Evaluating the Impact of IMF Programs Using the Synthetic Control Method*

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Abstract

We use the Synthetic Control Method to study the effects of IMF-programs on economic growth, inflation, and investment in sub-Saharan Africa. The analysis exploits the existence of IMF-programs that do not involve any financing (Policy Support Instruments, “PSIs”). This enables us to separate the effect of IMF monitoring, advice, and approval from direct financial assistance. In addition, countries with non-financial programs are typically not crisis-struck – thereby mitigating the reverse causality problem and facilitating the construction of counterfactuals. Results suggest that treated countries add about 1 percentage point in annual real GDP per capita growth in the medium run, with inflation being lower by some 3 percentage points per year. While there does not seem to be an impact on total investment and the resulting capital stock, PSI-treatment does seem to stimulate foreign direct investment. This may bring benefits in itself, such as knowledge transfers and better management, and could be an important channel through which IMF-programs bring improvements.

JEL-classification: E22, E31, F33, O40

Key words: International Monetary Fund, Program-evaluation, Economic growth, Inflation, Investment

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1 Introduction

A topic that has invoked much discussion and debate (both within academic circles as well as among the wider population) is whether economic programs of international financial institutions (IFIs) harm or help the countries involved.

The fact that this debate has proved to be so difficult to settle, lies in two (related) reasons. First of all, IFI-programs are normally surrounded by “adverse selection” and “reverse causality” problems: countries tend to apply for IFI-support because they are facing persistent economic problems. This then makes it difficult to establish whether any ongoing difficulties are the cause or the effect of IFI-involvement.

Secondly, constructing a realistic counterfactual is challenging since every economic crisis has its own unique elements, while it is hard to find reliable economic data from countries that live through a similarly severe economic crisis without IFI-support (it is for example not easy to construct a counterfactual for Greece during its latest debt-crisis). In addition, the fact that IFI-programs often involve direct financial transfers complicates the process of disentangling the contributions of IFI-involvement (advice, monitoring, and approval) on the one hand, and direct financial assistance on the other.

In this paper, we address both the “reverse causality” and “counterfactual” problem by applying the Synthetic Control Method to Policy Support Instruments set up by the International Monetary Fund (IMF).

The Policy Support Instrument (PSI)\(^1\) is a relatively new non-financial IMF-instrument, established in October 2005. It is available to countries that have no current or prospective Balance of Payments (“BoP”) needs (the presence of which is a necessary condition for all other IMF programs). PSIs can only be granted to countries that are “PRGT-eligible”, which implies that countries must have low per capita income levels and lack durable and substantial access to international financial markets (IMF, 2015).\(^2\) So far, PSIs have been adopted by seven countries (all in sub-Saharan Africa: Cabo Verde, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, and Uganda) – and these countries are the subject of this study.

The purpose of the PSI is to offer countries the possibility to obtain Fund advice without entering a borrowing arrangement. It intends to help countries design effective

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\(^1\)This section heavily draws on information that is available at www.imf.org/external/np/exr/facts/psi.htm.

\(^2\)“PRGT” refers to “Poverty Reduction and Growth Trust”, the IMF-facility through which all concessional lending is provided. The per capita income cutoff is set at the IDA operational cutoff, which was located at a per capita Gross National Income level of US$1,215 in 2015. Evaluation of the market access criterion is done on a more case-by-case basis.
economic programs, aimed at ensuring macroeconomic stability and debt sustainability, while encouraging structural reforms that remove constraints on growth and poverty reduction. It simultaneously aims to signal to donors, multilateral development banks, and market participants that the IMF endorses the member’s policies. For these reasons, one can think of a PSI as replicating a traditional IMF-program, without financing (Taylor, 2006).

Given that the PSI is a non-financial instrument, it tends to be used by countries that do not face a severe and urgent BoP need. This particular feature brings several advantages in assessing its effectiveness. Firstly, the absence of direct IMF-funding enables us to isolate the value of Fund advice, monitoring, and approval. Secondly, the fact that PSI-countries are typically not crisis-struck, mitigates the reverse causality problem that normally complicates the process of identifying the causal effect of IMF-programs – facilitating the construction of a counterfactual.

To construct counterfactuals, we use the Synthetic Control Method (SCM). This method was first employed in Abadie and Gardeazabal (2003) and extended by Abadie, Diamond, and Hainmueller (2010). It involves constructing a “synthetic control” for the treated unit. The synthetic control is constructed as a weighted-average of units that do not undergo treatment over the sample period (the underlying idea being that a combination of non-treated units might make a better counterfactual than any individual one). The weights are chosen such that relevant economic characteristics in the synthetic control unit, match the treated unit as closely as possible in the pre-intervention period. By comparing the subsequent evolution of an outcome variable in the synthetic control unit with that of the treated unit, one can obtain an estimate of the treatment effect.

In the context of this particular paper, “treatment” for a country is the adoption of a PSI. The synthetic control is subsequently constructed from a group of “untreated” developing countries that did not have any kind of IMF-program in place over the sample period.

