



# The Effect of IMF Programmes on Economic Growth in Low Income Countries: An Empirical Analysis

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**ABSTRACT** *Using an LIC-specific participation model, we adopt a propensity score matching (PSM) methodology to compare economic growth performance in countries with and without IMF programmes over the period 1989–2008. Concessional programmes are found to have had a generally positive effect on economic growth for up to two years after agreements were signed. The effects are contingent on other factors including overall initial economic conditions, recent prior growth performance, aid dependency, debt, IMF resources, recent history of IMF engagement and time period. We examine the implications of the results as the IMF considers how best to support the Sustainable Development Goals.*

## 1. Introduction

To replace the expiring Millennium Development Goals (MDGs), the United Nations adopted the Sustainable Development Goals (SDGs) in September, 2015. There are 17 SDGs, with a focus on five key elements: people, planet, peace, prosperity and partnership. The International Monetary Fund (IMF or the Fund) has claimed that it is ‘well positioned to support its members’ pursuit of the SDGs that focus on sustainable growth across economic, social and environmental dimensions’, p.4 (IMF, 2015).

Prior to the adoption of the SDGs, the Third United Nations Conference on Financing for Development, held in Ethiopia in July 2015 approved a financing strategy – the Addis Ababa Agenda – in order to meet the SDGs. The strategy called upon the IMF, consistent with its mandate, to ‘provide adequate levels of financial support to developing countries pursuing sustainable development to assist them in managing any associated pressures on the national balance of payments’, p.34 (United Nations, 2015).

The IMF’s mandate, as presented in its Articles of Agreement, directs the Fund to help bring about balance of payments adjustment without the need for countries to use measures that are ‘destructive of national prosperity’. Economic growth is a key component in achieving prosperity and sustained development.

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Over the years the Fund has sought to fulfil its mandate through a range of lending facilities to which low-income countries can turn when they have a balance of payments need. The institutional details of these facilities have been modified fairly often, with the latest changes being made in 2010. The Fund abandoned its Poverty Reduction and Growth Facility (PRGF), which itself had earlier replaced the Enhanced Structural Adjustment Facility (ESAF), and established a Poverty Reduction and Growth Trust with three concessional lending windows: the Extended Credit Facility (ECF), the Standby Credit Facility (SCF) and the Rapid Credit Facility (RCF). The details of these facilities may be found elsewhere (IMF, 2016). However, in spite of the institutional changes, the basic objective remains much as it was before with the IMF aiming to bring about macroeconomic stabilisation and structural reform as necessary in order to facilitate economic growth against the background of a sustainable balance of payments.

In its Medium Term Financial Strategy (MTFS) published in 2005, the IMF had presented one of its main challenges as that of its relationship with low-income countries (LICs), and recent institutional reform has been directed towards better meeting this challenge. In assessing contemporary reform it is important to have an accurate and empirically supported view of what has happened in the past. Many of the IMF's critics have argued that far from assisting economic development by encouraging economic growth, IMF programmes have had a negative effect.

In this paper we examine the effect that IMF programmes have had on economic growth in low-income countries. The main methodological problem in answering this question is in isolating the effect of programmes from the other factors that may affect both economic growth as well as the likelihood of signing an IMF agreement. It is possible that countries that participate in IMF programmes are systematically different from those that do not. We attempt to deal with the selection problem by using a propensity score matching approach. This method allows us to compare the growth performance of users and non-users of IMF resources that have broadly equivalent probabilities of participating in an IMF programme.

Since the effect on economic growth may be contingent on other factors, we also investigate whether the impact of IMF programmes varies with overall economic conditions, specific economic characteristics (such as past growth, aid flows and debt) the amount of resources accompanying concessional arrangements, and the degree to which programmes are completed. We also examine whether the impact has varied over different time periods.

The paper is organised in the following way. [Section 2](#) of the paper provides a brief and informal conceptual analysis of the ways in which IMF programmes might be expected to influence economic growth. This analytical discussion serves as a guide for the subsequent empirical investigation. [Section 3](#) offers a critical summary of the existing literature that examines the effect of IMF programmes on economic growth, and enables us to identify the contribution that we are endeavouring to make. [Section 4](#) presents a description of the data, the participation equation and the propensity score matching methodology that we use, as well as the empirical results that we find. [Section 5](#) discusses the results, offers an interpretation of them and examines their implications. Finally, [Section 6](#) provides a few concluding remarks. These place our findings in the context of the existing literature and the contemporary debate about the Fund's role in developing countries in the context of the SDGs and the recent institutional reforms.

## **2. An informal analytical framework**

Despite the controversy surrounding IMF involvement in them, in most years concessional programmes in LICs make up the majority of the Fund's activity in terms of number of agreements. The associated resources, while often dwarfed by the much larger non-concessional programmes in middle-income (and more recently in wealthier) countries, have typically represented a much more stable component of the IMF's financial portfolio.

It is difficult to establish a formal model that precisely captures the nexus of routes via which the Fund might affect economic growth in LICs. Consequently, we present and make use of a more

modest theoretical approach that views economic growth as being potentially constrained by the amount of external finance available and by the quality of economic policies pursued. IMF programmes may help to relax a financing constraint by providing resources either directly as part of the arrangement, or indirectly by catalysing additional capital inflows. For many LICs that have only limited access to private international capital markets, the potential catalytic effect of IMF programmes on foreign aid will be particularly important.

However, in some circumstances an IMF programme may transmit a negative signal about the size and nature of a country's economic difficulties. In this case the catalytic effect on other capital flows, especially private ones, may be adverse. This effect could then mean that, because of reduced capital inflows, IMF programmes have a negative rather than a positive effect on economic growth.

As far as economic policy is concerned, IMF programmes should have a beneficial effect on economic growth where they improve policy design. Better policies should lead to better outcomes. Moreover, by helping to generate economic stability and by reducing vulnerability to shocks, for example through creating fiscal space and promoting reserve accumulation, there could be further beneficial growth effects associated with IMF programmes.

However, there are ambiguities here as well. Some critics of the Fund have maintained that the economic policies embedded in IMF programmes are inappropriate for developing countries and rely excessively on compressing domestic aggregate demand. Consequently the implementation of a Fund programme may have a negative effect on economic growth, especially in the short-run.<sup>1</sup> It is on the basis of such arguments that IMF programmes are sometimes viewed as anti-growth and anti-development. There have also been long-standing debates about the IMF's promotion of neo-liberal policies (the Washington consensus) and whether these are appropriate for low income countries (Williamson, 1990).

