# The Economics and Politics of Foreign Aid and Domestic Revenue Mobilization

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## Abstract

There is considerable heterogeneity in the way aid can influence taxes in developing countries: central to this heterogeneity is the political calculus between aid and tax, measured according to accountability and bureaucratic costs. Increasing taxes is unpopular so aid can be seen as a politically less costly source of revenue. However, there are also attendant political costs in aid dependence. The main argument of this paper is that recipient countries gauge the political costs of aid against those of tax in determining which revenue source suit their political and economic objectives. Using data on 84 developing countries over the period 1980-2013, we find a positive long-run association between aid and taxes. Once novel measures of political costs are incorporated into the analysis, we find the political costs of aid (as well as its constituent parts) to be higher than those of tax, reinforcing the positive relationship between both variables. Countries with higher political costs have no significant aid-tax relationship (and occasionally a weaker relationship) than those with lower political costs. Furthermore, we find that higher bureaucratic costs of aid (as measured by high donor fragmentation) create instability in aid which is detrimental for revenue mobilisation.

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## 1. Introduction

The ratification of the Sustainable Development Goals shone spotlight on the importance of increasing taxes in developing countries. Dwindling foreign assistance will be insufficient to finance recipients' needs, with attention shifting towards supporting recipient countries' own revenue-raising efforts. Increasing taxes is a challenge for most low-income countries – where political economy constraints stymie revenue reform – allowing foreign aid to have direct effects on revenue mobilisation. Given the revenue challenges, aid provides a direct alternative source of revenue, with the choice between aid and tax depending on domestic political economy factors (Morrissey, 2015). There are legitimate concerns as to whether aid is a complement to or a substitute for domestically raised revenue; breeding a huge strand of empirical literature exploring the impact of aid on tax performance in developing countries. This paper contributes to the fiscal effects and tax performance literatures by examining, empirically, the long-run relationship between foreign aid and tax ratios in 84 developing countries over the period 1980 to 2013.

The paper focuses and builds on the political calculus between aid and tax as the primary channel through which aid affects taxation: recipient countries perceive political costs and benefits of aid and taxation as alternative sources of revenue so they make choices over which revenue source best meets their objectives (Morrissey, 2015; Morrissey & Torrance, 2015). The main argument is that collecting taxes is unpopular, and aid (especially grants) is a politically cheaper source of revenue to cover government spending. Nonetheless, there are also political costs associated with aid and the choice between aid and taxation depends on these costs, evaluated according to accountability and bureaucratic costs (Morrissey, 2013). The political calculus dimension has not received explicit theoretical and/or empirical attention in the fiscal effects and tax performance literatures but we posit that it is one of the main channels through which aid influences taxes in developing countries. This paper revisits the literature addressing the impact of aid on tax performance by providing novel proxies which measure the various political costs of aid and tax, and demonstrating – through formal econometric modelling – how they mediate the impact of aid on taxes.

Country-specific studies estimating fiscal response models (FRMs)[2] and cross-country regressions (including aid among the determinants of the tax/GDP ratio) dominate the empirical literature addressing the effect of aid on taxes. Individual country studies typically find that aid is associated with increased tax revenue (Mascagni & Timms, 2017 for Ethiopia; Osei, Morrissey, & Lloyd, 2005 for Ghana). For the cross-country studies, some find that aid crowds out tax revenue (Remmer, 2004; Bräutigam & Knack, 2004): positing that grants crowd out tax revenue while loans encourage tax effort (see *inter alia*, Gupta, Clemens, Pivovarsky, & Tiongson, 2004; Benedek, Crivelli, Gupta, & Muthoora, 2012). This implicitly assumes a behavioural impact of aid on tax revenue. Given that recipients' structural characteristics result in a contemporaneous negative relationship between high aid and low tax revenue, endogeneity (identification of the impact of aid on taxes) is a particular concern. Gupta et al., (2004) and Benedek et al., (2012) deal with this endogeneity by lagging aid for one period – using annual data it is equivalent to lagging aid by one year – and maintain their primary findings. Nonetheless, since taxes display considerable inertia and tax administration behaviour

[2] FRMs allow for the dynamic effect of aid on domestic fiscal aggregates: spending, taxes and domestic borrowing.

changes slowly, the impact of aid on taxes should take more time so using longer lags of aid is more appropriate. Clist & Morrissey (2011) explore this logic and find that their primary results are not robust. Furthermore, Clist & Morrissey (2011) find a positive relationship between aid and taxes over the period 1985 – 2005; perhaps reflecting the benefits of donor conditionality and technical assistance. Clist (2016) documents a positive relationship between aid and taxes and stresses the importance of taxation data: results are sensitive to how taxation is recorded across data sources. Carter (2013) uses more flexible panel methods – group fixed effects and (panel) time series – but finds no robust evidence of aid on taxes. These cross-country estimates provide no consensus view on the impact of aid on taxes, and we propose four reasons for dissension in the literature: persistence in aid and fiscal data, measuring aid and revenue, heterogeneity and endogeneity. Our paper uses novel methods in macro panel econometrics that circumvent these challenges.

This analysis provides new insights into the relationship between aid and taxation. First, we provide proxy variables for the political costs of taxation and aid – accountability and bureaucratic costs – in recipient countries and gauge how the primary findings change once these different political costs are explicitly incorporated into econometric analysis. Specifically, we include the vertical accountability index and constraints on the executive to proxy for accountability costs of tax. Additionally, we use the presence of an operational Semi-Autonomous Revenue Authority (SARA hereafter) in recipient countries, as well as the efficiency of revenue mobilisation (ERM) as measures of bureaucratic costs of tax.

Quantifying the political costs of aid is a novel concept since donors' characteristics/dynamics and how they mediate the aid-tax relationship have not been purposefully explored in the literature. We create a measure for the share of project finance relative to budget support as an accountability cost of aid. Most donors choose between providing project-type financing and budget support, and we posit that the former will be more than the latter in countries where the donor has limited trust in the recipient. Thus, countries where the averaged project financing is greater than averaged budget support are those for which the donors have less trust in the recipient. Hence, they are recorded as countries with high donor accountability costs. The reverse applies to countries with low accountability costs. An alternative measure of accountability costs of aid focuses on the use of recipient countries' Public Financial Management (PFM) systems by donors. The logic is that given the varying levels of pressure donors face in their own countries, their decision to either use recipient countries' PFM systems or not can be reflected in the accountability costs of aid. We posit that for recipient countries that receive an amount of aid through their country's PFM systems the accountability costs are lower. Conversely, those that do not receive any aid through their PFM systems are classified as high donor accountability cost countries. To conceptualise this, we create a dummy variable [0,1] which takes a zero for countries with high accountability costs of aid (those whose PFM systems are not used) and one for countries with low accountability costs of aid (those whose PFM systems are used).

We also create two measures of bureaucratic (administrative) costs of aid. The first measure is intended to capture fragmentation and the absence of coordination across donors. We construct a donor fragmentation index [0,100], including 21 DAC donors and seven multilateral donors. Higher values represent higher donor fragmentation, hence higher bureaucratic costs of aid and vice versa. Countries are split into the high (low) group if their averaged donor fragmentation index is higher (lower) than the median. The second measure of donor fragmentation also exploits the use of recipient

countries' PFM systems, focusing on the number of donors that bypass PFM systems in a specific recipient country. We posit that if a specific recipient country has most of their donors bypassing their PFM recipient systems, it erodes their technical capacity and is detrimental for revenue mobilisation. We operationalise this by counting the number of donors (using the same donors as in the first measure of bureaucratic costs of aid), within a specific recipient country, that bypass the country's system in disbursing aid. The variable can realistically range from 0 (no donor) to 28 (the maximum number of donors included in the analysis), with countries split based on their position relative to the median of the constructed variable.

Second, we demonstrate the importance of technical assistance for revenue performance and how it influences the political calculus between aid and taxation. Previous studies have mentioned the potential importance of technical assistance in generating a positive impact between aid and taxes (Morrissey & Torrance, 2015). However, no study explicitly measures and tests for the effect of technical assistance on tax performance, as well as its mediating impact on the political calculus between aid and taxation (especially in reducing the bureaucratic costs of taxation).

Third, we demonstrate that the stability of donor-recipient relationships, reflected by the stability of aid flows, is an important channel through which aid influences taxes. If the level of aid fluctuates wildly from one year to the next, aid may be too unpredictable for fiscal planning and may worsen revenue performance in developing countries. We generate two measures of aid uncertainty (instability) which influence tax performance: one influenced by changes in the level of donor fragmentation and the other influenced by the level of revenue diversification and exchange rate pressures. These measures are intended to represent aid uncertainty resulting from donors' characteristics, as well as aid uncertainty resulting from recipients' public revenue vulnerability, respectively.

The empirical section proceeds in four steps. Firstly, we estimate the impact of aid on taxation within an error correction model (ECM) framework by employing the dynamic Common Correlated Effects Mean Group (CCEMG) estimator (Chudik & Pesaran, 2015). The method permits testing to the presence of a long-run (co-integrating) relationship between aid and taxes, distinguishing between long-run and short-run relationships, and allowing for these effects to differ substantially across countries. Additionally, the method is robust to unobserved recipient heterogeneity (latent trends) arising from omitted variables and global shocks. Secondly, we invoke the political calculus argument in discussing the results and testing if the proxies for political costs of aid and taxation alter our main findings. No previous studies explicitly incorporate this political calculus argument into econometric specifications. Thirdly, we incorporate heterogeneity further by estimating the relationship using different aid components. While this form of heterogeneity has been explored extensively in the literature, there is a knowledge gap on the relationship between technical assistance and tax performance; especially through its impact on improving revenue administration in developing countries. There is also limited research on how aid instability resulting from donor fragmentation and revenue vulnerability influences revenue performance. Finally, simultaneity and endogeneity are addressed using time-series tests for the direction of long-run causality (Canning & Pedroni, 2008). The tests proposed by Canning & Pedroni (2008) also allow for cross-country heterogeneity and cross-section dependence, thus overcoming the problems encountered when using standard micro-econometric techniques.

Section 2 provides an analytical framework and discusses measurement of the political costs of taxation and aid. Section 3 describes the data. Section 4 sets out the econometric method used in the empirical analysis while section 5 provides results from the exploratory analysis. Section 6 concludes.

