineligible to use Fund resources, therefore, the observations with arrears to the Fund are excluded from normal episodes. Finally, observations with Fund financing for natural disasters through ENDA or PRGF augmentations are also excluded.

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[30] In many cases, CFFs were approved in parallel to SBAs, indicating that those members had policy slippages when they were hit by exogenous shocks. PRGF augmentations, however, are approved when a member with an on-track PRGF program is hit by an exogenous shock. In other words, they address purely exogenous shocks in most cases. CFFs and PRGF augmentations do not necessarily include all exogenous shocks leading to Fund financing since SBAs could address policy shocks combined with exogenous shocks.

[31] I am grateful to Anna Ivanova for sharing the Ivanova et. al. (2005) dataset on program interruptions. This dataset identifies interruptions by programs, therefore, it is extended to identify specific years of interruptions within a program. Mecagni (1999) dataset is used to identify SAF/ESAF program interruptions. Ex-Post Assessments (EPAs), specific program documents and staff reports are used to identify specific years of interruptions and fill the gaps in the sample vis-à-vis the aforementioned studies.

A further crucial refinement for normal episodes comes from clear cases where supply constraints are relevant. Specifically, the Fund would deny access to its resources owing to concerns for a member's ability to repay the Fund. These cases usually involve (i) program interruptions; (ii) lack of technical capacity/willingness to implement UCT quality adjustment programs; and (iii) significant arrears to other bilateral and multilateral creditors. Consequently, observations with program interruptions or break-up of negotiations for a program, Staff-Monitored Program (SMP), Emergency Post-Conflict Assistance (EPCA), and three years leading up to EPCAs are excluded.[32] SMPs are mostly called for track record purposes following program interruptions. In such cases, a country may have present balance of payments needs, however, prior to resuming normal Fund financing, it is required to establish a good track record of willingness and ability to implement necessary adjustment policies. For EPCA cases, obviously post-conflict countries face deep rooted structural balance of payments problems and most likely have immediate financing needs as well. However, such countries lack the ability to implement a UCT quality program, and therefore, the Fund provides emergency financing.[33] Finally, episodes during which members incurred arrears to other bilateral and multilateral creditors and did not have adjustment programs that would garner the Fund support and rescheduling by their major creditors are excluded. These heavily indebted members were obviously in a severe balance of payments crisis and needed financing, including from the Fund.[34] However, in the absence of a cooperative debt relief/rescheduling from other creditors, they lacked the capacity to repay the Fund, prohibiting the use of Fund resources.

B. Econometric Specification

The effects of various economic variables on the probability of the member requesting Fund financing in response to shocks are assessed by estimating a binary response model for panel data. The general specification for panel probit models is given by

$$\begin{aligned} &y_{it} = 1 \quad \text{if Fund financing is requested} \\ &y_{it} = 0 \quad \text{normal episodes} \\ &P(y_{it} = 1 \mid x_{it}, c_i) = \Phi(x_{it}'\beta + c_i) \quad i = 1,...,n \text{ and } t = 1,...,T \end{aligned} \tag{1}$$

where, y is the observed outcome, Φ is the cumulative normal density function (c.d.f.), x_{it} is the $1xk$ vector of explanatory variables, and β is $kx1$ vector of coefficients associated with x_{it}. The explanatory variables used in this study are discussed extensively in section III.

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[32] Three years prior to EPCA is taken as a proxy to exclude years that a country was in conflict and as such the Fund was not in a position to negotiate a Fund program. Typically a conflict lasts much longer.

[33] EPCA loans are usually quick-disbursing and do not involve adherence to performance criteria. A member requesting EPCA is required to describe the general economic policies that it proposes to follow.

[34] On the demand side, a member in severe balance of payments difficulties may still opt for no Fund financing and close its financing gap by a draconian policy adjustment as well as some distortionary measures. If they do not incur significantly increasing arrears to their creditors, these cases are still included in normal episodes.

Different estimators are constructed depending on their assumptions for the panel heterogeneity, i.e., how they treat c_i.

Pooled probit models assume independence of observations over both *t* and *i*, implying $P(y_t = 1 \mid x_{it}) = \Phi(x_{it}'\beta)$. A panel-robust or cluster-robust estimate of the variance-covariance matrix of the estimator is used to correct standard errors for any dependence over time for a given individual. A random effects (RE) probit model treats the individual specific effect, c_i, as an unobserved random variable with $c_i \mid x_{it} \sim IN(\mu_c, \sigma_c^2)$ if an overall intercept is excluded. Because of the presence of c_i, y_{it} are dependent across *t* conditional only on the observables. The correlation between two successive error terms for the same individual, $v_{it} = c_i + u_{it}$ with $u_{it} \sim IN(0, \sigma_u^2)$, is a constant given by $\rho = cor(v_{it}, v_{it-1}) = \sigma_c^2 / (\sigma_c^2 + \sigma_u^2)$. An RE probit model imposes that c_i and x_i are independent. Pooled estimation in nonlinear models leads to inconsistent parameter estimates if the assumed RE model is appropriate and vice versa. A fixed effects (FE) probit model treats c_i as parameters to be estimated along with β, therefore, it does not make any assumptions about the distribution of c_i given x_i. In long panels, this poses no problems. However, in short panels, both β and c_i are inconsistently estimated owing to an incidental parameters problem. Finally, a correlated RE model relaxes independence between c_i and x_i using the Chamberlain (1982)-Mundlak (1978) device under conditional normality as below. In this specification the time average is often used to save on degrees of freedom.

$$c_i = \psi + \bar{x}_i \xi + a_i \text{ where } a_i \sim IN(0, \sigma_a^2) \tag{2}$$

The estimations are carried out step-by-step under different estimators. Extensive results and robustness analysis are presented in Sections VII.A and B.

When interpreting estimation results, it is important to note that these are nonlinear models. As such, the estimated coefficients, $\hat{\beta}$, do not indicate the increase in the probability of the event given one unit increase in the corresponding independent variable. Rather the increase in the probability depends on the starting point, and thus upon the initial values of all the independent variables and their coefficients. This derives from $P_{it} = \Phi(x_{it}'\hat{\beta} + c_i)$ and the marginal effect of the *kth* covariate x_{it}^k is given by $\partial P_{it} / \partial x_{it}^k = \phi(x_{it}'\hat{\beta} + c_i) \cdot \hat{\beta}_k$, where $\phi(\cdot)$ is the normal probability density function. While the sign of the estimated coefficients does indicate the direction of change, magnitude depends on $\phi(x_{it}'\hat{\beta} + c_i)$, reflecting the steepness of the c.d.f. at $x_{it}'\hat{\beta}$. The steeper the c.d.f. the greater the impact of a change in the explanatory variable on the predicted probability.

VI. RESULTS

A. Estimation Results: Benchmark Specifications

Two models are estimated to explain: (i) approval of Fund arrangements in response to both policy and/or exogenous shocks; (ii) approval of Fund arrangements explicitly addressing exogenous shocks. The first model includes SBAs, SAF/ESAF/PRGF augmentations, CFFs and some SAF/ESAF/PRGF arrangements addressing immediate balance of payments needs as well in the financing events, while the latter includes only SAF/ESAF/PRGF augmentations and CFFs.

In order to avoid the endogeneity problem, explanatory variables, except those representing exogenous shocks, are lagged one period for Fund financing events. Fifty-five countries are included in the sample over 1980–2004 (Table A1). The estimation sample is restricted by the availability of explanatory variables.

Table 1 presents estimation results for benchmark specifications derived from a general-to-specific model reduction approach. For each model, two benchmark specifications are estimated: for the first model, columns (1) and (2) correspond to final specifications using the macroeconomic stability indicator versus components of this indicator; and columns (3) and (4) are the counterparts for the second model. An RE specification is strongly supported for the first model since the correlation between two successive error terms for the same individual, ρ, turns out very significant. Moreover, country specific averages of some explanatory variables are significant, therefore, a correlated RE model is appropriate to capture correlation between the unobserved heterogeneity and these explanatory variables.

The second model is estimated by probit with robust standard errors since ρ is not significant and none of the country specific averages of explanatory variables are found to be significant in the final specification. Tables A2 and A3 present estimation results for various alternative specifications as well as general models that the benchmark specifications in Table 1 are derived from (columns (4) and (6) in Table A2 for model one and Table A3 for model two).

Table 1. Estimation Results: Demand for the Fund Financing in Response to Shocks

	Model I: All Shocks		Model II: Exogenous Shocks	
	(1)	(2)	(3)	(4)
Current account balance to GDP 1/	-0.076 *** (-4.61)	-0.076 *** (-4.51)	-0.073 *** (-4.7)	-0.073 *** (-4.13)
Reserve coverage in months of imports (CFA) 1/	-0.478 *** (-6.08)	-0.492 *** (-6.15)	-0.466 *** (-4.12)	-0.448 *** (-3.96)
Reserve coverage in months of imports (non-CFA) 1/	-0.769 *** (-8.71)	-0.804 *** (-8.82)	-0.589 *** (-6.05)	-0.598 *** (-6.13)
Macroeconomic stability indicator 1/	0.068 *** (2.89)		0.072 ** (2.21)	
Depreciation 1/		0.016 *** (3.11)		0.020 *** (2.99)
Government balance to GDP 1/		-0.047 (-1.6)		-0.060 ** (-2.18)
Real GDP growth 1/	-0.113 *** (-4.24)	-0.127 *** (-4.69)	-0.167 *** (-5.71)	-0.180 *** (-5.85)
Official Grants to GDP 1/				-0.046 (-1.64)
Total debt service to exports 1/			0.027 *** (3.03)	0.030 *** (3.15)
Change in terms of trade in previous year	-0.022 *** (-2.8)	-0.019 ** (-2.49)	-0.028 *** (-4.19)	-0.028 *** (-4.26)
Change in real oil prices in previous two years	0.009 *** (2.85)	0.010 *** (3.57)	0.012 *** (3.96)	0.013 *** (4.44)
Real world trade, cyclical component	-0.099 ** (-2.53)	-0.087 ** (-2.28)	-0.099 *** (-2.77)	-0.109 *** (-2.71)
Change in real non-oil commodity prices	-0.020 (-1.58)		-0.031 ** (-2.12)	-0.022 (-1.45)
Real growth of goods exports in previous year	-0.009 * (-1.79)			
Real GDP per capita			-0.281 (-1.37)	-0.439 ** (-2.08)
Paris Club dummy	0.774 *** (3.24)	0.685 *** (2.95)	0.525 * (1.67)	0.587 * (1.72)
Constant	0.551 (1.23)	0.574 (1.19)	1.482 (1.17)	2.368 * (1.9)
Country Specific Averages				
Total debt service to exports	0.044 *** (2.63)	0.044 *** (2.64)		
FDI to GDP	-0.105 * (-1.76)	-0.106 * (-1.77)		
Pseudo R2	0.58	0.57	0.62	0.64
LR test : $\beta_2 = \ldots = \beta_k = 0$ χ^2(Prob)	376(0.00)	376(0.00)	194(0.00) 2/	205(0.00) 2/
LR test : $\rho = 0$ χ^2(Prob)	11(0.00)	10(0.00)		
# of observations	532	532	388	388
Sample probability	0.44	0.44	0.23	0.23
# of countries	55	55	53	53

Source: Author's calculations.

Note: Model 1: Fund financing for policy and/or exogenous shocks excluding natural disasters. Estimated by a correlated random effects probit model. Model 2: Fund financing for exogenous shocks excluding natural disasters. Estimated by a pooled probit model with robust standard errors. Significant at 10 percent:*; 5 percent:**; and 1 percent:***, t statistics in paranthesis. Third lag of real GDP per capita is used to avoid capturing recent shocks to real GDP growth. 1/ These variables are lagged one period for Fund financing events in order to avoid endogeneity problem. 2/ Wald test for model significance is reported.