Results obtained in this way suggest that IMF advice, monitoring, and approval have had a positive effect on economic development in the medium run: following treatment (the adoption of a PSI), countries tend to grow faster than their synthetic controls (by about 1 percentage point per year), while they are characterized by lower rates of inflation (by about 3 percentage points per year). There does not seem to have been a systematic effect on total investment and the resulting aggregate capital stock, but PSI-treatment does seem to stimulate foreign direct investment. This in itself may bring important economic benefits to a country, such as knowledge transfers and better management practices,
and could explain the aforementioned positive effects on output and inflation.

The itinerary of this paper is as follows. After discussing the related literature in Section 2, we document the types of IMF-engagement for the PSI-countries in Section 3. Section 4 then details the core contents of the seven PSIs that the IMF has launched to date. Section 5 goes on to describe the Synthetic Control Method, which we use to construct counterfactuals. Subsequently, Section 6 discusses our data and regression specifications, after which Section 7 presents our empirical findings. Section 8 discusses this paper’s results, after which Section 9 concludes.

2 Related literature

The literature on the effects of IFI-programs (and IMF-programs in particular) is vast. A comprehensive overview is offered in Dreher (2006).

Early studies include Reichmann and Stillson (1978), who compare economic performance in program countries before and after intervention, and Donovan (1981, 1982) who compares developments in target variables in program countries with those in a control-group of non-program countries. As surveyed by Haque and Khan (1998), these early studies typically conclude that IMF-programs have been successful in stabilizing the economy.

Many of these early studies can however be criticized on econometric grounds as they do not control for reverse causality or take a rather superficial approach when it comes to constructing the counterfactual.

More recent studies have therefore applied more advanced regression-based techniques to the problem at hand. Dicks-Mireaux, Mecagni, and Schadler (2000) use the General Evaluation Estimator (GEE) to construct counterfactuals. In particular, they use policy reaction functions from countries without an IMF-program to approximate the counterfactual for countries that did have one. Using this method, the authors find that IMF-supported programs have had positive effects on growth and the debt-service ratio, while no significant effect is found on inflation. The authors however note that diagnostic tests question the reliability of their results.

Przeworski and Vreeland (2000) and Atoyan and Conway (2006) use a dynamic version of the Heckman selection model and find that IMF-program participation lowers growth rates while the program is in place, with growth picking up once the program is completed. Atoyan and Conway (2006) see these results confirmed by taking a “matching” approach, where they compare countries with similar propensity scores (when it comes to asking for
IMF assistance) but different loan-participation decisions.

Barro and Lee (2005) state that IMF-loans are sensitive to political-economic variables. In particular, they argue that loans tend to be larger and more frequent when a country has a bigger quota, more professional IMF-staff, and when it is more connected to the United States and major European countries. They then exploit this variation to take an instrumental variables approach, the results of which suggests that a higher IMF loan-participation rate reduces economic growth, while having no significant effects on investment, inflation, government consumption, and openness. Dreher (2006) finds similar results using an alternative instrumental variables-approach, but his findings suggest that the negative effect on growth can be mitigated by compliance to conditionality.

The plurality of reported results illustrates that the debate on the impact of IMF-programs is ongoing. With this paper, we bring a new technique (the SCM) to this question, while focusing on non-disbursing PSIs (provided to countries without current or prospective balance of payments needs). This helps to mitigate the reverse causality problem that has complicated earlier analyses, while it also enables us to separate the impact of Fund advise, monitoring, and approval, from the direct effect of financial disbursements.

3 PSI-countries and the IMF

To date, seven countries (all located in sub-Saharan Africa) have adopted PSIs: Cabo Verde, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, and Uganda. As Figure 1 shows, PSIs often consist of multiple multi-year programs that are launched in succession. For three countries (Mozambique, Senegal, and Tanzania), the PSI co-existed with a disbursing IMF program – indicating an underlying BoP-need for those countries, but in all cases programs were relatively small.

At some point over our sample period, all countries (with the exception of Nigeria\textsuperscript{3}) did experience a BoP-need and entered funded IMF programs in response. In none of the cases was the BoP-need accompanied by an acute economic crisis.

At this stage, it is important to note that the presence of earlier programs may bias our results. However, as we argue in Section 8, this bias is likely to run in the \textit{opposite} direction of the results we find. Moreover, it should be kept in mind that disbursing programs differ in focus from PSIs: while the main objective of the PSI is to enhance

\textsuperscript{3}Nigeria had two Standby Arrangements in place (one from January 1991 to April 1992 and another one from August 2000 to October 2001) without ever drawing from it.
growth and reduce poverty, traditional IMF programs primarily aim to address BoP-problems (although growth and poverty reduction are explicitly taken into account since the adoption of the Poverty Reduction and Growth Facility in September 1999). This paper therefore does not analyze the impact of PSIs on the external position of countries (which is not their main objective), but focuses on growth and inflation outcomes instead.

4 Core contents of PSI-programs

As detailed in IMF (2016: 113), “all PSI-supported programs are aimed at maintaining or consolidating a stable and sustainable macroeconomic position consistent with strong and durable poverty reduction and growth [...] Specifically, PSI-supported programs should aim to maintain or consolidate (i) strong and durable poverty reduction and growth, (ii) low or moderate inflation, (iii) sustainable fiscal and current account balances, (iv) limited debt vulnerabilities, (v) adequate international reserves, and (vi) sufficient policy and institutional capacity to implement appropriate macroeconomic policies.”