## 2. Analytical framework and measurement of political costs of taxation

Domestic revenue is typically low in developing countries, reason why they receive aid, especially grants. Given the narrow tax bases in these countries – influenced by economic, political, institutional and social factors – revenue mobilisation is as high as economically feasible but not enough to generate political gains. Aid plays a crucial role in assuaging these revenue constraints, raising genuine scepticism in ascertaining whether aid is a complement to or a substitute for domestic taxation. Since aid provides revenue, governments are less inclined to expend political and administrative effort on tax collection. This is plausible because increasing taxes is unpopular, and recipients may see aid as a politically less costly source of revenue to cover government expenditure; reducing the urgency of tax revenue collection. However, there are attendant political costs associated with aid: increased dependency, costs of accountability (donors account to their parliaments while recipient governments account to their constituencies, and donors), as well as bureaucratic costs of administration. We posit that the choice between aid and tax depends on the respective political costs, and how they offset each other (Morrissey, 2015; Morrissey & Torrance, 2015). These costs are evaluated according to accountability and bureaucratic costs.

The costs of accountability refer to whom and the extent to which a government must account for its uses of revenue (Morrissey, 2015). Recipient countries have to account to their governments on how they spend tax revenue although accountability to domestic taxpayers – a function of the political system, the institutional framework underpinning tax collection, and the broader institutional framework – is weak in low income countries. Donor agencies have to account to their governments on how their aid is used so they implement strong monitoring mechanisms to minimise fungibility (De Renzio, 2016; Morrissey, 2013). They also attach conditions and recipients have to expend effort in trying to circumvent the conditions. Some donor agencies may operate in domestic environments where there are opponents to aid (usually political parties or vocal politicians), especially in cases where some aid projects financed by said donor agencies failed; thereby increasing the accountability costs of aid.

Additionally, there are bureaucratic (administrative) costs of tax and aid. The former relates to the costs of tax administration: with fiscal reform implemented in many developing countries tax administration has improved, increasing the efficiency of taxation and reducing the bureaucratic costs of tax (Moore, 2014). The bureaucratic costs of aid, which are a function of the number of donors, refer to the costs of organising, and attending meetings with different donor agencies. These bureaucratic costs of aid are high, exacerbated by donor proliferation, disbursement heterogeneity, and the changing requirements on monitoring aid.

To measure domestic accountability to taxpayers, we use two variables: the vertical accountability index and constraints on the executive. The vertical accountability index measures the extent to which citizens have the ability to hold their governments accountable, focusing specifically

on the relationship between citizens and their elected representatives (Lührmann, Marquardt, & Mechkova, 2020). The variable ranges from -5 to 5, with higher values reflecting more accountability from government to its citizens. The executive constraints variable depicts political institutions that place constitutional checks and balances on the power of the executive. The variable ranges from 0 to 1, with higher constraints eliciting more accountability to domestic taxpayers and vice versa. Data on both variables is obtained from the Varieties of Democracy (V-Dem) database, covering the period 1980-2013. The level of accountability to domestic taxpayers – as well as the level of executive constraints – is low in low income countries with weak political and tax systems (and those that are major recipients of aid), implying a low domestic accountability cost of aid. Empirically, this will translate to a significant positive aid/tax relationship for low accountability countries and an insignificant aid/tax relationship for high accountability countries. For the vertical accountability index, there are 40 low accountability and 39 high accountability countries while for executive constraints there are 39 low accountability and 40 high accountability countries.

To measure donors' accountability to their governments we create a variable which captures the level of project-type financing relative to that of budget support given to recipients. Donors are concerned with fungibility so to reduce their own accountability costs; we posit that the donors provide more project aid than budget support. Providing more budget support will imply higher trust between the recipients and donors, especially when their preferences are aligned (Clist, Isopi & Morrissey, 2012) while more project-type financing reflects an apparent mistrust the donor has for the recipient. We proceed by averaging project aid and budget support given to all recipients over the period 2002-2013, then creating a dummy variable which takes the value of 1 if averaged project aid exceeds averaged budget support for each recipient country, and zero otherwise. Thus, we expect a stronger relationship (in terms of the sign, significance and/or estimated coefficient) for countries with low donor accountability costs (dummy variable equal to 0) than for those with high donor accountability costs (dummy variable equal to 1). There are 77 countries with high donor accountability costs and six countries with low donor accountability costs.

To measure the bureaucratic (administrative) costs of taxation, we use two measures: the presence of an operational SARA in developing countries and the efficiency of revenue mobilisation (ERM hereafter). There is evidence on the positive effects of SARAs on revenue performance although the benefits are short-lived and heterogeneous, reflective of domestic political and economic events (Dom, 2019; Ahlerup, Baskaran, & Bigsten, 2015). In principle, the effectiveness of SARAs in improving revenue performance should enhance revenue efficiency and reduce the bureaucratic costs of taxation in recipient countries, if only slightly. Thus, we disaggregate countries based on the presence of an operational SARA in the country and posit that for countries with SARAs, the bureaucratic costs of taxation are lower and vice versa. This comprises 25 SARA countries and 59 non-SARA countries. The second measure of administrative costs of tax is the ERM, obtained from the World Bank's Country Policy and Institutional Arrangements (CPIA) database. Data on the ERM is available only for 49 countries over the period 2005 to 2013. The variable, which ranges from 1 to 6, captures both tax policy (for example, the nature of tax exemptions) and tax administrative (for example, costs of tax collection and compliance) performance criteria across countries so is an ideal proxy for bureaucratic costs of tax. Higher values indicate more efficient revenue mobilisation (hence lower bureaucratic

costs) and vice versa. Taking the average for all 49 countries, we split countries into 22 high ERM (average above the median) and 27 low ERM countries (average below the median).

For the bureaucratic costs of aid, we construct a variable intended to capture donor proliferation. Proliferation makes coordination donors difficult, with the ensuing short-term and long-term effects steep on recipients (Knack & Rahman, 2007). We follow the literature and construct a donor fragmentation index, the Herfindahl index (Knack & Rahman, 2007; Annen & Moers, 2017). The Herfindahl index, which ranges from 0 to 1, is obtained by; taking the share of a specific donor's aid over all aid received by the recipient in a specific year, squaring this share and summing over all donors' aid available to a specific recipient country over the period 1980-2013. We measure donor fragmentation as one minus the Herfindahl index, multiplied by 100. A higher value represents higher fragmentation (and thus, higher bureaucratic costs of aid).[3] Hence, we expect a stronger relationship (per the matrices described above) for countries with low donor fragmentation (42 countries) than for those with high donor fragmentation (42 countries).

Alternative measures of donors' accountability and bureaucratic costs resort to the OECD DAC's Paris Declaration Monitoring Survey (PDMS) in 2011. The PDMS provides 18 indicators which measure donors' advancement towards the Paris Declaration's (PD hereafter) goals of using recipients' PFM systems for aid disbursement. We proxy for both costs by focusing on donors' use of recipient countries' PFM systems (Knack, 2013, 2014). In this study, we rely on PD indicator 11: use of country's PFM systems as a percentage of government sector aid. Regarding donors' accountability costs, we posit that for countries where donors provide some of their aid through recipients' country PFM systems the costs will be lower as it would imply more trust from the donor to the recipient. We thus split countries into 37 high donor accountability costs (those whose country systems are bypassed) and 47 low donor accountability costs (the countries that receive aid through their PFM systems, no matter how small). Bureaucratic costs can be measured by the number of donors that do not use country systems for disbursement since bypassing countries' PFM systems adds to fragmentation costs, particularly when there are too many donors operating in a particular country. Thus, we proceed to measure bureaucratic costs by counting the number of donors, in a specific recipient country, that bypass their PFM systems. The variable ranges from 11 donors in Mozambique to 28 donors (equivalent to the total number of donors used for the index above) in Algeria and Angola (supplementary materials A2). The median is 27, allowing a split between 37 high fragmentation countries (those above the median) and 47 low fragmentation countries.

In general, the political calculus between aid and tax is heterogeneous across countries and two arguments for heterogeneity in the aid-tax relationship stand out. First, the extent to which citizens hold their governments accountable – in addition to the political institutions that place constraints on the power of the executive – varies considerably across countries, depending on a constellation of country-specific characteristics which relate to the governance and institutional framework in the country (Ricciuti, Savoia, & Sen, 2019). Secondly, vulnerability of public revenue depends on the level of revenue diversification and exposure to external shocks which differ considerably across countries;

[3] The fragmentation index increases with the number of donors in a specific country, reflecting the absence of a dominant donor. For the analysis, 21 DAC countries are included, as well as seven multilateral organisations whose remit is international development (see appendix Table A1).

and such vulnerability also differs by level of economic development, natural resource dependence and political regime (Morrissey et al., 2016).

Another type of heterogeneity is in aid flows, with the political calculus between aid and tax depending on the nature of the disbursement. The main distinction in the literature has been between grants and loans. Nonetheless, technical assistance – donor-funded projects in tax mobilisation – is also expected to influence tax performance since it potentially relaxes capacity constraints in implementing institutional policy reforms (particularly the establishment of SARAs), thereby improving revenue performance in developing countries. Morrissey & Torrance (2015) posit that the transfer of knowledge and capacity building from donors through technical assistance, as distinct from the amount of aid, is what potentially influences revenue mobilisation through strengthening of weak tax institutions and improving the formulation of tax policy.

Technical assistance is a form of aid for which the presence of too many donors in a recipient country (hence more donor fragmentation) is a distinct advantage insofar as more donors will imply more aid and hence, more technical assistance for tax reform. Technical assistance is thus invariant to the accountability costs argument, with focus lying entirely on the bureaucratic costs argument. Thus, we posit that for countries with high donor fragmentation (more donors) technical assistance will have a significant positive long-run impact on tax/GDP ratios while for those with low donor fragmentation there will be no significant effect. Likewise, we propound that for countries with high bureaucratic costs of tax (non-SARA countries, lower ERM) technical assistance will have no effect on tax/GDP ratios while for those with low bureaucratic costs of tax (SARA countries, higher ERM) technical assistance with have a positive long-run effect on tax/GDP ratios.