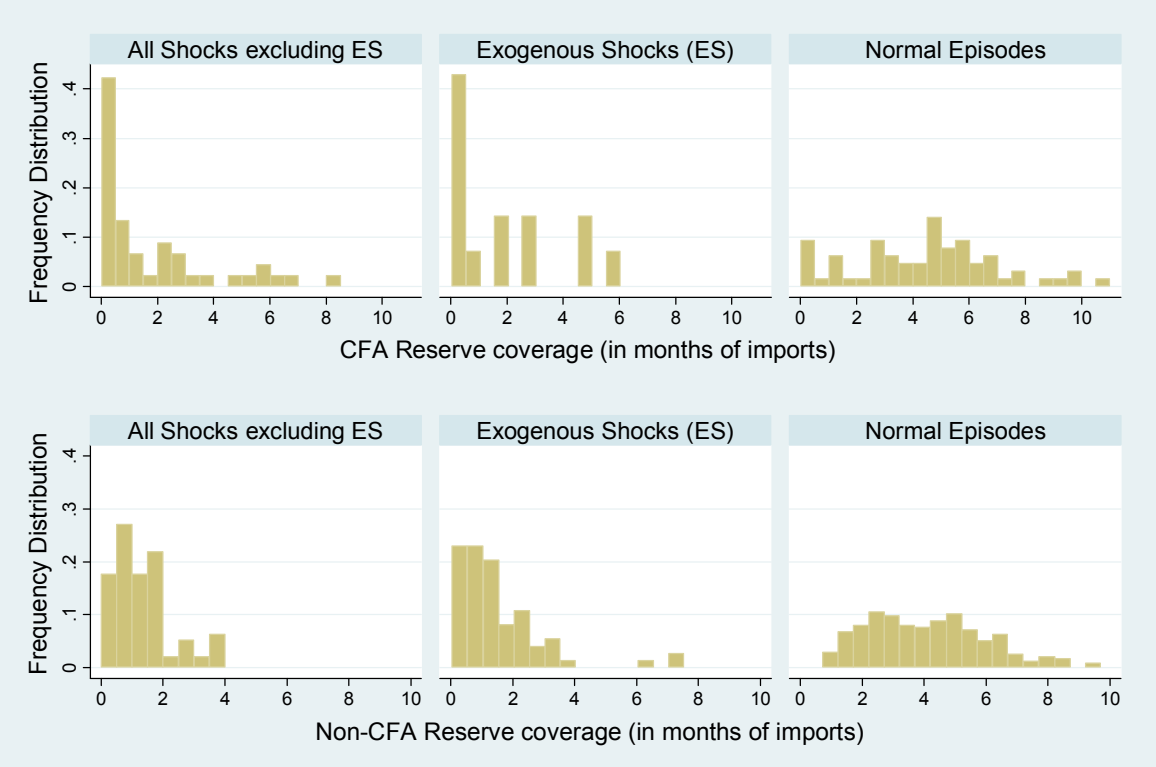
Overall, compared to earlier studies, examining a more homogenous group of financing events greatly improves model specification. For both models, economic variables are significant determinants of approval of Fund arrangements. Among the time-varying country-specific variables, reserve coverage, current account balance to GDP, real GDP growth, macroeconomic stability indicator, and terms of trade shocks turn out to be very significant in both models across various alternative specifications including general models. Among the time-specific variables representing common shocks, growth in real oil prices and cyclical component of world trade are significant in both models. Estimated coefficients for covariates are broadly similar in both models across different specifications, except for real GDP growth, terms of trade shocks and growth in real oil prices—they have larger effects in the second model. Finally, the Paris Club dummy is significant at 1 percent level in the first model and 10 percent level in the second model, reflecting a history of prolonged debt distress in the sample.[35] Thirty-eight out of fifty-five countries in the estimation sample had a Paris Club debt relief, for which a Fund arrangement had usually been a pre-requisite.

A noteworthy finding is that reserve coverage seems to have a larger impact on demand for Fund financing for non-CFA countries vis-à-vis CFA countries.[36] Naturally, one needs to consider whether these differences are statistically significant. The likelihood ratio (LR) test rejects equality of coefficients for the reserve coverage at 5 percent level in the first model. However, in the second model, Wald test for probit with robust standard errors cannot reject equality of these coefficients.

Figure 3 illustrates two relevant observations: First, some CFA countries did not request Fund financing despite exceptionally low level of their reserves. The reserve pooling arrangement among CFA countries as well as the French Treasury's guarantee for the convertibility of CFA franc might have provided an extra cushion when the level of reserves of a member was very low. Second, CFA countries seem to have obtained Fund financing sometimes with very comfortable reserve levels, more so for exogenous shocks. On the other hand, non-CFA countries rarely—and only for exogenous shocks, had Fund financing with reserve coverage higher than four months of imports.

[35] Its significance in the model for exogenous shocks could be explained by CFF financing often extended in parallel to new SBA arrangements.
[36] Estimating the model with only non-CFA countries gives qualitatively similar results (See section VI.F).

Figure 3. Distribution of Reserve Coverage in the Sample Prior to Financing Events versus Normal Episodes: CFA versus Non-CFA Countries



Source: WEO database and author's calculations.

Apart from the above mentioned similarities, there are some noteworthy differences in model specifications.

- First, while not significant across all specifications, an increase in real non-oil commodity prices seem to reduce the likelihood of Fund financing in the second model for exogenous shocks, possibly reflecting LICs' concentrated export base. This finding would suggest that "bunching" (absence) of Fund financing is likely to occur in response to an adverse (favorable) common shock to non-oil commodity prices. Financing for exogenous shocks were scarce in the latter part of the sample, coinciding also with strong commodity prices. This variable, though not significant, has a somewhat sizable effect and comes out with a correct sign in the first model for all shocks. Larger share of CFFs in financing events for the second model, addressing, by design, adverse shocks to exports, including price shocks, is likely to account for this finding. It also underscores the importance of studying a much more homogenous subset of events to improve the model specification.
- Second, countries with lower per capita GDP might be more likely to request financing for exogenous shocks. While this finding is not robust across specifications, it could imply that LICs are not a homogenous group in terms of their vulnerability to exogenous shocks. However, when all shocks are included, income per capita becomes insignificant.

This result presents evidence that LICs at the upper end of the income spectrum are just as likely to request Fund financing in response to policy shocks as those in the lower end. The significance of income per capita in previous studies seems to be driven by using mixed samples of LICs and MICs, and including SAF/ESAF/PRGF arrangements in the sample. Many LICs have had successive SAF/ESAF/PRGF to undertake structural economic reforms to address their protracted balance of payments needs.

- Third, in the first model, country specific averages of external debt service to exports and FDI to GDP ratio over the sample period are significant, and therefore, correlated with the unobserved country heterogeneity. In alternative specifications, country specific averages of net present value of debt to exports and net resource transfers to GDP become significant (Table A2 columns (1) and (2)). These findings may suggest that persistent divergences in debt burden and net resource inflows among LICs could explain why some countries are more frequent users of Fund resources. For the second model, no significant unobserved heterogeneity among countries is detected. Moreover, while external debt service to exports is very significant, none of the country specific averages of covariates are significant. This finding suggests that in the first model, the heterogeneity, correlated also with some covariates, is likely associated with Fund financing for policy shocks.

Except for FDI, other variables aimed at capturing investors/donors' willingness to meet financing needs prior to financing events versus normal episodes, including net resource transfers and its components, are not significant in either model (Columns (1), (2) and (3) in Tables A2 and A3). However, the country specific average of net resource transfers to GDP over the sample period is significant, and therefore, correlated with country heterogeneity in the first model. Quite frequent back-to-back financing events in the sample and PRGF augmentations could cancel out significance of net resource transfers, or its components, owing to the "catalytic" effect of existing Fund programs in the previous period. Both external debt service to exports and FDI to GDP ratio become significant in the first model if their country specific averages are excluded. Official grants, though insignificant, have somewhat sizable effect and come out with correct sign in the second model for exogenous shocks.

Specifications derived from general models using macroeconomic stability indicator versus its components separately are quite similar (columns (4) and (6) in Tables A2 and A3 and Table 1 separate columns for each model). In all equations parameter estimates for other variables remain broadly the same. This provides an important robustness check for the benchmark models derived from either approach. Inflation and nominal depreciation are highly correlated, therefore they enter the model specification one at a time. Among the individual indicators, nominal depreciation turns out very significant in both models, and the government balance to GDP is significant in the second model. Inflation turns significant in the first model when entered in place of nominal depreciation but the latter turns out very

significant in both models (columns (5) and (6) in Tables A2 and A3 and columns (2) and (4) in Table 1). When components are included separately the estimated coefficients come out with correct sign. While individual effects of other components of the composite indicator are found to be insignificant, they may, nevertheless, be important in some cases. Therefore, given the significance of the macroeconomic policy indicator in both models, specifications using this composite indicator are preferred to cope better with the case by case importance of different components.

Finally, let's discuss what does not work among other variables tested in this study. The real effective exchange rate (REER) is not significant. This covariate is included and found significant in a few previous studies, albeit with mixed signs.[37] Knight and Santaella (1997) acknowledge that predominance of variations in equilibrium REER may lead to estimating negative coefficients for REER. Bird and Rowlands (2001) note that while a real exchange rate appreciation is generally associated with worsening current account balance and may trigger an IMF program, continued depreciation over an extended period may be symptomatic of structural balance of payments problems. Therefore, the sign of this covariate could be ambiguous. Equilibrium REER in LICs may exhibit large movements owing to their exposure to large terms of trade shocks.[38] This could be an important factor rendering this covariate insignificant: a given real appreciation may be an equilibrium response rather than an indication of overvaluation, or a given real depreciation may not bring the actual REER close enough to the equilibrium REER that might have depreciated much more.

Alternative measures of terms of trade shocks scaled by GDP, and oil imports to GDP that could capture heterogeneity in oil dependence are not significant. The net present value of debt to exports is not significant while the total debt service to exports turns out highly significant. This finding suggests that the actual near term debt service burden is relevant to the timing of the member's decision to turn to the Fund. Nevertheless, country specific average of net present value of debt to exports is found to be an important source of country heterogeneity, suggesting that a country with a persistently high debt stock burden is more likely to need Fund assistance. U.S. real interest rate, capturing the global liquidity conditions and increase in debt service burden, does not seem to have a significant effect. Lack of market access for most LICs combined with their reliance on concessional official financing might explain this finding. To see the effect of change in the direction of macroeconomic policies, the change in macroeconomic stability indicator was added to the specification. However, it becomes significant only when the indicator itself is omitted from

[37] Santaella and Knight (1997) report a significant negative effect from a real exchange rate appreciation on the participation in Fund programs. Bird and Rowlands (2001) estimate a significantly positive coefficient.
[38] Cashin, Cespedes and Sahay (2002) report a long-run co-movement of real exchange rate and real commodity prices for some commodity-exporting countries.

the specification. Finally, separate election dummies corresponding to lagged elections and upcoming elections are not significant in either model.

