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What Does Aid Do to Fiscal Policy? New Evidence

by Jean-Louis Combes, Rasmane Ouedraogo, and Sampawende J.-A. Tapsoba

I N T E R N A T I O N A L M O N E T A R Y F U N D

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Fiscal Affairs Department

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Prepared by Jean-Louis Combes, Rasmane Ouedraogo, and Sampawende J.-A. Tapsoba¹

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Abstract

Foreign aid is a sizable source of government financing for several developing countries and its allocation matters for the conduct of fiscal policy. This paper revisits fiscal effects of shifts in aid dependency in 59 developing countries from 1960 to 2010. It identifies structural shifts in aid dependency: upward shifts (structural increases in aid inflows) and downward shifts (structural decreases in aid inflows). These shifts are treated as shocks in aid dependency and treatment effect methods are used to assess the fiscal effects of aid. It finds that shifts in aid dependency are frequent and have significant fiscal effects. In addition to traditional evidence of tax displacement and “aid illusion,” we show that upward shifts and downward shifts in aid dependency have asymmetric effects on the fiscal accounts. Large aid inflows undermine tax capacity and public investment while large reductions in aid inflows tend to keep recipients’ tax and expenditure ratios unchanged. Moreover, the tax displacement effects tend to be temporary while the impact on expenditure items are persistent. Finally, we find that the undesirable fiscal effects of aid are more pronounced in countries with low governance scores and low absorptive capacity, as well as those with IMF-supported programs.

JEL Classification Numbers: F35, H20, H62, E21, E22.

Keywords: Foreign aid, Fiscal policy, Tax displacement, Fungibility, Aid illusion.

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I. INTRODUCTION

Understanding the fiscal effects of aid has become an important issue for recipient countries. With most aid flows to developing countries channeled directly through government spending, it is crucial to assess the type of fiscal (dis)-incentives they produce, how these funds are allocated, and the overall impact they have on the fiscal stance. Investigating the fiscal consequences of aid is also timely given the current effort on domestic resources mobilization to fill financing gaps (see the third International Conference on Financing for Development in Addis Ababa in July 2015).

Studies in the literature have established different conclusions depending on the size of the sample, the timeframe, countries involved, and assumptions postulated. For instance, Moss, Pettersson and van de Walle (2008) and Benedek and others (2013) find that aid has a negative impact on tax collection. Other papers, however, find aid has a positive effect, including Clist and Morrissey (2011), Carter (2013) and Clist (2014). Ouattara (2006) even finds that the relationship is not significant. In addition, recipient countries can use aid for purposes not intended by the donor (Martins 2007, Acosta and de Renzio 2008, Morrissey 2015). In other words, aid intended to fund capital expenditure may be diverted to current expenditure.

Existing papers have focused on the average impacts of aid on fiscal variables. This approach may suffer from an identification problem and may mask the overall picture and some relevant policy messages. More conceptually, there is an agreement in the literature that the effect of aid on fiscal accounts is mostly non-linear. However, very few papers have explored non-linearities in the fiscal effects of changes in aid dependency. Existing studies have included either (or both) the aid variable and its squared term as covariates or the interaction between aid and macroeconomic variables (Clist and Morrissey 2011, Benedek and others 2013). Furthermore, the focus of the literature is often on the short-term, that is, the same-year effects of aid. However, aid may also have long-term effects on fiscal variables, given that aid is allocated usually for a multiyear period, and some projects supported by donors are often executed over several years. Thus, there are reasons to believe that structural increases or decreases in aid dependency may not have similar fiscal effects and may vary over time.

This paper focuses on the fiscal consequences of shifts in aid dependency. It provides a framework to examine the consequences of "almost-exogenous" aid events. Moreover, investigation of the shifts in aid dependency allows for an exploration of the static and dynamic impacts of the shifts by taking advantage of the heterogeneity around the shift points. In what follows, we propose an innovative approach by focusing on aid shifts and tests for the long-term effects. To this end, the paper applies the structural shift model of Bai and Perron (1998, 2003) to identify shift years in aid dependency. Thereafter, a probit model is used to explore the determinants of upward shifts (a shift to an increase) and downward shifts (a shift to a reduction) in aid dependency. To assess the fiscal effects of changes in aid dependency, we follow a treatment effect approach by adopting the propensity score matching (PSM) methodology. The PSM technique is a useful tool that accounts for potential selection bias when the treatment and the control groups have significant overlaps. The PSM has become a popular method of estimating causal treatment effects, but to the best of our knowledge, has not yet been applied

in the aid literature. In addition, the PSM methodology offers a framework to assess the short- and long-term effects of the shifts in aid dependency on fiscal policy in developing countries.

Using a panel of 59 developing countries from 1960 to 2010, the paper finds that structural changes in aid dependency are frequent in developing countries. Significant increases in aid dependency (upward shifts) are less common as the economic development of recipient countries improves and natural resources rents increase. The likelihood of an upward shift in aid dependency increases with the acceptance of market-oriented policies or the presence of an IMF program. As for significant reductions in aid-to-GDP ratios (downward shifts), estimates indicate that significant reductions in aid dependency occur more often as recipient countries develop or have fewer diplomatic ties with the key players in international relations, i.e., the United States or Russia. In terms of the fiscal effects of these shifts in aid dependency, we first document the traditional effects argued in the literature. These are the tax and investment displacement effects (tax effort and public investment are undermined by aid inflows) and the “aid illusion” effect (aid inflows serve only to inflate current expenditure more proportionately). In addition, our approach allows us to explore the asymmetric effects of large and sustained aid inflows and the significant reduction in aid dependency, the persistency of the fiscal effects of aid, and non-linearities. Second, we find that upward and downward shifts in aid dependency have asymmetric effects on fiscal accounts. Large and sustained aid inflows undermine tax capacity and public investment while significant reductions in aid inflows tend to have no effect on fiscal ratios or the composition of revenues and spending. Only current expenditure is affected, by increasing with significant surges in aid inflows and significant decreasing with falls in aid inflows. Aid upward shifts induce a fall of about 2.3 percent in tax revenues as a share of GDP and 3.3 percent in capital expenditure in percent of GDP. Moreover, the tax displacement effect last only two years while the impacts on expenditure items tend to be longer, at least five years. Furthermore, the tax displacement effect, the “aid illusion” effect, and capital expenditure reduction after aid upward shifts are only present in countries with low governance scores and countries with low absorptive capacity. Finally, the tax displacement effect tends to be muted under IMF-supported programs. The results are robust to several alternative specifications.

The rest of the paper is organized as follows: Section II describes a brief review of literature and Section III specifies our econometric estimation strategy, while Section IV describes our data sources. Section V gives an overview of shifts in aid dependency. Section VI focuses on the main results and explores the role of the quality of governance and absorptive capacity and Section VII concludes.

II. OVERVIEW OF THE LITERATURE

The impact of foreign aid flows on fiscal accounts has generated a prolific literature in the aid effectiveness debate. The literature can be categorized into two broad themes: (i) impact on tax effort and (ii) impact on expenditure.

Aid and tax effort. The relationship between aid and taxation cannot be determined a priori. Indeed, aid can be used in theory to improve tax collection but it can also have disincentive effects on tax effort. It is often argued that an increase in aid inflows will lower the government’s incentives to maintain or increase its tax effort, or even that tax effort can be undermined

because of policy reforms linked to aid flows (McGillivray and Morrissey, 2001). In fact, foreign aid can be a substitute for domestic tax revenue because it may influence tax effort in aid recipient countries by discouraging domestic tax effort (Teera and Hudson 2004, Chatterjee, Giuliano and Kaya 2012, Moss, Pettersson and van de Walle 2008, Carter 2013). Alternatively, other papers have argued that foreign aid may contribute to increase tax revenue through policy reforms bundled with conditional lending (see for instance Brun, Chambas and Guerineau 2008). The empirical literature has not reached a consensus on the impact of the effect of aid on tax efforts in recipient countries. Different studies have established different conclusions depending on the sample size, period, countries involved, and assumptions postulated. For instance, Moss, Pettersson and van de Walle (2008), Benedek and others (2013) find that aid has a negative impact on tax revenues. Other papers such as Clist and Morrissey (2011), Clist (2014) and Carter (2013) find a positive impact. Ouattara (2006) even find that the relationship to be not significant.

Aid and expenditure. It is well documented that aid is fungible. In simple terms, fungibility is a broad term that describes situations when recipients respond to aid by changing the way they use their own resources (see Morrissey 2015). Aid could be used to lower taxes, to fund projects in a different sector, or simply to line the pockets of corrupt officials. At the aggregate level, aid is fungible when one additional dollar of aid increases total government expenditure by less than one dollar (McGillivray and Morrissey 2004 and Morrissey 2015). It is fully fungible when government spending does not increase at all. Ouattara (2006), Lloyd and others (2009), and Martins (2007, 2010) have evidenced that aid is fungible. However, the aid fungibility debate considers only government expenditure such as current expenditure and capital development expenditure but does not deal with the broader fiscal impact of foreign aid over time. Our paper bridges this gap and studies the overall fiscal effects of foreign aid (expenditure and revenue sides).

