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The effects of IMF programs on poverty, income inequality and social expenditure in low income countries: an empirical analysis

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ABSTRACT

This paper examines the effect of IMF programs on poverty, income inequality and government expenditure on education and health. It distinguishes between non-concessional and concessional programs and examines the effect of contingent factors; program completion, IMF resources, the size of the initial economic problems and aid dependency. Our findings suggest that, in general, IMF programs have not significantly increased poverty and income inequality; in some instances they are associated with reduced poverty and income inequality. Moreover, we find little evidence that IMF programs lead to severe cuts in social expenditure.

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Policy Highlights

- Using a propensity score matching methodology to deal with selection bias we estimate the impact of IMF programs on various measures of poverty, income inequality and social expenditure.
- Unlike many other studies, we find that in general IMF programs have not significantly increased poverty and income inequality.
- We also find little evidence that IMF programs lead to severe cuts in social expenditure.

1. Introduction

Critics of the International Monetary Fund (IMF, or the Fund) have often accused it of pushing member states to pursue economic liberalization and reduce government spending.¹ These policies are also often seen as being associated with reduced social spending and increasing levels of poverty and income inequality. Partly in response to these criticisms, the Fund has introduced and modified a series of lending facilities intended to be particularly appropriate to the needs of low income countries (LICs) and to help them

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 Supplemental data for this article can be accessed [here](#).

strengthen their external balances while simultaneously reducing poverty. The objective as stated by the Fund is to “help low-income developing countries achieve and maintain a stable and sustainable macroeconomic position consistent with strong and durable poverty reduction and growth” (IMF Annual Report 2017, 52). Are the critics correct? Or has the IMF become a useful ally in the pursuit of the Sustainable Development Goal (SDGs) of eradicating extreme poverty by 2030?

The inter-relationship between IMF programs, poverty and income inequality is complex. Not only is it a matter of identifying the determinants of poverty and income inequality but also of understanding the channels through which IMF programs influence these determinants. Analyzing the relationship is made more difficult by the fact that some aspects of conventional IMF programs may be poverty-reducing while others may be just the opposite. Moreover, the channels are both direct (via government spending patterns) and indirect (through program effects on growth).

While there is a large literature examining the impact of IMF programs on various indicators of macroeconomic performance, only a few papers investigate their impact on poverty, income distribution and social expenditure by governments. Most existing studies find that Fund programs are generally associated with worsening poverty and increasing inequality. We investigate the effect of Fund programs on several indicators of poverty and inequality, as well as social spending. We employ propensity score matching (PSM) analysis to address the selection bias associated with non-random program participation by countries, and differentiate between non-concessional programs that are available to all members and concessional ones that are restricted to poorer countries. We also investigate whether the IMF’s impact on the chosen poverty and inequality indicators is contingent on other factors such as the extent to which programs are completed, the amount of IMF resources involved and the degree of the country’s aid dependency.

2. How IMF programs can affect poverty: theoretical considerations

A standard IMF program can affect poverty and inequality both directly and indirectly. Unfortunately, these influences are complex, and predicting their overall effect is difficult. The direct effects stem from the financing and conditionality associated with a Fund agreement. In many instances, countries (especially poorer ones) approach the IMF to alleviate immediate financial constraints, and in the wider context of economic instability and structural malaise. In cases of severe illiquidity, program funding can avoid an otherwise more severe reduction in government expenditures and may help to alleviate the impact of economic adjustment on poverty in both the short and long run. Well-resourced programs (or those accompanied by non-IMF resources) presumably reduce the pressures to cut pro-poor (and other) spending.

IMF resources are usually accompanied by conditionality which frequently includes targets for aggregate demand management, budget deficits, inflation, exchange rate policy and trade and financial liberalization. Many countries sign IMF agreements as a last resort, when facing a serious external imbalance and a large budget deficit, both of which imply a need for government spending cuts.² Depending on the government’s priorities and the detailed stipulations of the Fund, spending cuts may or may not be pro-poor. Cutting food subsidies, a potential consequence of IMF programs, can hurt the urban poor but may have fewer adverse effects on people in rural areas. Sales taxes,

another common feature of IMF programs, are generally seen as regressive, whereas income taxes may be progressive. Exchange rate depreciation, trade liberalization, and financial reforms have some effects that benefit the poor and others that are detrimental to them.³

The indirect effects of IMF programs on poverty and inequality are, if anything, even more complex. The primary channel for this indirect influence is via economic growth, but it is theoretically unclear how this influence will be exerted (Bird 2004). For instance, growth will be affected by the private and official resources that are associated with a Fund agreement.⁴ Well-resourced programs, or programs that have a strong positive catalytic effect on other sources of finance, may be expected to have more beneficial effects on growth in comparison to those involving relatively small amounts of IMF lending and possessing weak or even negative effects on other capital flows. In addition to financing, the Fund's program conditionality will also affect growth in various, potentially opposing ways. It may induce short-term contractions in the pursuit of stabilization and adjustment, but it can generate higher medium-term growth.