In circumstances where the policies favoured by the IMF focus on demand compression in the short-run and on enhancing aggregate supply in the long-run, the effects on economic growth will vary over time. Matters are made more complex where programmes involve currency devaluation since in principle such a policy has both expansionary and contractionary elements that again vary over time.<sup>2</sup>

Even where IMF programmes have a potentially beneficial impact because of the policy reform they incorporate, the potential will only be realised if the policies are implemented. In addition, their impact on growth may depend on the size of the initial economic difficulties encountered at the time of the programme, and on where the country is in terms of its regular pattern of expansion and contraction. When a country is currently in a cyclical trough there will tend to be more scope to increase output quite sharply in the short-term as spare capacity is absorbed. With continued expansion, however, the rate of economic growth may be expected to slow down since further growth will now rely on increasing supply capacity and productive potential. Movement through the cycle therefore further confounds the analysis of IMF effects.

In addition to allowing for the stage of the cycle, there may be non-linearities in the relationship between IMF programmes and economic growth depending on the initial conditions encountered at the time of the programme's inception. A non-linear relationship between IMF programmes and the catalysis of capital flows has been discovered in some studies, with the catalytic effect being strongest and most positive when the economic circumstances are only moderately poor rather than either reasonably good at one extreme, or very bad at the other (Bird & Rowlands, 2009c; Mody & Saravia, 2006). A similar pattern may exist for the relationship with economic growth.<sup>3</sup>

For countries where the underlying policies are already sound, there may be less scope for improvement as a consequence of IMF involvement. Negotiating an IMF programme may instead damage market confidence and thus may have a negative effect on growth. Similarly, for countries with very severe economic problems it may simply be beyond the ability of an IMF programme to turn things around in the short- to medium-term. If differences in the initial economic situation are themselves reflected in the type of IMF programme, then it may also follow that the effects of IMF programmes will vary according to whether they are primarily directed towards restoring stability in a country with sound fundamentals, or whether they are directed towards strengthening weak fundamentals.

With these considerations in mind, a contrast may be made between relatively short-term stand-by arrangements (SBAs) used in the majority of non-concessional IMF lending, and concessional lending to LICs under facilities supported by the PRG trust fund and their antecedents (the Structural Adjustment Facility, the ESAF and the PRGF). In the former case the emphasis is on creating stability, and the short-term effect on economic growth may be expected to be negative where conditionality compresses aggregate domestic demand. In the latter case there may be elements of macroeconomic mismanagement that lead to a programme and that need to be corrected, but there may also be structural deficiencies with weaknesses on the supply side of the economy. Longer-term concessional programmes with LICs are likely to incorporate structural conditionality designed to strengthen the fundamentals and increase economic efficiency.

The basic point that emerges is that it is difficult to formulate clear theoretical priors concerning the impact of IMF programmes on economic growth. While theory does allow us to identify the key factors that may influence programme growth effects, determining the magnitude of these potential influences is an empirical issue. The empirical analysis below is designed to estimate these effects and thus help to identify the potential implications of Fund activity for attainment of the SDGs.

### **3. The Effect of IMF programmes on economic growth: literature review**

There is a large literature that examines the macroeconomic effects of IMF programmes.<sup>4</sup>

A number of surveys exist (for example, Bird, 2007). Contributions to the literature vary in terms of the particular macroeconomic variables examined, the sample used and the methodology adopted; not surprisingly results also frequently differ. With regards to the impact on economic growth, the weight of evidence seems to suggest that the effects are more often negative. Key studies that report a negative effect include Bordo and Schwartz (2000), Przeworski and Vreeland (2000), Hardoy (2003), Hutchison (2003, 2004), Hutchison and Noy (2003), Vreeland (2003), IEO (2002), Barro and Lee (2005), Butkiewicz and Yanikkaya (2005), Dreher (2006), Eichengreen, Gupta, and Mody (2008), Marchesi and Sirtori (2011), and IMF (2012). Positive or mixed results are reported by Conway (1994), Dicks-Mireaux, Mecagni, and Schadler (2000), Evrensel (2002), Hutchison (2004), and Atoyán and Conway, (2006). Some of these studies find that while the short-run effects of IMF programmes on economic growth are negative, the long-run effects are positive. A useful detailed summary of all the main studies is presented in tabular form by Bal Gunduz et al. (2013).

A number of observations may be made about the existing literature. First, many of the studies do not distinguish between low- and middle-income countries, even though there is substantial reason to believe that the circumstances in which they refer to the Fund differ. LICs have a greater tendency to be prolonged users of IMF resources and undertake the majority of their borrowing under concessional lending windows. Bird, Hussain, and Joyce (2004) discover that the characteristics associated with prolonged engagement with the IMF are those often exhibited by LICs. Moreover, the factors associated with IMF programme participation differ between low-income and middle-income countries (Bird, Mylonas, & Rowlands, 2015; Bird & Rowlands, 2009b). We return to this issue in more detail later in the paper.

Second, some of the (especially earlier) studies often ignored or dealt only informally with the potential problem of selection bias. Even formal methods such as a Heckman two stage procedure or instrumental variables encounter the difficulty of identifying good exclusionary variables or instruments, that is variables that are correlated with participation in IMF programmes but not with economic outcomes such as growth. There is evidence from studies into the catalytic effect that results are sensitive to the technique used to deal with selection bias (Bird & Rowlands, 2002, 2009c). While there is no single ideal solution to this problem, propensity score matching (PSM) provides a useful and still relatively novel option.

Third, for the more recent studies that adopt a PSM approach, results depend on the accuracy of the underlying participation equation upon which the probability of IMF programmes is calculated. A participation equation derived from a data set that includes middle-income countries seems

inappropriate when applied to LICs. It also means that an equation used to explain short-term shock-related drawings may be inappropriate for explaining drawings under the PRGF and its predecessors and successors.