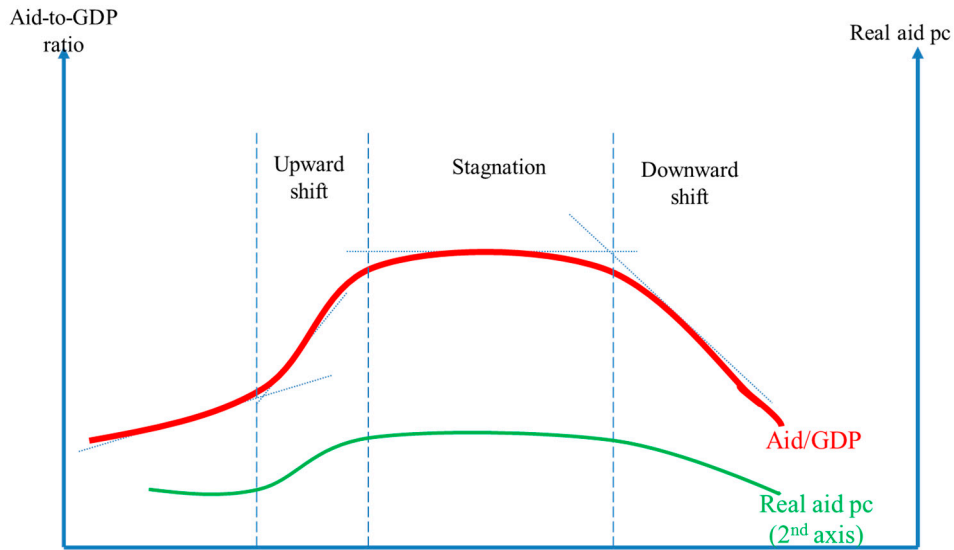
III. ECONOMETRIC STRATEGY

A. Shifts in Aid Dependency: A Structural Shift Approach

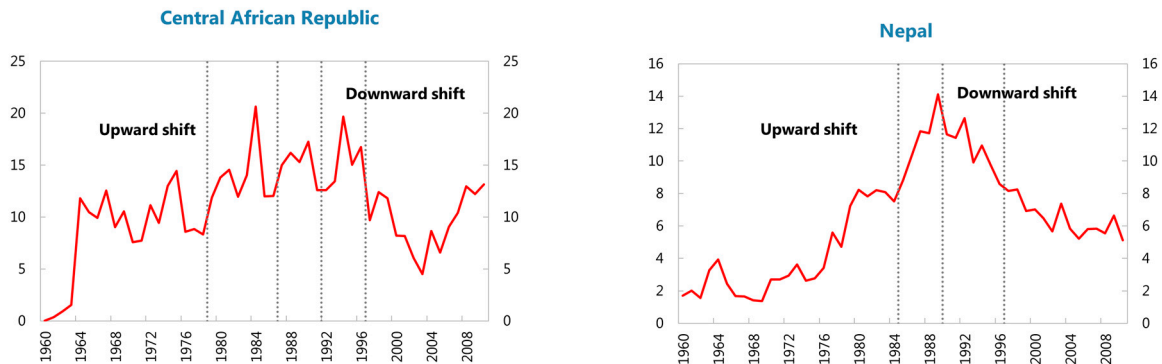
Given the fact that some shifts dates are difficult to detect by using a purely economic narrative, several authors use information criteria to estimate shift dates endogenously. As shown by Bai and Perron (1998, 2003), information benchmarks often used (e.g., Akaike, Bayesian, and Schwarz) can be biased when serial correlation is present.

We follow Bai and Perron in using test for multiple structural changes. Their methodology is sequential, starting by testing for a single structural shift. If the test rejects the null hypothesis that there is no structural shift, the sample is split in two and the test is reapplied to each subsample. This sequence continues until each subsample test fails to find evidence of a shift. The final number of shifts is equal to the number of rejections obtained with the parameter constancy tests.² Specifically, for n shifts and $(n+1)$ shifts, the basic data generating process considered is:

² A distinct advantage of the model selection procedures based on hypothesis testing is that, unlike information criteria, they can directly take into account the possible presence of serial correlation in the errors and non-homogeneous variances across segments.

Figure 1. Representation of Possible Shifts in Aid Dependency

Source: Authors.

Figure 2. Shifts in Aid Dependency in Central African Republic and Nepal, Aid-to-GDP (percent), 1960-2010

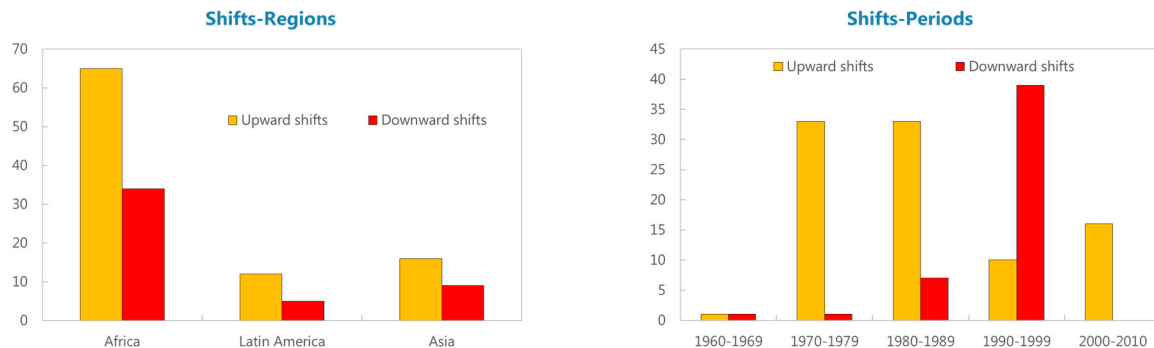
Source: Authors. Vertical lines represent the identified years of shifts in aid dependency.

We turn now to the overall overview of shifts in aid dependency. Surprisingly, changes in aid dependency are frequent in developing countries. 93 cases of upward shifts and 48 cases of downward shifts were identified.⁴ This means that the unconditional probability of experiencing an aid upward shift in any year is 4 percent, and 2 percent for an aid downward shift. Being the main destination of foreign assistance, the likelihood of shifts in aid dependency is logically high in Africa (Figure 3, right panel). Africa has experienced 64 episodes of “upward shifts” and 34 cases of “downward shifts”. The majority of upward shifts occurred between 1970 and 1990. Downward shifts were common in the 1990s (Figure 3, left panel). The upward shifts that

⁴ We also identify 28 indeterminacies in which per capita aid increases but aid-to-GDP decreases.

occurred in the late 1990s and early 2000s were correlated with the HIPC Initiative launched in 1996 by multilateral organizations including the IMF and the World Bank. The HIPC consisted of debt relief, which also included aid flows. Accordingly, the massive debt reduction is likely to translate into more upward shifts in aid dependency. The shifts are in magnitude large. On average, in aid dependency, the aid-to-GDP ratio increases by 5.9 percentage points during upward shifts and decreases by 7.1 percentage points during downward shifts.

Figure 3. Overview of Shifts in Aid Dependency, Numbers of Shifts, 1960-2010



Source: Authors.

B. Propensity Score Matching Approach

An important econometric issue in applying the propensity score matching (PSM) to assess the effects of shifts in aid dependency is the potential for non-random selection of observations. We use a variety of PSM techniques developed in the treatment effect literature to address the self-selection problem. Shifts (up or down) in aid dependency are taken as the treatment status. The propensity score is defined as the probability of a shift conditional on observable covariates. This likelihood is estimated from a regression model such as a logit or probit regression of the treatment variable conditional on covariates (see Heckman and others 1998, Dehejia and Wahba 2002). Put differently, the PSM involves a statistical comparison between the treated and the control group based on a two-pronged approach.

First, the probabilities of experiencing shifts in aid dependency for countries in a given year are estimated conditional on observable variables including economic conditions and country characteristics (selection model). Second, these probabilities (or propensity scores) are used to pair up country-years with aid shifts to those without aid shifts, and construct a “statistical” control group. This approach ensures the similarity of initial conditions in both the treated and the control groups. The control group provides in effect a proxy for the counterfactual, that is, for government accounts if an aid-experienced country had not experienced aid shifts. The impacts of aid shifts on fiscal variables are calculated as the mean differences in fiscal outcomes between the two groups.⁵ An important feature of the propensity score estimation is that the estimated propensity scores are determined independently from the outcome measure of interest. In this sense, this procedure allows us to remove systematic imbalances or differences between the

⁵ See in Appendix A4 for the description of PSM model.

treated and control cases prior to assessing any differences in any specific outcomes. Therefore, this method reduces the selection bias in aid allocation or in experiencing shifts in aid dependency.

Many matching methods have been proposed in the literature. In this paper, we focus on the four main ones: (i) nearest neighbor matching; (ii) radius matching; (iii) Kernel matching; and (iv) regression-adjusted local linear regression.

C. Selection Model: Estimating the Propensity Scores

We turn to the selection model. We follow the existing literature. The traditional explanatory variables of aid allocation are as follows: economic development and macroeconomic performance, alternative financial resources, exploitation of natural resources, quality of governance, exogenous shocks, and ideological considerations. In the following, we provide a literature summary motivating the choice of these factors.