Not only are the effects of IMF programs on economic growth in low income countries ambiguous (Bird and Rowlands 2017), but the effects of economic growth on poverty and, in particular, inequality can also be unclear.⁵ In general economic growth is a necessary but insufficient requirement for sustained reductions in poverty. However, Kuznets (1955) has also suggested that growth may initially be associated with widening income inequality. The interrelationships between IMF programs, growth, poverty and inequality also depend on the time horizon of the analysis. The short-term effects are likely to be different from those in the long run.

The empirical evidence regarding the impact of the IMF on economic growth is also unclear. Some studies claim that the relationship is largely negative (for example, Hutchison and Noy 2003; Prezworski and Vreeland 2000) although Dreher (2006) argues that the negative effects of IMF programs on economic growth may be ameliorated by better compliance. In addition to providing an overview of the existing empirical research, Bird and Rowlands (2017) present contrasting evidence that concessional IMF programs have had a significant positive effect on economic growth in low-income countries.⁶

Since theory does not provide any clear reason to expect IMF programs to have either beneficial or detrimental effects on absolute or relative poverty, we are left with an empirical issue. There are a few key studies that examine it. One of the earliest (Pastor 1987) found that the IMF was associated with worsening poverty and widening income inequality, though he used simple with-without and before-after comparisons without formally correcting for selection bias. Garuda (2000), Vreeland (2002), and Oberdabernig (2013), each use a different method to correct for selection bias, and generally find that inequality widened and/or poverty worsened after an IMF program. However, in some cases the effects were nuanced or changed over time. Garuda (2000) found that widening inequality occurred when initial external imbalances were severe, while Oberdabernig found that while both poverty worsened and inequality widened in the short run as a result of IMF programs for the 1982–2009 period, these effects seemed to fade away in the longer run. In addition, Fund programs were associated with falling poverty and narrowing inequality after 2000. Hajro and Joyce (2009) also examined the pre-2000 period and found no direct effects of IMF programs (concessional or non-concessional) on key outcomes such as

infant mortality or the Human Development Index, although there were indirect effects through growth that reduced infant mortality but, at the same time, worsened the HDI score. Finally, on the more positive side, Clements, Gupta, and Nozaki (2013) find that social spending increased for countries with IMF programs; results partially supported by other IMF researchers (Martin and Ubiergo 2004).

In this paper we examine the effects of IMF programs on multiple measures of absolute and relative poverty, as well as on current social expenditures often identified as “pro-poor”. We also examine how different conditions intermediate the effect of Fund programs on poverty and inequality. While finding a strong link between IMF programs and poverty rates or inequality would be somewhat surprising given the slow evolution of the latter two variables, it may be more likely that IMF programs have implications for government expenditure.

3. Measures of poverty

Before moving on to assess the effects of IMF programs on them, we assembled the various indicators of absolute and relative poverty that have been used in the extant literature, and collected data relating to them for forty-eight low income countries over the period 1990–2015. The standard measures of inequality or relative poverty include the Gini index and the income share of the lowest quintile. The analysis of absolute poverty uses four direct measures: the poverty gap and the poverty head count at both \$1.90 a day and \$3.10 a day (using 2011 purchasing power parity).⁷ As indirect measures of absolute poverty we also examined the infant mortality rate (IMR, defined as the number of deaths before the age of 1 per 1000 live births) and the UN’s Human Development Index (HDI), although data for the latter restricted our analysis to the period since 1990. Finally, we included public expenditures on education and on health (both as percentages of GDP) as indicators of a government’s commitment to these potentially pro-poor areas of spending.

Table 1 presents the simple correlations between the various measures. In general, we find that the two alternative measures of income inequality are very closely correlated. Similarly, we find a close correlation between the poverty gap and headcount measures of absolute poverty. The correlations between the measures of absolute poverty, income inequality and infant mortality, as well as the HDI, are less strong. Education and health spending are positively correlated with each other.

When looking across these groups of indicators, the correlations in Table 1 suggest that absolute and relative poverty are only relatively weakly related. While education and health are often significantly though weakly correlated with lower poverty levels, public health expenditures are negatively and significantly related to the share of income of the lowest quintile.

In light of the above findings, it becomes less surprising that existing studies report different conclusions about the impact of IMF programs on their selected measures of poverty and income inequality. In this paper we examine the effects of IMF programs on the full range of indicators.