To achieve these goals, country authorities and the IMF agree on a set of targets that forms the basis for the assessment of the progress towards the program goals. Such “conditionality” will typically consist of conditions on macroeconomic variables and structural measures that are within the member country’s control.

For all countries, conditionality within PSIs has focused on fiscal measures relating to the general government and measures to strengthen fiscal transparency. In particular:

- On the revenue side, measures included steps towards the streamlining of tax exemptions and incentives (Cabo Verde), the implementation of particular customs tariff regimes (Nigeria), and the elimination of tax cash payments in excess of a certain amount (Senegal). In Rwanda, a package of measures to strengthen revenue collection was part of both programs, including improvements to the risk-based assessment of tax form submissions (2010 program) and measures to decrease VAT exemptions, a revision of property taxation, new tax regimes for agriculture and mining, and measures to improve tax compliance (2013 program).

- Measures on expenditure management included restrictions on the contraction of new non-concessional financing and an analysis of the impact on debt sustainability (Mozambique), the adoption of a medium-term expenditure framework (Cabo Verde), and the development of guidelines to assess the rate-of-return on projects (Senegal). In the 2006 Uganda PSI, the program request also put substantial emphasis on the clearance of domestic arrears.
• More than one fourth of measures across PSIs focused on ensuring transparency of the budget and payments. They included the introduction of specifically designed systems and direct bank transfer to settle salary payments (Mozambique, Uganda), limiting the numbers of accounts around the treasury single account (Mozambique, Senegal), the introduction financial management information systems in ministries and the preparation of a tax expenditure budget (Rwanda), conditionality on publishing information, ex-post audits, and cost-benefit evaluations (Senegal), and measures to improve the monitoring on social spending (Tanzania).

Within other areas of conditionality, the focus varied depending on country circumstances:

• In Cabo Verde, which has a relatively developed financial system, about one quarter of structural conditionality centered around financial sector reforms. Examples include taking steps to expand and formalize the task of the Financial Stability Committee and moving forward with a banking law that unifies the regulatory framework.

• In Mozambique, programs were also aimed at strengthening the legal and regulatory framework in the mining and petroleum sectors through the adoption of new model contracts.

• In Nigeria, about one quarter of structural measures focused on the reform of public enterprises, such as the unbundling of the national electricity company and the opening of bids on the state telecommunications strategy.

• In Rwanda, Tanzania, and Uganda (all part of the East African Community) a significant amount of conditionality focused on Central Bank reform. In Rwanda, such measures included making monetary policy more transparent by publishing the economic assessments underlying the Central Bank’s decisions as well as quarterly inflation reports, and actions to strengthen liquidity management. In Tanzania, they included steps to move to consolidated supervision of commercial banks and strengthening the interbank market. In Uganda, the conditionality focused on actions to ensure capital adequacy by the Bank of Uganda.

• In Senegal, conditionality focused on strengthening transparency, such as through the adoption of an institutional framework for implementing and monitoring their accelerated growth strategy.

In the remainder of this paper, we will deploy the Synthetic Control Method to analyze the impact of all PSI-programs on certain key macroeconomic variables.
5 The Synthetic Control Method

The SCM was developed by Abadie and Gardeazabal (2003) and extended in Abadie, Diamond, and Hainmueller (2010). Here we describe the main principles underlying the method, referring to the aforementioned sources for all computational details.

Assume that we have time-series data about \( J + 1 \) units (in our context: countries), indexed by \( i = 1, 2, ..., J + 1 \). Without loss of generality, say that the first unit \((i = 1)\) undergoes treatment at time \( T_0 \). All \( J \) other units remain untreated over the sample period and constitute the “donor pool” which implies that they can serve as potential controls.

Let \( Y \) be the outcome variable of interest. If we define \( Y^N_{it} \) as the value of \( Y \) in unit \( i \) at time \( t \) in the absence of intervention, and \( Y^I_{it} \) as its equivalent when intervention does take place, our aim is to obtain an estimate of the effect of the policy in the treated unit \((i = 1)\), i.e. to obtain an estimate of:

\[
\alpha_{1t} = Y^I_{1t} - Y^N_{1t}, \quad t \geq T_0.
\]  

The problem however lies in the fact that the unit of interest is actually treated, as a result of which \( Y^N_{1t} \) is counterfactual and cannot be observed. This is where the SCM comes in. Its underlying idea is that a combination of units might be able to produce a better counterfactual than any individual one.

The SCM starts by specifying a factor model for the unobserved \( Y^N_{it} \):

\[
Y^N_{it} = \delta_t + Z_i \theta_t + \lambda_i \mu_i + \epsilon_{it}.
\]  

Here, \( \delta_t \) is a common factor with identical impact on all units, \( Z_i \) is a vector containing observed covariates, \( \theta_t \) includes the associated unknown parameters, the vector \( \lambda_i \) contains the unobserved factors, and \( \mu_i \) are the factor loadings. Finally, \( \epsilon_{it} \) is the error term, which is assumed to have zero-mean for all units.