Economic development and macroeconomic performance. First, aid allocation may be strongly linked to growth or macroeconomic performance in recipient countries. Such requirements aim to ensure that allocated aid is a source of development (Neumayer 2003b). Second, unsustainable public finances could justify a surge in foreign assistance. Indeed, difficulties in servicing public debt motivated the launch of the Heavily Indebted Poor Countries (HIPC) initiative in 1996 in order to help reduce debt ratios and provide policy space to qualified countries. On theoretical grounds, the relationship between aid and debt is mixed. Being a heavily indebted country is a negative fiscal signal of solvency, but at the same time, donors may help indebted countries in order to secure future partnerships. Third, IMF-supported programs could have important catalytic effects on the donor community: several donors rely on IMF involvement for budgetary support disbursements. Therefore, being or not under an IMF program may generate shifts in aid flows. Recently, Gündüz and Cristallin (2014) showed that countries following IMF-supported programs tend to receive more aid.

Alternative financial resources. International private financial flows may affect the allocation of aid. Indeed, private financing may reduce the need for aid. Private financing including FDI or remittances could act as a substitute for aid. For instance, Rajan and Subramanian (2008) and Fuchs, Dreher and Nunnenkamp (2014) observe that aid efforts weaken when other international financial flows increase. Harms and Lutz (2006) find that aid is negatively associated with foreign direct investment in countries with higher regulatory burdens. Some have argued that aid could be complementary to private financial flows. For instance, Bhavan, Xu and Zhong (2011) have found that foreign aid serve as complementary factor to foreign direct investment in South Asian economies. Furthermore, Donaubaauer, Dierk Herzer, Peter Nunnenkamp (2014) have shown that aid for education is positively associated with foreign direct investment in Latin American countries.

Exploitation of natural resources. The exploitation of abundant natural resources may reduce the need for aid, and at the same time, donors may allocate aid to resource-rich countries based on political and economic interests. Dobronogov and Keutiben (2014) show that aid received by a

number of resource-rich countries is on a par with their actual or potential revenues from natural resources.

Quality of governance. The impact of political and economic governance on the allocation of aid is ambiguous. Alesina and Weder (2002), Claessens, Cassimon and van Campenhout (2009) and Neumayer (2003a) document that countries with good governance tend to receive more aid, while Brautigam and Knack (2004), Dollar and Levin (2006) find that higher aid inflows are correlated with weak governance. We investigate whether “well-governed” countries are more likely to experience upward shifts or downward shifts in aid flows.⁶

Exogenous shocks. Shifts in aid dependency may be affected by exogenous shocks. We focus on natural disasters, conflict situations, and terms-of-trade fluctuations. Natural disasters, conflicts, or large terms-of-trade fluctuations may drive the likelihood of experiencing upward shifts or downward shifts in aid flows. For instance, Strömberg (2007) and Yang (2008) show that official aid increases significantly after disasters. It is also well documented that the majority of aid dependent countries are in conflict or in post-conflict (de Ree and Nillesen 2009). As for terms-of-trade shocks, Collier and Dehn (2001) find that aid works better in countries experiencing large fluctuations in the price of their commodity exports.

Ideological considerations. Foreign policy plays an essential role in international relations (Bailey, Strezhnev and Voeten 2013). Several studies have find that aid tends to be low when political ideology differs between the donor and the recipient (Alesina and Dollar 2000, Neumayer 2003a, Dreher, Schmaljohann and Nunnenkamp 2013). Others argue that the allocation of aid is dictated by political and strategic considerations, much more than by the economic needs and the policy performance of the recipients. Much aid is delivered on the condition that recipient countries implement market-oriented policies (Radelet 2006). Given the predominance of United States and Russia in international relations, we conjecture that developing countries diplomatically close to these countries are likely to receive more aid. At the national level, we check for the influence of nationalism, religion, and military in politics.

In order to investigate the drivers of upward shifts and downward shifts in aid dependency, we follow Hausmann, Pritchett and Rodrik (2005), hereafter HPR, by constructing an aid shift variable as a dummy taking the value 1 the year before, during, and after the shift identified by Bai and Perron’s (2003) methodology (and 0 otherwise). The 3-year window (as in HPR) is intended to capture uncertainty around the identification of the shift. We use a probit model with year dummies to control for unobservable covariant shocks. All other control variables are lagged by one year to mitigate the simultaneity problem.

⁶ We also explore whether the holding of national elections, the plurality of political parties, and the relative importance of the opposition represent decisive factors in aid allocation.

IV. DATASET

We use a comprehensive dataset of 59 countries covering the period 1960-2010. It is noteworthy that only data availability and constraints related to Bai and Perron's methodology restricted our sample.⁷ In addition, small countries with less than 1 million inhabitants were excluded from the sample. Data for aid are taken from the OECD's QWIDS (Query Wizard for International Development Statistics) dataset, available online.⁸ We use aid data measured as a disbursement. Fiscal data including tax revenue, capital and current expenditures are compiled from various IMF datasets. All of these variables are expressed in percent of GDP. The data on GDP per capita, GDP growth, public debt over GDP, foreign direct investment, and remittances over GDP, trade openness defined as the sum of exports and imports over GDP, and natural resources rents over GDP are extracted from the World Bank's 2014 World Development Indicators. The quality of governance is captured by the CPIA (Country Policy and Institutional Assessment) index which is a composite index representing the quality of policies and institutions. IMF programs, natural disaster and conflict variables are dummy variables from the IMF databanks, EM-DAT (CRED 2014) and Uppsala University's Conflict Data Program (Jarstad, Nilsson and Sundberg 2012), respectively.

The terms of trade shocks series are constructed by using the Hodrick-Prescott (HP) filter to extract the cyclical component.⁹ The data on terms of trade are from CERDI's database (CERDI 2014). The index of market-oriented policies and variables on the proximity with the United States and Russia are based on the UN votes data from Bailey, Strezhney and Voeten (2013). Data on the market orientation are estimated using a dynamic ordinal spatial model on votes made in the United Nations General Assembly and measure the degree of acceptability on votes related to market orientation policies. Proximity with the United States and Russia is defined as a similarity index, which is equal to the total of votes where both the recipient country and the United States or Russia agree over total of joint votes.

V. RESULTS

A. Determinants of Aid Shifts

Table 1 reports probit estimates of the marginal effects for upward shifts and downward shifts in aid dependency.¹⁰ We only comment on significant results at the 5 and 1 percent levels. We find that upward shifts in aid dependency are less frequent as countries develop or natural resources

⁷ We applied the Bai and Perron method on both aid-to-GDP ratio and aid per capita. This is because we combined both the two variables to define a shift in aid dependency. This means that, for each country, the two variables should work with the Bai and Perron method. If aid to GDP ratio works with the Bai and Perron method while aid per capita does not for a given country, we cannot include this country in the sample. Vice versa, if aid per capita works with the Bai and Perron method while aid to GDP does not for another country, we cannot also include this country in the sample. The approach has been applied to all aid recipients and the sample size of 59 countries are those countries where both aid per capita and aid to GDP ratio work with the Bai and Perron method.

⁸ Available at <http://stats.oecd.org/qwids>

⁹ We follow Ravn, M. O. and H. Uhlig (2002) who suggested a smoothing parameter of 6.25 for annual data.

¹⁰ Given the fact that the marginal impact of changing a variable is not constant in a probit model, we set all variables to their means to compute it

rents increase. At the same time, they are positively correlated with the acceptance of market-oriented policies or the presence of an IMF program. Aid downward shifts are more likely when recipient countries develop or are less diplomatically close to the United States or Russia.

Upward shifts. The estimates are in line with expectations. The estimated marginal effect of GDP per capita is negative and statistically significant (see columns 1 and 3). An increase in per capita GDP by US\$ 50 decreases the probability of an aid upward shift by 25 percent. In addition, natural resources rents are a significant factor in the structural changes in aid inflows. As expected, an increase in natural resources rents received reduces the need for aid. The marginal effect of natural rents is negative and robust on aid upward shifts (see columns 1 to 3). On average, an increase in natural rents by 1 percent of GDP decreases the probability of an aid upward shift by 14 percent. Conversely, as anticipated, IMF-supported programs are positively and significantly associated with a higher likelihood of upward shifts (see columns 1 to 3). This corroborates the argument that an IMF-supported program in developing countries plays a catalytic role in the donor community. Being under an IMF program increase the probability of experiencing a surge in aid inflows as percent of GDP by almost 37 to 42 percent. Regarding ideological considerations, Table 1 shows that the acceptance of market-oriented policies is associated with a higher probability of aid upward shifts. The related marginal effect is statistically positive and significant. More precisely, a one standard deviation increase in the score of the acceptance of market-oriented policies results in an increase of the probability of experiencing an aid upward shift of 21 percent. This finding is consistent with Radelet (2006) who stressed that market-oriented policies play a central role in aid allocation systems. Furthermore, countries with diplomatic proximity with the United States or Russia are more likely to experience an aid upward shift. The associated marginal effects are positive and statistically significant. More specifically, a one standard deviation increase in diplomatic proximity with the United States results in an increase of the probability of experiencing an aid upward shift of 40 percent, against 28 percent for political proximity with Russia. This finding is in line with the existing literature. For instance, Alesina and Dollar (2000) find that the destination of aid is dictated by political and strategic considerations. The remaining potential determinants are not statistically significant.