B. Goodness of Fit

Two frequently used measures of model performance are the likelihood ratio test for the hypothesis $H_0 : \beta_2 = \beta_3 = ... = \beta_k = 0$ and a scalar measure called the *pseudo-R^2*. The latter is given by *pseudo-*$R^2 = 1 - (\ln L(\hat{\Omega}) / \ln L(\hat{\omega}))$ where $\ln L(\hat{\Omega})$ is the value of the likelihood function evaluated at $\hat{\beta}$ and $\ln L(\hat{\omega})$ is the maximum value of the likelihood function under the hypothesis $H_0 : \beta_2 = \beta_3 = ... = \beta_k = 0$. As a crude measure, it is 1 when the model is a perfect predictor and 0 when $\ln L(\hat{\Omega}) = \ln L(\hat{\omega})$, i.e., H_0 holds. However, between these limits it has no obvious intuitive meaning. Hauser (1978) shows that in an information theoretic context, *pseudo-R^2* measures the percent of "uncertainty" in data explained by empirical results.[39] *Pseudo-R^2* indicates that about 57 to 64 percent of the uncertainty in the data is explained by these empirical models. For both models H_0, i.e., coefficients of explanatory variables being jointly zero, is significantly rejected by the likelihood ratio test.

Measuring the "goodness" of fit of the predictions is not straightforward, since the statistical model predicts conditional probabilities that must be compared to actual events. A predicted probability of less than one still assigns a nonzero probability to the alternative event, i.e., by model predictions both outcomes are possible, albeit with different probabilities. Keeping this point in mind, it is, nevertheless, useful to examine the distribution of in sample and out-of-sample predicted probabilities for financing events versus normal episodes to get a sense of fit (Table 2).

Distributions of predicted probabilities by type of events are quite distinct. Moreover, the predicted probabilities are well dispersed in the [0,1] interval, indicating the ability of the empirical model to differentiate alternative outcomes. The less informative the model, the less dispersed the predicted probabilities, the limiting case being the flat sample probability predicted for both types of events. In first model, the median predicted probability for financing events is 0.96 vis-à-vis 0.04 for normal episodes. Ninety percent of financing events have probabilities above 0.41 whereas 75 percent of normal episodes have probabilities below 0.21. Only 10 percent of normal events exceed the probability of 0.59. In

[39] Cameron and Windmeijer (1997) use the Kullback-Leibler divergence to construct an R^2 measure of goodness of fit. It would measure the proportionate reduction in uncertainty due to the inclusion of regressors, lies between 0 and 1, and is non-decreasing as regressors are added. They note that in Bernoulli models, such as probit and logit, this measure coincides with the likelihood ratio index, supporting use of this index rather than the many other competing R^2 measures.

the second model, predicted probabilities are above 0.22 for 90 percent of financing events while 90 percent of normal episodes have probabilities below 0.29.

Table 2. Predicted Probabilities (Percentiles)

	Model I				Model II			
	In sample		Out of sample 1/		In sample		Out of sample 1/	
	Financing events	Normal episodes	Financing events	Normal episodes	Financing events	Normal episodes	Financing events	Normal episodes
1%	0.03	0.00	0.73	0.00	0.00	0.00	0.54	0.00
5%	0.22	0.00	0.73	0.00	0.13	0.00	0.54	0.00
10%	0.41	0.00	0.78	0.00	0.22	0.00	0.54	0.00
25%	0.74	0.00	0.89	0.00	0.52	0.00	0.97	0.00
50%	0.96	0.04	1.00	0.14	0.87	0.01	0.98	0.07
75%	1.00	0.21	1.00	0.55	0.99	0.10	1.00	0.37
90%	1.00	0.59	1.00	0.89	1.00	0.29	1.00	0.68
95%	1.00	0.72	1.00	0.97	1.00	0.45	1.00	0.82
99%	1.00	0.86	1.00	1.00	1.00	0.69	1.00	0.94
Obs.	235	297	15	98	91	297	6	98

1/ Same model is estimated for 1980-2000. Predicted probabilities are for 2001-2004.

In examining the out of sample predictions from both models, the same specifications are estimated for 1980–2000 and probabilities are predicted for 2001–04. This is particularly challenging for the model because financing events during the out-of-sample period are extremely rare compared to the estimation period. The proportion of financing events declines from about 54 percent to 12 percent in the first model, and from 30 percent to 6 percent in the second model. Nevertheless, both models present distinct distributions for financing events versus normal episodes. Percentiles for financing events are much higher compared to those of the full sample. The first model predicts probabilities higher than 0.73 for all 15 financing events, while 75 percent of normal episodes have predicted probabilities lower than 0.55. The second model predicts probabilities higher than 0.97 for 5 out of 6 financing events while 90 percent of normal episodes have predicted probabilities for lower than 0.68. That said, the upper percentiles of predicted probabilities are higher for normal episodes than in sample counterparts, increasing the share of wrong calls for a given threshold probability. Related to this point, the next section looks into the determination of the threshold probability.

C. The Threshold Probability Analysis

The loss function approach suggested by Demirgüc-Kunt and Detragiache (1999) determines the threshold probability—a predicted probability exceeding this threshold signals a financing event. The expected loss function is the weighted average of type I and type II errors, with weights reflecting costs attached to each type of error. Minimization of the loss function yields the threshold probability. This study calculates threshold

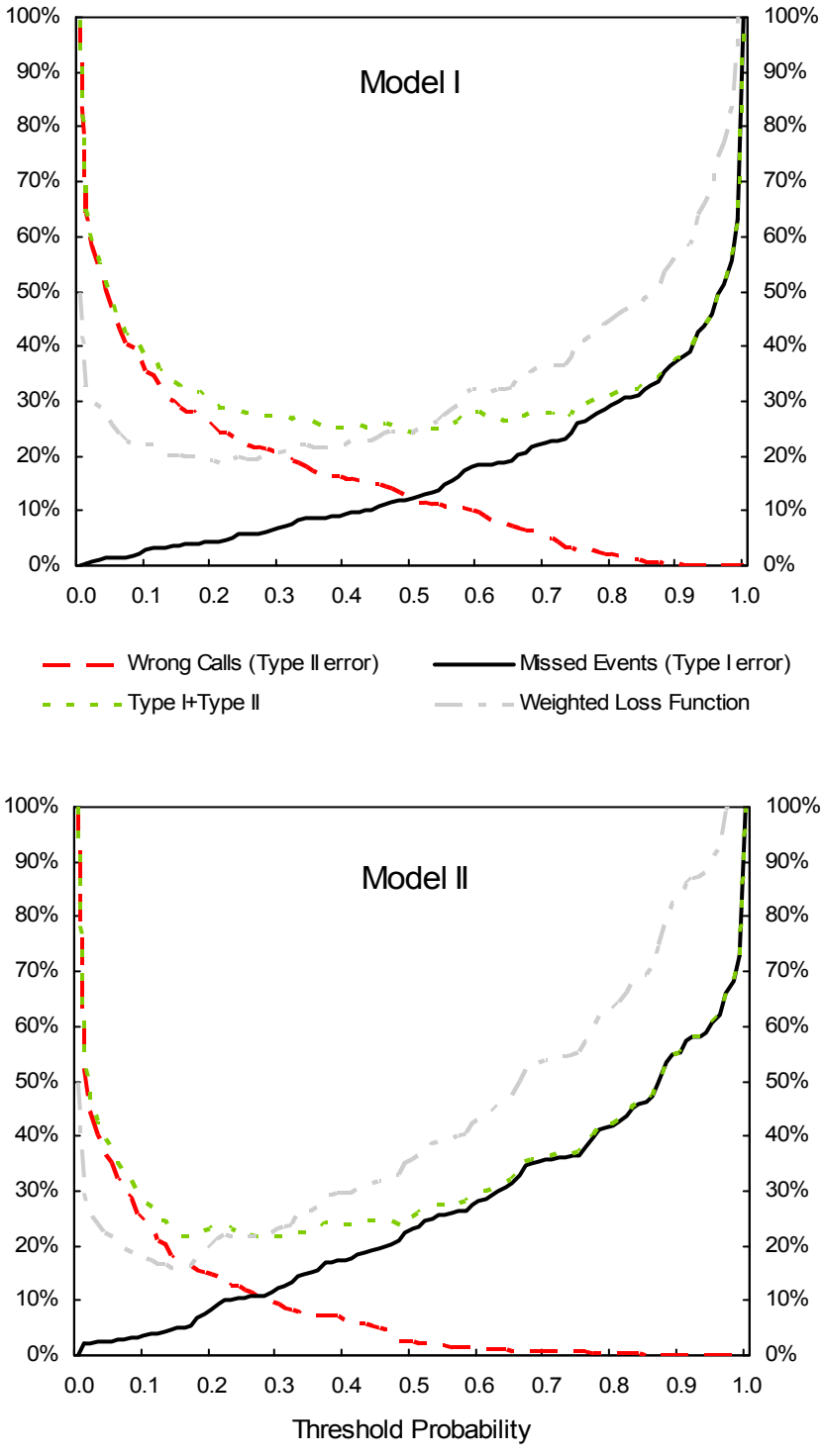
probabilities for equal weights as well as 3:1 ratio for missed financing events (type I error) versus wrong calls (type II error).[40] The latter ratio is subjective, reflecting the trade-off between missing a financing event versus clarifying the signal issued, i.e., reducing the wrong calls. In order to capture countries that might need Fund financing at an early stage, it is preferred to make missing financing events more costly. Figure 4 plots missed financing events (type I error), wrong calls (type II error), the equally weighted loss function (summation of type I error and type II error) and the 3:1 weighted loss function versus the threshold probability.

An increase in the threshold probability raises type I error while reducing type II error. In the first model, the asymmetrically weighted loss function is minimized at a threshold probability of 0.21, corresponding to about 24 percent wrong calls versus 5 percent missed financing events in the sample. A threshold probability of 0.50, obtained from the equally weighted loss function, would reduce wrong calls to 12 percent of the normal episodes while missing 12 percent of the financing events. In the second model, threshold probabilities are 0.14 and 0.28 respectively for the asymmetrically weighted loss function versus equally weighted one. The former limits the missed financing events to only 5 percent, albeit at a higher rate of wrong calls (18 percent). The latter corresponds to about 10 percent wrong calls versus 11 percent missed financing events. Overall, the second model provides clearer signals since wrong calls are more limited for a given level of missed financing events.

The probabilities predicted by both models compared to their corresponding threshold probabilities constitute an operational forecasting framework. The thresholds derived above aim to minimize the risk of missing a financing event. Countries with predicted probabilities above these basic thresholds could be considered "vulnerable," indicating a possible need for Fund financing. Within this group, a set of "highly vulnerable" countries could be separately identified using higher threshold probabilities associated with fewer wrong calls. In the first model, a predicted probability above 0.59 reduces wrong calls to less than 10 percent of normal episodes in the sample. The corresponding probability in the second model is 0.28, the same as the threshold obtained from the equally weighted loss function.

[40] The definition of type I and type II errors is relative to the formulation of the null hypothesis being tested. Here, as a matter of convenience, the null hypothesis is formulated around the outcome of interest: "the member will request Fund financing" versus the alternative of "the member will not request Fund financing."

Figure 4. Threshold Probability Analysis



Source: Author's calculations.

D. Effects of Explanatory Variables on the Probability of Financing Events

As discussed earlier, owing to nonlinearity of the model, the effect of a variable on the probability of the financing event depends not only on its coefficient but also on the values of other explanatory variables and their coefficients. As such, estimated coefficients have no direct interpretation. Nevertheless, marginal effects of variables calculated at preset values of other independent variables, usually at their means or medians, are customarily reported. Instead this study uses a set of counterfactual simulations to illustrate how a single explanatory variable affects the predicted probability over its sample range for different initial values for other explanatory variables.[41] This presentation is preferred to provide a better visual illustration. In simulations, other explanatory variables are fixed at two different sets of initial values corresponding to: (i) sample median and (ii) 75^{th} (25^{th}) percentile if their estimated coefficient is positive (negative). Table 3 presents specific values used in the simulations and the corresponding predicted probabilities in both models. Both sets of simulations set changes to global variables to zero, thus highlighting the effect of each variable on a "median PRGF country" versus a weakly positioned PRGF country in the absence of common shocks. Naturally, simulations related to global variables would readily illustrate the effects of common shocks on these two differently situated countries.