The idea is to use the above structure to estimate the counterfactual for the treated unit as a linear combination of realized outcomes in the potential controls, i.e. construct the estimate for the counterfactual as:

\[
\hat{Y}^N_{1t} = \sum_{i=2}^{J+1} w_i Y_{it}, \quad t \geq T_0.
\]  

The unit weights \( w_i \) are selected such that the synthetic control unit matches certain characteristics of the treated unit as closely as possible. In particular, let us define \( X_1 \) as a vector containing the average values of pre-intervention variables of the treated unit.
that we wish match with our synthetic control. These “predictors” should not be affected
by the policy intervention itself. Typically, \( X_1 \) at least includes the covariates in \( Z \), but
it may also include pre-intervention values of the outcome variable \( Y \). The vector \( X_0 \)
collects the same variables for units in the donor pool. The goal now becomes to pick
the weights \( w_i \) such that the resulting synthetic control unit matches the pre-treatment
characteristics of the treated unit (\( X_1 \)) as closely as possible. This will be achieved if the
vector of weights \( W^* \) follows from solving:

\[
\min_{W} \|X_1 - X_0 W\|_V = \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)}
\]

\[
\text{s.t. } w_i^* \geq 0 \text{ for } i = 2, \ldots, J + 1
\]

\[
\sum_{i=2}^{J+1} w_i^* = 1,
\]

where the constraints make sure that the method does not rely on extrapolation of
unit-characteristics (units cannot get negative weights or weights larger than one). \( V \) is a
symmetric and positive semi-definite matrix that weighs the importance of all explanatory
variables. It is selected so as to minimize the mean-squared prediction error for the
outcome variable in the pre-treatment period.

Once the weights have been obtained, the counterfactual can be constructed for any
\( t \geq T_0 \) by using equation (3). Subsequently, one can obtain an estimate of the treatment
effect at time \( t \geq T_0 \):

\[
\hat{\alpha}_{1t} = Y_{1t}^I - \hat{Y}_{1t}^N.
\]

To assess whether the synthetic control makes a good counterfactual, we use the
pre-treatment “Fit Index” employed by Adhikari and Alm (2016) and Adhikari, Duval,
Hu, and Loungani (2016). This measure starts from the root mean square prediction error (RMSPE) of the outcome variable (\( RMSPE = \sqrt{\frac{1}{T_0} \sum_{t=1}^{T_0} (Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt})^2} \)),
but normalizes it – thereby enabling a cross-country comparison. In particular:

\[
Fit \ Index = \frac{RMSPE}{\text{benchmark } RMSPE},
\]

where the benchmark RMSPE = \( \sqrt{\frac{1}{T_0} \sum_{t=1}^{T_0} (Y_{1t})^2} \) is the RMSPE obtained from
the zero-fit model.

A Fit Index of zero implies a perfect fit; a Fit Index greater than one indicates a
6 Data and regression specifications

Motivated by the observation that PSIs aim to promote growth, contain inflation, and reduce inequality, we primarily look at the evolution of real GDP per capita (to assess growth) and the Consumer Price Index (also since inflation is a key driver of inequality, especially in developing countries where the inflation tax is mainly carried by the poor who are not able to hedge themselves). To gain more insight into the possible channels of operation, we also analyze the evolution of the capital stock (total and foreign-owned). Unfortunately, data limitations prevent us from analyzing fiscal variables as well as more direct measures of inequality (like Gini coefficients).

The SCM requires the input of an outcome variable, as well as that of covariates which are believed to affect the outcome (where the covariates shouldn’t be affected by treatment itself). In all cases, we rely upon earlier studies when determining what covariates to include.

We take real GDP per capita from the IMF’s *World Economic Outlook* database, expressed in 2010 US dollars. All used data series are at the annual frequency and span the years 1992 (when most of the required data become available) through 2015 – except for Rwanda where we start in 1995, so that we exclude the 1994-genocidal episode. Inspired Abadie and Gardeazabal (2003) and Barro and Sala-i-Martin (1995), we include the following variables as predictors (see Table 1 for an overview): the investment rate (gross fixed capital formation as a share of GDP), an indicator of economic openness (the sum of exports and imports as a share of GDP), population density, the sectoral share of agriculture, the sectoral share of industry, the secondary school enrolment rate, and the tertiary school enrolment rate. Since institutions are an important determinant of economic performance in our developing country sample, we follow Cavallo et al. (2013) in adding the absolute value of latitude to our specification. All predictor-series are taken from the World Bank’s *World Development Indicators*, except for the investment rate which comes from the *World Economic Outlook* database (which has broader coverage). Following the recommendation in Kaul et al. (2016), we include only a small number of outcome-variable observations from the pre-treatment period as predictors, namely real GDP per capita in the years 1995, 2000, and 2005.

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4Cavallo et al. (2013) also include the polity2 score, but that variable is not available for many countries in our sample.