Downward shifts. As for aid downward shifts, we find that they are positively and robustly correlated with the level of development, and negatively with the proximity with the United States or Russia (see columns 1 to 3). The evolution of the development stage changes the probability of a reduction in aid. Aid inflows tend to decrease as countries become richer. An increase of per capita GDP of US\$ 50 increases the probability of an aid downward shift by 50 percent. Diplomatic preferences also matter for structural changes in aid. A one standard deviation increase in political closeness with the United States induces a fall of 63 percent in the probability of experiencing an aid downward shift, compared with a fall of 57 percent for political proximity with Russia. Other potential factors are not statistically robust.

Table 1. Determinants of Aid Shifts

	Upward shifts			Downward shifts		
	(1)	(2)	(3)	(4)	(5)	(6)
Log(Aid), t-1	-0.112 (0.0901)	-0.103 (0.0956)	-0.0963 (0.0922)	0.119 (0.0793)	0.1550* (0.0898)	0.1600* (0.0872)
GDP growth, t-1	-0.459 (1.018)	-0.668 (1.054)	-0.454 (1.035)	-0.585 (1.222)	-1.121 (1.118)	-0.75 (1.237)
Debt, t-1	0.00035 (0.083)	0.0113 (0.0969)	0.0085 (0.093)	0.0246 (0.076)	-0.06 (0.0877)	-0.0613 (0.0933)
Natural resources, t-1	-0.1430*** (0.0473)	-0.1600*** (0.049)	-0.1510*** (0.0467)	0.0185 (0.0131)	0.0252* (0.0139)	0.0166 (0.0144)
FDI, t-1	-0.0227 (0.0217)	-0.0249 (0.023)	-0.0167 (0.0219)	-0.0042 (0.0213)	-0.0137 (0.022)	0.0014 (0.0203)
Remittances, t-1	-0.0499 (0.034)	-0.0671* (0.0345)	-0.0623* (0.0346)	-0.0533* (0.0303)	-0.0436 (0.0347)	-0.0798** (0.0372)
IMF, t-1	0.3760** (0.168)	0.4180** (0.17)	0.4140** (0.17)	0.2750* (0.143)	0.191 (0.158)	0.194 (0.161)
Disaster, t-1	0.0087 (0.0112)	0.0079 (0.0115)	0.0093 (0.0114)	-0.0151 (0.0106)	-0.0173 (0.011)	-0.0114 (0.0112)
Conflict, t-1	0.0203 (0.168)	0.115 (0.165)	0.0963 (0.167)	0.15 (0.148)	0.0096 (0.153)	-0.0055 (0.161)
ToT, t-1	0.131 (0.398)	0.185 (0.391)	0.137 (0.412)	-0.125 (0.386)	-0.292 (0.464)	-0.109 (0.423)
Log(GDPPC), t-1	-0.2490** (0.106)	-0.156 (0.103)	-0.2090** (0.102)	0.2920*** (0.0969)	0.2690*** (0.103)	0.3440*** (0.107)
CPIA, t-1	-0.803 (0.622)	-0.535 (0.62)	-0.848 (0.591)	-0.731 (0.582)	-0.958 (0.587)	-0.453 (0.614)
Market-Orientation, t-1	0.4630** (0.188)			-0.0661 (0.15)		
Pact USA, t-1		4.0960*** (0.941)			-7.0330*** (0.811)	
Pact Russia, t-1			2.0420*** (0.481)			-4.1880*** (0.534)
Constant	2.2520** (0.905)	2.0530** (0.893)	0.361 (1.002)	-2.6880*** (0.909)	-3.7520*** (0.936)	-0.0415 (1.046)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	858	858	858	858	858	858
Pseudo R ²	0.0944	0.1121	0.1237	0.0963	0.1518	0.18

Note: Marginal effects and standard errors in parentheses. ***p<0.01, significant at 1%; **p<0.05, significant at 5%; *p<0.10, significant at 10%.

B. Effects of Aid Shifts

We use the PSM estimator to assess the effect of aid shifts (up and down) on fiscal accounts (tax revenue, capital and current expenditures).¹¹ We compute bootstrapped standard errors based on 500 replications. The results are reported in Table 2. Overall, we find that with large and sustained aid inflows, fiscal authorities in these countries do not maintain (or increase) their tax effort, spend more on current expenditure at the expense of capital expenditure which is reduced as a share of GDP.

Upward shifts. As argued by several prior papers, we find evidence that aid upward shifts undermine tax collection efforts in recipient countries (columns 1-4). This tax displacement effect is strong and significant at the 1 percent level. Experiencing an aid upward shift leads to a loss of about 2.3 percent of tax-to-GDP. In other words, during aid upward shifts a one percentage increase in the aid-to-GDP ratio translates into a reduction in the tax-to-GDP ratio by about 0.4

¹¹ Note that the covariates are balanced. Results for balance test are reported in Appendix A5.

percentage points.¹² This finding is consistent with McGillivray and Morrissey (2001) and Benedek and others (2013) who argue that foreign aid creates disincentives for governments to maintain or step up domestic resource mobilization. On the expenditure side, there is evidence of competition effects of aid upward shifts. On the one hand, higher aid inflows tend to reduce public investment as a share of GDP. We find that aid upward shifts are robustly associated with a decrease in capital expenditure as a share of GDP. The effect is significant at the 1 percent significant level. Experiencing an aid upward shift yields to a decrease in capital expenditure by about 3.3 percentage points of GDP. This is equivalent to a decrease in capital expenditure by about 0.6 percentage points for a one percentage increase in the aid-to-GDP ratio during upward shift episodes. This is consistent with Franco-Rodriguez (2000). They find that aid reduces investment spending. On the other hand, aid upward shifts are associated with higher current expenditure, though significant at only the 10 percent level. After an aid upward shift, current expenditure tends to increase by 6.4 percent of GDP. Put differently, this corresponds to an increase of current expenditure by about 1.1 percentage points for a one percentage increase in the aid-to-GDP ratio. This last finding is consistent with the theory of “aid illusion” according to which aid can induce excess spending mostly on current expenditure items (McGillivray and Morrissey, 2000). We further estimate the effect of upward and downward shifts in aid dependency on each tax component: personal income tax, corporate income tax, value added tax (VAT), and trade tax. Results are reported in Table 3. Except for trade tax revenue, we find that upward shifts in aid dependency negatively affect all types of tax revenues. This effect is more pronounced for VAT revenue and less for corporate income tax revenue. Moreover, we find that the results for trade tax revenue are not significant.

Downward shifts. For downward shifts, results are different (columns 5-8). Tax displacement is not observed. Capital expenditure remains unaffected. Only current expenditure is reduced after a large reduction in aid inflows. The effect is statistically robust at the 5 percent level. After an aid downward shift, current expenditure is reduced by about 2.8 percent. This is equivalent to a decrease in current expenditure by about 0.5 percentage points for every one percentage decrease in the aid-to-GDP during the downward shift episode. We also find that aid upward shifts and aid downward shifts have asymmetric effects of fiscal accounts in developing countries. Large and sustained aid inflows undermine tax capacity and public investment while large reductions in aid inflows tend to have no impact on tax and spending ratios. Only current expenditure is affected, by increasing with significant increases in aid inflows and decreasing with falls in aid inflows. Furthermore, we find that aid upward shifts in aid dependency create a crowding out effect on tax collection, whereas aid down-breaks do not affect tax-to-GDP ratio. However, given that total tax revenues encompasses several components, the global effect may hide differences between different taxes. Estimates indicate that they have detrimental effects on corporate income tax and goods and services tax revenues. Downward shifts in aid dependency may lead to a decline in foreign help on capacity building in technical assistance, which in turn results in less means to collect taxes. On the contrary, we find that downward shifts in aid dependency have positive effects on trade tax revenues.

¹² Recall that on average, in aid dependency, the aid-to-GDP ratio increases by 5.9 percentage points during upward shifts and decreases by 7.1 percentage points during downward shifts.

Table 2. Effects of Aid Shift

		Upward shifts				Downward shifts			
		Nearest-Neighbor Matching k=1	Radius Matching r=0.01	Kernel	Local Linear Regression	Nearest-Neighbor matching k=1	Radius matching r=0.01	Kernel	Local Linear Regression
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tax revenue	ATT	-2.2950*** (0.764)	-2.2950*** (0.837)	-2.2950*** (0.794)	-2.2950*** (0.817)	1.183 (1.006)	1.183 (0.98)	1.183 (0.975)	1.183 (0.987)
	Treated	71	71	71	71	83	83	83	83
	Control	670	670	670	670	658	658	658	658
	Total	741	741	741	741	741	741	741	741
Capital expenditure	ATT	-3.3260*** (1.097)	-3.3260*** (1.085)	-3.3260*** (1.045)	-3.3260*** (1.063)	-0.398 (1.319)	-0.398 (1.332)	-0.399 (1.24)	-0.399 (1.253)
	Treated	71	71	71	71	95	95	95	95
	Control	765	765	765	765	741	741	741	741
	Total	836	836	836	836	836	836	836	836
Current expenditure	ATT	6.3800* (3.6)	6.3800* (3.547)	6.3800* (3.528)	6.3800* (3.561)	-2.8390** (1.118)	-2.8400*** (1.033)	-2.8400*** (1.096)	-2.8400** (1.183)
	Treated	72	72	72	72	95	95	95	95
	Control	765	765	765	765	742	742	742	742
	Total	837	837	837	837	837	837	837	837

Note: Bootstrapped standard errors are reported in parentheses based on 500 replications. ***p<0.01, significant at 1%; **p<0.05, significant at 5%; *p<0.10, significant at 10%.