In both models, the predicted probability for Fund financing is zero for the median country whereas for the country with weaker fundamentals, the predicted probability increases to 0.84 and 0.59 respectively in the first and the second model. In reference to the threshold probabilities derived in the previous section, it is predicted that the median country will not request Fund financing. On the other hand, for the weakly positioned country, Fund financing is predicted in both models.

Figure 5 presents counterfactual simulations from the first model incorporating all shocks. An isolated change in a single explanatory variable within its sample range has a much larger effect on the weakly positioned country, in some cases swinging the predicted probability of Fund financing from below the threshold probability to one. Reserve coverage is particularly influential because both the predicted probability and the upper bound of its confidence interval cross the threshold probability within the sample range. For instance, a financing event is predicted for a weakly positioned non-CFA country at reserve coverage less than 3.6 months of imports. The 95 percent confidence interval of the predicted probability falls below the threshold if reserve coverage is above 4.4 months of imports. The corresponding figures are 5.1 and 7.3 months of imports respectively for a similarly situated CFA country. Only a current account surplus above 15 percent of GDP would bring the predicted probability below the threshold for the weakly positioned country.

[41] These simulations are counterfactual since all other variables remain unchanged while a single variable is allowed to change over its entire sample range. Some time-specific variables, including real oil prices, real commodity prices and cyclical component of the world trade, are extended beyond their actual sample range to illustrate effects of more extreme shocks to these variables. Dummy variable is set to zero.

Table 3. Values of Explanatory Variables in Counterfactual Simulations

	Median	75th (25th) percentile
Current account balance to GDP (%)	-4.9	-8.9
Reserve coverage in months of imports 1/	3	1.3
Macroeconomic stability indicator	1.9	4.5
Real GDP growth (%)	4.3	1.7
Total debt service to exports (%)	16.1	26.1
Change in terms of trade in previous year (%)	0	-8.4
Change in real oil prices in previous two years (	0	0
Real world trade, cyclical component (%)	0	0
Change in real non-oil commodity prices (%)	0	0
Real GDP per capita 2/	327	221
Country Specific Averages		
FDI to GDP (%)	1.1	0.4
Total debt service to exports (%)	18.7	25.4
Predicted probability 3/		
Model I	0 [0.0 0.0]	0.84 [0.69 0.94]
Model II	0 [0.0 0.0]	0.59 [0.39 0.77]

1/ Set equal for both the CFA and non-CFA countries.
2/ In constant 2000 US$.
3/ The 95 percent confidence interval for the predicted probability is in brackets.

An isolated change in any other explanatory variable is unlikely to reduce the predicted probability below the threshold level for the weakly positioned country. Even if the central predicted value could be brought down slightly below the threshold for extremely favorable terms of trade shocks and surging real non-oil commodity prices, the predicted confidence intervals are quite large to safely assume no Fund financing. Nevertheless, the predicted probability approaches 1 in the case of a significant isolated deterioration in any of the explanatory variables. As such, this leads to classifying more countries as "highly vulnerable" and predicting Fund financing with greater confidence. A more plausible case of combined deterioration would converge the predicted probability much faster toward 1. For instance, a sharp negative terms of trade shock is more likely to lead to significant widening of current account balance and a substantial decline in the reserve coverage, thereby further increasing the predicted probability.

In this counterfactual exercise, the median country does not need Fund financing except in the following cases: a very low level of reserve coverage for non-CFA countries; a very large current account deficit; or an extremely instable macroeconomic environment. Nevertheless, the threshold probability falls within the confidence interval of predicted probabilities if any of the following holds while other variables are fixed: reserve coverage less than 1.4 months of imports for non-CFA countries; current account deficit to GDP exceeding 18¾ percent; GDP contraction exceeding 4¾ percent; severe adverse terms of trade shocks; and real oil prices increasing more than twofold. Again, it is important to underscore the counterfactual nature of this experiment because it is hard to imagine other variables remaining unchanged

when any of these explanatory variables takes these stated extreme values. Therefore, the threshold probability would likely be exceeded at less extreme values than those implied by this experiment. A more plausible case would be a broad-based cumulative weakening of covariates for most LICs following a severe adverse common external shock. Such a shock would likely work its effect also through deterioration in the current account balance, a drop in reserve coverage, a sharp decline in terms of trade and a weakening GDP growth. As a result of this overall deterioration, the median PRGF country could exceed the threshold probability, implying that the number of countries requiring the Fund assistance could dramatically increase.

Figure 6 presents counterfactual simulations in the model for exogenous shocks. These simulations are qualitatively similar to those for all shocks. For a non-CFA country, the predicted probability falls below the threshold at 3.5 months of imports and its 95 percent confidence interval also falls below the threshold above 5 months of imports. The corresponding figures are 4.1 and 8 months of imports respectively for a CFA-country. GDP growth and terms of trade shocks have a more profound effect and are also estimated with higher precision, swinging the predicted probability and the confidence interval from below the threshold to one for a weakly positioned country. Common global shocks also have a more prominent impact. For instance, a sharp adverse shock to real non-oil commodity prices could bring the predicted probability over the threshold for a median country. The real GDP per capita has only a limited effect in this specification.

Figure 5. Model I: Counterfactual Simulations—Effects of Explanatory Variables on the Probability of Fund Financing

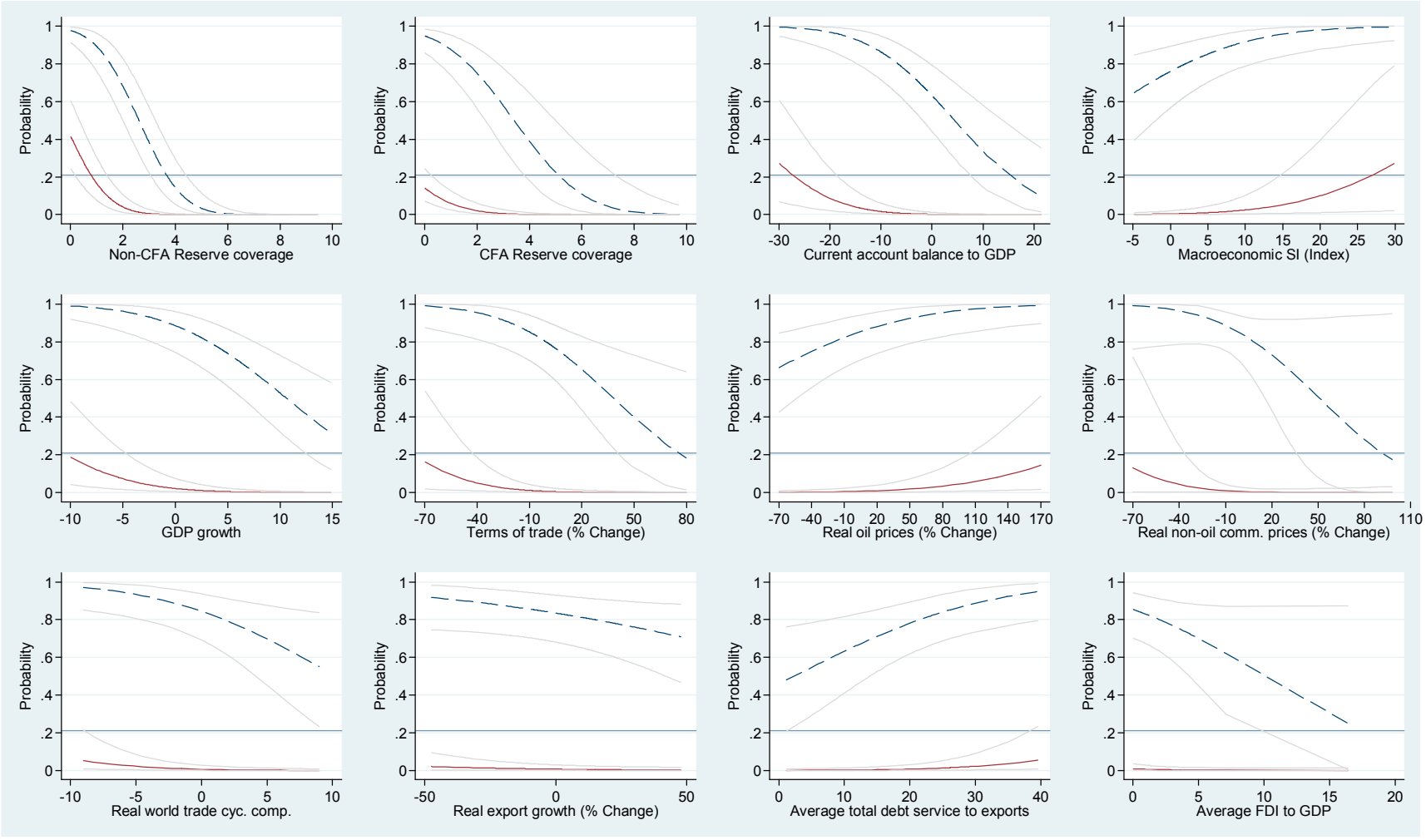
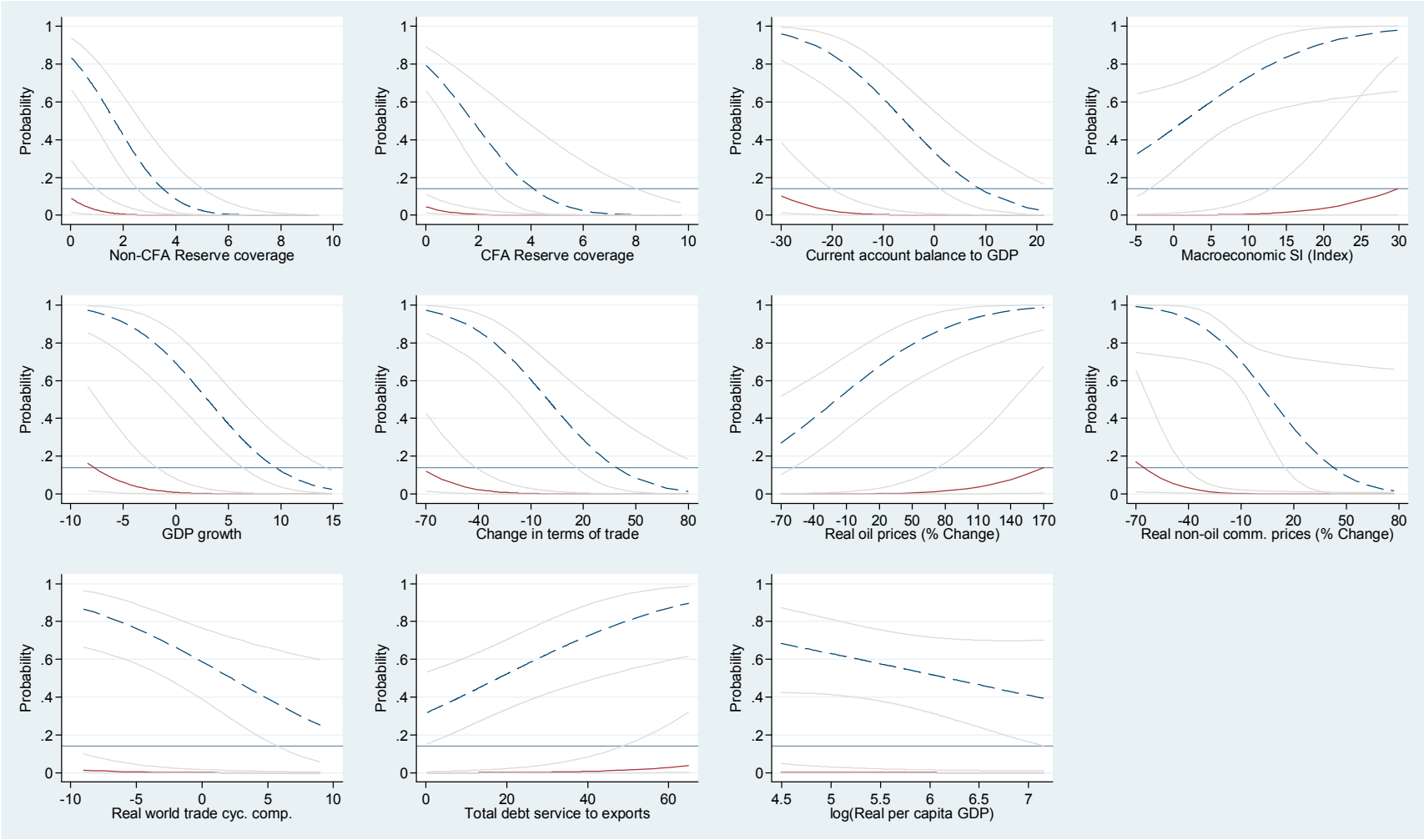