## 3. Data

Annual data on 84 developing countries covering the period 1980 to 2013 are used in the analysis. Variable definitions, sources and descriptive statistics can be found in appendix Tables A3, A4 and A5. Data on net and gross aid disbursements, aid loans, aid grants and technical assistance are sourced from the OECD's DAC database, version 2016. To measure in a way that influences taxes, technical assistance is deducted from grants to obtain a new measure of grants. This measure is then added to net loans to get net Official Development Assistance (ODA) figures for the econometric analysis; and scale it with GDP data sourced from the IMF's *World Economic Outlook*. We explore aid heterogeneity by estimating variants of the main model with, grants, loans and technical assistance (all as percentages of GDP) as regressors of primary interest.

For data on taxation we rely on the Global Revenue Dataset (GRD), version 2016 (Prichard, Cobham, & Goodall, 2014). Crucially, the GRD distinguishes between resource and non-resource components of tax revenue, allowing for consistency in the treatment of natural resource revenue in econometric analyses while also permitting the construction of a tax variable exclusive of natural resources. This is very important as fiscal theory posits that aid should affect only non-resource taxation. The dependent variable is non-resource tax excluding grants and social contributions. Non-resource tax revenue excludes royalties and natural resource taxes (Prichard et al., 2014).

Interest is in the cross-country average effect of aid/GDP on tax/GDP ratios, making the use of annual data appropriate. However, use of annual data raises concerns about the distorting influence

of business cycles on empirical inference (Eberhardt & Teal, 2013; Temple, 1999), such that analysis is usually carried out with time-averaged data (Morrissey & Torrance, 2015). In this paper we argue that adopting a common factor approach deals with any business cycle effects, whether they represent spill-over effects (idiosyncratic to a small number of countries) or global shocks with more profound, albeit heterogeneous impacts.

## 4. Empirical Strategy

### *4.1 Linear Dynamic Model*

To estimate the effect of aid on the tax/GDP ratio in country $i$ at time $t$ we employ a multifactor error framework of the form:

$$tax_{it} = \beta_i' aid_{it} + u_{it} \qquad u_{it} = \alpha_i + \lambda_i' f_t + \varepsilon_{it} \tag{1}$$

where $tax_{it}$ is the log of the tax/GDP ratio over time periods $t$=1, 2,…, $T$ and countries $i$=1, 2,…, $N$. $aid_{it}$ is the log of the percentage of net Official Development Assistance to GDP. The vector of parameter coefficients ($\beta_i$) differs across countries, but is constant over time. Equation (1) also includes country-specific intercepts ($\alpha_i$) and a vector of unobserved common factors $f_t$ with country-specific factor loadings $\lambda_i$ to account for the levels and evolution of unobservables, respectively. The common factors could represent a global shock, such as the coronavirus pandemic, or local spill-over effects (for example the devaluation of the CFA franc in 1994) which affect countries to varying degrees. The impacts of these shocks and countries' abilities to respond differ considerably across countries.

Given the importance of dynamics – dynamics easily encapsulate the political economy nature of tax policy and how it responds to aid changes – as well as the need to distinguish long-run (equilibrium) from short-run dynamics, we employ an unconditional error correction model (ECM) of the form:

$$\Delta tax_{it} = \alpha_i + \rho_i\left(tax_{it-1} - \beta_i^{aid} aid_{it-1} - \lambda_i' f_{t-1}\right) + \gamma_i^{aid}\Delta aid_{it} + \gamma_i^{F}\Delta f_t + \varepsilon_{it} \tag{2}$$

where the expression in brackets represents the potential co-integrating relationship we seek to identify, $\beta_i^{aid}$ represents the long-run relationship between the tax/GDP and aid/GDP ratios, the $\gamma_i^{j}$ represent the short-run adjustment dynamics and $\rho_i$ indicates the speed of convergence of the economy to its long-run equilibrium. Cointegration tests here are based on the statistical significance of the error correction term in the ECM, with a negative and significant error correction coefficient representing co-integration. The ECM distinguishes between short-run and long-run effects; such that for the long-run effect it is not essential to specify the variable lags through which aid will impact taxes.

In addition to the appeal of parsimony in (panel) time-series applications, we do not include other covariates as is typical in the tax performance literature for two main reasons. First, the covariates are inadequate proxies for the various tax bases (Morrissey, 2013) and the proxy variables do not account for policy changes in tax rates and tax administration, nor do they incorporate the salience of donor-recipient relationships. Finding co-integration between tax/GDP and aid/GDP ratios, thus, gains more importance as it would imply no potentially important non-stationary variables have been

omitted from estimation (Herzer & Morrissey, 2013). Second, given the data dimensions and econometric methods intended in this paper, including other covariates will create dimensionality issues.

Following Pesaran (2006), we employ the Common Correlated Effects Mean Group (CCEMG) estimator which uses (weighted) cross-section averages of the dependent and independent variables constructed to filter out the unobserved common factors and omitted elements of the co-integrating relationship. Chudik & Pesaran (2015) extend the standard Pesaran (2006) approach to accommodate dynamics (feedback) from weakly exogenous regressors and find that the standard CCEMG is subject to small sample bias, especially in samples of moderate time series. Chudik & Pesaran (2015) provide an empirical strategy to deal with the bias: in addition to the cross-section averages from the standard CCEMG, they suggest including lags of cross-section averages in the ECM, in our setup[4]

$$\Delta tax_{it} = \pi_{0i} + \pi_i^{EC} tax_{it-1} + \pi_i^{aid} aid_{it-1} + \Phi_i^{aid} \Delta aid_{it} + \pi_{1i}^{CA} \overline{\Delta tax}_t + \pi_{2i}^{CA} \overline{tax}_{t-1} + \pi_{3i}^{CA} \overline{aid}_{t-1} + \pi_{4i}^{CA} \overline{\Delta aid}_t + \sum_{l=1}^{p} \pi_{5i}^{CA} \overline{\Delta tax}_{t-p} + \sum_{l=1}^{p} \pi_{6i}^{CA} \overline{\Delta aid}_{t-p} + \varepsilon_{it} \quad (3)$$

Chudik & Pesaran (2015) show that once the CCEMG estimator has been augmented with a sufficient number of lags $p = \sqrt[3]{T}$ the estimator is unbiased in the presence of weakly exogenous regressors. From the levels terms ($\pi_i^{aid}$) we obtain the long-run coefficients, $\beta_i^{aid} = -\frac{\pi_i^{aid}}{\pi_i^{EC}}$ whereas the regression coefficients on the terms in first differences capture the short-run (transitory) effects, and can be read off directly from estimation.

Even after including cross-section averages and their lags, cross-section dependence may still prevalent. Pesaran, Smith, & Yamagata (2013) suggest including cross-section averages of one or more other covariates (other than aid) which may help identify the unobserved common factors. The country series of the additional covariates do not enter the model, just their cross-section averages and lags of cross-section averages do. The objective is to identify the unobserved common factors $f_t$ so including variables that are determinants of tax/GDP ratios (in the spirit of Gupta, 2007) is reasonable.

### *4.2 Endogeneity and Causality*

Aid is allocated in a non-random manner. Thus, interest is in investigating if donors respond to recipients' fiscal imbalances (revenue shortfalls) when disbursing aid, or if disbursement is independent of the fiscal situation in recipient countries. *Ex ante* structural characteristics – both observable and unobservable – may determine both low (high) revenue and high (low) aid; with poor countries that have weak tax bases and low tax ratios attracting more aid and vice versa. Clist & Morrissey (2011) and Morrissey & Torrance (2015) argue that lagging aid by one or two years as is done in previous studies

[4] Inference on $\pi_i^{EC}$, the speed of convergence to equilibrium, provides insights into the presence of a long-run (co-integrating) relationship between aid and taxes. If $\pi_i^{EC} = 0$ then there is no cointegration, and the model reduces to one with variables in first differences. If $\pi_i^{EC} \neq 0$ then there is 'error correction' in the model. That is, following a shock the economy returns to its long-run equilibrium path and therefore there exists a co-integrating relationship between aid and taxes.

is insufficient to curb the simultaneity. Due to the high persistence of tax/GDP ratios, uncertainties of the timeline for which aid is likely to influence taxation and because recipient countries' structural characteristics change slowly, longer lags are needed to deal with simultaneity. Morrissey & Torrance (2015) attempt to deal with endogeneity by using longer lags for aid and find that the results are not robust: aid coefficients become insignificant as more lags of aid are included.

Endogeneity is dealt with differently in a (panel) time series context. If aid and taxes are both non-stationary and co-integrated, then tests for weak exogeneity (i.e. the direction of long-run causality) are applicable (Eberhardt & Presbitero, 2015; Canning & Pedroni, 2008). The power of the weak exogeneity tests lies in their ability to fully explore the temporal dimension of the data. As they are estimated in ECM form (see paragraph below), they control for the contemporaneous correlation between aid and taxes while allowing for an agnostic, albeit long timeframe within which aid can influence taxes. Furthermore, they easily incorporate cross-country heterogeneity and unobserved common factors which plague findings using standard micro-econometric methods. If donors – in their aid allocation decisions – respond to domestic revenue shortfalls in recipient countries, this implies aid is endogenous for the long-run equilibrium; suggesting a behavioural impact of aid on taxes for the donors. If donors do not respond to such changes in their allocation decisions but aid/GDP influences tax/GDP ratios, aid is weakly exogenous or long-run forcing.