Table 3. Effects of Shifts in Aid Dependency on Revenue Items

		Upward shifts	Downward shifts
		(1)	(2)
Goods and Services revenue	ATT	-0.7705*** (0.293)	-0.6552** (0.2778)
	Treated	71	80
	Control	659	650
	Total	730	730
Value Added Tax revenue	ATT	-0.7824* (0.4272)	0.0889 (0.4659)
	Treated	35	23
	Control	210	222
	Total	245	245
Income Tax Revenue	ATT	-0.7238*** (0.277)	0.1513 (0.3918)
	Treated	69	83
	Control	669	655
	Total	738	738
Corporate Tax Revenue	ATT	-0.4594*** (0.133)	-0.3928** (0.153)
	Treated	61	66
	Control	565	560
	Total	626	626
Trade Tax Revenue	ATT	-0.3502 (0.5094)	1.5203** (0.7229)
	Treated	71	80
	Control	660	651
	Total	731	731

Note: Nearest-Neighbor matching estimator. Bootstrapped standard errors are reported in parentheses. They are based on 500 replications of the data. ***p<0.01, significant at 1 percent; **p<0.05, significant at 5 percent; *p<0.10, significant at 10 percent.

C. Non-linear Effects of Aid Shifts

In previous literature, the effect of foreign aid on government accounts has been addressed by using a linear framework. Few authors have tried to explore the non-linear effect of aid on fiscal policy. Existing studies have been run by including either both the aid variable and its squared term as explanatory variables or by interacting aid with other macroeconomic variables (see Benedek and others 2013, Gupta and others 2003, Morrissey, Islei and M'Amanja 2006, Brun, Chambas and Guerinéau 2008, Clist and Morrissey 2011). Below, we explore the role of key non-linearities identified in the existing literature. We focus mostly on the presence of IMF-supported programs, the quality of governance, and the absorptive capacity.

IMF-supported programs and tax displacement

IMF program has an important role in revenue mobilization in developing countries. There is an increased reliance on revenue conditionality in IMF-supported programs through IMF's technical assistance. However, evidence on the role of IMF-supported programs on revenue are limited and mixed. Bulir and Moon (2003) and Cho (2009) in 93 developing countries during 1951-2000 and found that IMF-supported programs had no effect on revenue collections. By contrast, Brun, Chambas and Laporte (2010) concluded that IMF-supported programs had a positive impact on total revenues in sub-Saharan Africa during 1984-2007. Recently, Crivelli and Gupta (2014) analyze the impact of revenue conditionality in IMF-supported programs on tax

revenue collection in developing countries. They find that revenue conditionality embedded in IMF-supported programs has a positive impact on tax revenue. We further explore the role of IMF-supported in the fiscal effects of shifts in aid dependency in developing countries. To explore the role of IMF-supported programs, we follow split the sample into IMF and non-IMF program observations. The results are reported in Table 4. We find that the adverse effect on tax collection of upward shifts in aid dependency is muted under IMF programs. The tax displacement effect documented earlier is relatedly larger during upward shifts with no IMF-supported program. The estimated coefficient is significant and 3 times higher than the baseline estimates. In contrast, under IMF-supported program, the undesirable effect tends to be muted. This is in line with Brun, Chambas and Laporte (2010) and Crivelli and Gupta (2014). Conditionalities embedded in IMF-supported programs have a positive effect on revenue mobilization and help mute the tax displacement effect.

Table 4. IMF-supported Programs and Tax Displacement

		Upward shifts		Downward shifts	
		IMF program	Non-IMF program	IMF program	Non-IMF program
		(1)	(2)	(3)	(4)
Tax revenue	ATT	-0.7479 (0.9562)	-6.779*** (0.954)	1.2054 (1.085)	1.761 (2.159)
	Treated	57	14	62	21
	Control	454	216	449	209
	Total	511	230	511	230

Note: Nearest-Neighbor matching estimator. Bootstrapped standard errors are reported in parentheses. They are based on 500 replications of the data. *** $p < 0.01$, significant at 1 percent; ** $p < 0.05$, significant at 5 percent; * $p < 0.10$, significant at 10 percent.

Quality of governance and absorptive capacity and fiscal effects of aid

In this section, we assess the role of absorptive capacity constraints and the quality of governance. Previous literature has pointed out that developing countries can have difficulties in absorbing foreign aid (Guillaumont and Guillaumont Jeanneney 2006, Feeny and McGillivray 2011, Feeny and de Silva 2012). Absorptive capacity constraints limit the ability of recipient countries to manage aid productively. We follow Feeny and de Silva (2012) to construct an index of absorptive capacity. This index incorporates three major components: capacity constraints (including human capital and infrastructure constraints), governance constraints (including policy and institutional constraints), and donor practices.¹³ As for quality of governance, since the influential work of Burnside and Dollar (2000) who noted that aid is effective in a good policy environment, there has been an increasing attention on the role of the quality of governance on aid effectiveness (Alesina and Weder 2002, Neumayer 2003a). We therefore consider the Polity2 index of degree of democracy extracted from the Polity IV database (Marshall, Gurr and Jaggers 2012).

To assess the role of absorptive capacity constraints and the quality of governance, we divide our sample into two sub-samples determined by the median score.¹⁴ The results are reported in Table 5 for both the absorptive capacity and the quality of governance. It turns out that the tax displacement effect of aid, the “aid illusion” effect on current expenditure, and the decline in

¹³ See in Appendix A3 for more detail of the index of absorptive capacity.

¹⁴ We also use the mean score. The results remain broadly unchanged.

capital expenditure after aid upward shifts are only present in low absorptive capacity countries. When a country suffers from low absorptive capacity, aid undermines the recipient government's incentive to invest in effective domestic tax collection, and diverts public investment into government consumption. When absorptive capacity constraints become more of a problem, unit costs for tax collection and investment rise and reduce recipient countries' ability to mobilize tax revenue or invest in the economy. As for aid downward shifts, Table 5 shows that they are correlated with a decline in capital expenditure when the absorptive capacity is low.

We now turn to the role of the quality of governance. The results are similar to those for absorptive capacity as regards aid upward shifts. Aid upward shifts lower tax collection by about 2.9 percent of GDP and capital expenditure when the recipient country has low governance score. As for aid downward shifts, they have fiscal effects only when the quality of governance is low. More specifically, aid downward shifts reduce government expenditure (total, current, and capital expenditure) and this crowding-out effect is related to the cuts in potential aid income.

In summary, we find that the tax displacement effect of aid, the "aid illusion" effect on current expenditure, and the decline in capital expenditure after aid upward shifts are only present in countries with low governance scores and low absorptive capacity countries.

D. Time-varying Effects of Aid Shifts

The focus of the literature is on the short-term effects of aid. However, aid may also have long-term effects on fiscal variables given the fact that aid is usually allocated for a multi-annual period and some projects supported by donors are often executed in over several years. In this section, we investigate the dynamic effects of aid shifts on the fiscal accounts in recipient countries. From a policymaker viewpoint it is essential to assess whether the consequences identified above are permanent or short-lived. Indeed, over time, governments could implement necessary reforms and adapt to the fiscal consequences of aid upward shifts or downward shifts. On the contrary, governments may be unable to manage sustainably significant changes in aid dependency. To assess the potential dynamic effects of aid shifts on fiscal accounts, we follow Fang and Miller (2011) by using dynamic propensity score matching. This approach allows us to explore whether the fiscal effects of aid are lasting. We retain the 4-year window for the analysis. The results for both aid upward shifts and downward shifts are reported in Table 6.

Table 5. Role of Quality of Governance and Absorptive Capacity and Fiscal Effects of Aid

		Absorptive capacity				Quality of governance			
		Upward shifts		Downward shifts		Upward shifts		Downward shifts	
		Low	High	Low	High	Low	High	Low	High
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tax revenue	ATT	-1.6770***	-0.44	0.789	2.52	-2.9260***	-1.084	1.415	1.234
		(0.551)	(2.405)	(0.894)	(1.804)	(0.717)	(1.303)	(1.186)	(1.416)
	Treated	50	21	46	37	35	36	31	52
	Control	296	374	300	358	203	467	207	451
	Total	346	395	346	395	238	503	238	503
Capital expenditure	ATT	-2.1030**	-1.161	-2.2480***	2.708	-4.6640***	-1.36	-2.7910**	1.147
		(0.992)	(2.337)	(0.856)	(2.26)	(1.328)	(1.516)	(1.152)	(1.947)
	Treated	50	21	51	44	35	36	35	60
	Control	337	428	336	405	235	530	235	506
	Total	387	449	387	449	270	566	270	566
Current expenditure	ATT	2.2880*	1.5832	-0.46	-5.2270***	0.7398	1.673	-0.9671***	0.6
		(1.385)	(0.994)	(1.392)	(1.565)	(0.6157)	(1.843)	(0.2162)	(1.224)
	Treated	49	23	51	44	39	33	35	60
	Control	334	431	332	414	242	523	246	496
	Total	383	454	383	454	281	556	281	556

Note: Nearest-Neighbor matching estimator. Bootstrapped standard errors are reported in parentheses. They are based on 500 replications of the data. ***p<0.01, significant at 1 percent; **p<0.05, significant at 5 percent; *p<0.10, significant at 10 percent.