Figure 6. Model II: Counterfactual Simulations—Effects of Explanatory Variables on the Probability of Fund Financing

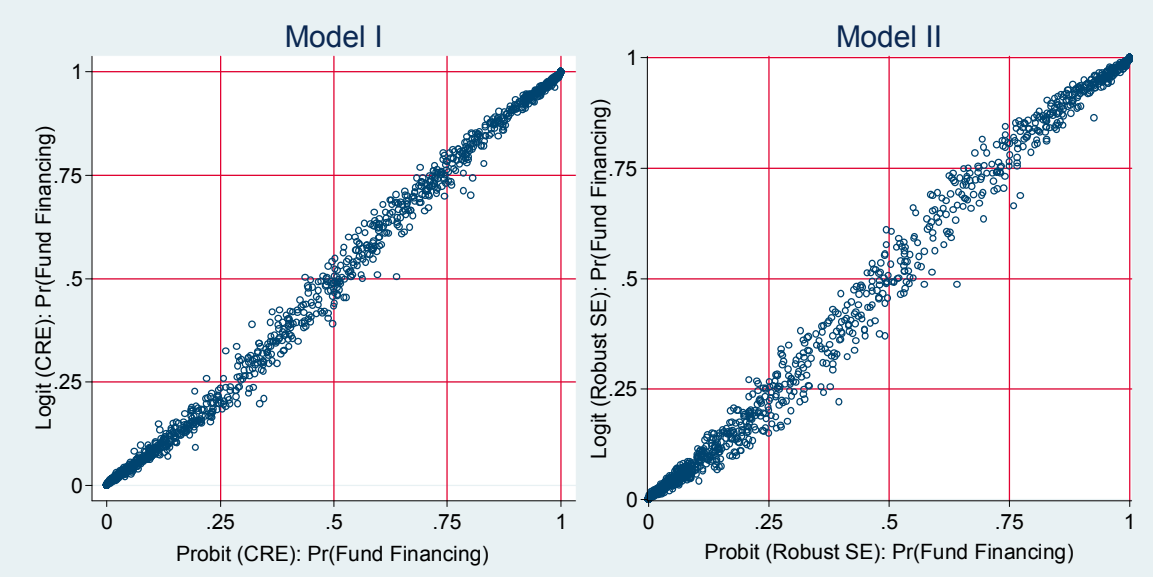


VII. Robustness Checks

A. Logit versus Probit Model

The logit model is obtained if Φ in equation (1) is the c.d.f. of the logistic distribution, instead of the normal distribution. Both models have similar shapes for central values of c.d.f. but differ in the tails. Therefore, these two forms give similar predictions unless there are an extreme number of observations in the tails. The predicted probabilities obtained from the correlated random effects probit versus the logit models are presented in Figure 7. The two sets of predicted values are very similar and their correlation is very high at 0.99. The log likelihoods are also quite close. Although both models have the same number of parameters, if a likelihood ratio test with one restriction were applied these two models being indifferent could not be rejected.

Figure 7. Comparison of Predicted Probabilities: Probit versus Logit Estimates



Source: Author's calculations.

B. Alternative Probit Estimators for the Country Specific Heterogeneity

This section examines sensitivity of estimation results to alternative probit estimators in each model. Alternative estimators with their underlying assumptions for the country specific heterogeneity are discussed in section V.B. As explained in section VI.A, final specifications are estimated by a correlated RE estimator in model I and by a pooled probit estimator with cluster robust standard errors in model II. Tables A4 and A5 compare the results for alternative estimators for final specifications of model I and model II respectively. The first column reports results for the linear probability model (LPM) with cluster robust standard errors. LPM often gives good estimates of average partial effects (APE), i.e., partial effects of a specific covariate on the response probability averaged across the distribution of

covariates. Overall, the ratio of APEs is a good indicator of the relative impact of covariates on the probability of Fund financing. Sign and significance of covariates are quite similar across different estimation methods. Magnitudes of coefficients and APEs across different estimators are also broadly comparable in each model. This finding may suggest that correlation between unobserved heterogeneity and covariates is not strong. In the first model, FDI to GDP and total debt to exports become insignificant while their country specific averages are significant in the correlated RE model.

C. Is There a Persistence Caused by Previous Fund Programs?

Many studies have shown that the existence of a current program with the Fund depends significantly and positively upon whether there have been previous programs.[42] In order to test for the persistence of Fund financing over the years, this study looks into whether having some form of previous Fund engagement increases the likelihood of signing a new program. Therefore, a dummy variable is constructed, taking the value of one if the member had a Fund program, including SAF/ESAF/PRGF or EFF arrangements as well as those for shocks financing, in the previous five years versus zero otherwise. For both models, results for other explanatory variables remain broadly the same (Table A6). The dummy variable for Fund engagement is significantly negative for all shocks and insignificant for exogenous shocks. In other words, previous Fund engagement seems to significantly reduce the likelihood of financing in response to policy shocks.

This result is in contrast with earlier research invariably reporting significant positive association between previous Fund arrangements and current participation in mixed samples. Moreover, research on prolonged use of Fund resources has reached a consensus that repeated participation is associated with lower per capita income, and that it is significantly correlated with previous participation for PRGF-eligible countries. On the other hand, the negative correlation reported in this study is comparable to the Conway (2005) result for MICs: the duration of IMF program "spells" is reduced significantly by previous participation in Fund programs. MICs typically request Fund financing for their immediate balance of payments needs. It is noteworthy that when counterpart arrangements are examined for LICs, a similar result comes out. Most LICs have had successive programs under SAF/ESAF/PRGF to address their protracted balance of payments needs, naturally requiring a gradual structural adjustment. When these arrangements are included in the sample, it is not surprising to find persistence of Fund engagement with LICs in previous research. Therefore, distinguishing arrangements dealing with immediate balance of payments needs from those dealing with protracted needs might explain this result.

[42] Conway (1994), Knight and Santaella (1997), Przeworski and Vreeland (2000), Hutchison and Noy (2003), Bird, Hussain and Joyce (2004) and Conway (2005).

D. Natural Disasters: Why Omitted from the Financing Events?

Emergency Natural Disaster Assistance (ENDA) and PRGF augmentations addressing natural disasters undoubtedly meet the affected member's immediate balance of payments needs, however, in both models they are deliberately excluded from the financing events. As previously indicated, the different nature of shocks leading to these financing events justifies this decision. Specifically, it is quite unlikely that one could predict these events ahead of time, conditional on a similar set of explanatory variables as in policy and other exogenous shocks. This point is illustrated by estimating demand for ENDA and PRGF augmentations addressing natural disasters starting from a general model similar to those for policy and other exogenous shocks. The only addition to the explanatory variables is the share of the population affected by natural disasters in the current and the previous year. Table 4 presents the final specification.

Table 4. Financing for Natural Disasters: Estimation Results

Share of affected population	0.041	**	(2.47)
Reserve coverage in months of imports 1/	-0.412	**	(-2.31)
Real GDP growth 1/	-0.144	*	(-1.79)
Constant	-1.233		(-1.39)
Pseudo R2	0.24		
LR test : $\beta_2 = \ldots = \beta_k = 0$ χ^2(Prob)	28(0.00)		
LR test : $\rho = 0$ χ^2(Prob)	15(0.00)		
# of observations	312		
Financing events	17		
Normal episodes	295		
Sample probability	0.05		
# of countries	50		

Source: Author's calculations.

Note: Significant at 10 percent:*; 5 percent:**; and 1 percent:***, t statistics in paranthesis. 1/ These variables are lagged one period for Fund financing events in order to avoid endogeneity problem.

Financing for natural disasters, only 17 in the sample, is rare vis-à-vis 295 normal episodes. The sample probability is quite low at 0.05. The final specification is distinctly different from the models for policy and other exogenous shocks. The share of the population affected, reserve coverage and GDP growth are significant. All other variables become insignificant. Of course one should note that the extremely limited number of positive outcomes provides little information for distinguishing financing versus normal episodes and results should be taken cautiously. Nevertheless, this empirical evidence supports conceptual arguments against including natural disasters in the event set.

E. The Effect of Export Concentration: Non-oil Commodities

Estimation results show that an adverse common shock to real non-oil commodity prices significantly reduces the likelihood of Fund financing for exogenous shocks (model II). In

the model including all shocks, this variable turns out to be insignificant but has a somewhat sizable effect. This section explores whether this result holds if the model is estimated on a sub-sample of LICs with a high concentration of exports in non-oil commodities. In other words, a potential source of heterogeneity within LICs as a group is examined more closely. Table 5 presents estimation results for sub-samples of LICs with ratios of non-oil commodity exports to total merchandise exports above a specific threshold. These ratios are calculated as the sample average for 1980–2004 by country.

Table 5. The Effect of Export Concentration: Non-oil Commodities

		Share of Non-oil Commodities in Exports			
	Benchmark 1/	>45%	>50%	>60%	>70%
Current account balance to GDP 2/	-0.076 ***	-0.084 ***	-0.085 ***	-0.081 ***	-0.077 ***
Reserve coverage in months of imports (CFA) 2/	-0.478 ***	-0.518 ***	-0.473 ***	-0.495 ***	-0.505 ***
Reserve coverage in months of imports (non-CFA) 2/	-0.769 ***	-0.957 ***	-0.948 ***	-0.956 ***	-0.963 ***
Macroeconomic stability indicator 2/	0.068 ***	0.086 **	0.079 ***	0.068 **	0.071 **
Real GDP growth 2/	-0.113 ***	-0.101 ***	-0.094 ***	-0.094 ***	-0.099 ***
Change in terms of trade in previous year	-0.022 ***	-0.025 ***	-0.021 ***	-0.023 **	-0.016
Change in real oil prices in previous two years	0.009 ***	0.008 **	0.009 ***	0.007 *	0.006
Real world trade, cyclical component	-0.099 **	-0.161 ***	-0.146 **	-0.125 **	-0.124 **
Change in real non-oil commodity prices	-0.020	-0.029 *	-0.027	-0.037 **	-0.033 *
Real growth of goods exports in previous year	-0.009 *	-0.011 *	-0.010 *	-0.010 *	-0.009
Paris Club dummy	0.774 ***	0.933 ***	0.876 ***	0.795 ***	0.685 **
Constant	0.551	0.287	0.311	0.427	0.565
Country Specific Averages					
Total debt service to exports	0.044 ***	0.057 ***	0.057 ***	0.060 ***	0.063 ***
FDI to GDP	-0.105 *	-0.116 *	-0.104 *	-0.163	-0.181
# of observations	532	405	381	347	321
Sample probability	0.44	0.48	0.49	0.48	0.46
# of countries	55	42	40	36	33

Source: Author's calculations.