Provided there exists a co-integrated relationship between the aid/GDP and tax/GDP ratios the Granger Representation Theorem (Engle & Granger, 1987) states that at least one variable must adjust to maintain an equilibrium relation; and the variables can be represented in the form of a dynamic ECM. For a pair of co-integrated variables, we can then test for weak exogeneity in the following ECMs:

$$\Delta tax_{it} = \rho_{1i} + \theta_{1i}\hat{e}_{it-1} + \sum_{j=1}^{K} \lambda_{11ij}\Delta \text{tax}_{it-j} + \sum_{j=1}^{K} \lambda_{12ij}\Delta aid_{it-j} + \epsilon_{it}^{tax} \quad (4)$$

$$\Delta aid_{it} = \rho_{2i} + \theta_{2i}\hat{e}_{it-1} + \sum_{j=1}^{K} \lambda_{21ij}\Delta aid_{it-j} + \sum_{j=1}^{K} \lambda_{22ij}\Delta tax_{it-j} + \epsilon_{it}^{aid} \quad (5)$$

where $\hat{e}_{it-1}$ is the disequilibrium term $\hat{e} = y - \hat{\beta}_i x - \hat{d}$ constructed using the cointegrating relationship between the variables ($d$ represents deterministic terms obtained after estimating equations 4 and 5). Equations (4) and (5) also include cross-section averages of the non-error terms in the weak exogeneity regressions. The disequilibrium term represents how far the variables are from the equilibrium relationship, with the error correction mechanism then indicating the speed of adjustment following a deviation from the long-run equilibrium (Canning & Pedroni, 2008). Each variable may react to its lagged differences, as well as lagged differences of other variables in the co-integrating relationship. The Granger representation theorem implies that at least one of the adjustment coefficients $\theta_{1i}$, $\theta_{2i}$, must be non-zero if a cointegrating (equilibrium) relationship between the variables is to hold (Canning & Pedroni, 2008, p. 512). If $\theta_{1i} \neq 0$ then $aid_{it}$ has a long-run causal impact on $tax_{it}$ and if $\theta_{2i} \neq 0$ then $tax_{it}$ has a long-run causal impact on $aid_{it}$. If both $\theta_{1i}$ and $\theta_{2i}$ are non-zero then $aid_{it}$ and $tax_{it}$ determine each other jointly.

The ECM regressions are estimated at the country-level and empirical estimates of $\theta_i$ are investigated using standard $t$-ratios, given that all the variables in the ECM regressions (4) and (5) are stationary (Canning & Pedroni, 2008; Eberhardt & Presbitero, 2015). Following Canning & Pedroni

(2008) we present the group-mean statistic ($GM$ hereafter) which averages the $\theta_i$ from individual country estimations of equations (4) and (5) and the test for the null of 'no long-run causal impact' is computed from the averaged $t$-ratio from country regressions ($\bar{t}_{\theta_2} = N^{-1}\sum_{i=1}^{N} t_{\theta_2}$). The $GM$ statistic follows a standard normal distribution under the null hypothesis of 'no causal impact'.

## 5. Empirical Results

We investigate the cross-section correlation and time series properties of the data using the Pesaran (2015) CD and Pesaran (2007) tests, respectively. Results indicate that the variable series are subject to considerable cross-section dependence (appendix Table B1). Furthermore, tests for variable stationarity show that all the variables are non-stationary in levels and stationary in first differences (appendix Table B2).

### *5.1 Heterogeneous Baseline Estimates*

Results from estimating equation (3) are presented in panel A of Table 1. The long-run average coefficient is obtained by averaging ECM coefficients, then computing the long-run coefficient, with standard errors computed through the Delta method.[5] The coefficient on the lagged dependent variable is negative and statistically significant, indicating that the system reverts to its equilibrium path following a shock. The results indicate that on average there is a long-run equilibrium relationship between the tax/GDP and aid/GDP ratios, with increases in the tax/GDP ratio sustained by movements in the aid/GDP ratio.[6] The long-run average coefficient on the aid/GDP is positive and statistically significant; and the average impact is robust to outliers (see appendix Table B3) and omitted variables (by virtue of the econometric method). The results are largely consistent with country-specific FRMs (Mascagni & Timms, 2017; Osei et al., 2005) and the relatively recent evidence from cross-country regressions (Clist, 2016; Clist & Morrissey, 2011).

The significant country-specific coefficients ($\beta_i' aid_{it}$) are presented in figure 1. The country-specific estimates should be interpreted with caution given the limited number of time series observations per country. Nonetheless, they demonstrate considerable heterogeneity in the aid/tax relationship: with 20 positive coefficients, 6 negative ones and 54 insignificant ones, ranging from -0.339 in Nicaragua to 0.503 in Laos PDR. The heterogeneity does not depict any clear pattern: some aid dependent, low-income countries (Tanzania and Malawi) show a negative relationship between aid and tax while less aid dependent, middle income countries (Sri Lanka, Mauritius, Ghana) show a positive relationship between aid and tax. Interest is not in explaining the country-specific point estimates but in demonstrating the direction of effects between aid and tax across countries. The cross-country heterogeneity in coefficients is influenced by the political calculus across countries.

[5] We employ the robust regression (see Hamilton 1992) – which weighs down outliers in computing the averages – in all estimations. Relevant diagnostics which inform the fit of the model - RMSE, $CD$ test statistic and the CIPS test statistic – are reported at the bottom of the table.

[6] Additionally, as residual testing for stationarity also provides an alternative test for cointegration, cointegration is confirmed.

**Table 1.** Linear Dynamic Estimates

*PANEL A: Baseline Estimates*

| | CCEMG |
|---|---|
| *Long-Run* | |
| Aid/GDP | 0.077*** |
| | [0.027] |
| *Short-Run* | |
| Aid/GDP | 0.014 |
| | [0.012] |
| *EC Coefficient* | |
| $y_{it-1}$ | -0.495*** |
| | [0.031] |
| $t$-statistic | -16.14 |
| | |
| *Diagnostics* | |
| RMSE | 0.092 |
| Stationarity $\overline{\mathrm{T}}$ | I(0) |
| $CD$ test | -1.42 |
| ($p$-value) | (0.154) |
| Observations ($N$) | 2371 (84) |

*PANEL B: Accountability Costs*

| | DONORS | | RECIPIENTS | |
|---|---|---|---|---|
| | High | Low | High | Low |
| Donors' accountability costs (1) | **0.079**** | **0.151***** | | |
| | **[0.031]** | **[0.037]** | | |
| Donors' accountability costs (2) | 0.057 | **0.091**** | | |
| | [0.036] | **[0.041]** | | |
| Vertical Accountability | | | 0.020 | **0.120***** |
| | | | [0.046] | **[0.035]** |
| Executive Constraints | | | 0.052 | **0.117***** |
| | | | [0.040] | **[0.044]** |

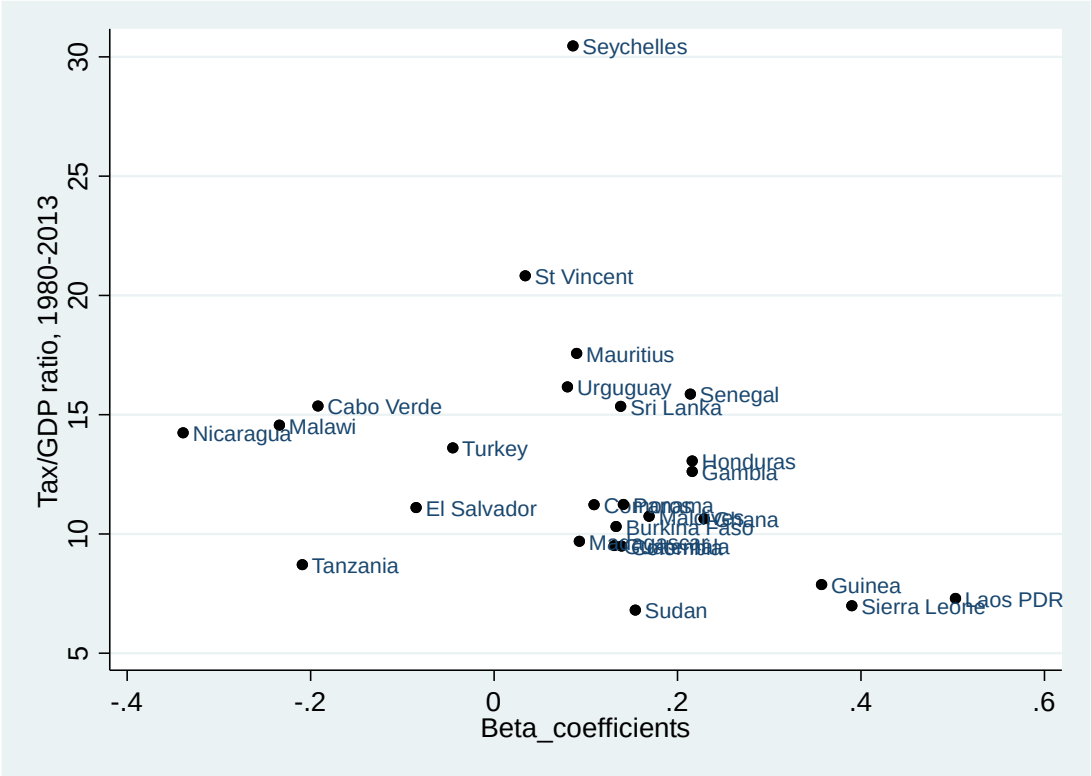
*PANEL C: Bureaucratic Costs*

| | DONORS | | RECIPIENTS | |
|---|---|---|---|---|
| | High | Low | High | Low |
| Donor fragmentation index (1) | **0.087**** | **0.102**** | | |
| | **[0.033]** | **[0.054]** | | |
| Donor fragmentation index (2) | 0.053 | **0.110**** | | |
| | [0.040] | **[0.044]** | | |
| SARA | | | 0.044 | **0.090***** |
| | | | [0.049] | **[0.033]** |
| ERM | | | 0.041 | **0.158***** |
| | | | [0.073] | **[0.053]** |

*Notes:* The results in Panel A are based on an ECM for all 84 countries in the sample with the first difference of log (tax/GDP) as dependent variable. The long-run and short-run averages are reported, with standard errors reported below the averages. RMSE is the root mean square error, $\overline{\mathrm{T}}$ Pesaran (2007) test results for ADF tests on the residuals: I(0) – stationary, I(1) – nonstationary. $\mathrm{CD}$ test is the Pesaran (2015) test distributed $\mathrm{N}(0,1)$ under the null of weak cross-section independence ($\mathrm{p}$-value in parantheses below). *, ** and *** indicate significance at 10%, 5% and 1% respectively. Panel B shows the means of the long-run aid/GDP coefficient when countries are split by their level of accountability costs while Panel C shows a split by bureaucratic costs.