4. Empirical estimations

4.1. Methodology and data

The key methodological issue to deal with is selection bias; IMF programs are typically adopted during periods of economic distress that would independently have required policy adjustments that could affect poverty, inequality, and social spending. Identifying persuasive counterfactual comparisons is particularly problematic when the IMF is brought in as a last resort. While there are a variety of statistical methodologies available to deal with selection bias,⁸ all of them require a well-performing model that distinguishes between program and non-program countries.⁹

For our analysis we adopt the propensity score matching (PSM) approach. This procedure estimates the effect of a treatment or policy by accounting for the covariates that predict receiving the treatment. The first step in our analysis is therefore to estimate a participation equation that allows us to identify countries with broadly similar propensities to participate in IMF programs. The second step tests whether the outcome variables being evaluated differ significantly between countries with programs and those without, conditioned on their having similar participation propensities.

We estimate the participation equation upon which the propensity scores are based using a logit regression model that relates the probability of participating in an IMF program to a range of factors that both economic theory and existing empirical studies suggest are significant and important. We also allow the participation equations to differ between concessional and non-concessional IMF programs. A similar approach is used in Bird, Mylonas, and Rowlands (2015), whose equations we modify for the analysis here.

Having estimated the participation equations, we divide our sample into treatment and control groups to calculate the impact of IMF programs on our selected measures of poverty, income inequality and social expenditure; not only in the year of signing but also in the following two years. This we do by taking the difference in the means of the observations between the treatment and control groups.

$$ATE(Y) = E[Y_{it1} | D_{it} = 1, p(x_{it})] - E[Y_{it0} | D_{it} = 0, p(x_{it})]$$

where Y refers to the indicators of poverty, income inequality and social expenditure, D indicates the existence of an IMF program, and $p(x_{it})$ stands for the propensity score.

We use a binary indicator of participation in IMF programs and explore their effects on the Gini index, the income share of the lowest quintile, poverty headcount ratios, poverty gaps, infant mortality rates, the human development index, as well as the level of government spending on education and health. Using a range of outcome variables enables us to compare our findings with those reported in other studies (Garuda 2000; Martin and Ubiergo 2004; Hajro and Joyce 2009; Oberdabernig 2013; Clements, Gupta, and Nozaki 2013).

There are 48 countries in the full sample and 35 in the concessional-only sample. The estimations cover the years 1990–2015. Details of the countries included in our sample, as well as the sources of our data are provided in a data appendix that is available in the online version of this paper.

4.2. Estimating participation equations

We first estimate participation equations covering all IMF programs taken together and then covering concessional and non-concessional programs taken separately. In formulating the participation equations, we draw on relevant theory and on estimations presented in previously published research (Garuda 2000; Vreeland 2002; Oberdabernig 2013; Bal-Gunduz et al. (2013); Bird, Mylonas, and Rowlands 2015; and Bird and Rowlands 2017).

We begin the exercise with a relatively large number of potential explanatory variables in our participation equation and then eliminate in a stepwise fashion those variables whose coefficient estimates are statistically insignificant. In our base model we focus on the economic factors that affect the probability of signing an IMF program, although as part of our robustness checks we also examine a more general model that incorporates political variables as well, including voting coincidence with the US in the United Nations General Assembly on key votes, bilateral aid from the US, the presence of coups, measures of democracy and autocracy, the proximity of elections and Freedom House measures of civil rights and political liberties. We report the results from this more general model later in the paper.

Table 2. IMF participation equations: the probability of signing an IMF program.

Lagged Explanatory Variable	Non-Concessional IMF		
	All IMF Programs	Programs	Concessional IMF Programs
Past IMF Programs	0.238*** (7.69)	0.118*** (3.99)	
Average GDP Growth		-0.0119*** (-3.93)	0.0225*** (3.54)
GDP per Capita		0.0000277*** (5.63)	-0.000038*** (-3.57)
Exports to GDP Ratio	-0.00390*** (-3.20)	-0.00198*** (-2.36)	
Aid Share		0.0165*** (4.20)	
Total Reserves in Months of Imports	-0.0174** (-2.07)	-0.0146*** (-2.40)	-0.0231** (-2.04)
Inflation CPI			-0.00353** (-2.21)
External Debt Stock to GNI Ratio		0.000334*** (2.54)	0.00217*** (3.51)
Global Agricultural Price Index		-0.00156** (-2.07)	
Global Oil Price Index	-0.00113*** (-4.12)		-0.000938** (-2.21)
Current Account Problems Indicator	0.0599* (1.75)		
Global Financial Crisis Indicator	0.101*** (3.08)		0.123*** (2.76)
Population Share	-0.0100* (-1.84)		-0.0811*** (-2.85)
Total Debt Service to GNI Ratio	0.00946* (1.99)		
Observations	574	496	293
Pseudo R ²	0.2399	0.2100	0.2645
Prob > chi ²	0.000	0.000	0.000

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 2.5, 5, and 10 percent two-tailed test levels of significance, respectively. Errors were estimated using robust estimation to correct for general heteroscedasticity.