5Many earlier studies have included all pre-intervention outcomes as economic predicts, but as set out in Kaul et al. (2016), this renders all other covariates irrelevant – irrespective of how important they are in predicting post-treatment outcome values. This may lead to biased estimates. Using only a limited number of pre-intervention outcomes as predictors, prevents this.
We study the evolution of Consumer Price Indices (CPIs) over the same 1992-2015 sample period (with the exception of Rwanda and Nigeria, for which CPI-data only become available in 1995). CPI-data are taken from the IMF’s *World Economic Outlook* database and are rebased such that all countries have a CPI of 100 in the year 2005. Inspired by Ghosh, Ostry, and Tsangarides (2010), we include a 7-way classification of the de facto exchange rate regime and a measure of central bank governor turnover (a proxy for central bank independence) as predictors. Again, we include some outcome-variable observations from the pre-treatment period as predictors, namely the CPI in the years 1995 and 2000.

When analyzing the evolution of the capital stock (as a percentage of GDP), we look at both the total capital stock (taken from the *Penn World Tables*), as well as the foreign-owned capital stock (taken from the updated and extended version of the Lane and Milesi-Ferretti (2007) dataset). These series end in 2014, so in this case our sample period spans 1992-2014. We follow Sanso-Navarro (2011) – who in turn based his choice on Blonigen et al. (2007) – by including the following predictors: population size (to reflect potential market size), openness (the sum of exports and imports as a share of GDP), the secondary school enrolment rate, the tertiary school enrolment rate, an index of capital account openness (see Chinn and Ito (2006)), and the absolute value of latitude. The latter two series are included to proxy for, what Blonigen et al. (2007) call, “host-country investment costs”. As with output and prices, we again include outcome-variable observations from the pre-treatment period as predictors, namely the capital stock in 1995, 2000, and 2005.

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6The classification comes from the IMF’s *Annual Report on Exchange Arrangements and Exchange Restrictions*. It is coded such that the value “1” represents hard pegs, “2” conventional pegs, “3” basket pegs, “4” pegs within bands, “5” crawling pegs, “6” managed floats, and “7” independent floats.

7Ghosh, Ostry, and Tsangarides (2010) also include broad money growth, real GDP growth, fiscal balance, trade openness, and terms of trade growth as explanatory variables in their regression. Apart from the latter two, all of these series are potentially affected by the policy-treatment – invalidating them as predictors in the SCM. Adding trade openness and terms of trade growth to the algorithm does not affect our findings (but significantly reduces sample size, thereby worsening pre-treatment fit).

8Since the CPI equals 100 for every country in the year 2005, there is no point in adding that observation as a predictor.

9Blonigen et al. (2007) and Sanso-Navarro (2011) also included real GDP to reflect potential market size, but since this variable is directly affected by IMF-treatment (see below) including this variable as a co-variate would bias estimates.

10Blonigen et al. (2007) use a composite risk index, but that variable is not available for most countries included in the present study.
Table 1: Overview of co-variates for all three outcome variables.

<table>
<thead>
<tr>
<th>Real GDP per capita</th>
<th>Inflation</th>
<th>Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>investment rate</td>
<td>exchange rate regime</td>
<td>population size</td>
</tr>
<tr>
<td>openness</td>
<td>central bank independence</td>
<td>openness</td>
</tr>
<tr>
<td>population density</td>
<td>sec school enr rate</td>
<td>tert school enr rate</td>
</tr>
<tr>
<td>share of agriculture</td>
<td>capital account openness</td>
<td>latitude (absolute value)</td>
</tr>
<tr>
<td>share of industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sec school enr rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tert school enr rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>latitude (absolute value)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Since its inception in 2005, seven countries (all located in sub-Saharan Africa) have adopted PSIs: Cabo Verde (August 2006-February 2012), Mozambique (June 2007-June 2016), Nigeria (October 2005-October 2007), Rwanda (June 2010-December 2016), Senegal (November 2007-June 2018), Tanzania (February 2007-July 2017), and Uganda (February 2006-June 2016).\(^{11}\)

For each and every country, the synthetic control is constructed from a donor pool that contains all developing countries that did not have any kind of IMF-program in place over the period 1992-2016. Given that cross-country spillovers to and from sub-Saharan African countries tend to be minimal (if present at all),\(^{12}\) the possibility that developments in treated countries affect control countries (which would be problematic to the SCM-approach) does not seem a major worry. This leaves us with 39 countries that form potential controls (see Table A1 in the Appendix for a full list). The SCM subsequently picks the actual countries to be included in the counterfactual (along with their weights), as discussed in Section 5.

7 Results

In this section, we report our results. For all treated countries, Tables A2-A5 in the Appendix show which countries make up what proportion of the synthetic control unit, while those tables also report pre-treatment Fit Indices (calculated as in equation (6)).

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\(^{11}\) Given that we have annual data, we “round” dates to their nearest integer in our empirical exercise. So for Cabo Verde, treatment starts in 2007, for Nigeria in 2006, et cetera.

\(^{12}\) See Canales-Kriljenko et al. (2013), Basdevant et al. (2014) and World Bank (2016).
7.1 Output

Figure 1 shows results obtained by applying the SCM to our seven treated countries on the real GDP per capita dimension, while Table 2 calculates average growth rates over the post-treatment period for treated countries and synthetic controls. As the figure and table show, all seven PSI-countries have managed to outperform their SCM-constructed counterfactual in the post-treatment period. As Table 1 shows, treated countries seem to have experienced per capita real GDP growth rates that are about 1 percentage point higher than their synthetic equivalents. The fact that outperformance is observed across all treated countries gives credence to the robustness of the result.