The short-run coefficient of aid on tax is insignificant, further demonstrating heterogeneity across countries with dynamics on average cancelling out. Tax/GDP ratios exhibit high persistence in the short-run, stymying any potential impact aid/GDP ratios can have on revenue performance (as measured by the tax/GDP ratio). Furthermore, tax administrators' and policy makers' behaviour also display considerable persistence so taxes do not easily adjust to changes to aid. These explain the insignificant short-run results for the aid/GDP ratio.

**Figure 1.** County-specific aid coefficients ($\beta_i' aid_{it}$)




*Notes:* Figure 1 shows a scatter plot between the estimated country-specific $\beta_i'$ from equation (3) and the averaged non-resource tax/GDP ratio over the period 1980-2013.

In micro-econometric analysis, the measures of political costs could be easily incorporated by using interaction terms to gauge changes in the primary relationship. Such an approach is not possible in macro panels given that the variables series are integrated and co-integrated (Eberhardt, 2019). Thus, sample splits based on high/low comparisons are logical. Just the means for each cell are presented (the full set of results incorporating the political costs can be found in the supplementary materials).

Both pairs of matrices show that the accountability costs of aid are higher than those of tax (panel A). For donors' accountability costs (1), both countries with high donor accountability costs and those with low accountability costs demonstrate significant aid-tax relationships. However, the estimated coefficient on aid for the latter group of countries is about twice as large (and displays stronger statistical significance) as that of the former group. For the second measure, countries with high accountability costs do not show a significant relationship aid-tax relationship while those with low accountability costs show a strong positive aid-tax relationship. The findings show that higher

donor accountability costs lessen the positive impact of aid on taxes. For countries with higher vertical accountability (as well as those with higher executive constraints) there is no significant relationship between aid and taxes while for countries with lower vertical accountability (and executive constraints) there is a significant positive relationship between aid and taxes as postulated by the analytical framework. The balance of evidence suggests that the accountability costs of aid are higher than those of taxes.

The bureaucratic costs of aid are also higher than those of tax (panel B). For donor fragmentation index (1), there is a significant positive aid-tax relationship across both sets of countries, those with high donor fragmentation and those with low donor fragmentation. The estimated coefficient is, however, larger for the countries with low donor fragmentation and it shows that higher donor competition (hence fragmentation) assuages the positive effect of aid on taxes. For the second measure, countries with high fragmentation show no significant aid-tax while those with low fragmentation show a strong positive relationship between aid and taxes. For countries with SARAs (hence countries with low administrative costs of tax) there is no observable aid-tax relationship while for those without SARAs (hence with higher administrative costs of tax) there is a positive long-run relationship between aid and taxes. These results are mirrored when we use the ERM variable as an alternative measure of bureaucratic costs of tax. We do not make too much of these results as we posit that for countries with SARAs, for the SARAs to imply reduced bureaucratic costs of taxes and indeed for enhancing the efficiency of revenue mobilisation, technical assistance is a more important measure of aid (see section 5.2 below). The evidence, based on the above analysis, suggests that the political costs of aid are higher than those of taxation.

### *5.2 Heterogeneity in aid flows*

We estimate the heterogeneous effects of grants, loans and technical assistance on the tax/GDP ratio. Accordingly, we re-estimate equation (3) with respectively, grants (column 1), loans (column 2) and technical assistance (column 3) as the measure of aid and report the results Table 2a. Grants have a long-run positive association with tax/GDP ratios in recipient countries, while loans have no effect on tax/GDP ratios. The political costs of grants, for both the donors and recipients, are higher than for loans (Table 2b, panels A and B). While the original grants-tax relationship is mediated by incorporating measures of political costs, the pristine loans-tax relationship is invariant to most of the measures of political costs. A plausible explanation is that for donors, it is easier to justify to their governments and parliaments, the disbursement of a loan than a grant. The straightforward reason being that loans come with obligations of repayment and servicing while grants are seen as 'free' money. Thus, donors implement more stringent policies to monitor their aid grants and minimise fungible use. For recipients, they will have to account to the donors how the grants they disbursed are being spent.

**Table 2a.** Heterogeneity in Aid Flows

| | **Grants** | **Loans** | **Technical Assistance** |
|---|---|---|---|
| Additional covariate(s) † | | | *gdppc* |
| *Long-Run* | | | |
| Aid/GDP | 0.057*** | 0.010 | 0.077** |
| | [0.018] | [0.018] | [0.039] |
| *Short-Run* | | | |
| Aid/GDP | 0.013 | 0.0007 | 0.015 |
| | [0.008] | [0.007] | [0.018] |
| *EC Coefficient* | | | |
| $y_{it-1}$ | -0.521*** | -0.517*** | -0.503*** |
| | [0.029] | [0.026] | [0.034] |
| $t$-statistic | -17.85 | -19.66 | -14.98 |
| | | | |
| *Diagnostics* | | | |
| RMSE | 0.092 | 0.089 | 0.085 |
| Stationarity ϒ | I(0) | I(0) | I(0) |
| $CD$ test | -0.04 | -1.60 | -1.64 |
| ($p$-value) | (0.965) | (0.110) | (0.102) |
| Observations ($N$) | 2414 (84) | 2328 (84) | 2412 (84) |

*Notes:* Error correction models are estimated for all 84 countries in the sample; first with grants/GDP as the aid variable of interest (column 1), then loans/GDP (column 2), and finally technical co-operation/GDP (column 3). The CCEMG with two lags of cross-section averages is used for estimation. † The CCEMG estimator is implemented with two lags of cross-section averages and cross-section averages of other variables (gdppc – GDP per capita in constant $2010 values, in logs) as indicated – see main text for details. For all other details see Table 1.

Technical assistance has a long-run positive association with taxes: through potentially relaxing capacity constraints in tax administration and policy, as well as increasing tax collection efficiency without necessarily increasing tax rates, thereby reducing the bureaucratic costs of taxation. Due to the persistence of tax/GDP ratios such improvements are mostly medium to long-term; corresponding to the long-run positive association between the technical assistance and taxes. For technical assistance, high bureaucratic costs of aid are cancelled out by low bureaucratic costs of tax. Countries with high donor fragmentation demonstrate a positive long-run relationship between technical assistance and tax/GDP ratios while those with low fragmentation demonstrate no discernible relationship between technical assistance and tax ratios. For countries with SARAs (low bureaucratic costs of tax) there is a positive long-run relationship between technical assistance and tax/GDP ratios while for countries without SARAs.

**Table 2b. Aid heterogeneity and political costs**

| *Panel A: Grants* | | | | |
|---|---|---|---|---|
| | DONORS | | RECIPIENTS | |
| | High | Low | High | Low |
| Donors' accountability costs (1) | 0.056*** | 0.123* | | |
| | [0.020] | [0.068] | | |
| Donors' accountability costs (2) | 0.034 | 0.077*** | | |
| | [0.028] | [0.024] | | |
| Vertical Accountability Index | | | 0.061** | 0.075*** |

| | | | | |
|---|---|---|---|---|
| | | | [0.029] | [0.026] |
| Executive Constraints | | | 0.078*** | 0.056** |
| | | | [0.029] | [0.026] |
| Donor fragmentation index (1) | 0.049** | 0.063** | | |
| | [0.021] | [0.031] | | |
| Donor fragmentation index (2) | 0.077*** | 0.034 | | |
| | [0.024] | [0.028] | | |
| SARA | | | 0.086** | 0.050** |
| | | | [0.042] | [0.020] |
| ERM | | | 0.031 | 0.076** |
| | | | [0.048] | [0.031] |

| *Panel B: Loans* | | | | |
|---|---|---|---|---|
| | DONORS | | RECIPIENTS | |
| | High | Low | High | Low |
| Donors' accountability costs (1) | 0.009 | 0.003 | | |
| | [0.019] | [0.058] | | |
| Donors' accountability costs (2) | 0.034 | -0.014 | | |
| | [0.024] | [0.025] | | |
| Vertical Accountability Index | | | -0.010 | 0.051* |
| | | | [0.023] | [0.029] |
| Executive Constraints | | | 0.002 | 0.057 |
| | | | [0.018] | [0.035] |
| Donor fragmentation index (1) | -0.005 | 0.041 | | |
| | [0.020] | [0.032] | | |
| Donor fragmentation index (2) | -0.014 | 0.034 | | |
| | [0.025] | [0.025] | | |
| SARA | | | 0.091*** | -0.019 |
| | | | [0.034] | [0.019] |
| ERM | | | 0.036 | 0.023 |
| | | | [0.038] | [0.037] |

| Panel C: Technical Assistance | | | | |
|---|---|---|---|---|
| | DONORS | | RECIPIENTS | |
| | High | Low | High | Low |
| Donor fragmentation index (1) | 0.111** | 0.002 | | |
| | [0.055] | [0.044] | | |
| Donor fragmentation index (2) | 0.031 | 0.080 | | |
| | [0.049] | [0.050] | | |
| SARA | | | 0.105** | 0.064 |
| | | | [0.053] | [0.054] |
| ERM | | | 0.004 | 0.139* |
| | | | [0.068] | [0.071] |

*Notes:* Error correction models are estimated are estimated for all countries in the sample by splitting them into high and low political costs of aid and taxation. *, ** and *** indicate significance at 10%, 5% and 1% respectively. Panel A shows results for grants/GDP, Panel B shows results for loans/GDP and Panel C shows results for technical assistance/GDP.

### *5.3 Stability of donor-recipient relationships*

The impact of aid on tax revenues may be influenced by donor policies, particularly the stability of donor-recipient relationships and how they relate to the stability of aid flows to developing countries

(Lensink & Morrissey, 2000). Changes in donors' characteristics, such as increased fragmentation or increased dependence on specific donors can create high year-on-year variation in the level of aid which erodes the impact of aid on taxes. The year-on-year variation in aid disbursement may lead to fiscal vulnerability across recipient countries – with aid being too unpredictable to be incorporate into fiscal planning – resulting in reduced tax/GDP ratios. Additionally, aid volatility may also be induced by a recipient country's vulnerability of domestic revenue such that changes in that level of vulnerability elicit more than average changes in the level of aid. Furthermore, increased donor fragmentation and revenue vulnerability may be amplified by global business cycles and latent trends – such as the ongoing coronavirus pandemic and the relatively recent financial crisis – creating more unanticipated instability in aid. Alternatively, aid volatility may underpin transitions towards increased tax reliance and aid independence. The ultimate impact of aid volatility can only be deciphered empirically.