Note: 1/ Fund financing for policy and/or exogenous shocks excluding natural disasters. Estimated by a correlated random effects probit model. Significant at 10 percent:*; 5 percent:**; and 1 percent:***. 2/ These variables are lagged one period for Fund financing events in order to avoid endogeneity problem.

One quick observation is that for countries with less than 45 percent of their exports in non-oil commodities, the sample probability of Fund financing drops to about 0.31 versus 0.48 for those above that threshold. Nevertheless, the benchmark specification holds up remarkably well through these significant step-wise reductions in the sample. Results are qualitatively similar and sizes of coefficients are broadly comparable. After a certain point, small sample problems appear to kick in. It's important to note that the estimated coefficients for the change in real non-oil commodity prices are much higher and become significant in reduced samples. Similarly, the estimated coefficients of the cyclical movements in real world trade are considerably higher. These findings are intuitive.

These results suggest that LICs are not a homogenous group in terms of their export concentration. Working with sub-groups of LICs with high concentration in non-oil

commodities improves the specification for common shocks. For other variables, the benchmark model remains resilient.

F. Fund Financing to CFA versus Non-CFA Countries

Earlier results indicate that reserve coverage has a significantly larger effect on demand for Fund financing for non-CFA countries vis-à-vis CFA countries. A natural question is whether CFA countries, as members of a currency union, need Fund financing less than non-CFA countries, owing to their reserve pooling arrangement backed by the French Treasury.

Table 6. Model I: The Fund Financing to Non-CFA Countries

	Benchmark 1/		CFA Dummy		Non-CFA Countries	
Current account balance to GDP 2/	-0.076	***	-0.075	***	-0.074	***
Reserve coverage in months of imports (non-CFA) 2/	-0.769	***	-0.797	***	-0.774	***
Macroeconomic stability indicator 2/	0.068	***	0.062	***	0.053	***
Real GDP growth 2/	-0.113	***	-0.114	***	-0.114	***
Change in terms of trade in previous year	-0.022	***	-0.021	***	-0.020	**
Change in real oil prices in previous two years	0.009	***	0.008	***	0.009	***
Real world trade, cyclical component	-0.099	**	-0.096	**	-0.057	
Change in real non-oil commodity prices	-0.020		-0.021	*	-0.027	*
Real growth of goods exports in previous year	-0.009	*	-0.009	*	-0.007	
Paris Club dummy	0.774	***	0.801	***	0.769	***
CFA Dummy			-0.506			
Constant	0.551		0.666		0.569	
Country Specific Averages						
Total debt service to exports	0.044	***	0.045	***	0.048	***
FDI to GDP	-0.105	*	-0.104	*	-0.108	**
# of observations	532		532		412	
Sample probability	0.44		0.44		0.42	
# of countries	55		55		45	

Source: Author's calculations.

Note: 1/ Fund financing for policy and/or exogenous shocks excluding natural disasters. Estimated by a correlated random effects probit model. Significant at 10 percent:*; 5 percent:**; and 1 percent:***. 2/ These variables are lagged one period for Fund financing events in order to avoid endogeneity problem.

Table 6 presents the benchmark specification compared to two alternatives looking specifically into the effect of the CFA membership. The second column presents results when a CFA dummy is added to the benchmark specification. The dummy is negative but insignificant.[43] Estimates for other coefficients are not affected, while the change in real non-oil commodity prices becomes borderline significant. The third column re-estimates the benchmark specification only for non-CFA countries. Overall, results are qualitatively similar and coefficient estimates are broadly comparable, therefore, the benchmark

[43] Standard error of the estimated coefficient for the CFA dummy is 0.46 corresponding to a t-statistic of -1.1.

specification remains valid. The estimated coefficient for change in real non-oil commodity prices becomes higher and significant at 10 percent level. However, the estimated coefficient for the cyclical movements in real world trade is lower and becomes insignificant.

VIII. Concluding Remarks

This study aims at identifying economic factors affecting LIC demand for Fund financing in response to policy and exogenous shocks. Previously, no study has looked into determinants of this specific sub-set of Fund arrangements. This paper fills the gap in the empirical literature and also provides a tool for identifying LICs that might need Fund financing. A further contribution of this study is that it extensively examines effects of global conditions on demand for Fund financing in response to various common exogenous shocks to LICs.

Steinwand and Stone (2008) emphasize that the plethora of contradictory results from variety of models explaining participation in IMF programs indicates that existing models are far from definitive. Previous studies on participation in IMF arrangements have little consensus on which variables really matter. Bird (2007) suggests that heterogeneity of circumstances leading to Fund financing could be an explanation: certain things are important in some cases but not in others. As such, their significance effectively cancels out in large sample studies using mixed samples of MICs and LICs, and also capital account and current account crisis. Only Bird and Rowlands (2009) explore determinants of participation in LICs, albeit without much success in improving the model specification. This study makes two important contributions to the existing literature that would improve the model specification. First, it examines a more homogenous subset of Fund financing events: Fund financing to address immediate balance of payments needs of LICs in response to shocks. A subset of this group is studied as well by differentiating arrangements explicitly addressing exogenous shocks. Moreover, potential sources of heterogeneity within LICs as a group and robustness of benchmark results are explored in sub-samples of LICs with high export concentration in non-oil commodities. Second, this study uses observable "supply constraints" that would preclude a member's access to Fund financing in identification of normal episodes to distinguish effects of economic factors on demand.

Examining a more homogenous group of financing events and accounting for observable supply constraints significantly improve the model specification compared to earlier studies. Both within the sample and out-of-sample predictive power is good; and the benchmark specification holds up remarkably well through a comprehensive set of robustness checks. First, a wider range of economic variables are found to be significant determinants of approval of Fund arrangements with LICs. Reserve coverage, current account balance to GDP, real GDP growth, macroeconomic stability indicator and terms of trade shocks are very significant in both models. Second, global economic conditions, including the change in real oil and non-oil commodity prices, and the cyclical component of world trade have significant effects on the demand for Fund financing. Therefore, an adverse global environment may tip

the balance for weakly positioned countries, thus increasing the demand for Fund financing. Estimating the model for all shocks with sub-samples of LICs differentiated by export concentration in non-oil commodities improves the specification for common shocks. Third, the country specific averages of external debt burden indicators— total debt service to exports and net present value of debt to exports, as well as resource inflows— FDI to GDP and net resource transfers to GDP, are found to be significantly associated with unobserved country heterogeneity in the model for all shocks. These findings suggest that divergences in debt burden and resource inflows among countries in the sample may partly explain why some countries are more frequent users of Fund resources. No significant country heterogeneity is detected for approval of arrangements addressing exogenous shocks. Finally, significance of income per capita disappears in the model for all shocks, although it was invariably found significant in previous studies using mixed samples of LICs and MICs. This finding suggests that its significance might be driven by using a mixed sample. However, there is some weak evidence that it may be significant for Fund financing addressing exogenous shocks, possibly indicating that LICs may not be a homogenous group in terms of their vulnerability to exogenous shocks.

It is noteworthy that no persistence of Fund programs could be detected. On the contrary, previous Fund engagement is found to reduce the likelihood of financing in response to policy shocks. This finding contrasts with the consensus reached by the research on prolonged use of Fund resources that repeated participation increases significantly by prior participation for PRGF-eligible countries. Conway (2005) finds that the duration of IMF program "spells" is reduced significantly by prior participation in Fund programs for MICs—users of Fund resources typically for immediate balance of payments needs. When counterpart arrangements are examined for LICs in this study, an analogous result comes out. Most LICs have had successive programs under SAF/ESAF/PRGF to address their protracted balance of payments needs, obviously requiring a gradual structural adjustment. Therefore, distinguishing arrangements dealing with immediate balance of payments needs from those dealing with protracted needs might explain this finding.

Overall, results suggest that recent adverse common shocks impacting LICs and weakening their external positions are likely to significantly increase the number of LICs requiring Fund financing. Owing to the nonlinear nature of the relationship between the determinants of participation in Fund arrangements and the probability of requesting Fund financing, a severe enough cumulative deterioration in their balance of payments positions owing to these common shocks could increase the probability of Fund financing more than proportionally. The future demand for Fund resources is likely to be characterized by cycles in response to global conditions with the intensity mainly to be determined by the severity and persistence of exogenous shocks.

This framework could be used in conjunction with the IMF's semi-annual World Economic Outlook (WEO) forecasts to help identify LICs that have a greater likelihood of requiring

Fund financing. In addition to WEO based forecasts, further work could usefully incorporate a complementary "stress testing" approach to this framework to systematically gauge the potential demand for Fund financing by LICs in response to a range of adverse common and country specific exogenous shocks as well as a deterioration in their policy frameworks.

Appendices

I. Data

Variable	Source
Present value of debt	World Bank internal study by Dikhanov (2004)
Paris Club debt rescheduling and cancellations	Paris Club webpage
Principal arrears on long-term debt outstanding	WB Global Development Finance (GDF) dataset
Interest arrears long-term debt outstanding	WB GDF
Long-term public and publicly guaranteed debt	WB GDF
Total debt service paid	WB GDF
Overdue obligations to the IMF principal	IMF Fund Accounts database
Overdue obligations to the IMF interest and charges	IMF Fund Accounts database
Gross domestic product, current and constant prices	IMF World Economic Outlook (WEO) database
Current account balance	IMF WEO
GDP per capita (constant 2000 US$)	WB World Development Indicators (WDI) and IMF WEO
Non-oil commodity exports	WB WDI
Population	WB WDI
Exchange rate, national currency per US$	IMF WEO
Exports of goods and services	IMF WEO
Export of goods (volume)	IMF WEO
Imports of goods and services	IMF WEO
Value of oil imports	IMF WEO
General government balance	IMF WEO
CPI Inflation	IMF WEO
Terms of trade, goods	IMF WEO
Gross international reserves at year end	IMF WEO
Black market premium	Reinhart and Rogoff (2004) dataset
FDI	IMF WEO and WB GDF
Portfolio investment net	WB GDF and IMF WEO
Net transfers on debt	WB GDF
Short-term debt outstanding	WB GDF
Profit remittances on FDI	WB GDF
Grants, excluding technical cooperation	WB GDF
Real effective exchange rate	IMF Information Notice System database
Real Oil prices (ASPS)	Oil prices deflated by US CPI (WEO)
Real non-oil commodity prices	Non-oil commodity prices prices deflated by US CPI (WEO)
World trade (index number 2000=100)	IMF WEO
World GDP (index number 2000=100)	IMF WEO
Real US interest rate	IMF WEO
SBA, CFF, PRGF/SAF/ESAF arrangements, ENDA, EPCA, SMP	IMF databases: Fund Accounts, International Financial Statistics (IFS) and the Fund Arrangements database of the IMF Finance Department
Program interruptions	Ivanova et. al. (2005) dataset, Mecagni (1999), various country reports and IMF MONA database
Elections	WB the Database on Political Institutions (DPI)
Population affected by natural disasters	Centre for Research on the Epidemiology of Disasters database
Dummy variable for oil exporting LICs	IMF WEO