As far as LICs are concerned, there is a sub-set of the literature that is particularly relevant to our study. Some of these LIC-focused studies have concentrated more directly on the specific facilities under which programmes have been arranged; particularly the PRGF and its predecessor the ESAF (for example, Schadler, Rozwadowski, Tiwari, & Robinson, 1993; Bredenkamp & Schadler, 1999; Dicks-Mireaux et al., 2000; Ghosh et al., 2005; Hajro & Joyce, 2009; Botchwey, Collier, Gunning, & Hamada, 1998; Gupta, Plant, Dorsey, & Clements, 2002; and Bird & Mosley, 2006). Other studies, although not focusing narrowly on poor countries, carry implications for the impact of IMF programmes in them (for example Easterly, 2005; Hutchison, 2003; and Hutchison & Noy, 2003). Although relevant to the research we report in this paper, the findings of these earlier studies have been mixed. Dicks-Mireaux et al. (2000) find some evidence that IMF programmes in LICs have had positive macroeconomic effects, including that of benefitting economic growth, but their results fail conventional tests of statistical significance. Bird and Mosley (2006) find evidence that suggests that the PRGF and the ESAF may have helped recipient countries to increase their rate of economic growth, and also to redirect government expenditure in a pro-poor way and increase social capacity, but their results rely on a relatively small number of examples and their non-programme control group is only relatively informally established.

A recent study published by the IMF (Bal Gunduz et al., 2013) uses a PSM approach to address many of the problems that have beset earlier research into the effects of IMF programmes. It provides evidence to support the argument that long-running involvement by LICs with the IMF, as well as short-run engagement associated with shock-related drawings, have a beneficial effect on economic growth. Although this study represents an important step forward, the effects of standard IMF concessional programmes are not investigated. Moreover, it remains interesting to investigate the extent to which the growth effects change along with the specification of the participation model.

We attempt to add value to the existing literature by investigating in detail the effects of IMF programmes on economic growth in LICs in the period following the programme. We focus on concessional programmes although we briefly compare their effects with those of non-concessional ones. In each case we use a specifically designed participation equation to deal with the potential selection problem. We also examine the influence of other factors that theory suggests may be relevant in conditioning the effect of IMF programmes. Providing a thorough and nuanced understanding of programme effects on growth in low-income countries will be valuable in assessing the IMF's role in helping to attain the SDGs.

#### **4. The effect of IMF programmes on economic growth in LICs: new evidence**

##### *4.1. Data and the participation equation*

In order to use the propensity score matching approach to deal with the potential selection problem, we need to estimate a reasonably well-fitting equation to explain participation in both concessional and non-concessional IMF programmes. The general literature on participation is reviewed in Bird (2007), Steinwand and Stone (2008) and Bird et al. (2015), though relatively few studies focus on low-income countries (Bird & Rowlands, 2007; Bal Gunduz, 2009; and Moser & Sturm, 2011) despite the fact that, as discussed earlier, poor countries may be expected to turn to the Fund in circumstances that differ from those motivating middle-income or emerging economies.

For our initial PSM analysis of the growth effects of Fund programmes we focused on the best participation equations we could obtain using fairly standard measures of economic circumstances in the country as they existed in the year before the agreement. We explicitly eliminated certain classes of variables including political conditions (to improve the matching on economic conditions), subsequent debt rescheduling (to avoid potential endogeneity) and previous IMF history variables<sup>5</sup> (to avoid contaminating the effects associated with a specific programme). But we examine the growth effects

associated with some of these omitted variables, and we also examine the sensitivity of our results to using less constrained estimating models. In constructing these participation equations we started with a wide variety of variables as identified in the associated literature, and sequentially dropped those variables with insignificant coefficient estimates (probability score less than 0.1) to increase the sample, and to improve the convergence and balancing properties in the PSM analysis. We then took the resulting parsimonious model and re-tested the previously excluded variables to minimise the likelihood that the sequence of dropping the variables did not distort the results. The estimation procedure is a basic probit model with robust estimation; alternative estimations that took into account the panel nature of the data produced reasonably similar results.

The data cover programmes signed between 1989 and 2008, and include up to 66 low-income countries (depending on the estimating equation) that were eligible to draw under the Fund's concessional windows.<sup>6</sup> (Details of the data may be found in the Appendix) The dependent variable takes the value of 1 in a year when a country signs an IMF agreement and 0 otherwise; countries with an IMF programme in continuous operation (and thus extremely unlikely to sign a new agreement) are dropped from the sample to avoid building in false negative observations. We examine separately concessional agreements (ESAFs and PRGFs) and non-concessional agreements (SBAs and EFFs). The results are presented in Table 1.

**Table 1.** Probit models of IMF programme participation by LICs, 1989–2008

Explanatory Variables (lagged one year)	Concessional programmes	Non-Concessional programmes
Total debt service-to-GDP ratio	1.13*** (3.44)	0.321* (2.13)
Real GDP per capita		0.00000944* (1.96)
Past growth in nominal GDP		-0.000884*** (-3.95)
Investment-to-GDP ratio	-0.00305* (-2.13)	
Domestic bank credit-to-GDP ratio	-0.000772* (-2.08)	
Low reserves indicator		0.185*** (3.67)
Reserves-to-debt ratio	-0.282*** (-3.55)	
Presence of current account problems	0.0665*** (2.69)	
Fixed exchange rate	0.0678** (2.37)	
Share of sample country aid flows	0.00623* (2.12)	
Share of sample country exports	-15.3*** (-3.22)	4.56*** (3.64)
Share of sample country population	-	-1.47*** (-3.13)
World Agricultural Price index		.00284*** (3.83)
Sample size	765	700
Pseudo R <sup>2</sup>	0.130	0.189
Pr( $\beta_i = 0$ for all $i$ )	0.00	0.00

*Notes:* Reported values are the marginal effect of the variable on the probability of signing an IMF agreement. The z-statistics appear in parentheses, and \*\*\*, \*\*, \*, † identify coefficient estimates that are significant at the 1, 2.5, 5 and 10 per cent two tailed test levels of significance, respectively. Errors were estimated using robust estimation to correct for general heteroscedasticity.

Two observations are of relevance. First, the pseudo  $R^2$  for the two equations in Table 1 are 0.13 for concessional agreements and 0.19 for non-concessional ones. While these results are reasonably comparable to many other participation studies, even those with smaller samples, they are not as high as those for more specialised estimations for shock-related drawings such as in Bal Gunduz (2009). What is important to note is that we obtain these reasonably good measures of fit despite the restrictions imposed on the estimation, and specifically the removal of a variable measuring a country's recent involvement with the IMF (by far the most important determinant of subsequent participation in standard participation equations). In the sensitivity analysis, discussed below, we relax some of the model restrictions and obtain pseudo R-squared measures that exceed significantly many standard results. Part of the improvement in fit is also a consequence of removing middle-income countries from the sample, providing evidence that there are some important differences in country-Fund relations associated with income levels.