Aid uncertainty can be defined as the unanticipated variability in the aid/GDP resulting from donor disbursement difficulties and vulnerability of the revenue system, both influenced by global business cycles (Lensink & Morrissey, 2000; Aizenman & Marion, 1993). It is measured by the standard deviation of the residuals of a forecasting regression (an $AR(2)$ process) of the aid/GDP ratio to determine the expected component of the aid/GDP ratio (Lensink & Morrissey, 2000). The forecasting equations are as follows:

$$aid_{it} = \alpha_i + \beta_1 aid_{it-1} + \beta_2 aid_{it-2} + \beta_3 DFI_{it} + \beta_4 aid_{it-1} * DFI_{it} + \beta_5 aid_{it-2} * DFI_{it} + \Gamma_t + \mu_{it} \quad (6)$$

$$aid_{it} = \alpha_i + \beta_1 aid_{it-1} + \beta_2 aid_{it-2} + \beta_3 RFI_{it} + \beta_4 ERPI_{it} + \beta_5 aid_{it-1} * RFI_{it} + \beta_6 aid_{it-2} * ERPI_{it} + \beta_7 aid_{it-1} * RFI_{it} + \beta_8 aid_{it-2} * ERPI_{it} + \Gamma_t + \mu_{it} \quad (7)$$

where $aid_{it}$ is net aid as a percentage of GDP, $DFI_{it}$ is the donor fragmentation index discussed in section 2, $RFI_{it}$ is a revenue fragmentation index and $ERPI_{it}$ is an exchange rate pressure index. $\alpha_i$ is a constant term, $\Gamma_t$ represents period effects and $\mu_{it}$ is an error term with standard $i.i.d$ properties. The revenue fragmentation index is also constructed as a Herfindahl index: obtained by summing the squared shares of taxes over all major revenue sources covering the period 1980-2013.[7] The index ranges from 0 to 1 but is rescaled to range from 0 to 100, with higher values representing higher revenue fragmentation (more revenue diversification), hence less revenue vulnerability. The exchange rate pressure index captures the impact of balance of payment shocks exchange rates, and as long as the exchange rate pressures are linked to trade and capital outflows, they will affect direct taxation through personal and corporate income taxes (Morrissey et al., 2016). The pressure index is thus calculated following (Morrissey et al., 2016)

Given the difficulty in incorporating interaction terms in panel time series analysis, equations 6 and 7 are estimated using the two-way fixed effects estimator which includes country and time fixed effects. Time dummies are included to model the time fixed effects arising from cross-sectional dependence (latent trends), albeit at the cost of restricting the impact of cross-sectional dependence to be the same across countries. Interest is not in interpreting the $\beta$ coefficients from equations 6 and 7 but in obtaining residuals from the which we can obtain measures of aid uncertainty (instability): the

[7] The major taxes included are the personal income tax, corporate income tax, sales tax/VAT, excises and trade taxes.

standard deviation of residuals. Countries classified as high aid uncertainty are those above the median of the standard deviation of the residuals, and vice versa.

**Table 3.** Heterogeneity in aid uncertainty

| | *Aid Uncertainty: Donor Fragmentation* | | *Aid Uncertainty: Revenue Vulnerability* | |
|---|---|---|---|---|
| | High | Low | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.050 | 0.107** | 0.022 | 0.148*** |
| | [0.031] | [0.047] | [0.026] | [0.050] |
| *Short-Run* | | | | |
| Aid/GDP | 0.017 | 0.015 | 0.011 | 0.035 |
| | [0.013] | [0.021] | [0.013] | [0.022] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.519*** | -0.469*** | -0.489*** | -0.541*** |
| | [0.048] | [0.039] | [0.053] | [0.037] |
| $t$-statistic | -10.75 | -12.18 | -9.22 | -14.77 |
| *Diagnostics* | | | | |
| RMSE | 0.093 | 0.090 | 0.100 | 0.077 |
| Stationarity $\mathbb{1}$ | I(0) | I(0) | I(0) | I(0) |
| $CD$ test | -0.61 | 1.45 | -0.08 | 0.81 |
| ($p$-value) | (0.544) | (0.146) | (0.935) | (0.420) |
| Observations ($N$) | 1157 (42) | 1214 (42) | 1105 (40) | 1266 (44) |

*Notes:* Error correction models are estimated for all countries in the sample by splitting countries based on their level of aid uncertainty. *, ** and *** indicate significance at 10%, 5% and 1% respectively.

The results presented in Table 3 are clear-cut. For countries with high aid uncertainty resulting from donor fragmentation, there is no long-run relationship between aid and tax/GDP ratios while for those with low aid uncertainty, there is a significant positive relationship between aid and tax/GDP ratios. This suggests that high year-on-year variation as a result of donors' characteristics, especially the absence of donor coordination or at least a dominant donor, may offset any potential positive effect of aid on taxes. For countries with high aid uncertainty due to the vulnerability of their revenue systems, there is no discernible long-run relationship between aid and taxes while for those with low aid uncertainty there is a strong positive aid-tax relationship. Higher revenue vulnerability is detrimental for tax revenue mobilisation as it results in volatile tax bases (and possible revenue shortfalls), eliciting more volatile aid flows.

### *5.4 Endogeneity and Causality*

In Table 4 we present results for weak exogeneity tests using specifications of equations (4) and (5). The results are based on the dynamic CCEMG model augmented with two lags of cross-section averages (the long-run relationship from which the disequilibrium term is constructed). In each row with 'equation', the specified variable is used as dependent variable in the ECM regression. We also report the panel robust $\hat{\theta}_i$ estimate, and its associated $t$-statistic (Canning & Pedroni, 2008). We would expect a high $t$-statistic on the average $\hat{\theta}_i$ coefficients in the tax equations (which can be interpreted

as evidence of a long-run causal relationship from aid to taxes) and a low $t$-statistic (below 1.96) in the aid equations (Eberhardt & Presbitero, 2015).

**Table 4. Weak exogeneity tests**

| | $GM$ | $(p)$ | Mean $\hat{\theta}_i$ | $t$-stat |
|---|---|---|---|---|
| ***Baseline Estimates*** | | | | |
| Tax Equation | -1.974 | 0.048 | -0.493 | -12.766 |
| Aid Equation | -0.124 | 0.901 | -0.109 | -1.044 |
| ***Heterogeneous Aid (1)*** | | | | |
| Tax Equation | -2.144 | 0.034 | -0.586 | -15.044 |
| Grants Equation | -0.040 | 0.968 | -0.080 | -0.564 |
| ***Heterogeneous Aid (2)*** | | | | |
| Tax Equation | -2.085 | 0.037 | -0.586 | -14.293 |
| Technical Assistance Equation | -0.089 | 0.929 | -0.094 | -1.214 |

*Notes:* We report statistics developed by Canning and Pedroni (2008). $GM$ denotes the group-mean statistic which is the average of country-specific $t$-ratios on the disequilibrium term which is distributed $N(0,1)$ for the null of 'no causal impact'. We also report the robust $\hat{\theta}_i$ and its associated $t$-statistic.

In examining the details of Table 4, the first clear pattern is the $GM$ statistic fails to reject the null of 'no causal impact'; with long-run causality running from the aid/GDP ratio to the tax/GDP ratio. This implies changes in the level of aid induce permanent changes in the level of taxation. The results conform to the statutory nature of tax systems such that tax policy, once implemented, is reversible only in the long-run. With regard to the ECM specifications with aid as dependent variable, the results have three distinctive features. First, we cannot reject the null that tax/GDP ratios have a zero-average long-run impact on aid/GDP ratios. We can conclude that the long-run impact of taxes on aid is not pervasively zero; such that changes in tax/GDP ratios may induce changes in the aid/GDP ratio in some, but not all countries. While aid is important for long-run taxation behaviour in developing countries (fiscal planners have expectations for aid as commitments are known in advance), the level of aid is independent of revenue performance in recipient countries. Second, grants are strongly weakly exogenous but long-run forcing; as they have a significant long-run impact on tax/GDP ratios. Accounting for the contemporaneous correlation between high grants and low tax-to-GDP ratios (through the heterogeneous ECM), we find that in the long-run the level of grants is independent of revenue performance in recipient countries. Third, technical assistance is weakly exogenous, which is intuitive. As this is a measure of off-budget aid it is determined irrespective of the recipients' revenue and/or growth characteristics but it has a long-term beneficial impact on tax/GDP ratios.

Ultimately, given the data dimensions and characteristics, and given the all the problems and caveats of individual country and panel exogeneity tests, we suggest most conservatively that long-run causation runs mainly from aid/GDP to tax/GDP ratios; with aid (and its components) being weakly exogenous. There is no 'donor disbursement rule' in which recipients' revenue performance influences the level of aid received.

## 6. Conclusion

Aid is an important source of financing for recipient governments' spending so its impact on tax performance, as measured by the tax/GDP ratio, bears considerable policy significance. There is thus considerable research on the impact of foreign aid on taxes in developing countries. What earlier studies ignore is the fact that the choice between aid and tax, as sources of finance for spending, is impacted by attendant political costs (a political calculus) and the revenue choice can be influenced by donors through technical. The main purpose of this paper is to incorporate this political calculus dimension into the fiscal effects and tax performance literatures, a salient dimension which has hitherto been ignored. We evaluate the costs according to accountability and bureaucratic costs, providing novel proxies for both.

Looking at net aid, the results show a long-run (co-integrating) relationship between net aid and tax/GDP ratios: with the estimated impact of net aid on tax/GDP positive and significant. Once proxies of political costs are incorporated into the analysis, the new findings show that splitting the sample into high/low cost groups is important for analysis. The political costs of aid are indeed higher than those of taxation as higher donor accountability and bureaucratic costs reduce the positive impact aid has on taxes.