Table A1. Country List: Estimation Sample

1	Albania	29	Lao PDR
2	Armenia	30	Madagascar
3	Azerbaijan	31	Malawi
4	Bangladesh	32	Mali
5	Benin	33	Mauritania
6	Bolivia	34	Moldova
7	Burkina Faso	35	Mongolia
8	Burundi	36	Mozambique
9	Cambodia	37	Nepal
10	Cameroon	38	Nicaragua
11	Central African Republic	39	Niger
12	Chad	40	Nigeria
13	Comoros	41	Pakistan
14	Republic of Congo	42	Papua New Guinea
15	Côte d'Ivoire	43	Rwanda
16	Democratic Republic of Congo	44	Senegal
17	Ethiopia	45	Sierra Leone
18	The Gambia	46	Sri Lanka
19	Georgia	47	Sudan
20	Ghana	48	Tajikistan
21	Guinea	49	Tanzania
22	Guinea Bissau	50	Togo
23	Guyana	51	Uganda
24	Haiti	52	Uzbekistan
25	Honduras	53	Vietnam
26	India	54	Zambia
27	Kenya	55	Zimbabwe
28	Kyrgyz Republic		

Table A2. Model I Policy and Exogenous Shocks: Estimation Results for Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)
Current account balance to GDP 1/	-0.072 *** (-3.71)	-0.067 *** (-4.02)	-0.077 *** (-3.85)	-0.072 *** (-3.78)	-0.068 *** (-3.49)	-0.070 *** (-3.47)
Reserve coverage in months of imports (CFA) 1/	-0.517 *** (-4.43)	-0.493 *** (-6.05)	-0.508 *** (-4.38)	-0.499 *** (-4.37)	-0.489 *** (-4.31)	-0.521 *** (-4.38)
Reserve coverage in months of imports (non-CFA) 1/	-0.806 *** (-7.47)	-0.777 *** (-8.55)	-0.810 *** (-7.54)	-0.766 *** (-7.54)	-0.764 *** (-7.13)	-0.803 *** (-7.11)
Macroeconomic stability indicator 1/	0.069 *** (2.69)	0.076 *** (3.01)	0.069 *** (2.74)	0.069 *** (2.82)		
Inflation 1/					0.005 * (1.71)	
Depreciation 1/						0.016 *** (2.73)
Government balance to GDP 1/					-0.050 (-1.54)	-0.045 (-1.29)
Change in reserve coverage 1/					-0.042 (-0.35)	0.003 (0.02)
Real growth of goods exports in previous year	-0.009 * (-1.77)	-0.008 * (-1.66)	-0.010 * (-1.89)	-0.009 * (-1.77)	-0.008 (-1.64)	-0.009 * (-1.66)
Real GDP growth 1/	-0.112 *** (-3.95)	-0.109 *** (-3.93)	-0.112 *** (-3.97)	-0.106 *** (-3.86)	-0.105 *** (-3.84)	-0.116 *** (-4.06)
Net resource transfers to GDP 1/	-0.009 (-0.61)					
Net resource transfers on debt to GDP 1/			-0.006 (-0.29)			
Official Grants to GDP 1/			-0.029 (-0.92)	-0.032 (-1.01)	-0.026 (-0.85)	-0.057 * (-1.66)
FDI to GDP 1/			-0.005 (-0.1)	0.002 (0.05)	0.002 (0.05)	0.006 (0.14)
Total debt service to exports 1/				0.005 (0.4)	0.010 (0.86)	0.011 (0.94)
Change in terms of trade in previous year	-0.022 *** (-2.71)	-0.022 *** (-2.76)	-0.022 *** (-2.77)	-0.020 *** (-2.62)	-0.020 ** (-2.54)	-0.021 *** (-2.62)
Change in real oil prices in previous two years	0.009 ** (2.35)	0.009 *** (2.83)	0.008 ** (2.17)	0.010 *** (2.61)	0.010 *** (2.72)	0.010 ** (2.54)
Real world trade, cyclical component	-0.086 ** (-2.18)	-0.089 ** (-2.28)	-0.090 ** (-2.24)	-0.097 ** (-2.47)	-0.097 ** (-2.48)	-0.100 ** (-2.48)
Change in real non-oil commodity prices	-0.016 (-1.04)	-0.020 (-1.59)	-0.017 (-1.12)	-0.017 (-1.15)	-0.017 (-1.12)	-0.017 (-1.11)
US real interest rates	0.030 (0.46)		0.017 (0.25)	0.031 (0.48)	0.051 (0.81)	0.001 (0.02)
Real GDP per capita 3/	-0.264 (-0.31)		-0.455 (-0.52)	-0.129 (-0.16)	-0.305 (-0.37)	-0.525 (-0.6)
Net present value of debt to exports 1/	-0.096 (-1.29)		-0.108 (-1.4)			
Paris Club dummy	0.880 *** (3.5)	0.798 *** (3.24)	0.881 *** (3.46)	0.812 *** (3.32)	0.810 *** (3.31)	0.840 *** (3.3)
Election dummy	0.165 (0.74)		0.194 (0.87)	0.166 (0.76)	0.162 (0.73)	0.179 (0.79)
Constant	1.468 (0.79)	1.491 *** (4.02)	-0.096 (-0.05)	-0.030 (-0.02)	-0.246 (-0.14)	-0.057 (-0.03)
Country Specific Averages						
Current account balance to GDP	0.012 (0.34)		0.003 (0.07)	-0.001 (-0.04)	-0.005 (-0.12)	0.009 (0.2)
Reserve coverage in months of imports (CFA)	0.104 (0.65)		0.055 (0.35)	0.085 (0.56)	0.092 (0.59)	0.159 (0.96)
Reserve coverage in months of imports (non-CFA)	0.102 (0.84)		0.090 (0.74)	0.091 (0.8)	0.126 (1.06)	0.147 (1.18)
Macroeconomic stability indicator	0.018 (0.34)		0.026 (0.48)	-0.005 (-0.09)		
Real GDP growth	-0.119 (-1.29)	-0.083 (-1.59)	-0.117 (-1.33)	-0.127 (-1.5)	-0.121 (-1.43)	-0.122 (-1.37)
FDI to GDP			-0.169 * (-1.86)	-0.128 (-1.43)	-0.126 (-1.26)	-0.111 (-1.09)
Total debt service to exports				0.037 * (1.84)	0.031 (1.47)	0.027 (1.26)
Net resource transfers to GDP	-0.053 (-1.64)	-0.060 ** (-2.15)				
Net present value of debt to exports	0.311 ** (2.43)	0.241 ** (2.46)	0.203 (1.5)			
Inflation					0.002 (0.22)	
Depreciation						-0.002 (-0.26)
Government balance to GDP					0.046 (0.6)	0.010 (0.12)
Change in reserve coverage					-0.552 (-1.12)	-0.569 (-1.09)
Pseudo R2	0.57	0.56	0.58	0.58	0.57	0.59
LR test : $\beta_2 = \ldots = \beta_k = 0$ χ^2(Prob)	375(0.00)	370(0.00)	378(0.00)	381(0.00)	379(0.00)	389(0.00)
LR test : $\rho = 0$ χ^2(Prob)	11(0.00)	15(0.00)	11(0.00)	6(0.00)	5(0.00)	6(0.00)
# of observations	532	532	532	532	532	532
Sample probability	0.44	0.44	0.44	0.44	0.44	0.44
# of countries	55	55	55	55	55	55

Source: Author's calculations.

Note: Dependent variable is the Fund financing for policy shocks and/or exogenous shocks excluding natural disasters. Estimated by a correlated random effects probit model. Significant at 10 percent:*; 5 percent:**; and 1 percent:***, t statistics in paranthesis. Third lag of real GDP per capita is used to avoid capturing recent shocks to real GDP growth. 1/ These variables are lagged one period for Fund financing events in order to avoid endogeneity problem.

Table A3. Model II Exogenous Shocks: Estimation Results for Alternative Specifications

	(1)		(2)		(3)		(4)		(5)		(6)	
Current account balance to GDP 1/	-0.082 ***	(-4.81)	-0.074 ***	(-4.82)	-0.089 ***	(-4.23)	-0.087 ***	(-3.98)	-0.090 ***	(-3.87)	-0.078 ***	(-3.34)
Reserve coverage in months of imports (CFA) 1/	-0.511 ***	(-3.98)	-0.505 ***	(-4.2)	-0.506 ***	(-3.98)	-0.457 ***	(-4.11)	-0.471 ***	(-3.87)	-0.448 ***	(-3.76)
Reserve coverage in months of imports (non-CFA) 1/	-0.581 ***	(-6.55)	-0.589 ***	(-6.32)	-0.594 ***	(-6.42)	-0.579 ***	(-6.28)	-0.560 ***	(-6.71)	-0.584 ***	(-6.55)
Macroeconomic stability indicator 1/	0.086 **	(2.48)	0.086 **	(2.38)	0.082 **	(2.45)	0.073 **	(2.19)				
Inflation 1/									0.004	(1)		
Depreciation 1/											0.018 ***	(2.83)
Government deficit to GDP 1/									-0.029	(-0.97)	-0.060 **	(-2.09)
Change in reserve coverage 1/									-0.255 *	(-1.9)	-0.173	(-1.29)
Real growth of goods exports in previous year	-0.006	(-1.43)			-0.006	(-1.45)	-0.005	(-1.21)	-0.003	(-0.75)	-0.003	(-0.57)
Real GDP growth 1/	-0.156 ***	(-5.75)	-0.163 ***	(-5.5)	-0.159 ***	(-5.8)	-0.160 ***	(-5.8)	-0.172 ***	(-6.05)	-0.179 ***	(-6.27)
Net resource transfers to GDP 1/	-0.010	(-0.79)										
Net resource transfers on debt to GDP 1/					0.013	(0.7)						
Official Grants to GDP 1/					-0.036	(-1.36)	-0.035	(-1.24)	-0.029	(-1)	-0.049	(-1.63)
FDI to GDP 1/					-0.037	(-1.38)	-0.023	(-0.88)	-0.022	(-0.8)	-0.006	(-0.22)
Total debt service to exports 1/							0.025 ***	(2.85)	0.027 ***	(3.22)	0.028 ***	(2.95)
Change in terms of trade in previous year	-0.030 ***	(-3.56)	-0.029 ***	(-3.81)	-0.031 ***	(-3.7)	-0.029 ***	(-4.04)	-0.025 ***	(-3.45)	-0.028 ***	(-3.82)
Change in real oil prices in previous two years	0.011 ***	(3.16)	0.009 ***	(3.06)	0.011 ***	(3.01)	0.013 ***	(3.93)	0.013 ***	(4.22)	0.014 ***	(4.28)
Real world trade, cyclical component	-0.103 ***	(-2.77)	-0.090 ***	(-2.66)	-0.109 ***	(-2.95)	-0.113 ***	(-2.95)	-0.122 ***	(-3.06)	-0.122 ***	(-2.88)
Change in real non-oil commodity prices	-0.020	(-1.18)	-0.029 **	(-2.05)	-0.024	(-1.44)	-0.026	(-1.49)	-0.021	(-1.26)	-0.020	(-1.13)
US real interest rates	0.076	(1.05)			0.035	(0.52)	0.042	(0.63)	0.071	(1.19)	0.029	(0.49)
Real GDP per capita	-0.365	(-1.62)	-0.300	(-1.56)	-0.308	(-1.4)	-0.310	(-1.39)	-0.394 *	(-1.78)	-0.434 **	(-2.08)
Net present value of debt to exports 1/	-0.011	(-0.24)			-0.003	(-0.07)						
Paris Club dummy	0.589 *	(1.7)	0.597 **	(1.97)	0.605 *	(1.69)	0.545	(1.54)	0.582	(1.64)	0.558	(1.54)
Election dummy	-0.306	(-1.44)			-0.321	(-1.43)	-0.306	(-1.38)	-0.304	(-1.3)	-0.379	(-1.53)
Constant	2.420 *	(1.66)	2.075 *	(1.74)	2.294	(1.6)	1.788	(1.23)	2.188	(1.58)	2.415 *	(1.81)
Pseudo R2	0.61		0.60		0.61		0.63		0.62		0.65	
Wald test 2/	182(0.00)		176(0.00)		187(0.00)		195(0.00)		227(0.00)		243(0.00)	
# of observations	388		388		388		388		388		388	
Sample probability	0.23		0.23		0.23		0.23		0.23		0.23	
# of countries	53		53		53		53		53		53	

Source: Author's calculations.