Second, a distinctly different set of variables is significant in the case of concessional programmes as compared with non-concessional ones, and it is therefore important to use the most appropriate model when testing the effects of IMF programmes. The only explanatory variables appearing in both the concessional and non-concessional equations are the debt service-to-GDP ratio (which is positively related to both concessional and non-concessional programme signing) and a country's relative share of exports in the sample (which is negatively associated with concessional programmes but positively linked to non-concessional ones). These results provide strong evidence for the proposition that participation equations need to be separated for different classes of IMF agreement.

#### 4.2. The propensity score matching methodology and results

We use a standard unweighted nearest-neighbour PSM procedure that identifies explicitly the selection equation to be used for identifying suitable pairs of programme and non-programme countries. The PSM procedure starts by identifying pairs of countries that have similar characteristics (as per the selection equation variables) and thus similar propensities to enter an IMF agreement, with one of the pair actually signing an agreement (the treatment) and the other not. Tests show that we can strongly reject the hypothesis that our participation equation is unbalanced, so that we can be reasonably assured that our pairs have fairly similar initial economic characteristics. Finally, the PSM procedure uses all the identified pairs and tests for any statistically significant differences in the outcome variable (growth). We focus on the growth performance over three periods; the year the agreement is signed, and each of the following two years. In principle, the two years after an agreement is signed may provide the best gauge of the short- to medium-term effects of a Fund programme, since the effects in the year in which the agreement is signed may be sensitive to exactly when in the year the programme began.<sup>7</sup> Finally, to avoid having new agreements contaminate the analysis of previous ones, we adjusted the sample for the evaluations of one and two years after the agreement by dropping observations when another IMF programme was signed.

Table 2 presents the main PSM results for IMF programmes. The results are clear; concessional IMF programmes are associated with improved growth performance in the immediate year of signing as

**Table 2.** Effect of IMF programmes on LIC growth

Equation	Concessional programmes			Non-Concessional programmes		
	Year signed	Year after	Two years after	Year signed	Year after	Two years after
Average Treatment Effect	1.09** (0.017)	1.32** (0.021)	1.72*** (0.00)	-0.75 (0.52)	-3.60† (0.082)	-0.73*** (0.00)
Sample size	754	603	498	689	511	307

Notes: \*\*\*, \*\*, \*, † identify coefficient estimates that are significant at the 1, 2.5, 5 and 10 per cent one tailed test levels of significance, respectively. The p-value is provided in parentheses.

well as in the subsequent two years, with the magnitude of the effect increasing over time and ranging from a low of around 1 per cent per annum in the year of signing to 1.7 per cent two years later. By contrast, non-concessional programmes are associated with no immediate statistically significant effect, and significant negative effects one and two years later.

### 4.3. Contingent circumstances

Using the broad theoretical discussion from Section 2 as a guide, we use the PSM methodology to examine different contingent circumstances that might influence the effect of concessional agreements on economic growth. These circumstances include: the severity of a country's overall initial conditions (as measured by the estimated propensity to sign an agreement); the initial growth performance of the country; aid flows; debt conditions; programme completion; the amount of IMF finance provided; country income level; and time period. For brevity we do not report all these tests, but instead focus on describing the general picture that emerges. However, we do present what we consider to be the most interesting results.<sup>8</sup> Full results are available from the authors on request. The picture that emerges is actually quite complex and nuanced.

**4.3.1. Initial conditions.** We first examine whether initial conditions, as measured by the estimated probability of participating in a programme, affected the impact of IMF programmes on economic growth. Some of the research on the catalytic effect suggests that IMF programmes encourage private lending to countries with moderate economic difficulties, but not in the extreme cases of either favourable or severe economic conditions (Bird & Rowlands, 2009c; Mody & Saravia, 2006). To test the possibility of such a non-linear effect we divided the sample into three subsamples in which the estimated probability of signing a Fund agreement was low, medium, or high. While these categories are arbitrary, we tried to select propensity ranges that provided reasonable sample sizes but still retained a degree of sample homogeneity. The PSM results (Table 3) suggest that the growth effect is linearly increasing with the severity of initial conditions. While there is no statistically significant effect for countries with a low signing propensity, those in the medium range exhibit a positive and statistically significant association with higher growth that ranges from 0.17 per cent in the year of signing and increases to over 2 per cent in the second year after signing. For countries in the highest signing propensity sub-sample, the effect is even stronger, ranging between 3.2 per cent and 3.5 per cent.

**4.3.2. Recent growth performance.** Next we divided the sample according to recent growth performance. The first set of results in Table 4 provides the results for low growth (average growth over the previous three years of less than 4%) versus high growth countries. There is strong and consistent evidence of IMF programmes having a positive effect of between 1.5 and 3 per cent on growth rates for countries with poorer prior growth performance; a result that is also true for countries where recent growth performance is below the country's trend rate (that is in a cyclical downturn). While it is

**Table 3.** Effect of concessional IMF programmes on LIC growth, by signing propensity

Equation	Low propensity (under .2)			Medium Propensity (.2 to .5)			High propensity (above 0.4)		
	Year signed	Year after	Two years after	Year signed	Year after	Two years after	Year signed	Year after	Two years after
Average Treatment Effect	0.47 (0.39)	0.60 (0.27)	0.61 (0.59)	0.17* (0.036)	1.95*** (0.009)	2.10** (0.02)	3.34** (0.015)	3.20*** (0.002)	3.53** (0.038)
Sample size	420	350	290	326	247	204	51	41	34

Notes: \*\*\*, \*\*, \*, † identify coefficient estimates that are significant at the 1, 2.5, 5 and 10 per cent one tailed test levels of significance, respectively. The p-value is provided in parentheses.