Upward shifts. We find that the tax displacement effect lasts only two years. Indeed, the magnitude of the tax displacement effect of an aid upward shift decreases over time moving from 2.3 percent in T0 to 2.0 percent of GDP in T2. It also vanishes over two years, as the estimates for outer years are not statistically significant. Conversely, the effect of an aid upward shift on capital expenditure is permanent, lasting at least five years and even increasing over time. The negative effect of an aid upward shifts on capital expenditure increases over time until it reaches a crowding-out effect of about 4.0 percent of GDP at T4. In addition, the positive effect on current expenditure is permanent and around 6.5 percent of GDP (significant at only 10 percent) at least for four years.

Downward shifts. Table 6 shows the effects of aid downward shifts discussed above are persistent. Aid downward shifts do not affect tax collection over time. This finding is consistent with previous results, which showed that aid downward shifts are not correlated with tax revenue. However, the declines in current expenditure seem to be persistent over time until the year T4. However, this crowding-out effect is lower for current expenditure. Contrary to previous results, Table 6 shows that aid downward shifts negatively affect capital expenditure from the year T4.

VI. ROBUSTNESS CHECKS

We check the robustness of our findings using several alternative specifications. We primarily focus on the use of larger trimming factor, the double robustness method suggested by Lunceford and Davidian (2004), and estimate multi-valued treatment effects. So far, we have used a trimming $\varepsilon = 0.10$, which represents a minimum number of 5 years between segments. Here, we test for $\varepsilon = 0.15$, corresponding to 8 years between segments. In other words, each aid dependency period must contain the minimum number of 8 years. The results are reported in Table 7 for the two first robustness exercises. Our previous findings are robust to these checks.

Table 6. Time-varying Effects of Aid Shifts

		Upward shifts				Downward shifts			
		T1	T2	T3	T4	T1	T2	T3	T4
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tax revenue	ATT	-2.1753** (0.8401)	-2.0380** (0.95)	-1.6943 (1.1756)	-1.5926 (1.2811)	0.9334 (0.9528)	0.7402 (0.9221)	0.6230 (0.8323)	0.5127 (0.8481)
	Treated	69	67	66	67	84	84	85	89
	Control	674	653	633	609	659	636	614	587
	Total	743	720	699	676	743	720	699	676
Capital expenditure	ATT	-3.3892*** (1.0912)	-3.5271*** (0.8945)	-3.851*** (0.9093)	-4.0111*** (0.8431)	-0.5839 (1.2394)	-0.8621 (1.2864)	-1.6472 (1.1184)	-2.1739** (1.0021)
	Treated	71	71	71	72	95	95	95	95
	Control	762	729	695	659	738	705	671	636
	Total	833	800	766	731	833	800	766	731
Current expenditure	ATT	6.3027* (3.472)	6.1414* (3.4504)	6.0646* (3.3822)	6.1094* (3.4412)	-2.9487*** (1.1025)	-2.7631** (1.0891)	-2.4292** (1.1188)	-2.0067* (1.1482)
	Treated	72	72	72	72	95	95	95	95
	Control	762	729	695	661	739	706	672	638
	Total	834	801	767	733	834	801	767	733

Note: Nearest-Neighbor matching estimator. Bootstrapped standard errors are reported in parentheses. They are based on 500 replications of the data. ***p<0.01, significant at 1 percent; **p<0.05, significant at 5 percent; *p<0.10, significant at 10 percent.

Table 7. Robustness Checks: Fiscal Effects of Aid Shifts

		Upward shifts		Downward shifts	
		Large trimming factor	Double robustness	Large trimming factor	Double robustness
		(1)	(2)	(3)	(4)
Tax revenue	ATT	-3.0740*** (0.542)	-2.2950*** (0.805)	4.0950** (1.882)	1.183 (0.923)
	Total observations	741	741	741	741
Capital expenditure	ATT	-4.1890*** (1.146)	-3.3260*** (1.048)	4.296 (2.677)	-0.398 (1.225)
	Total observations	836	836	836	836
Current expenditure	ATT	1.0202** (0.4722)	6.3800* (3.385)	-5.3200*** (0.946)	-2.8390** (1.125)
	Total observations	837	837	837	837

Note: Bootstrapped standard errors are reported in parentheses. They are based on 500 replications of the data. ***p<0.01, significant at 1%; **p<0.05, significant at 5%; *p<0.10, significant at 10%. We use the Nearest Neighbor Matching estimator.

VII. CONCLUSION

In this paper we take a closer look at the correlates and the fiscal effects of shifts in aid dependency. This study takes a different approach from the traditional aid allocation framework by looking directly at shifts in aid dependency the determinants of these shifts, and their effects on fiscal accounts. We adopted the structural shift model of Bai and Perron's (1998, 2003) methodology to identify the shift points in aid for a sample of 59 developing countries over the period from 1960 to 2010.

We find that aid shifts are frequent in developing countries. Upward shifts tend to be correlated negatively with the economic development of recipient countries, the exploitation of natural resources, and positively correlated with the acceptance of market-oriented policies or the presence of an IMF program. In addition, countries with diplomatic proximity with the United States or Russia are more likely to experience an aid upward shift. As for aid downward shifts, we find that their likelihood is higher when recipient countries develop or do not have diplomatic proximity with the United States or Russia. We further assess the fiscal effects of these shifts in aid dependency using propensity score matching estimators which control for selection bias. Overall, we find that aid upward shifts and aid downward shifts have asymmetric effects on the fiscal accounts. We find that large aid inflows not only undermine governments' tax efforts, but also create a crowding-out effect on capital expenditure. [Sustained external financing fuels current expenditure and creates the "aid illusion" effect. Aid downward shifts have negative effects on current expenditure. Aid spent on current expenditure items is just withdrawn when aid flows are reduced. These effects are more pronounced in countries with low governance scores, low absorptive capacity, and without an IMF-supported program. In addition, we find that the tax displacement effect last only two years while the impacts on expenditure items tend to last at least five years.

In summary, our investigation points that aid inflows should be managed with cautious especially to countries with low governance or absorptive capacity. Efforts and capacity building should focus on maintaining or even strengthening tax capacities or public investment implementation in recipient countries. Conversely, when countries graduate or are rationed from aid, efforts could focus on preserving current spending which is essential for inclusive growth, such as well targeted social programs.

APPENDICES

Appendix A1. Distribution of Aid Shifts by Country

Aid upward shifts with a trimming of $\epsilon=10$, by country						Aid downward shifts with a trimming of $\epsilon=10$, by country			
Country	Year	Country	Year	Country	Year	Country	Year	Country	Year
Afghanistan	2004	Gambia	1977	Niger	1973	Burundi	1995	Sri Lanka	1996
Burundi	1978	Gambia	1986	Niger	1985	Benin	1997	Lesotho	1994
Burundi	1986	Guinea-Bissau	1977	Nicaragua	1979	Bolivia	1997	Lesotho	2000
Burundi	2004	Guinea-Bissau	1987	Nicaragua	1991	Botswana	1999	Mozambique	1995
Benin	1978	Guyana	1990	Nepal	1987	Central African Rep.	1992	Mauritania	1998
Benin	1989	Honduras	1982	Oman	1974	Central African Rep.	1997	Niger	1995
Benin	2004	Haiti	1994	Papua New Guinea	1966	Cote d'Ivoire	1997	Nepal	1992
Burkina Faso	1973	Haiti	2005	Rwanda	1978	Cameroon	1995	Nepal	1997
Burkina Faso	1978	Jordan	1974	Rwanda	1991	Congo, Rep.	1999	Oman	1983
Burkina Faso	1990	Jordan	1980	Rwanda	2005	Comoros	1994	Papua New Guinea	1985
Bolivia	1989	Kenya	1978	Senegal	1979	Costa Rica	1988	Papua New Guinea	1993
Bhutan	1982	Kenya	1987	Senegal	1986	Costa Rica	1993	Papua New Guinea	1999
Bhutan	1988	Kenya	2005	Sierra Leone	1978	Djibouti	1995	Rwanda	1996
Bhutan	1995	Cambodia	1994	Sierra Leone	1993	Egypt	1978	Senegal	1993
Botswana	2005	Laos	1989	Sierra Leone	2003	Egypt	1996	Sierra Leone	1998
Central African Rep.	1979	Laos	1995	El Salvador	1978	Guinea	1995	El Salvador	1994
Central African Rep.	1987	Liberia	2005	El Salvador	1982	Guinea	2000	Swaziland	1981
Cote d'Ivoire	1990	Sri Lanka	1978	Syria	1974	Gambia	1994	Syria	1984
Cameroon	1989	Sri Lanka	2003	Chad	1974	Guinea-Bissau	1997	Chad	1997
Congo, Rep.	1975	Lesotho	1978	Chad	1987	Haiti	1999	Togo	1993
Congo, Rep.	1994	Madagascar	1980	Togo	1977	Jordan	1986	Tunisia	1993
Congo, Rep.	2004	Madagascar	2004	Togo	1985	Jordan	1992	Tanzania	1993
Costa Rica	1978	Mali	1973	Tunisia	2001	Kenya	1992	Congo, Dem. Rep.	1992
Costa Rica	1983	Mali	1979	Uganda	1980	Kenya	1997		
Egypt	1973	Mongolia	1991	Uganda	1988				
Egypt	1990	Mongolia	1997	Congo, Dem. Rep.	1987				
Ethiopia	1985	Mozambique	1987	Congo, Dem. Rep.	2002				
Ethiopia	2004	Mauritania	1974	Zambia	1986				
Ghana	1986	Malawi	1978						
Guinea	1987	Malawi	1987						