With respect to our base model, results using probit and logit models turned out to be similar and here we report the results from the logit estimation. The dependent variable is a binary indicator that takes the value of one if a country signs a program in a given year and zero if it does not. In years when there is already a program in operation, countries are unlikely to sign another program and we eliminate these from the analysis since their inclusion could yield false negative observations (Bird and Rowlands 2017).

Table 2 presents the results for all IMF programs taken together (column 2) and then for non-concessional (column 3) and for concessional (column 4) programs taken separately. The details relating to the data can be found in the appendix at the end of the paper.

Since the underlying equations are estimated including only statistically significant variables, the resulting pseudo R^2 s are not as high as reported in some studies. Nevertheless, they are comparable to those reported by Moser and Sturm (2011) and Bird and Rowlands (2017) and we are confident that they provide a reasonable basis upon which to undertake propensity score matching.

We tested for multi-collinearity by examining the variance inflation factor (VIF) from the equivalent OLS regressions. Results showed that the VIFs of all the regressors are below 5.¹⁰ Although tests for autocorrelation and heteroscedasticity did not reveal any serious problems for the sample, we used robust standard errors in the estimations since the tests are not ideal for non-linear models with panel data.¹¹

Rather than focus on the details of the participation equations (which are generally consistent with previous studies) we simply note that Table 2 identifies the substantial differences between the participation equations for non-concessional and concessional programs and thus the importance of viewing them as distinct. Consequently, we focus the PSM analysis on the two distinct types of Fund programs, using the propensity scores based on their respective participation equations.

4.3. Estimating the effects of IMF programs on poverty, income inequality and social expenditure

Having estimated the participation equations, our next step involves matching propensity scores and identifying countries with similar probabilities of signing an IMF program. This then allows us to compare what happens to our variables of interest in countries that signed (the treatment group) and did not sign (the control group) programs. In this analysis we use the “nearest neighbor” matching technique, although studies suggest that with large sample sizes such as ours, different matching algorithms yield similar results.

Table 3 presents the average treatment effects for non-concessional and concessional IMF programs generated from the PSM analyses.¹² The Table shows the effects of the programs on our various measures of poverty, income inequality and social spending in the year of signing, as well as in the first and second calendar years after signing. In the year of signing we discover no statistically significant effects on any of the indicators except for a small increase in HDI associated with non-concessional programs and a decline in the income share of the bottom quintile associated with concessional programs. Results for the year in which a program is signed need to be interpreted with caution since programs signed early in the year have had longer to exert an impact

than those signed towards the end of the year. It may therefore be safer to put more emphasis on the results relating to the first and second calendar years after signing.

In the first and second years following the signing of a non-concessional program, income inequality (Gini Index) is significantly lower; the decline of almost 8 points in the second year represents 18% of the mean Gini value in the sample. Similarly, the income share of the lowest quintile increases by 1.67% for non-concessional programs. These measures of relative poverty are largely unchanged for concessional programs. There is also consistent evidence that non-concessional programs are associated with a significant decline in the measures of absolute poverty. For example, the difference in the poverty gaps (based on \$1.90 per day) for countries with a non-concessional agreement and those without is about 3.2, which represents nearly 40% of the average poverty gap for the sample. Concessional programs, by contrast, are not generally associated with any statistically significant changes in poverty measures (although the average treatment effects show a decline in poverty the first year and an increase in the second year). The infant mortality rate and HDI do not seem to respond to either IMF program type, as is the case with public spending on health. There is some evidence that spending on education rises after IMF programs, especially non-concessional ones, but the effect is often weak statistically and, for concessional programs, the estimated effect has different

Table 3. Effects of IMF programs on social indicators of development (after signing).

	Non-Concessional IMF Programs			Concessional IMF Programs		
	Year signed	Year after	Two years after	Year signed	Year after	Two years after
Gini Index	-.708 (0.865)	-4.60* (0.069)	-7.936*** (0.001)	1.904 (0.166)	-6.521 (0.245)	3.542 (0.354)
	168	133	105	80	56	56
Income share of lowest Quintile	-.0098 (0.992)	1.091** (0.036)	1.670*** (0.000)	-.668* (0.094)	1.599 (0.325)	-.796 (0.336)
	169	134	106	81	57	57
Poverty Gap (\$1.90)	.632 (0.729)	-3.156*** (0.001)	-3.208*** (0.000)	.925 (0.607)	-4.559 (0.708)	4.447* (0.094)
	178	143	115	81	57	57
Poverty Gap (\$3.10)	-1.146 (0.686)	-5.742*** (0.020)	-6.699 (0.108)	1.506 (0.212)	-9.916 (0.606)	5.081 (0.286)
	179	144	116	81	57	57
Poverty Head Count (\$1.90)	-1.269 (0.725)	-7.781*** (0.006)	-7.826*** (0.000)	2.455 (0.146)	-14.074 (0.615)	8.485 (0.227)
	178	143	115	81	57	57
Poverty Head Count (\$3.10)	-5.751 (0.251)	-10.86 (0.124)	-14.453*** (0.000)	2.505 (0.809)	-19.126 (0.517)	3.744 (0.664)
	179	144	116	81	57	57
Infant mortality rate	23.2 (0.190)	16.614 (0.249)	14.764 (0.336)	-3.501 (0.244)	-.144 (0.963)	-4.913 (0.224)
	496	396	325	293	238	198
Human Development Index	.058*** (0.000)	.046 (0.304)	.048 (0.385)	.005 (0.678)	-.001 (0.904)	.001 (0.925)
	483	386	317	275	224	187
Education Spending	.153 (0.611)	.808** (0.039)	.781 (0.140)	-.348 (0.273)	-.466 (0.404)	.964*** (0.011)
	275	227	183	159	131	112
Health Spending	-.212 (0.654)	-.153 (0.737)	-.380 (0.449)	-.087 (0.692)	-.193 (0.410)	-.169 (0.439)
	407	337	281	239	198	169