**Table 4.** Effect of concessional IMF programmes on LIC growth, by growth history and aid levels

Equation	Low growth countries			High growth countries		
	Year signed	Year after	Two years after	Year signed	Year after	Two years after
Average Treatment Effect	1.53** (0.011)	1.97** (0.011)	1.82*** (0.00)	-0.07 (0.92)	-0.26 (0.77)	1.49 (0.12)
Sample sizes	378	302	250	376	301	248
	Low aid dependent countries			High aid dependent countries		
Average Treatment Effect	1.09† (0.09)	1.11† (0.085)	1.56* (0.03)	-0.08 (0.93)	-0.35 (0.66)	0.65 (0.63)
Sample sizes	343	265	212	395	324	275
	Programmes with lower funding-to-GDP			Programmes with higher funding-to-GDP		
Average Treatment Effect	1.76*** (0.003)	1.53*** (0.01)	1.63*** (0.01)	-0.19 (0.78)	-0.25 (0.66)	1.78*** (0.00)
Sample sizes	666	516	412	696	550	448
	Current programme completed			Current programme not completed		
Average Treatment Effect	1.47 (0.126)	0.36 (0.49)	1.64*** (0.00)	0.96† (0.086)	0.05 (0.87)	0.67† (0.08)
Sample sizes	705	558	454	655	506	404
	Countries without recent agreements			Countries with recent agreements		
Average Treatment Effect	0.0007 (0.999)	0.99 (0.18)	-9.38 (0.70)	1.86*** (0.00)	1.75*** (0.007)	1.74*** (0.01)
Sample sizes	345	293	249	409	310	249
	Poorer low-income countries			Richer low-income countries		
Average Treatment Effect	1.54*** (0.01)	1.71** (0.021)	1.57*** (0.01)	1.11* (0.029)	1.24 (0.52)	2.30 (0.30)
Sample sizes	433	520	295	321	254	203
	Pre 2000 period			Post 1999 period		
Average Treatment Effect	1.28** (0.02)	0.90† (0.091)	2.01 (0.13)	-0.46 (0.62)	-0.59 (0.66)	0.58 (0.53)
Sample sizes	450	452	315	304	233	183

Notes: \*\*\*, \*\*, \*, † identify coefficient estimates that are significant at the 1, 2.5, 5 and 10 per cent one tailed test levels of significance, respectively. The p-value is provided in parentheses.

tempting to suggest that the effect is simply related to the country's natural recovery or regression to the mean, it should be remembered that the PSM method is identifying a positive growth effect for low-growth countries with an IMF agreement relative to similar low-growth countries without a programme. Further analysis shows that the relative effect is probably not a consequence of IMF programme countries experiencing a larger recovery effect. It turns out that amongst low-growth countries, those that ultimately sign an agreement have a higher growth rate than those that do not (1.27% on average versus 0.76%).

*4.3.3. Foreign aid.* We then examined whether the growth effect was conditional on the development assistance-to-GNI (aid dependence); an assessment that is complicated by the positive link between aid flows and Fund programmes (Bird & Rowlands, 2007, 2009a; Powell, 2003; Rowlands, 2000; Stubbs, Kentikelenis, & King, 2016). The results suggest that there is a weak positive effect on growth (in terms of both magnitude and statistical significance) for countries with lower initial aid dependence. In addition, low-aid countries with an IMF programme increase their aid flows faster than non-programme countries, suggesting that growth effects may be linked to catalysis. When we tested sub-samples identified by low and high past aid growth, the results indicated positive and often statistically significant growth effects in both cases, especially for the two-year growth effect of programmes in high aid-growth countries.

*4.3.4. Debt.* To analyse the effect of debt conditions we examined the debt-to-GNI ratio, the rate of debt accumulation, and the presence of future debt reschedulings. There was frequent but inconsistent evidence of positive and statistically significant growth effects across the various sub-samples. The strongest and most consistent effect of IMF programmes was to raise growth rates (often by more than 2%) in countries experiencing high rates of debt growth. Low-debt countries tended to respond better to IMF programmes initially, though there was also a significant improvement in the growth of high-debt countries two years after an agreement. The relationship between IMF programme growth effects was strongest for countries that did not reschedule, but the evidence is mixed and generally insignificant in statistical terms.

*4.3.5. Programme size, completion and past IMF involvement.* To determine whether concessional Fund programmes affect growth beyond their simple presence, we next examined whether programme size, current and past programme completion, and recent programme history exerted a conditioning influence on any growth effect. The analysis of programme size (measured as IMF programme funding as a proportion of GDP) provides fairly solid evidence that smaller programmes have a more positive effect on country growth than larger programmes over the entire time horizon of the analysis; countries with relatively larger programmes experience a positive effect only in the second year after an agreement is signed. Further analysis shows that countries with relatively large programme resources have higher signing propensities (and thus presumably worse initial conditions), with a 0.31 average signing probability for large programmes versus 0.24 for smaller ones. So part of the explanation of these results may simply be that programmes in countries with worse conditions attract more IMF resources but that it takes time for the programmes to exert a beneficial impact on economic growth.<sup>9</sup>

To test the effects of programme completion we first split the sample between those countries with a history of completing, or not completing, any recent IMF programmes.<sup>10</sup> Although we do not present the full results here we found that the positive growth effects of a new concessional arrangement are somewhat stronger and occur earlier when there are no past incompletions. They are also somewhat stronger in the second year when there were recent agreements that were not completed. In addition, and as shown in [Table 4](#), when the current agreements are themselves actually completed there is a stronger growth effect in the second year after signing compared to cases where the programme ultimately remains incomplete.

As also shown in [Table 4](#), a country's history of involvement with the IMF seems to condition programme growth effects. The positive growth effects are highly significant over the entire two year span after programme signing when a country has had agreements in operation in the previous three years. For low-income countries an enduring engagement with the Fund seems to provide more benefits in terms of growth.

*4.3.6. Income level.* We next divided our low-income sample into countries with relatively low- and relatively high-income, with the cut-off being \$2000 per capita according to the Penn World Tables. While the estimated growth effect of IMF programmes is fairly large in magnitude, the effects are consistently statistically significant only for the poorer group of low-income countries.

*4.3.7. Time period.* Finally, we examined different time periods. We split the sample into before and after 2000, the year in which the Fund began 'streamlining' programme conditionality. As the results at the bottom of [Table 4](#) indicate, it is only in the earlier (pre-2000) period that there is any evidence of significant growth effects for concessional programmes. For this time period, all of the estimates indicate that concessional programmes were associated with improved growth performance, effects that are very strong in statistical significance and magnitude one year after the agreement is signed. By contrast, in the post-2000 period the estimated effects are often negative, although these estimated effects are also consistently insignificant statistically. Further tests indicate that the initial signing propensities (presumably indicating the severity of initial conditions) were generally worse for the earlier period (an average signing propensity of 0.21 compared to 0.16 for the later period) while programme completion rates were fairly similar in both time periods. Therefore the finding of a

stronger growth effect prior to 2000 is consistent with our earlier finding that the growth effects of IMF programmes becomes stronger as initial conditions deteriorate. But it could also be that the movement away from structural conditionality in the form of performance criteria may have reduced the impact of IMF programmes on economic growth.