Appendix A2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP growth	2005	0.0365	0.0617	-0.7139	0.72406
Debt	1877	81.029	90.9155	1.7221	209.92
Natural resources	1995	1.5137	4.3678	0	46.4998
FDI	1860	2.4648	6.2188	0.2892	91.0073
Remittances	1582	17.7439	2.4286	9.2085	23.0766
IMF	1549	0.5571	0.4968	0	1
Market Oriented	2087	-0.463	0.4558	-1.9223	1.6873
Disaster	2130	0.2681	0.5308	0	1
Conflict	2130	0.2056	0.4042	0	1
ToT	1868	-0.2014	0.3131	-3.4561	7.851
Log(GDPPC)	1963	6.5219	0.9231	3.9128	9.6254
CPIA	1654	0.5508	0.1359	0.1666	1
Pact USA	2086	0.1697	0.0913	0	1
Pact Russia	2086	0.7021	0.1386	0.1666	1
Election	2189	0.1973	0.3981	0	1
Military	1110	0.2717	1.6397	0	1
Plurality	1410	0.7723	0.4195	0	1
Opposition	2131	2.657	1.5898	1	76.0963
Nationalism	2084	0.1617	0.3683	0	1
Polity2	1923	-1.4056	6.6065	-10	10
Absorptive capacity	2113	0.1088	0.0892	0.000096	0.6321

Appendix A3. Components of the Index of Absorptive Capacity

Component	Measurement	Source
Human capital	(i) Number of nurses per thousand people	World Development Indicators
	(ii) Number of primary school teachers per thousand people	World Bank (2014)
	(iii) Number of secondary school teachers per thousand people	
	(iv) Adult literacy	
Infrastructure	(i) Paved roads (percent of total)	
	(ii) Number of telephone lines per thousand people	
Policy/institutional	CPIA	IMF database
Donor practices	Ratio of the number of donors to the log of government expenditure	OECD-QWIDS datasets

Source: Feenv and de Silva (2012)

Appendix A4. The Propensity Scores Matching (PSM) Method

As highlighted above, aid shift country-years are the treatment group whereas the remainder of the sample constitutes the control group. When estimating the effect of aid shifts on fiscal variables, the average treatment effect of aid shifts on the treated group (ATT) would be of interest and is given by:

$$ATT = E[\Delta FV_{i1}|AB_i = 1] - E\Delta FV_{i0}|AB_i = 1 \quad (A1)$$

With AB a dummy variable identifying countries experiencing aid shifts in any given year, $\Delta FV_{i0}|AB_i = 1$ the change in fiscal variables that would have been observed if a country experiencing aid shift had not experienced such a shift, and $\Delta FV_{i1}|AB_i = 1$ is the change in fiscal variable observed on the same country. However, given the fact that the initial macroeconomic conditions of countries experiencing aid shifts could be different from those of non-affected countries, it is not plausible to assume that fiscal variables would be the same in the absence of aid shifts. Therefore, a sizeable selection bias would be present. The propensity score matching method allows overcoming this problem of selection on observables problem. The key assumption to eliminate selection bias from equation (A1) through matching methods is conditional independence, which requires that conditional on some control variables X, the effect be independent of the aid shift dummy, i.e., $E[\Delta FV_{i0}|AB_i = 1, X_i] - E\Delta FV_{i0}|AB_i = 0, X_i$ would be zero. Under this assumption, equation (1) can be rewritten as:

$$ATT = E[\Delta FV_{i1}|AB_i = 1, X_i] - E\Delta FV_{i0}|AB_i = 0, X_i \quad (A2)$$

Rosenbaum and Rubin (1983) propose that the treated units and control units can be matched on their propensity scores, which can be estimated by simple probit or logit models. A further assumption needed to apply PSM is the common support assumption ($p(X_i) < 1$), which requires the existence of some comparable control units for each treated unit. When PSM is used, the ATT now can be estimated as:

$$ATT = E[\Delta FV_{i1}|AB_i = 1, p(X_i)] - E\Delta FV_{i0}|AB_i = 0, p(X_i) \quad (A3)$$

The strategy consists of calculating the difference in the fiscal variable for observations with similar propensity scores (the probability of experiencing aid shift).

Appendix A5. Balance Tests

We examine whether the treatment model balanced the covariates by performing a statistical test. The Table below reports the probabilities of the over identification test for covariate balance. The null hypothesis is that the covariates are balanced. We cannot reject the null hypothesis that the covariates are balanced. We can trust the estimated treatment effect.

	Upward shifts	Downward shifts
Tax revenue	0.882	0.445
Total expenditure	0.833	0.88
Capital expenditure	0.905	0.989
Current expenditure	0.837	0.904
Overall balance	0.372	0.943
H0: Covariates are balanced. Table reports probabilities of Chi(2)		

REFERENCES

- Acosta M.A, and P. de Renzio (2008). Aid, rents, and the politics of the budget process. IDS Working Paper 311. Institute of Development Studies, Brighton, United Kingdom. ISBN 9781858645379.
- Alesina, A. and B. Weder (2002). Do corrupt governments receive less foreign aid? *American Economic Review*, Vol. 92(4), pp. 1126-37.
- Alesina, A, and D. Dollar (2000). Who gives foreign aid to whom and why? *Journal of Economic Growth*, Vol. 5 (1), pp. 33-63.
- Bai, J. and P. Perron (1998). Estimating and Testing Linear Models with Multiple Structural Changes. *Econometrica*, Vol. 66 (1), pp. 47-78.
- Bai, J. and P. Perron (2003). Computation and Analysis of Multiple Structural Break Models. *Journal of Applied Econometrics*, Vol. 18, pp. 1-22.
- Bailey, M; Strezhnev, A. and Voeten, E. (2013). Estimating Dynamic State Preferences from United Nations Voting Data (September 25, 2013).
- Benedek, D, E. Crivelli, S. Gupta and P. Muthoora (2013). Foreign Aid and Revenue: Still a Crowding-Out Effect? *Public Finance Analysis*, Vol. 70 (1), pp. 67-96.
- Bhavan, T, C. Xu, C. Zhong (2011). The Relationship between Foreign Aid and FDI in South Asian Economies. *International Journal of Economics and Finance*, Vol. 3, No 2, pp. 143-149.
- Brautigam, D. A. and S. Knack (2004). Foreign aid, institutions, and governance in Sub-Saharan Africa. *Economic Development and Cultural Change*, Vol. 13, pp. 255-285.
- Brun, J-F, G. Chambas and B. Laporte (2010). IMF programs and tax effort. What role for institutions in Africa? CERDI. Etudes et Documents E 2010.33. Clermont-Ferrand, France
- Brun, J-F, G. Chambas and S. Guerineau (2008). Aide et mobilization fiscal dans les pays en développement. CERDI, Etudes et Documents, E 2008.12, Clermont-Ferrand, France
- Bulir, A. and S. Moon (2003). Do IMF-Supported Programs Help Make Fiscal Adjustment More Durable? IMF Working Paper WP/03/38. Washington, D.C.
- Burnside, C. and Dollar, D. (2000). Aid, polities, and growth. *American Economic Review*, Vol. 90(4). pp. 847-68.
- Carter, P. (2013). Does foreign aid discourage taxation? Mimeo: Department of Economics, University of Bristol, Bristol, United Kingdom.
- Cattaneo, M. D. (2010). Efficient semiparametric estimation of multi-valued treatment effects under ignorability. *Journal of Econometrics*, Vol. 155, pp. 138-154.
- Cattaneo, M. D, D. M. Druker, and A. D. Holland. (2013). Estimation of multivalued treatment effects under conditional independence. *Stata Journal* 13, pp. 407-450.
- Chatterjee, S, Giuliano, P, and Kaya, I. (2012). Where Has All the Money Gone? Foreign Aid and the Composition of Government Spending. The B.E. *Journal of Macroeconomics*, Vol. 12(1), pp. 1-34.