Following the SCM-literature, one can also analyze robustness by conducting placebo exercises: in them, we iteratively swap the treated country with every country in the donor pool and counterfactually pretend that the control country was actually treated. Absence of a strong treatment effect in placebo cases provides evidence in favor of the difference in Figure 1 being due to the actual treatment. In this exercise, it is customary to only include placebo runs that have good pre-treatment fit. In particular, we follow Adhikari and Alm (2016) by requiring the Fit Index for the placebo to be lower than, or equal to, the Fit Index for the treated country. If less than five placebo countries meet this criterion, we select the five placebo countries that have the lowest Fit Index (i.e.: the ones that have the best pre-treatment fit).

As shown in Figure 2, treatment effects that are observed for treated countries do tend to be large compared to the placebo effects for untreated countries (although there are typically not many countries in the control group for which we can construct counterfactuals with a fit that is at least as good as for the treated country, which limits the informativeness of this exercise). This gives further credence to our findings underlying Figure 1 and Table 2.

Our results continue to hold when we eliminate the countries that receive the largest weight in the baseline synthetic control (except for Senegal, where the treatment effect then turns negative). Our results are similarly robust to extending our baseline specification with the rule-of-law index as a co-variate. In both cases, the size of the donor pool shrinks though – thereby bringing about a substantial worsening in the pre-treatment Fit

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13 In the placebo-exercises, there is one country that – although untreated – consistently “takes off” in the post-treatment period, namely Namibia (which is the clear outlier visible in the panels for Cabo Verde, Nigeria, Rwanda, Tanzania, and Uganda). This illustrates that the SCM has difficulty in dealing with country-specific developments. Theoretically, all differences in Figure 1 could be driven by such idiosyncratic developments, but given that a positive treatment effect emerges in all seven treated countries, this is unlikely. A common underlying cause (PSI-treatment) seems a more plausible explanation.
Table 2: Average annual real GDP per capita growth rates post-treatment.

<table>
<thead>
<tr>
<th>Country</th>
<th>Actual (a)</th>
<th>Synthetic Control (b)</th>
<th>Treatment effect (a-b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabo Verde</td>
<td>1.8%</td>
<td>1.3%</td>
<td>+0.5%</td>
</tr>
<tr>
<td>Mozambique</td>
<td>3.9%</td>
<td>2.2%</td>
<td>+1.7%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>3.7%</td>
<td>0.7%</td>
<td>+3.0%</td>
</tr>
<tr>
<td>Rwanda</td>
<td>4.4%</td>
<td>3.2%</td>
<td>+1.2%</td>
</tr>
<tr>
<td>Senegal</td>
<td>1.0%</td>
<td>0.4%</td>
<td>+0.6%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>4.0%</td>
<td>2.9%</td>
<td>+1.1%</td>
</tr>
<tr>
<td>Uganda</td>
<td>3.0%</td>
<td>1.8%</td>
<td>+1.2%</td>
</tr>
</tbody>
</table>

Source: World Economic Outlook database and own calculations.

[Insert Figures 1&2]

7.2 Price level

Given that containing inflation is an explicit goal of PSIs, Figure 3 and Table 2 analyze the impact of PSI-treatment on the evolution of CPIs. For many developing countries, containing inflation is an important challenge – especially bearing in mind that inflation tends to increase inequality (Albanesi, 2007) as the poor often lack access to financial instruments through which they can hedge themselves against inflation.

In all PSI-countries except for Uganda, annual inflation rates were lower than in their synthetic control – typically by about 3 percentage points (despite the fact that growth tended to be higher; recall Section 7.1). Inflation in Uganda was mainly pushed up by an inflationary episode spanning 2011-12, when inflation equaled 18.7 and 14.0 percent respectively.

Reassuringly, the robustness exercises reported in Figure 4 again show that the placebo effects are small relative to the treatment effects (with the exception of Senegal and, of course, Uganda). This suggests that PSIs have indeed helped to control inflation.\(^{14}\)

\(^{14}\) Again, there is one country in the control group that displays a substantial treatment effect in the placebo-exercise, namely Suriname. This is the downward outlier visible in the panels for Mozambique, Nigeria, Senegal, and Tanzania. They managed to control their inflation by implementing reforms that strengthened Central Bank independence, stabilized the exchange rate, and anchored inflation (IMF, 2006; 2007).
Table 2: Average annual CPI-inflation rates post-treatment.