Note: Dependent variable is the Fund financing for exogenous shocks excluding natural disasters. Estimated by a pooled probit model with robuts standard errors. Significant at 10 percent:*; 5 percent:**; and 1 percent:***, t statistics in paranthesis. Third lag of real GDP per capita is used to avoid capturing recent shocks to real GDP growth. 1/ These variables are lagged one period for Fund financing events in order to avoid endogeneity problem. 2/ Probabilities are in pharantesis.

Table A4. Model I Policy and Exogenous Shocks: Comparison of Alternative Estimators and Average Partial Effects

	Linear Model	Pooled Probit		Correlated Pooled Probit		Random Effects (RE) Probit		Correlated RE Probit	
	APE		APE		APE		APE		APE
Current account balance to GDP 1/	-0.009 ***	-0.070 ***	-0.011	-0.069 ***	-0.011	-0.077 ***	-0.011	-0.076 ***	-0.010
Reserve coverage in months of imports (CFA) 1/	-0.111 ***	-0.424 ***	-0.067	-0.421 ***	-0.065	-0.484 ***	-0.070	-0.478 ***	-0.066
Reserve coverage in months of imports (non-CFA) 1/	-0.101 ***	-0.638 ***	-0.101	-0.657 ***	-0.101	-0.751 ***	-0.108	-0.769 ***	-0.106
Macroeconomic stability indicator 1/	0.007 **	0.063 ***	0.010	0.062 ***	0.010	0.071 ***	0.010	0.068 ***	0.009
Real GDP growth 1/	-0.014 ***	-0.107 ***	-0.017	-0.109 ***	-0.017	-0.110 ***	-0.016	-0.113 ***	-0.016
FDI to GDP 1/	-0.004	-0.052 *	-0.008			-0.052 *	-0.008		
Total debt service to exports 1/	0.002	0.026 ***	0.004			0.019 **	0.003		
Change in terms of trade in previous year	-0.002 **	-0.016 ***	-0.002	-0.018 ***	-0.003	-0.021 ***	-0.003	-0.022 ***	-0.003
Change in real oil prices in previous two years	0.002 ***	0.010 ***	0.002	0.007 ***	0.001	0.011 ***	0.002	0.009 ***	0.001
Real world trade, cyclical component	-0.017 ***	-0.093 **	-0.015	-0.096 ***	-0.015	-0.099 **	-0.014	-0.099 **	-0.014
Change in real non-oil commodity prices	-0.001	-0.016 *	-0.002	-0.018 *	-0.003	-0.017	-0.002	-0.020	-0.003
Real growth of goods exports in previous year	-0.001 *	-0.006 **	-0.001	-0.007 **	-0.001	-0.008	-0.001	-0.009 *	-0.001
Paris Club dummy	0.126 ***	0.673 ***	0.112	0.640 ***	0.103	0.813 ***	0.123	0.774 ***	0.111
Constant	0.643 ***	0.548 *		0.364		0.845 **		0.551	
Country Specific Averages									
FDI to GDP				-0.087 *	-0.013			-0.105 *	-0.014
Total debt service to exports				0.041 ***	0.006			0.044 ***	0.006
R2/ Pseudo R2	0.51	0.58		0.61		0.56		0.58	
# of observations	532	532		532		532		532	
# of countries	55	55		55		55		55	

Source: Author's calculations.

Note: Dependent variable is Fund financing for policy and/or exogenous shocks excluding natural disasters. Linear probability model is estimated by the fixed effects regression with robust standard errors. Both pooled probit and correlated pooled probit are estimated with robust standard errors. Significant at 10 percent:*; 5 percent:**; and 1 percent:***, t statistics in paranthesis. Third lag of real GDP per capita is used to avoid capturing recent shocks to real GDP growth. APE stands for average partial effects. 1/ These variables are lagged one period for Fund financing events in order to avoid endogeneity problem.

Table A5. Model II Exogenous Shocks: Comparison of Alternative Estimators and Average Partial Effects

	Linear Model	Pooled Probit		Correlated Pooled Probit		Random Effects (RE) Probit		Correlated RE Probit	
	APE		APE		APE		APE		APE
Current account balance to GDP 1/	-0.011 ***	-0.073 ***	-0.009	-0.094 ***	-0.011	-0.078 ***	-0.009	-0.096 ***	-0.011
Reserve coverage in months of imports (CFA) 1/	-0.061 **	-0.466 ***	-0.055	-0.377 **	-0.043	-0.486 ***	-0.055	-0.377 **	-0.042
Reserve coverage in months of imports (non-CFA) 1/	-0.065 ***	-0.589 ***	-0.070	-0.609 ***	-0.070	-0.620 ***	-0.071	-0.632 ***	-0.070
Macroeconomic stability indicator 1/	0.009 **	0.072 **	0.009	0.059	0.007	0.075 ***	0.009	0.062 **	0.007
Real GDP growth 1/	-0.024 ***	-0.167 ***	-0.020	-0.179 ***	-0.020	-0.174 ***	-0.020	-0.185 ***	-0.020
Total debt service to exports 1/	0.004 *	0.027 ***	0.003	0.013	0.002	0.027 ***	0.003	0.014	0.001
Change in terms of trade in previous year	-0.003 ***	-0.028 ***	-0.003	-0.030 ***	-0.003	-0.030 ***	-0.003	-0.032 ***	-0.004
Change in real oil prices in previous two years	0.002 ***	0.012 ***	0.001	0.012 ***	0.001	0.012 ***	0.001	0.012 ***	0.001
Real world trade, cyclical component	-0.010 **	-0.099 ***	-0.012	-0.109 ***	-0.012	-0.102 **	-0.012	-0.110 **	-0.012
Change in real non-oil commodity prices	-0.001	-0.031 **	-0.004	-0.024	-0.003	-0.032 **	-0.004	-0.025	-0.003
Paris Club dummy	0.075 *	0.525 *	0.067	0.494	0.060	0.551 *	0.067	0.503 *	0.059
Constant	-0.148	1.482		1.659		1.686		1.771	
Country Specific Averages									
Current account balance to GDP				0.046 *	0.005			0.044	0.005
Reserve coverage in months of imports (CFA)				-0.072	-0.008			-0.096	-0.011
Reserve coverage in months of imports (non-CFA)				-0.025	-0.003			-0.036	-0.004
Macroeconomic stability indicator				0.041	0.005			0.044	0.005
Real GDP growth				0.043	0.005			0.049	0.005
Total debt service to exports				0.031 *	0.004			0.032	0.004
R2/ Pseudo R2	0.45	0.62		0.63		0.59		0.61	
LR test : $\rho = 0$ χ^2(Prob)						0.7(0.21)		0.3(0.28)	
# of observations	388	388		388		388		388	
Sample probability	0.23	0.23		0.23		0.23		0.23	
# of countries	53	53		53		53		53	

Source: Author's calculations.

Note: Dependent variable is Fund financing for policy and/or exogenous shocks excluding natural disasters. Linear probability model is estimated by the fixed effects regression with robust standard errors. Both pooled probit and correlated pooled probit are estimated with robust standard errors. Significant at 10 percent:*; 5 percent:**; and 1 percent:***, t statistics in paranthesis. Third lag of real GDP per capita is used to avoid capturing recent shocks to real GDP growth. APE stands for average partial effects. 1/ These variables are lagged one period for Fund financing events in order to avoid endogeneity problem.

Table A6. Effect of Previous Fund Engagement

	Model I				Model II			
	(1)		(2)		(3)		(4)	
Current account balance to GDP 1/	-0.081 ***	(-4.41)	-0.079 ***	(-4.58)	-0.090 ***	(-3.93)	-0.085 ***	(-4.12)
Reserve coverage in months of imports (CFA) 1/	-0.467 ***	(-5.61)	-0.478 ***	(-5.88)	-0.458 ***	(-4.16)	-0.476 ***	(-4.22)
Reserve coverage in months of imports (non-CFA) 1/	-0.782 ***	(-8.12)	-0.802 ***	(-8.48)	-0.591 ***	(-6.5)	-0.608 ***	(-6.37)
Macroeconomic stability indicator 1/	0.069 ***	(2.62)	0.070 ***	(2.6)	0.074 **	(2.23)	0.071 **	(2.2)
Real growth of goods exports in previous year	-0.008	(-1.55)			-0.005	(-1.03)		
Real GDP growth 1/	-0.114 ***	(-4.12)	-0.114 ***	(-4.12)	-0.155 ***	(-6.14)	-0.160 ***	(-6.06)
Official Grants to GDP 1/	-0.026	(-1.04)			-0.038	(-1.3)		
FDI to GDP 1/	-0.003	(-0.07)			-0.025	(-0.93)	-0.031	(-1.15)
Total debt service to exports 1/	0.009	(0.76)			0.026 ***	(2.84)	0.026 ***	(2.79)
Change in terms of trade in previous year	-0.020 **	(-2.45)	-0.021 ***	(-2.63)	-0.028 ***	(-3.55)	-0.027 ***	(-3.7)
Change in real oil prices in previous two years	0.010 ***	(2.68)	0.008 ***	(2.68)	0.013 ***	(3.93)	0.012 ***	(4)
Real world trade, cyclical component	-0.107 ***	(-2.61)	-0.104 ***	(-2.58)	-0.119 ***	(-3.18)	-0.111 ***	(-3.07)
Change in real non-oil commodity prices	-0.016	(-1.03)			-0.026	(-1.47)	-0.030 **	(-2)
US real interest rates	0.032	(0.49)			0.041	(0.62)		
Real GDP per capita	-0.117	(-0.42)			-0.302	(-1.32)	-0.235	(-1.09)
Fund engagement dummy	-1.059 **	(-2.3)	-1.009 **	(-2.19)	-0.593	(-0.91)	-0.594	(-0.95)
Paris Club dummy	0.842 ***	(3.35)	0.787 ***	(3.21)	0.575	(1.57)	0.510	(1.54)
Election dummy	0.159	(0.7)			-0.287	(-1.33)		
Constant	1.984	(1.17)	1.325 **	(2.25)	2.267	(1.41)	1.827	(1.3)
Country Specific Averages								
FDI to GDP	-0.081	(-0.95)	-0.091	(-1.44)				
Total debt service to exports	0.045 **	(2.04)	0.053 ***	(2.86)				
Pseudo R2	0.58		0.58		0.63		0.62	
LR test : $\beta_2 = \ldots = \beta_k = 0$ χ^2(Prob)	383(0.00)		381(0.00)		236(0.00) 2/		241(0.00) 2/	
LR test : $\rho = 0$ χ^2(Prob)	13(0.0)		14(0.0)					
# of observations	532		532		388		388	
Sample probability	0.44		0.44		0.23		0.23	
# of countries	55		55		53		53	

Source: Author's calculations.

Note: Model 1: Fund financing for policy and/or exogenous shocks excluding natural disasters. Estimated by a correlated random effects probit model. Model 2: Fund financing for exogenous shocks excluding natural disasters. Estimated by a pooled probit model with robust standard errors. Significant at 10 percent:*; 5 percent:**; and 1 percent:***, t statistics in paranthesis. Third lag of real GDP per capita is used to avoid capturing recent shocks to real GDP growth. 1/ These variables are lagged one period for Fund financing events in order to avoid endogeneity problem. 2/ Wald test for model significance is reported.

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