***, **, * identify coefficient estimates that are significant at the 2.5, 5 and 10 percent two-tailed test levels of significance, respectively. The p-value is provided in parentheses. Perfect predictors are eliminated where necessary.

signs for the two years after an agreement is signed, although only the second year effect is statistically significant.

In general, the results reported in [Table 3](#) suggest that IMF programs (concessional and non-concessional) do not have large and significant adverse effects in terms of increasing poverty and income inequality. In this respect our results stand in contrast to most previous studies, especially the earlier ones. For example, Garuda (2000) and Vreeland (2002) find that the IMF programs are generally associated with increased income inequality, though Garuda notes that this effect is contingent on the severity of the external imbalance. We also discover that there are some cases in which income inequality and poverty have risen, but the impact is statistically insignificant. Overall, our results suggest that where IMF programs have a significant effect, they are poverty-reducing.¹³ Our finding that education expenditures rise in the aftermath of a program's initiation is broadly consistent with the findings of Martin and Ubiergo (2004) and Clements, Gupta, and Nozaki (2013).¹⁴

In a related exercise we explored the results for “all programs” taken together, combining concessional and non-concessional ones. For this we used the “all country” participation equation reported in [Table 2](#). We do not present our detailed findings here. We found a statistically significant increase in the HDI and fall in the infant mortality rate in the year of signing an IMF agreement, as well as a significant narrowing in income inequality according to both measures we use in the year following a signing. Some of our measures also suggested a significant fall in poverty in the second year after signing an agreement. The fact that the results for all programs differed from those for the subgroups of non-concessional and concessional programs reinforces the importance of making a distinction between the two types of program. However, in the all program group, as well as the non-concessional and concessional groups, we do not find the adverse effects on poverty and the widening of income inequality that have reported in many other studies.¹⁵

4.4. Estimating post program effects

A conceptual difficulty in assessing the influence of the IMF is the extent to which any of the outcome variables, apart from the social spending ones, can reasonably be expected to change significantly within a year or two of an IMF program being started. The Fund has often claimed that its programs are designed to create the macroeconomic stability and balance of payments viability that are preconditions for future economic and social development. Although longer time lines of analysis are also problematic due to the presence of intervening shocks, it is still useful to determine whether IMF programs have an enduring effect on poverty, income inequality, and social spending beyond the time at which they ended. To undertake this test we estimated a separate participation model to examine the probability of a country participating in a program rather than just signing one.¹⁶

We then used the same PSM procedure as before to compare whether the key outcome variables varied between those countries that had participated in and ended a program with the IMF and countries that had not. The results for both concessional and non-concessional programs are presented in [Table 4](#).

For years under a program and for the year after, non-concessional programs are associated with no changes to the inequality measures, but we find statistically

Table 4. Effects of programs on social indicators of development (after end date).

	Non-Concessional IMF Programs			Concessional IMF Programs		
	Years under	Year after	Two years after	Years under	Year after	Two years after
Gini Index	2.433 (0.298)	6.505 (0.517)	3.290 (0.677)	.085 (0.971)	-1.624 (0.747)	-6.07* (0.085)
	215	113	93	174	44	29
Income share of lowest Quintile	-527 (0.393)	-1.35 (0.539)	-759 (0.677)	-047 (0.928)	.806 (0.509)	1.334 (0.205)
	216	114	94	175	45	30
Poverty Gap (\$1.90)	-3.393*** (0.004)	-1.409*** (0.020)	-.332 (0.843)	-.278 (0.938)	-.510 (0.770)	-7.401*** (0.019)
	225	123	103	175	45	30
Poverty Gap (\$3.10)	-5.495*** (0.001)	-3.679*** (0.000)	-.585 (0.843)	-.473 (0.914)	1.156 (0.749)	-13.875 (0.168)
	226	124	104	175	45	30
Poverty Head Count (\$1.90)	-7.443*** (0.001)	-4.952*** (0.000)	-1.341 (0.699)	-1.608 (0.800)	.209 (0.969)	-18.73 (0.128)
	225	123	103	175	45	30
Poverty Head Count (\$3.10)	-9.602 (0.001)	-9.451 (0.392)	-1.943 (0.742)	.545 (0.875)	7.00 (0.376)	-27.087 (0.351)
	226	124	104	175	45	30
Infant mortality rate	-4.61 (0.426)	-16.175*** (0.000)	-9.845*** (0.000)	2.387 (0.465)	-2.833** (0.029)	10.88 (0.288)
	602	374	306	595	205	149
Human Development Index	.035* (0.067)	.107*** (0.000)	.088*** (0.000)	-.024** (0.036)	.033 (0.649)	.033 (0.428)
	586	364	299	567	192	139
Education Spending	.246 (0.524)	-1.303*** (0.000)	-.103 (0.735)	.055 (0.849)	.454 (0.529)	-.266 (0.625)
	349	219	184	330	105	78
Health Spending	-.006 (0.988)	2.488** (0.047)	2.170*** (0.000)	-.067 (0.756)	-.21 (0.453)	-513*** (0.014)
	493	316	267	494	166	122