<table>
<thead>
<tr>
<th>Country</th>
<th>Actual (a)</th>
<th>Synthetic Control (b)</th>
<th>Treatment effect (a-b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabo Verde</td>
<td>2.5%</td>
<td>5.8%</td>
<td>-3.3%</td>
</tr>
<tr>
<td>Mozambique</td>
<td>5.9%</td>
<td>14.2%</td>
<td>-8.3%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>10.0%</td>
<td>11.5%</td>
<td>-1.5%</td>
</tr>
<tr>
<td>Rwanda</td>
<td>4.1%</td>
<td>7.4%</td>
<td>-3.3%</td>
</tr>
<tr>
<td>Senegal</td>
<td>0.5%</td>
<td>2.7%</td>
<td>-2.2%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>9.7%</td>
<td>15.1%</td>
<td>-5.4%</td>
</tr>
<tr>
<td>Uganda</td>
<td>9.1%</td>
<td>4.8%</td>
<td>+4.3%</td>
</tr>
</tbody>
</table>

Source: World Economic Outlook database and own calculations.

[Insert Figures 3&4]

7.3 Capital stock

Finally, we analyze whether PSI-programs have had any effect on the accumulation of capital. It is often argued that IMF-programs fulfill an important signaling role and that they catalize investment. To check this claim, we first of all analyze the evolution of the total capital stock (in percent of GDP). As Figures 5 and 6 show, the adoption of a PSI does not seem to have a large effect on capital accumulation (with the possible exception of Cabo Verde, Tanzania, and Uganda, although the positive treatment effects for Tanzania and Uganda are not very robust and tend to be sensitive to the particular co-variates included in the regression). Consequently, it seems that PSI-treatment does not spur overall investment.

[Insert Figures 5&6]

There might however be an effect on foreign direct investment (henceforth “FDI”), as foreign investors might put a greater weight on the signal emitted by the adoption of an IMF-program. Encouraging FDI could be important since there is evidence that having a larger foreign-owned capital stock is beneficial to economic development. As for example argued in De Mello (1999), FDI is accompanied by significant knowledge transfers, such as labor training and skill acquisition and the introduction of better management practices and organizational arrangements. Consequently, we perform the same analysis on the evolution of the foreign-owned capital stock.
Here, there is more evidence for a positive treatment effect (see Figures 7 and 8): all treated countries, except for Tanzania, accumulated more foreign-owned capital in the years following the adoption of a PSI than their untreated synthetic controls did (although the effect does not seem to have lasted in Senegal, where the foreign-owned capital stock fell sharply in 2014).\textsuperscript{15} From Figure 8, one can also see that treatment effects tend to be large relative to placebo effects. Results are furthermore robust to different regression specifications.

This suggests that PSI-programs can indeed emit a positive signal to investors – catalyzing FDI. Although there is no strong evidence that this leads to a higher overall investment rate (through crowding out of domestic investment), attracting FDI can be an important driver of growth in itself as it is thought to bring substantial knowledge transfers.

8 Discussion

As noted in Section 3, six out of the seven countries that have received PSIs, also went through traditional IMF programs over our sample period (mainly prior to their adoption of a PSI). It is important to think through how this could bias our findings. We see three possibilities:

1. traditional IMF programs had no impact on the macroeconomic situation;

2. traditional IMF programs had a positive impact on the macroeconomic situation;

3. traditional IMF programs had a negative impact on the macroeconomic situation.

In case 1, there would be no bias and traditional programs can be neglected for the purposes of this paper. Case 2 would bias our results downward: in that case, the country already received a boost before adopting a PSI – making it harder for the SCM to find any additional positive effects after adoption (since it then compares the actual outcome against a stronger synthetic control). Case 3 would be more problematic: if it were true that traditional IMF programs reduce growth and promote inflation, the positive effects that we tend to find could simply stem from the termination of a traditional program (rather than from the adoption of a PSI).

\textsuperscript{15}Especially the case of Mozambique illustrates that improved institutions in countries that host natural resources can trigger impressive FDI take-offs: in Mozambique, initial exploration investments (stimulated by improvements in the business climate) led to the discovery of a major gas field in the Rovuma basin, which then led to further FDI flowing in (Xiong, 2014). Also see Arezki, Van der Ploeg, and Toscani (2016) on these dynamics.
Fortunately, our sample contains three countries that operated disbursing IMF programs parallel to a PSI (Mozambique, Senegal, and Tanzania; recall Figure 1). If traditional IMF programs indeed had significant negative macroeconomic side-effects, these countries should display smaller treatment effects. But our results do not hint in this direction. In addition, the observation that our findings for Nigeria (the only PSI-country that did not go through a disbursing IMF program during our sample) are very much in line with those for other PSI-countries, gives further credence to our findings.\footnote{In fact, Nigeria is the country for which the SCM finds the biggest treatment effect for growth (+3.0 percentage points). If anything, this suggests that the presence of earlier programs in other countries biases our findings towards zero.}

What could then explain the differences between results reported in this paper and those in earlier studies (most notably Barro and Lee (2005) and Dreher (2006), who find negative or no effects from IMF-programs)?

First of all, it is possible that the effectiveness of IMF-programs has changed over time: most earlier studies were conducted on data that spanned the 1970-2000 period, while IMF operations have changed considerably since. In particular, IMF programs have evolved from more prescriptive structural adjustment programs, toward programs that support country-led development agendas (Bal-Gunduz et al., 2013).