- Cho, H. J. (2009). Do IMF Programs Discipline Budget Deficit? The Effects of IMF Programs on Government Budget Balance, Expenditures and Revenue. *The Korean Journal of International Relations*, Vol. 49 (6), pp. 7-33.
- Claessens, S, D. Cassimon and B. van Campenhout (2009). Evidence on changes in aid allocation criteria. *World Bank Economic Review*, Vol. 23 (2), pp. 185-208.
- Clist, P. (2014). Foreign aid and domestic taxation: Multiple sources, one conclusion. ICTD Working Paper 2014 (20), Brighton, United Kingdom.
- Clist, P, and O. Morrissey, (2011). Aid and Tax Revenue: Signs of a Positive Effect since the 1980s. *Journal of International Development*, Vol. 23, pp. 165-80.
- Collier, P. and Dehn, J. (2001). Aid, shocks and growth. World Bank Working Paper 2688, The World Bank, Washington, DC.
- Crivelli, E. and S. Gupta (2014). Does conditionality in IMF-supported programs promote revenue reform? IMF Working Paper WP/14/206. Washington, DC.
- Dehejia, R, and Wahba, S. (2002). Propensity score-matching methods for non-experimental causal studies. *Review of Economics and Statistics*, Vol. 84, pp. 151-161.
- de Ree, J. and Nillesen, E. (2009). Aiding Violence or Peace? The Impact of Foreign Aid on the Risk of Civil Conflict in Sub-Saharan Africa. *Journal of Development Economics*, Vol. 88 (2), pp. 301-313.
- Dobronogov, A. and O. Keutiben (2014). Containing Volatility: Windfall Revenues for Resource-Rich Low-Income Countries. Policy Research Working Paper 6956, The World Bank. Washington, DC.
- Dollar, D, and Levin, V. (2006). The increasing selectivity of foreign aid, 1984-2003. *World Development*, Vol. 34 (12), pp. 2034-2046.
- Donaubauer, J, Herzer, D, and Nunnenkamp, P. (2014). Does Aid for Education Attract Foreign Investors? An Empirical Analysis for Latin America. *European Journal of Development Research*, Vol. 26, pp. 597-613.
- Dreher, A, M. Schmaljohann and P. Nunnenkamp. (2013). The Allocation of German Aid: Self-interest and Government Ideology. *Economics and Politics*, Vol. 27 (1), pp. 160-184.
- Fang, W. and Miller, S, (2011). The lag in effect of inflation targeting and policy evaluation. *Applied Economic Letter*, Vol. 18 (14), pp. 1371-1375.
- Feeny, S. and A. de Silva (2012). Measuring absorptive capacity constraints to foreign aid. *Economic Modelling*, Vol. 29, pp. 725-733
- Feeny, S. and M. McGillivray (2011). Scaling-up Foreign Aid: Will the 'Big Push' Work. *The World Economy*, Vol. 34, pp. 54-73
- Franco-Rodriguez, S. (2000). Aid and the Public Sector in Pakistan: Evidence with Endogenous Aid. *Journal of International Development*, Vol. 12, pp. 429-441.
- Fuchs, A, A. Dreher and P. Nunnenkamp, (2014). Determinants of Donors Generosity: A Survey of the Aid Budget Literature. *World Development*, Vol. 56, pp. 172-199, 2014.

- Gündüz, Y. B. and M. Crystallin (2014). Do IMF-Supported Programs Catalyze Donor Assistance to Low-Income Countries? IMF Working Paper WP/14/202. Washington, DC.
- Gupta, S, Clements, B, Pivovarsky, A. and Tiongson, E.R, (2003). Foreign Aid and Revenue Response: Does the Composition of Aid Matter? IMF Working Paper, WP/03/176. Washington, DC.
- Harms, P, and Lutz, M. (2006). Aid, governance and private foreign investment: Some puzzling findings for the 1990s. *The Economic Journal*, Vol. 116 (513), pp. 773-790.
- Hausmann R, Pritchett L, Rodrick D, (2005). Growth Accelerations. *Journal of Economic Growth*, Vol. 10, pp. 303-329.
- Heckman, J, Ichimura, H, Todd, E, (1998). Matching as an econometric evaluation estimator. *Review of Economic Studies*, Vol. 65, pp. 261-294.
- Jarstad, A, D. Nilsson and R. Sundberg (2012). The IMPACT (Implementation of Pacts) Dataset Codebook, Version 2.0, Department of Peace and Conflict Research, Uppsala University, available at <http://www.pcr.uu.se/data/>. Accessed on June 2015.
- Lloyd, T, McGillivray, M, Morrissey, O, and Opoku-Afari, M. (2009). The fiscal effects of aid in developing countries: A comparative dynamic analysis. In G. Mavrotas, and M. McGillivray (Eds.), *Development aid: A fresh look* (pp. 158-179). Basingstoke: Palgrave Macmillan UNU-WIDER Studies in Development Economics and Policy.
- Lu, C, Schneider, M, Gubbins, P, Leach-Keman, K, Jamison, D, and Murray, C. (2010). Public financing of health in developing countries: A cross-country systematic analysis. *Lancet*, Vol. 375, pp. 1375-1387.
- Lunceford, J. K, and M. Davidian. (2004). Stratification and weighting via the propensity score in estimation of causal treatment effects: a comparative study. *Statistics in Medicine*, Vol. 23, pp. 2937-2960.
- Marshall, M. G, T. R. Gurr and K. Jagers (2012). Political Regime Characteristics and Transitions, 1800-2012. Polity IV Project.
- Martins, P.M.G, (2007). The impact of foreign aid on government spending, revenue and domestic borrowing in Ethiopia. International Poverty Centre working paper. Brasilia, Brazil.
- Martins, P.M.G, (2010). Fiscal dynamics in Ethiopia: A cointegrated VAR model with quarterly data: CREDIT research paper 10/05. University of Nottingham, School of Economics, Nottingham, United Kingdom.
- McGillivray, M, and O. Morrissey (2000). Aid illusion and public sector fiscal behavior. CREDIT Research Paper 00/9, University of Nottingham. Nottingham, United Kingdom.
- McGillivray, M, and O. Morrissey (2001). A review of evidence of the fiscal effects of aid. CREDIT Research Paper 01/13, University of Nottingham. Nottingham, United Kingdom.
- McGillivray, M, and Morrissey, O. (2004). 'Fiscal effects of aid. In T. Addison, and A. Roe (Eds.), *Fiscal policy for development* (pp. 72-96). Basingstoke: Palgrave/WIDER, Helsinki, Finland.
- Morrissey, O. (2015). Aid and fiscal Behavior: Assessing Recent Evidence. *World Development*, Vol. 69, pp. 98-105.

- Morrisey, O, O. Islei and D. M'Amanja (2006). Aid Loans versus Aid Grants: Are the Fiscal Effects Different? Prepared for the WIDER Conference on *Aid: Principles, Policies and Performance*, Helsinki, 16-17 June.
- Moss, T, Pettersson, G, and van de Walle, N. (2008). An aid-institutions paradox? A review essay on aid dependency and state building in sub-Saharan Africa. In *Reinventing Foreign Aid*, ed. William Easterly, Cambridge MA: The MIT Press.
- Neumayer, E. (2003a). The Determinants of Aid Allocation by Regional Development Banks and United Nations Agencies. *International Studies Quarterly*, Vol. 47 (1), pp. 101-122.
- Neumayer, E. (2003b). Do human rights matter in bilateral aid allocation? A quantitative analysis of 21 donor countries. *Social Science Quarterly*, Vol. 84 (3), pp. 650-66.
- Ouattara, B. (2006). Foreign aid and fiscal behavior in developing countries: panel data evidence. *Economic Modelling*, Vol. 23 (3), pp. 506-514.
- Pettersson, J. (2007). Foreign sectoral aid fungibility, growth and poverty reduction. *Journal of International Development*, Vol. 19 (8), 1074-1098.
- Radelet, S. (2006). A primer on Foreign Aid. Center for Global Development, Working Paper N°92. Washington, DC.
- Rajan, R.G. and Subramanian, A. (2008). Aid and growth: what does the cross-country evidence really show? *The Review of Economics and Statistics*, Vol. 90 (4), pp. 643-65.
- Ravn, M. O. and H. Uhlig (2002). On Adjusting the Hodrick-Prescott Filter for the Frequency of Observations. *Review of Economics and Statistics*, Vol. 84, pp. 371-376.
- Strömberg, D. (2007). Natural Disasters, Economic Development, and Humanitarian Aid. *Journal of Economic Perspectives*, Vol. 21, pp. 199-222.
- Teera, J, and Hudson, J. (2004). Tax performance: A comparative study. *Journal of International Development*, Vol. 16(6), pp. 785-802.
- Van de Sijpe, N. (2013). Is foreign aid fungible? Evidence from the education and health sectors. *World Bank Economic Review*, Vol. 27(2), pp. 320-356.
- Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. 2nd ed. Cambridge, MA: MIT Press.
- World Bank. (2014). World Development Indicators. Accessed on June 2015.
<http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>
- Yang, D. (2008). Coping With Disaster: The Impact of Hurricanes on International Financial Flows. *B.E. Journal of Economic Analysis and Policy*, Vol. 8 (1), pp. 1-43.