***, **, * identify coefficient estimates that are significant at the 2.5, 5 and 10 percent two-tailed test levels of significance, respectively. The p-value is provided in parentheses. Perfect predictors are eliminated where necessary.

significant declines in most of the direct measures of poverty. The differences in poverty outcomes disappear two years after the program ends. The year after a non-concessional program ends there is a decline in the infant mortality rate, an increase in the HDI, a decline in education spending, and an increase in health spending. These same effects are observed two years after a program has ended as well, although the education spending effect is not statistically significant. Overall, the period after non-concessional programs have ended seems to be associated with improved social indicators (aside from education spending).

Statistically significant changes associated with the end of concessional programs are sporadic. For them, the only significant effect in the year after a program ends is a reduction in the infant mortality rate by just under 3%. Two years after ending, the Gini index falls (although the effect is statistically significant only at the 10% level), the poverty gap is reduced, and health spending is lower. The enduring effects of concessional IMF programs on poverty, income inequality and social spending are at best muted.

The interpretation of these estimated average treatment effects for the post-program years is complex. Are they the result of successful stabilization and the establishment of

better economic foundations while under the IMF's influence? Or do they reflect the country's return to its previous policies? A key result from the PSM analysis remains that, in general, social indicators are more responsive to non-concessional programs than their concessional counterparts. In addition, these IMF agreements, which tend to be shorter in duration and focused on rapid adjustment and stabilization, are often associated with improvements in social indicators both quite quickly after they are initiated and after they end.

5. Extensions of the analysis and robustness checks

We undertook further estimations to extend the analysis and determine if the observed effects in Tables 3 and 4 are contingent on the following factors: program completion, the IMF resources made available under the agreement, the degree of a country's aid dependency, and the initial economic conditions at the outset of the program. We do not report the details here but only the key results.¹⁷

5.1. The impact of program completion

The extent to which an IMF program affects policy should depend on whether the program was fully implemented. We use the convention of identifying a program as complete if most of the financing is drawn down (80 per cent or more).¹⁸ Shortages of data meant that it was not possible for us to distinguish between concessional and non-concessional programs across the complete range of social indicators, so in this case we focused on the results for all programs taken together.

Looking at all IMF programs, completed programs are associated with a more sustained decline in the Gini index, a more sustained increase in the income of the lowest quintile, a decline in infant mortality, and sustained increases in health spending. Incompleted programs, in turn, are weakly associated with an increase in education spending. Both completed and incompleted programs are associated with declines in the direct poverty measures in the second year, but not subsequently.

When we analyze concessional and non-concessional programs separately, we can only examine infant mortality, HDI, and spending, due to the smaller sample sizes. The most sustained effect is an improvement in HDI for incompleted non-concessional programs, with statistically significant improvements in both years after the program signing; the magnitude of the improvements ranges from about 10% to 15% of the mean HDI value. A similar improvement occurs in the year after a concessional program is signed but not completed; but the effect is not sustained. Finally, spending on social programs tends to be higher with incompleted programs, though these effects are present for only one of the two years examined after program signing. Given the sample sizes and the absence of consistent and sustained effects, caution needs to be exercised in claiming that program completion critically affects how social indicators change in the presence of IMF programs.

Program completion as measured by the proportion of resources drawn down by the end of the program may not be a fully reliable indicator of the extent to which policies incorporated in IMF programs are implemented. For example, where economic performance improves, countries may not need to fully draw down available IMF resources.