Second, it is important to keep in mind that all earlier studies have focused on IMF-programs that do come with financial assistance. Consequently, the samples underlying those studies include countries that were hit by severe economic crises (such as the Latin American debt crisis in the 1980s and the Asian crisis of the 1990s) – thereby introducing an urgent need for the econometrician to correct for reverse causality.\footnote{While Mozambique, Senegal, and Tanzania also relied upon disbursing programs during their PSI-spell, this was not the result of severe economic crises and the programs launched in response were relatively small (ranging from 37.5 to 109.9 percent of quota; to compare, South Korea drew over 3000 percent of quota during their crisis in the late 1990s). As a result, adverse selection continues to be a possible source of bias in these countries \textit{against} finding positive effects from treatment), but a much smaller one. The observation that the SCM \textit{does} find positive results from treatment (despite the absence of a bias correction) supports this.} While the aforementioned studies have employed clever instrumental variable techniques to address this challenge, it is possible that a residual effect remains present (leading to a less favorable evaluation of IMF-programs). By exploiting the existence of non-funded IMF-programs (launched in countries \textit{without} an acute crisis), this paper faces a lesser challenge along this dimension.

Finally, it is also possible that other IMF-programs are less effective than the PSI. We for example cannot rule out the possibility that IMF-advice is less useful or apt in times of severe crisis, or that such advice is less beneficial to countries at different stages of
development (remember that all PSI-countries are sub-Saharan African developing countries – typically with limited access to external financing). It is also conceivable that the presence of a large financial component plays a negative role: as demonstrated in Van Wijnbergen (1986), large financial aid inflows can lead to real appreciations with Dutch Disease-driven adverse consequences on economic development. Along these lines, Rajan and Subramanian (2011) indeed find evidence that aid inflows reduce a country’s competitiveness, while it is also possible that financial aid reduces reform-incentives (Boockmann and Dreher, 2003). Future research is needed to shine further light on the net effect of this important issue.

9 Conclusion

This paper is the first to apply the Synthetic Control Method to the evaluation of programs operated by an international financial institution (in this particular case, the IMF). We have exploited the fact that there exist non-financial IMF programs (Policy Support Instruments, or “PSIs”). They enable us to isolate the contribution of IMF advice, monitoring, and approval, while mitigating the reverse causality problems that have complicated earlier analyses. Our results suggest that IMF advice, monitoring, and approval bring considerable macroeconomic benefits – particularly when it comes to promoting economic growth and containing inflation. The channel seems to run through higher foreign investment, which is associated with better management practices and positive knowledge transfers.

An important caveat is however in order: our results stem solely from analyzing PSIs. As explained in the introduction, limiting the analysis to PSIs facilitates the process of constructing counterfactuals, while enabling us to eliminate any effects from direct financial assistance (since the PSI is a non-financial instrument). On the downside, however, our specific focus limits the validity of our results to other types of IMF-programs: they do come with a financial component, while they tend to be launched in times of severe economic crises. Additional research is necessary to establish whether IMF-advice is equally useful in such stressing circumstances, while financial aid inflows can furthermore lead to real appreciations with adverse consequences on economic development.
10 Appendix

Table A1: Countries in the donor pool

<table>
<thead>
<tr>
<th>Bahamas*</th>
<th>Equatorial Guinea*</th>
<th>Marshall Islands</th>
<th>Qatar*</th>
<th>Timor-Leste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain*</td>
<td>Eritrea</td>
<td>Mauritius*</td>
<td>Samoa</td>
<td>Tonga</td>
</tr>
<tr>
<td>Barbados*</td>
<td>Fiji*</td>
<td>Micronesia</td>
<td>Saudi Arabia*</td>
<td>Trinidad &amp; Tobago*</td>
</tr>
<tr>
<td>Belize*</td>
<td>Iran*</td>
<td>Montenegro</td>
<td>Saint Lucia*</td>
<td>Turkmenistan</td>
</tr>
<tr>
<td>Bhutan*</td>
<td>Kiribati</td>
<td>Myanmar</td>
<td>Sudan*</td>
<td>Tuvalu</td>
</tr>
<tr>
<td>Botswana*</td>
<td>Kuwait</td>
<td>Namibia*</td>
<td>Suriname*</td>
<td>Utd Arab Emirates*</td>
</tr>
<tr>
<td>Brunei</td>
<td>Lebanon*</td>
<td>Oman*</td>
<td>Swaziland*</td>
<td>Vanuatu</td>
</tr>
</tbody>
</table>

Note: due to data limitations, not all countries can be included. Only the countries in bold are considered in the exercise for real GDP per capita; only the countries in italics are considered in the CPI-exercise; only the countries with an asterisk are considered in the capital-stock exercises.

11 References


Figure 1: SCM-results: real GDP per capita (in constant 2010 USD)
Figure 2: Placebo-results: real GDP per capita (in constant 2010 USD)
Figure 3: SCM-results: CPI (2005 = 100)
Figure 4: Placebo-results: CPI (2005 = 100)
Figure 5: SCM-results: capital stock (in percent of GDP)
Figure 6: Placebo-results: capital stock (in percent of GDP)
Figure 7: SCM-results: foreign-owned capital stock (in percent of GDP)
Figure 8: Placebo-results: foreign-owned capital stock (in percent of GDP)