#### 4.4. Sensitivity analysis

The above PSM analysis used a reasonably well-performing participation equation that was restricted to exclude non-economic conditions, future reschedulings, and past IMF programme participation. These restrictions facilitate a better matching of countries with similar initial economic conditions, and help to avoid problems of simultaneity, endogeneity, and mis-specification of the IMF's effects. The cost, however, is that the resulting estimating equation performs less well in terms of explanatory power. Our main sensitivity test involves relaxing these restrictions to obtain better-performing participation equations.

We included in our equation numerous variables that have been found to have statistically significant coefficient estimates by other researchers, including political variables. We also experimented with different forms of most variables, such as scaling reserves to exports or imports rather than GDP. We selected the best performing variables and eliminated in a step-wise fashion those that did not meet a 0.1 threshold for statistical significance. After identifying two additional versions of our equation (one with past IMF agreements as a variable, one without) we then repeated our PSM analysis to determine if the effects described above remained evident.

The first conclusion is that by focusing on concessional programmes in low-income countries we are able to obtain quite high pseudo R-squared values. For the best, fully-unrestricted model, the pseudo R-squared of 0.26 is considerably higher than is typically found for general IMF programme arrangements in poorer countries. When we remove the variable measuring past-IMF programme engagement, which typically has the greatest explanatory power in participation equations, and include new current economic variables to try and compensate for this, the pseudo R-squared drops from 0.26 to only 0.22 for roughly similar sample sizes (756 versus 763). Excluding the future official rescheduling variable reduces the pseudo R-squared from 0.22 to 0.13, the largest drop that cannot be compensated for. Dropping the elections variables reduces the pseudo R-squared even further to 0.11. The addition of related variables such as the debt service-to-GDP ratio, and investment-to-GDP ratio, and an indicator of current account balance of payments problems raises the explanatory power, but only slightly (to a pseudo R-squared of 0.13). It should be noted that the coefficient estimates of the other economic and political variables identified in other studies do not retain their statistical significance in this estimating equation, and they are dropped from our analysis.

To test the sensitivity of our results we applied the PSM method to both the completely and partially unrestricted equations described above. Our general conclusions of a positive growth effect for concessional programmes is strongly supported using these two additional selection equations, with slightly lower magnitudes for the unrestricted model results, for which the year-of-signing effect was positive but statistically insignificant.

The analysis of sub-samples to determine conditional effects were generally qualitatively similar, but frequently somewhat weaker (in magnitude and statistical significance) than those reported above. The results from the less restricted equation support the conclusion that there are significant and positive growth effects for countries with higher estimated signing propensities, especially in the second year after agreements are signed. The conclusion that the association between Fund programmes and positive subsequent growth effects are strongest for low-growth countries also remains robust.

Though somewhat less robust, the sensitivity analysis remains largely supportive of the idea that IMF programmes seem to work better in countries with lower aid-to-GNI ratios, though the results are less clear for ODA growth. However, the connection between the debt variables and any growth effect from IMF programmes is less clear. While the previous results are generally supported, the evidence of a nuanced contingent effect is less compelling. Caution is also necessary when linking the growth effect to IMF programme completion or programme size, although again the evidence from the unrestricted models is generally consistent with that reported above. In particular the conclusion that

the positive effects of Fund programmes on growth are strongest when there is a history of recent agreements remains strongly supported by the new estimations.

Finally, the conclusions regarding the contingent effects found when splitting the sample between richer and poorer LICs, and between the pre- and post-2000 periods, remain largely substantiated by the sensitivity analysis.

Overall we find that the key conclusion that emerges from our initial analysis, namely that concessional IMF programmes have a significant positive effect on economic growth, is strong and robust, although some caution is required in interpreting the detailed intermediating effect of debt, programme completion and programme size.

## 5. Discussion, interpretation and implications of the results

Although there are nuances in the findings reported in the previous section, we generate some results that are reasonably robust. These allow us to reach a number of fairly firm conclusions about the IMF's relationship with LICs and the effect of IMF programmes on economic growth.

*First*, low-income countries participate in IMF programmes in circumstances that differ from those found in middle-income and emerging economies. Similarly, the circumstances in which they participate in concessional programmes differ from those in which they use non-concessional ones. These findings are important not only from the viewpoint of designing programmes to meet the needs of LICs, but also when it comes to evaluating the effects of programmes and dealing with selection bias. An inappropriate participation model will reduce the confidence that can be attached to results concerning the effects of programmes, and this point needs to be kept in mind when assessing the results reported across studies. Our results reinforce those of some other studies. But unlike some of these studies, our estimations pass tests of statistical significance (Dicks-Mireaux et al., 2000) and address the problem of potential selection bias (Bird & Mosley, 2006). They also relate to regular concessional IMF programmes and not just those associated with shock-related lending (Bal Gunduz et al., 2013).

*Second*, propensity score matching analysis shows that concessional programmes have a robust, statistically significant and positive effect on LIC growth over the three year horizon analysed in this paper, which contrasts with the (often statistically significant) negative effects associated with non-concessional programmes.

*Third*, the effect of IMF programmes on economic growth in LICs depends on the severity of the economic conditions surrounding the initial referral to the Fund. There is reasonably strong evidence of a positive effect that is at its strongest and most significant for countries with a high estimated probability of signing a programme, and therefore initially exhibiting relatively weak economic performance.

*Fourth*, the generally positive effect of concessional IMF programmes on economic growth is more pronounced for countries that have poorer prior growth performance, rising debt levels, and lower levels of pre-existing aid dependence. The effects of these contingent factors are generally quite nuanced and sometimes sensitive to the participation equation that is used.

*Fifth*, programmes accompanied by a relatively low level of IMF financing are consistently associated with positive growth effects. The effects of more generously resourced concessional programmes on LIC growth are less consistent and more sensitive to the participation equation used. This initially counter-intuitive finding could result from the heavier reliance on adjustment that is implied by less financing. It may also reflect the possibility that programmes involving relatively larger amounts of IMF resources tend to occur in countries that have, on average, more severe initial economic conditions. If so, it is unlikely that reduced IMF funding would have a generally favourable impact on the growth effects of programmes.