5.2. The impact of resources

To test the importance of IMF resources we distinguish between programs with high and low funding relative to GDP. The threshold for high funding is where the committed resources represent 1.5 per cent of the country's GDP or more in the case of concessional programs, and 1.0 per cent in the case of non-concessional ones. The thresholds were set by reference to the median values, with the threshold for concessional programs being lower to balance the sample size of the two groups. In general, we find, apparently somewhat paradoxically, that low resourced programs tend to perform better in terms of reducing inequality and poverty. This may mean that the size of the economic problems that are confronted when programs are signed is reflected by the level of committed resources rather than that additional resources generate negative returns with respect to poverty and income equality. There is some indication, however, that better-funded programs are associated with increased government expenditures on education, particularly in the case of concessional programs. Paradoxically, increased health expenditures are more likely for less well-funded programs.

5.3. The relevance of aid dependency

We divided the sample into countries with a high level of aid dependency (over 1.5% of GNI for non-concessional programs, over 5% of GNI for concessional ones) and those that were less aid-dependent. It appears that concessional programs are associated with higher government expenditures on education and health in countries with a relatively high level of aid dependency, and with lower expenditures where there is low aid dependency.

5.4. Initial economic conditions

The last contingent factor we examined related to the initial economic conditions being experienced at the time of signing an IMF program. We used the propensity scores to reflect the severity of the initial conditions, with high propensity scores suggesting greater severity. Countries with more severe economic conditions showed some improvements in the case of non-concessional programs, with lower infant mortality rates and higher education expenditures. Countries with low signing propensities and non-concessional agreements had higher HDI and education expenditures two years after signing, but generally had lower health expenditures. For countries with high signing propensities, concessional programs showed some improvements in social spending but no other statistically significant effects, while for countries with low signing propensities the concessional programs were associated with lower infant mortality rates, higher health spending, and lower education spending one year after signing; there were no significant effects two years after signing. Once again, no clear overall picture emerges with regard to the initial economic conditions.

5.5. Additional robustness analysis

To check the robustness of our results we estimated an expanded model to identify the probability of signing an IMF agreement. We included a larger range of variables, especially political ones and kept them in the model if they improved the overall goodness of fit, even if their individual coefficients were statistically insignificant. Once again, we distinguished between non-concessional and concessional programs. We then re-ran our propensity matching scores using this more general participation model. The results were broadly similar to the ones we report earlier in this paper. Non-concessional programs in the first and second years after signing were associated with reduced income inequality, lower poverty rates, and increasing government expenditure on education. Concessional programs had no significant effects on any of our measures of poverty or income inequality, but in the second year after signing were associated with an increase in government expenditure on education but a reduction in health spending.

6. Concluding remarks

The international community has set itself a goal of eradicating extreme poverty by 2030, which in substantial measure means dealing with poverty in low income countries. These countries have had frequent arrangements with the IMF under the auspices of both concessional and non-concessional programs. The Fund has clearly stated the institutional importance of its relationship with low-income countries and has acknowledged that its programs in these countries need to address issues of poverty, income inequality and human development. As stated in its Articles of Agreement, one of the Fund's purposes is to help bring about balance of payments adjustment whilst avoiding policies that are destructive of national prosperity.

The connections between IMF programs and poverty, income inequality and social expenditure are complex and often contradictory. There is considerable ambiguity in terms of what relationships might be expected on the basis of theory. Moreover, it may be unreasonable to expect that IMF programs will, over a two or three-year span, exert a discernible and significant effect on poverty and income inequality in either direction.

However, a common caricature of the IMF's involvement in low income countries is that its preoccupation with macroeconomic stabilization implies that IMF programs will have severe negative effects in the form of increasing poverty, increasing income inequality and cutting social expenditure by the government. This caricature has been reinforced by empirical studies that claim to have identified negative consequences, and, despite the nuances of some of these results, this image of the effect of IMF programs has become something of a conventional wisdom.

Our findings suggest that this image of IMF programs needs to be re-assessed. We attempt to deal with a potential selection problem by adopting a propensity score matching approach which allows us to compare countries with and without IMF programs, but with approximately similar probabilities of participating in one, based on their underlying economic circumstances. Our analysis does not find any strong and universally negative association between Fund programs and a wide range of key social indicators that we examine. Instead, the effects are highly nuanced and contingent on country and program characteristics; the estimated treatment effects exhibit considerable variance. While our

findings do not allow firm and universal conclusions to be reached about the effects of IMF programs on poverty and income inequality, they do raise questions about the degree of confidence that should be placed in what has tended to become the conventional wisdom.

The next round of research needs to more fully account for the above mentioned variances and examine the circumstances under which IMF programs are most and least likely to be beneficial in the pursuit of the Sustainable Development Goals. This will no doubt involve an approach based on structured case studies. The significant variances that we report suggest that the effect of IMF programs on poverty, income inequality and other social indicators depends on a collection of contingent factors that are not adequately represented in large sample analysis.