The importance of aid heterogeneity, with different effects for grants and loans, is confirmed in this study. The argument that aid grants tend to reduce effort while aid loans encourage tax effort is tenuous: there are associations between aid and tax in the data, largely due to structural characteristics of the economy whereby high aid grants are associated with determinants of tax revenue. We argue that grants are associated with higher political costs (especially accountability costs) than loans, hence the positive relationship between the former and taxes. Technical assistance is also important as it reduces the bureaucratic costs of taxation: particularly revenue reform linked to the establishment of SARAs. It is better for recipient countries to have more donors when technical assistance is the measure of aid, such that more donors (hence higher fragmentation) is better for revenue performance. This is confirmed for countries with higher donor fragmentation: a positive significant relationship between aid and taxes. Furthermore, increased donor fragmentation and the volatility of domestic tax bases (hence higher tax revenue vulnerability) are particularly detrimental for revenue performance.

Using recently developed tests for the direction of long-run causality in panel time-series econometrics we can isolate the presence of an effect of aid on taxes while simultaneously controlling for the reverse effect that taxes are likely to have on aid. Across different specifications, we find that causality between aid and taxes is uni-directional; with pervasive evidence for long-run causality from aid to taxes. This underscores the argument that previous research in the literature tends to treat correlation as causation.

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# APPENDIX

## A DATA

**Table A1: Donors included in the Herfindahl Index**

| Bilateral Donors | Multilateral Donors |
|---|---|
| 1. Australia | 1. International Bank of Reconstruction and Development (IBRD) |
| 2. Austria | 2. Islamic Development Bank |
| 3. Belgium | 3. UNFPA |
| 4. Canada | 4. UNICEF |
| 5. Denmark | 5. UNRWA |
| 6. Finland | 6. World Food Program (WFP) |
| 7. France | 7. Asian Development Bank |
| 8. Germany | |
| 9. Ireland | |
| 10. Italy | |
| 11. Japan | |
| 12. Luxembourg | |
| 13. Netherlands | |
| 14. New Zealand | |
| 15. Norway | |
| 16. Portugal | |
| 17. Spain | |
| 18. Sweden | |
| 19. Switzerland | |
| 20. United States of America | |
| 21. United Kingdom | |

*Notes:* The multilateral institutions included here are chosen based on data availability and also those with a development mandate.

**Table A2: Donors in the fragmentation index (2)**

| Country | Fragmentation Index | Country | Fragmentation Index |
|---|---|---|---|
| Algeria | 28 | Madagascar | 27 |
| Angola | 28 | Malawi | 23 |
| Argentina | 28 | Maldives | 28 |
| Bangladesh | 24 | Mali | 20 |
| Belize | 28 | Mauritania | 24 |
| Benin | 24 | Mauritius | 28 |
| Bhutan | 28 | Mexico | 28 |
| Botswana | 28 | Morocco | 23 |
| Burkina Faso | 19 | Mozambique | 11 |
| Burundi | 26 | Nepal | 21 |
| Cameroon | 26 | Nicaragua | 28 |
| Cape Verde | 25 | Niger | 25 |
| Central African Rep. | 28 | Pakistan | 28 |
| Chad | 28 | Panama | 28 |
| Chile | 28 | Papua New Guinea | 24 |
| China | 28 | Paraguay | 28 |
| Colombia | 27 | Peru | 23 |
| Comoros | 27 | Philippines | 24 |
| Congo, Dem. Rep. | 27 | Rwanda | 21 |
| Congo, Republic | 28 | Sao Tome and Principe | 27 |
| Costa Rica | 28 | Senegal | 24 |
| Cote d'Ivoire | 28 | Seychelles | 28 |
| Dominica | 28 | Sierra Leone | 26 |
| Dominican Republic | 27 | Solomon Islands | 26 |
| Ecuador | 26 | Sri Lanka | 28 |
| Egypt | 28 | St Vincent | 28 |
| El Salvador | 27 | Sudan | 28 |
| Equatorial Guinea | 28 | Swaziland | 28 |
| Ethiopia | 19 | Tanzania | 14 |
| Fiji | 28 | Thailand | 28 |
| Gabon | 27 | Togo | 27 |
| Gambia | 27 | Tonga | 26 |
| Ghana | 21 | Turkey | 28 |
| Guatemala | 26 | Uganda | 18 |
| Guinea | 28 | Uruguay | 28 |
| Guinea-Bissau | 27 | Vanuatu | 82 |
| Honduras | 27 | Venezuela | 28 |
| India | 28 | Zambia | 19 |
| Indonesia | 23 | | |
| Iran | 28 | | |
| Jamaica | 27 | | |
| Jordan | 27 | | |
| Kenya | 22 | | |
| Kiribati | 28 | | |
| Laos PDR | 24 | | |
| Lesotho | 26 | | |

**Table A3: Variable definitions, construction and sources**

| Variable Name | Variable Description | Data Source |
|---|---|---|
| Aid | Net aid (net of repayments) | OECD-DAC (Table 2a) |
| Grants | Gross ODA grants | OECD-DAC (Table 2a) |
| Loans | Gross ODA loans | OECD-DAC (Table 2a) |
| Technical Assistance | Technical cooperation | OECD-DAC (Table 2a) |
| Tax Revenue | Non-resource tax revenue | GRD Database, version 2016 |
| Total Tax Revenue | Resource + Non-resource tax revenue | GRD Database, version 2016 |
| Total Government Revenue | Government revenue excluding grants | GRD Database, version 2016 |
| Vertical Accountability Index | The extent to which citizens hold their governments accountable. | V-Dem Database |
| Executive Constraints | Political institutions that place checks and balances on the power of the executive. | V-Dem Database |
| Donors' Accountability Costs (1) | Dummy variable describing the share of project aid to budget support. | Author's calculation on OECD-CRS Database |
| Donors' Accountability Costs (2) | Dummy variable describing the use (or lack thereof) of recipient countries' PFM systems | Author's calculation on OECD Paris Declaration Monitoring Survey (PDMS) in 2011 |
| SARA Dummy | Dummy variable describing whether or not a recipient country has an operational SARA | Author |
| ERM | Tax policy and tax administration performance across countries | CPIA |
| Donor Fragmentation Index (1) | 1-Herfindahl index | Author's calculation on OECD-DAC (Table 2a) |
| Donor Fragmentation Index (2) | Number of donors, per recipient country, that bypassed the latter's country systems. | Author's calculation on OECD Paris Declaration Monitoring Survey (PDMS) in 2011 |
| Aid uncertainty (1) | Aid uncertainty as a result of donor fragmentation. | Author's calculation based on OECD-DAC (Table 2a) |
| Aid uncertainty (2) | Aid uncertainty as a result of revenue concentration and exchange rate pressures. | Author's calculation based on OECD-DAC (Table 2a) and WDI |

*Notes:* CPIA – Country Policy and Institutional Arrangements; GRD – Governemnt Revenue Dataset; OECD-CRS – Creditor Reporting System; OECD-DAC (Table 2a) – Development Assistance Committee; OECD-PDMS – Paris Declaration Monitoring Survey; V-Dem – Varieties of Democracy; WDI – World Development Indicators.

**Table A4: Average aid and non-resource tax/GDP ratios over the sample period**

| | Aid/GDP | Tax/GDP | | Aid/GDP | Tax/GDP |
|---|---|---|---|---|---|
| Algeria | 0.26 | 11.73 | Madagascar | 7.55 | 9.69 |
| Angola | 1.90 | 6.67 | Malawi | 10.40 | 14.56 |
| Argentina | 0.04 | 15.07 | Maldives | 4.40 | 10.74 |
| Bangladesh | 2.11 | 5.91 | Mali | 9.23 | 10.89 |
| Belize | 2.75 | 20.05 | Mauritania | 11.40 | 12.61 |
| Benin | 0.32 | 12.87 | Mauritius | 1.04 | 17.57 |
| Bhutan | 10.34 | 8.23 | Mexico | 0.03 | 9.26 |
| Botswana | 2.02 | 15.02 | Morocco | 1.43 | 20.34 |
| Burkina Faso | 9.31 | 10.31 | Mozambique | 16.41 | 10.54 |
| Burundi | 16.44 | 12.23 | Nepal | 5.29 | 8.49 |
| Cameroon | 2.95 | 10.28 | Nicaragua | 8.90 | 14.24 |
| Cape Verde | 15.45 | 15.36 | Niger | 10.16 | 9.13 |
| CAR | 8.57 | 9.24 | Pakistan | 1.20 | 9.85 |
| Chad | 6.70 | 5.03 | Panama | 0.33 | 11.24 |
| Chile | 0.08 | 16.11 | Papua New Guinea | 3.61 | 18.00 |
| China | 0.14 | 15.03 | Paraguay | 0.70 | 10.16 |
| Colombia | 0.21 | 9.49 | Peru | 0.54 | 13.37 |
| Comoros | 11.59 | 11.23 | Philippines | 0.67 | 13.03 |
| Congo Rep. | 4.17 | 10.25 | Rwanda | 14.02 | 9.96 |
| Costa Rica | 0.87 | 1.11 | Sao Tome & Principe | 27.03 | 10.13 |
| Cote D'Ivoire | 3.50 | 16.13 | Senegal | 7.15 | 15.86 |
| Dominica | 5.53 | 20.27 | Seychelles | 3.35 | 30.46 |
| Dominican Republic | 0.44 | 10.30 | Sierra Leone | 10.84 | 6.99 |
| DRC | 6.17 | 5.69 | Solomon Islands | 18.34 | 17.19 |
| Ecuador | 0.50 | 8.46 | Sri Lanka | 2.89 | 15.35 |
| Egypt | 1.81 | 12.18 | St. Vincent | 3.20 | 20.82 |
| El Salvador | 2.85 | 11.11 | Sudan | 4.79 | 6.81 |
| Eq. Guinea | 8.76 | 10.86 | Swaziland | 1.74 | 23.62 |
| Ethiopia | 7.42 | 9.45 | Tanzania | 9.53 | 8.71 |
| Gabon | 0.83 | 10.89 | Thailand | 0.25 | 15.21 |
| Gambia | 10.38 | 12.62 | Togo | 6.54 | 14.71 |
| Ghana | 3.90 | 10.64 | Tonga | 10.46 | 15.61 |
| Guatemala | 1.06 | 9.51 | Turkey | 0.17 | 13.61 |
| Guinea | 5.94 | 7.88 | Uganda | 7.73 | 7.29 |
| Guinea-Bissau | 16.18 | 5.05 | Uruguay | 0.13 | 16.17 |
| Honduras | 4.05 | 13.06 | Vanuatu | 11.84 | 16.46 |
| India | 0.29 | 9.51 | Venezuela | 0.03 | 8.69 |
| Indonesia | 0.45 | 8.45 | Zambia | 9.95 | 15.72 |
| Iran | 0.04 | 5.57 | | | |
| Jamaica | 1.49 | 23.33 | | | |
| Jordan | 5.95 | 17.32 | | | |
| Kenya | 3.61 | 13.98 | | | |
| Kiribati | 21.93 | 16.36 | | | |
| Laos | 8.10 | 7.30 | | | |
| Lesotho | 9.88 | 42.07 | | | |

*Notes:* Aid/GDP = Aid to GDP ratio, Tax/GDP =Non-resource tax to GDP ratio. CAR – Central African Republic, DRC – Democratic Republic of Congo, Congo Rep – Republic of Congo, St. Vincent – St. Vincent and the Grenadines.