*Sixth*, the implementation of IMF conditionality seems to matter. Our results provide some evidence that completed programmes that follow periods of unsuccessful IMF programme completion have stronger growth effects. The positive and statistically significant growth effects are also more robustly associated with countries that have had recent prior agreements, and thus more likely to be engaged in

a sustained period of adjustment. This result is consistent with one of the results reported by Bal Gunduz et al. (2013). It implies that an important part of the positive effect occurs through the modality of sustained policy reform under the auspices of the IMF. It also implies that the policies embodied in concessional IMF programmes do not entail excessive compression of domestic aggregate demand.

*Seventh*, the positive effects on LIC growth are much more apparent for the poorer LIC countries. The positive and statistically significant effects are between 1.2 and 2.4 per cent, occur for the current and two subsequent years of a programme, and are generally quite robust to the selection equation used.

*Eighth*, the positive effect of concessional programmes on economic growth were greater in the pre-2000 period than in the post-2000 one. In principle this result could be because the reforms to IMF conditionality introduced under the umbrella of the streamlining initiative served to reduce the impact of IMF programmes on economic growth. However, the global economic environment in the first part of the 2000s, and up until the crisis towards the end of the decade, was relatively benign for LICs. Fewer of them therefore had reason to turn to the IMF for assistance and, for those that did, the value added of programmes in terms of increasing the rate of economic growth might have diminished. It was during the early 2000s period that the world made the most progress towards reaching the MDGs, due in large part to economic growth in key countries such as China and India. With less favourable conditions in the post-2008 period, there may be a renewed opportunity for LICs to use the IMF's concessional programmes to advantageous effect.

*Finally*, our results are relevant in the context of both the 2010 IMF reforms mentioned in the Introduction and the setting of the Sustainable Development Goals established in 2015 as well as the related Addis Ababa Agenda (AAA). Within the constraints of its existing mandate, and through its programmes, we show that the Fund can exert a significantly beneficial effect on economic growth in LICs. This result implies that the IMF has the capability to assist poor countries in seeking to achieve the SDGs. This beneficial effect can occur not only directly by raising sustainable rates of economic growth but also indirectly by helping to achieve the SDGs that are themselves connected to economic growth. The effect can be particularly pronounced in those LICs with relatively severe economic problems and with an inferior growth record. These are likely to be the countries that exhibited relatively little success in achieving the Millennium Development Goals. They are also the countries that are more likely to encounter problems in sustaining economic development.

While, up to a point, the IMF may help in alleviating the external financing constraints that LICs encounter, the Fund's assistance may work best by having a positive catalytic effect on foreign aid. A partnership between the IMF and aid donors that seeks to exploit institutional comparative advantage seems likely to be more efficient in the pursuit of the SDGs than one that sees the IMF as a leading source of finance and aid donors as the designers of economic reform. Increasing the IMF's lending capacity to small LICs may be helpful in some circumstances, (particularly where they are exposed to shocks) but it may not necessarily result in a stronger effect on economic growth. The Fund's influence over economic reform, and in particular reform aimed at securing appropriate structural change, remains important. The partnerships that are stressed in seeking to achieve the SDGs therefore involve not only the IMF's relationship with aid donors, but also with the governments of client LICs. The problem here is that by reducing the importance attached to its preferred structural reforms as incorporated in conditionality, the Fund may make its relationship with governments less conflictual but may also risk sacrificing some of the success that has been exhibited in improving growth performance in LICs.

While we find that completion matters, it is fundamentally the implementation of appropriate economic reform that is important. Thus, the completion rate of IMF programmes may be raised by 'softening' conditionality but this will not necessarily bring with it improved growth performance if the programmes that are more fully completed are themselves less appropriate for achieving sustainable economic growth. Of course an associated caveat is that once growth enhancing structural economic reform has been adopted, it may no longer be necessary to include structural conditionality as a key component of Fund agreements. In these circumstances the Fund's role may be in helping to maintain macroeconomic stability and avoiding slippage in structural reform.

## 6. Concluding remarks

The IMF's Articles of Agreement state that economic adjustment should be undertaken in ways that are not destructive of national prosperity. However, a 'popular' view is that the IMF prioritises macroeconomic stability and the balance of payments over economic growth, and, along with others, the Meltzer Commission (2000) argued that the Fund should withdraw from lending to LICs largely because it was seen as being ineffective.

With the launch of its medium-term strategy in 2005 the Fund has paid a great deal of attention to its relationship with poor countries. It introduced a package of reforms in 2010 to modify the facilities under which it lends to LICs and it increased the quantity of resources that it can provide. Given the contemporary debates about the best ways in which the Fund can assist LICs under the umbrella of the SDGs it is important to have an accurate appreciation of the effect that IMF programmes have had on economic growth.

A relatively large number of published empirical studies have suggested that in general the growth effects of IMF programmes are negative, at least in the short-run. But for various reasons these findings may be insecure in the context of LICs. Many of the studies cover all programmes taken together and not just programmes in low-income countries. These studies also vary widely in terms of how effectively they deal with potential selection bias. Theory implies that the effects of IMF programmes on economic growth will be multi-faceted and nuanced. Moreover, programmes that focus on creating macroeconomic stability by managing aggregate demand and are organised under the Fund's non-concessional lending facilities may be expected to have rather different consequences for economic growth than those that seek to strengthen the supply side.

In this paper we have attempted to deal with some of these limitations by focusing narrowly on concessional programmes in low-income countries, and by considering the various contingent factors that may in principle influence the connection between IMF programmes and economic growth. We have used a propensity score matching approach to address the potential problem of selection bias and have based this on a participation model that is specifically designed to capture the circumstances in which LICs turn to the IMF to sign programmes.

Our findings are inconsistent with the claim that concessional IMF programmes in LICs are based on 'austerity' and on compressing aggregate demand, although we also find that there are important differences between concessional and non-concessional programmes. Taking contingent factors into account, we discover that concessional IMF programmes in LICs are generally associated with a subsequent significant increase in the rate of economic growth; a conclusion that holds up when tested for robustness. The enduring economic growth that is necessary to achieve the SDGs may be encouraged by IMF involvement, particularly where countries are relatively poor, the initial economic conditions are severe, the record on prior growth is weak and there is scope to encourage an increase in foreign aid.

However, our results also carry with them some cautionary implications. The growth effects after the 2000 reforms that were intended to streamline conditionality are weaker, and may provide some guidance about what aspects of conditionality appear to be the most useful. The agreement details (conditions and resources), the degree of programme implementation, and the history of engagement with the Fund also seem to influence the growth effect that is observed. Consequently our findings that IMF involvement in LICs under the auspices of concessional ESAF and PRGF programmes had beneficial growth effects may raise questions about some aspects of the reforms introduced in 2010. By modifying the status of structural conditions, and including them as 'benchmarks' rather than 'performance criteria' the reforms may appear to de-emphasise the importance of economic reforms aimed at achieving structural adjustment. The historical evidence on concessional programme growth enhancement can provide some lessons on how the IMF may most effectively assist poorer countries in their pursuit of the SDGs.