Notes

1. For a review of the IMF's role and operations that contains more details of the criticisms that have made of the IMF and identifies the critics, see Bird (2007).
2. However, spending cuts are not a universal requirement (IEO, 2003).
3. For an analysis of the effect of trade liberalization on poverty see, for example, Berg and Krueger (2003), Bhagwati and Srinivasan (2002), Winters (2002) and Dollar and Kraay (2004). For a survey of the evidence of the relationship between financial development and economic development see Auerbach and Siddiki (2004). Also see Beck, Demirgüç-Kunt, and Levine (2007). A more detailed analysis of the ways in which exchange rate policy, trade liberalization and financial liberalization may affect poverty and income distribution may be found in the longer working paper version of this article that is available from the authors.
4. Bird and Rowlands (2002) provide both a theoretical and empirical analysis of the impact of IMF programs on private capital flows. A discussion of the impact of IMF programs on foreign aid may be found in Bird and Rowlands (2007); Bal-Gunduz and Crystallin (2014); and Stubbs, Kentikelenis, and King (2016).
5. Further discussion and empirical analysis of the relationships between economic growth, poverty and income inequality may be found in: Bruno, Ravallion, and Squire (1998); Cingano (2014); Dollar and Kraay (2000); Eastwood and Lipton (2000); Ghura, Leite, and Tsangarides (2002); Kakwani (2000); Lopez et al. (2006); Norris et al. (2015); and Ravallion (2004). Ostry, Berg, and Tsangarides (2014) claim that income inequality has a negative effect on economic growth.
6. Also see Bal-Gunduz et al. (2013) and Bird and Mosley (2003).
7. The poverty gap is the ratio by which the mean income of the poor falls below the poverty line, defined as half the median household income of the total population. The poverty headcount is simply the proportion of a population with incomes below the poverty line. The data on income inequality (GI and ISLQ) and poverty (PG and PHR) reported by the World Bank is based on primary household survey obtained from governmental statistical agencies and World Bank country departments. The World Bank warns its users about the timeliness, quality, and frequency of the data especially for the low-income countries since the surveys are not conducted regularly. Despite the potential inadequacies, there is no other alternative for large sample analysis. All existing studies of poverty to which we refer in this paper have extracted their data from the same source and this makes our study comparable to them.
8. For a useful summary of the various methods for trying to deal with the selection problem see Bal-Gunduz et al. (2013). Also see Atoyán and Conway (2006). For a more detailed description of the propensity score matching approach that we use in this paper see Bonn and Kopeinig (2008) and Rosenbaum and Rubin (1983).

9. Of course, if countries reach different decisions with regard to IMF referral they must be different somehow, perhaps politically or institutionally, despite similar economic conditions. The point is to try and minimize the importance of unobservable or idiosyncratic factors that affect program adoption.
10. VIFs less than 5 exhibit no collinearity.
11. To check for autocorrelation we used Woolridge's test, although this is not well designed to detect autocorrelation in non-linear binary models such as ours. The test implied that autocorrelation was not a problem for the sample, but the results were sometimes marginal. Using robust standard errors to tackle the potential presence of heteroscedasticity can also correct for potential autocorrelation when $N > T$ as in our data.
12. Perfect predictors are eliminated from the estimations where necessary.
13. Garuda (2000) and Bird and Rowlands (2017) measured the effects of IMF programs depending on the severity of initial economic conditions using low, medium, and high propensity score bands. Problems of convergence with the sample size meant that we could only replicate this analysis for some of the outcome variables; the results are reported in section 5.
14. We do not find an equivalent effect on health expenditure. For further discussion of the effects of IMF programs on health and health expenditure see Batniji (2009). Goulas and Zervoyianni (2016) claim that there is a link between IMF programs and deaths from suicide. Stubbs et al. (2017) claim that IMF conditionality has an adverse effect on health expenditure per capita. For a more general discussion of the relationship between IMF programs and government spending see Nooruddin and Simmons (2006).
15. The differences we discover between non concessional and concessional programs are of some interest. Concessional programs are generally found in the poorer countries in our overall sample. These countries may face fundamental economic problems and encounter deeply entrenched difficulties in reducing poverty. Concessional programs are likely to incorporate structural economic reforms that take time to have an impact. Non concessional programs are more likely to focus on shorter term stabilization. In these circumstances, countries that borrow from the IMF may be more able to protect poverty reducing policies than countries that, while facing similar difficulties, do not receive financial assistance from the IMF.
16. Space constraints prevent us from presenting the results here, but they are available from the authors.
17. Complete results are available from the authors.
18. This approach provides an imperfect measure of policy implementation since relatively low draw down of resources could also be associated with full policy implementation and economic success that then makes it unnecessary to borrow further from the Fund. Similarly, waivers and program modifications may enable resources to be fully drawn down despite less than complete implementation of policy conditionality. For a conceptual analysis of IMF program implementation see Bird (2008). Arpac, Bird, and Mandilaras (2009) offer an empirical analysis of the determinants of implementation.

Disclosure statement

No potential conflict of interest was reported by the authors.

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