An important issue raised by our results relates to the mechanisms through which the positive effects on growth materialise. Reforms designed to improve the Fund's contribution to achieving the SDGs need to be based on a better understanding of these mechanisms.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

## Notes

1. An early critical analysis of the role of the IMF in poor countries may be found in Helleiner (1983). Subsequent reports by the Council on Foreign Relations (1999) and the Overseas Development Council (2000) argued that the Fund should withdraw from much of its lending in poor countries and leave the role to the World Bank and aid donors. Bird (2004) provides an account of the IMF's policies towards economic growth and poverty reduction and links this to recent research into the causes of economic growth in poor countries.
2. The effect depends on the relationship between economic growth and the balance of payments. A negative relationship could occur if economic growth is sacrificed by emphasising reductions in aggregate demand as a means of reducing imports. However, if the balance of payments strategy is based on expenditure switching devices such as devaluation rather than on expenditure reduction, then the negative growth effect may be ameliorated. For a measured assessment of the IMF's approach to fiscal policy, see IEO (2003). In the aftermath of the global economic and financial crisis at the end of the 2000s the Fund's approach to fiscal policy depended on the amount of fiscal space that countries were perceived to have.
3. Indeed, this relationship may be a derivative of the one associated with the catalytic effect. Where countries are in the middle of the range of economic circumstances, an IMF programme that encourages further capital inflows may relieve financing constraints and therefore foster economic growth. Enhancing this effect, programmes in these circumstances may nudge policy in an appropriate direction and breed confidence.
4. In addition to the studies that examine the macroeconomic effects of IMF programmes, there are also studies that investigate more directly their effects on poverty and income inequality (Bird, 2004; Bird & Mosley, 2006; Garuda, 2000; Hajro & Joyce, 2009; IEO, 2004; Oberdabemig, 2013; Vreeland, 2003).
5. One referee usefully suggested that using previous IMF agreements as a variable in the participation equation could bias the assessment of programme growth effects, hence the adjustment. To compensate we tested growth effects to see if they are contingent on past programme activity, and the results are presented below.
6. We end the sample period in 2008 to avoid complicating the analysis with the repercussions of the global financial crisis.
7. The analysis of the year of signing is more problematic, as the growth differences might reflect the worsening of conditions that contribute to the need for the programme, or it might reflect any immediate improvement in growth associated with an agreement. We re-ran the estimations focusing on agreements signed in the first six months of a year compared to those signed later in the year; there were no systematic differences in our results.
8. Complete results are available on request from the authors.
9. It may also be the case that less well-funded programmes have to place more emphasis on adjustment, though this interpretation would be contrary to the dominant view of the IMF adjustment process as being contractionary. This reputation may be less applicable to the longer-term concessional programmes. In addition, countries that have programmes with lower funding-to-GDP have, on average, economies that are more than three times larger than their better-funded counterparts, and export sectors that are 50 per cent larger. So it could be that the growth effect somehow differs by country size; further investigation failed to identify any such contingent effect. We tentatively conclude that the effect of programme funding reflects economic conditions, and that countries in worse conditions are relatively under-funded.
10. The measure of programme completion we use is that the total disbursement under the programme is at least 80 per cent of the resources available. This is an approximate measure of completion and one that also assumes that the final disposition of the programme resources is a reasonable proxy for implementation over the lifespan of the agreement. There are various other measures of implementation that have been used in the literature. These are reviewed in Arpac, Bird, and Mandilaras (2008). One measure that has often been favoured is irreversible programme interruption. Arpac et al. (2008) find that this measure is closely correlated with the non-completion measure that we use here.

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## Appendix

### *Main variables used in the participation equations in Table 1*

*Dependent variables.* Signing of an IMF programme: A binary indicator that takes on the value of 1 for years in which a country signs an IMF programme, and zero otherwise. The concessional programme indicator includes ESAF and PRGF programmes, while the non-concessional programme indicator includes SBA and EFF programmes. (IMF 1975-2012).

*Independent Variables.* Total debt service-to-GDP ratio (0.038; 0.047): A country's total long term-debt service payments as a share of GDP (World Bank, 2012).

Real GDP per capita (2214; 1470): A country's real per capita GDP in constant US Dollars using a chain rule adjustment (Heston, Summers & Aten, 2009).

Past growth in nominal GDP (21.72; 38.12): The percentage change in a country's GDP over the past three years expressed as a percentage of the initial level (World Bank, 2012).

Investment-to-GDP ratio (16.6; 14.1): The investment share of real GDP per capita (Heston, Summers & Aten, 2009).

Domestic bank credit-to-GDP ratio (40.1; 86.7): Domestic credit provided by the banking sector as per centage of GDP (World Bank, 2012).

Low reserves indicator (0.043; 0.203): A binary indicator that takes the value of 1 if the total non-gold foreign reserves drops by more than 50 percent in a given year, and zero otherwise (World Bank, 2012).

Reserves-to-debt ratio (0.255; 0.410): The ratio of non-gold foreign reserves to total debt outstanding and disbursed (World Bank, 2012).

Presence of current account problems (0.358; 0.480): A binary indicator that takes the value of 1 if the current account deficit is larger than 5 percent of GDP, and zero otherwise (World Bank, 2012).

Fixed exchange rate (0.226; 0.418): A binary indicator that takes the value of 1 if the exchange rate is coded as being fixed in the Reinhart and Rogoff Exchange Rate regime classification data set (category 1 in the coarse code), and zero otherwise (Ilzetzki, Reinhart and Rogoff, 2010).

Share of sample country aid flows (3.77; 15.3): The total bilateral aid flows received by a country as a percentage of total bilateral aid flows received by low income countries in the sample (World Bank, 2012).

Share of sample country exports (0.005; 0.013): The total exports by a country as a percentage of total exports from low income countries in the sample (World Bank, 2012).

Share of sample country population (0.009; 0.034): The total population of a country as a percentage of the total population of all low income countries in the sample (World Bank, 2012).

World Agricultural Price index (102; 9.04): The world price index for commodity agricultural raw materials, 2005 = 100 (International Monetary Fund, 2013).