**Table A5: Grants, Loans and Technical Assistance**

| | Grants/GDP | Loans/GDP | TA/GDP | | Grants/GDP | Loans/GDP | TA/GDP |
|---|---|---|---|---|---|---|---|
| Algeria | 0.08 | 0.21 | 0.16 | Madagascar | 5.58 | 4.18 | 1.96 |
| Angola | 1.24 | 0.56 | 0.50 | Malawi | 8.90 | 3.82 | 2.47 |
| Argentina | 0.01 | 0.03 | 0.03 | Maldives | 1.95 | 3.34 | 1.85 |
| Bangladesh | 1.11 | 1.81 | 0.47 | Mali | 5.93 | 4.66 | 2.93 |
| Belize | 1.24 | 1.72 | 1.56 | Mauritania | 8.05 | 5.83 | 2.35 |
| Benin | 0.21 | 0.13 | 0.09 | Mauritius | 0.46 | 0.98 | 0.53 |
| Bhutan | 5.22 | 2.69 | 4.86 | Mexico | 0.01 | 0.03 | 0.02 |
| Botswana | 1.19 | 0.46 | 1.31 | Morocco | 0.56 | 1.37 | 0.53 |
| Burkina Faso | 6.14 | 3.56 | 3.06 | Mozambique | 11.77 | 5.98 | 3.20 |
| Burundi | 13.36 | 5.16 | 3.82 | Nepal | 2.65 | 2.79 | 2.08 |
| Cameroon | 2.08 | 1.57 | 0.88 | Nicaragua | 6.44 | 3.53 | 2.14 |
| Cape Verde | 8.45 | 5.07 | 5.78 | Niger | 7.46 | 3.41 | 3.16 |
| CAR | 6.65 | 2.27 | 3.01 | Pakistan | 0.51 | 1.33 | 0.27 |
| Chad | 4.05 | 2.66 | 2.02 | Panama | 0.20 | 0.24 | 0.23 |
| Chile | 0.04 | 0.04 | 0.11 | Papua New Guinea | 2.29 | 0.66 | 1.44 |
| China | 0.02 | 0.19 | 0.05 | Paraguay | 0.24 | 0.68 | 0.53 |
| Colombia | 0.08 | 0.08 | 0.17 | Peru | 0.26 | 0.38 | 0.29 |
| Comoros | 6.74 | 4.77 | 5.33 | Philippines | 0.23 | 0.82 | 0.31 |
| Congo Rep. | 2.78 | 2.13 | 1.25 | Rwanda | 10.73 | 3.32 | 3.71 |
| Costa Rica | 0.42 | 0.75 | 0.46 | Sao Tome & Principe | 16.23 | 10.38 | 10.65 |
| Cote D'Ivoire | 2.28 | 2.25 | 0.72 | Senegal | 4.28 | 3.98 | 2.73 |
| Dominica | 3.18 | 3.71 | 1.26 | Seychelles | 1.50 | 1.76 | 1.94 |
| Dominican Republic | 0.22 | 0.43 | 0.23 | Sierra Leone | 8.42 | 4.39 | 1.96 |
| DRC | 5.64 | 1.22 | 0.56 | Solomon Islands | 6.86 | 2.62 | 12.77 |
| Ecuador | 0.19 | 0.35 | 0.32 | Sri Lanka | 1.06 | 3.37 | 0.71 |
| Egypt | 0.99 | 1.48 | 0.75 | St. Vincent | 1.91 | 2.03 | 0.74 |
| El Salvador | 1.71 | 1.41 | 1.26 | Sudan | 3.30 | 1.66 | 1.25 |
| Eq. Guinea | 3.89 | 3.97 | 5.25 | Swaziland | 0.94 | 0.71 | 1.21 |
| Ethiopia | 5.71 | 2.33 | 1.26 | Tanzania | 6.60 | 3.83 | 2.42 |
| Fiji | 0.74 | 0.11 | 1.55 | Thailand | 0.07 | 0.42 | 0.18 |
| Gabon | 0.49 | 0.55 | 0.62 | Togo | 4.78 | 3.57 | 2.30 |
| Gambia | 6.79 | 5.87 | 3.60 | Tonga | 5.28 | 1.81 | 6.60 |
| Ghana | 2.77 | 2.75 | 0.65 | Turkey | 0.09 | 0.23 | 0.05 |
| Guatemala | 0.60 | 0.40 | 0.49 | Uganda | 5.50 | 3.51 | 1.57 |
| Guinea | 4.22 | 3.79 | 1.54 | Uruguay | 0.06 | 0.07 | 0.12 |
| Guinea-Bissau | 10.60 | 6.30 | 5.66 | Vanuatu | 5.02 | 1.29 | 9.46 |
| Honduras | 2.59 | 2.69 | 1.11 | Venezuela | 0.01 | 0.01 | 0.03 |
| India | 0.10 | 0.44 | 0.07 | Zambia | 6.86 | 5.43 | 2.38 |
| Indonesia | 0.11 | 0.68 | 0.19 | | | | |
| Iran | 0.12 | 0.01 | 0.04 | | | | |
| Jamaica | 0.94 | 2.00 | 0.54 | | | | |
| Jordan | 4.51 | 2.35 | 1.06 | | | | |
| Kenya | 1.94 | 2.12 | 1.22 | | | | |
| Kiribati | 12.24 | 0.68 | 12.73 | | | | |
| Laos | 3.65 | 4.16 | 2.80 | | | | |
| Lesotho | 5.66 | 3.79 | 4.45 | | | | |

*Notes:* TA/GDP = technical assistance to GDP ratio.

## B EMPIRICAL ANALYSIS

### Table B1: Cross-section dependence

| Panel A | Variables in Levels | | | | |
|---|---|---|---|---|---|
| | $Tax_{it}$ | $Aid_{it}$ | $Grants_{it}$ | $Loans_{it}$ | $TA_{it}$ |
| avg $\hat{\rho}_{ij}$ | 0.121 | 0.133 | 0.139 | 0.268 | 0.522 |
| avg $\lvert\hat{\rho}_{ij}\rvert$ | 0.401 | 0.335 | 0.354 | 0.359 | 0.602 |
| $CD$ | 37.71 | 40.35 | 43.83 | 82.15 | 160.69 |
| $p$-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Panel B | Variables in First Differences | | | | |
| | $\Delta Tax_{it}$ | $\Delta Aid_{it}$ | $\Delta Grants_{it}$ | $\Delta Loans_{it}$ | $\Delta TA_{it}$ |
| avg $\hat{\rho}_{ij}$ | 0.003 | 0.042 | 0.036 | 0.016 | 0.152 |
| avg $\lvert\hat{\rho}_{ij}\rvert$ | 0.181 | 0.178 | 0.193 | 0.183 | 0.223 |
| $CD$ | 0.88 | 13.02 | 10.95 | 4.61 | 45.36 |
| $p$-value | 0.381 | 0.000 | 0.000 | 0.000 | 0.000 |

*Notes:* Tax revenue (Tax), Net ODA (Aid), Grants, Loans and Technical Assistance (TA); all as percentages of GDP.

### Table B2: Panel unit roots test

| Levels: CIPS with intercept only | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Tax | | Aid | | Grants | | Loans | | TA | |
| Lags | Z*t*bar | *p* | Z*t*bar | *p* | Z*t*bar | *p* | Z*t*bar | *p* | Z*t*bar | *p* |
| 0 | -4.80 | 0.00 | -8.32 | 0.00 | -11.35 | 0.00 | -12.55 | 0.00 | -4.10 | 0.00 |
| 1 | -3.30 | 0.00 | -3.88 | 0.00 | -6.13 | 0.00 | -6.52 | 0.00 | -0.41 | 0.34 |
| 2 | -0.90 | 0.18 | -0.74 | 0.23 | -2.71 | 0.00 | -5.34 | 0.00 | -0.08 | 0.47 |
| 3 | -0.86 | 0.20 | -0.94 | 0.17 | -1.79 | 0.04 | -4.17 | 0.00 | -0.32 | 0.38 |
| 4 | -1.03 | 0.15 | 2.00 | 0.98 | 2.55 | 1.00 | -2.03 | 0.02 | 1.65 | 0.95 |
| Levels: CIPS with intercept & trend | | | | | | | | | | |
| Variable | Tax | | Aid | | Grants | | Loans | | TA | |
| Lags | Z*t*bar | *p* | Z*t*bar | *p* | Z*t*bar | *p* | Z*t*bar | *p* | Z*t*bar | *p* |
| 0 | -6.46 | 0.00 | -8.22 | 0.00 | -10.73 | 0.00 | -11.81 | 0.00 | -6.18 | 0.00 |
| 1 | -4.79 | 0.00 | -3.70 | 0.00 | -4.72 | 0.00 | -3.56 | 0.00 | -1.66 | 0.05 |
| 2 | -1.51 | 0.07 | -0.47 | 0.32 | -1.24 | 0.11 | -1.28 | 0.10 | 0.10 | 0.54 |
| 3 | 0.16 | 0.56 | 0.59 | 0.72 | -0.64 | 0.26 | 0.40 | 0.65 | 0.75 | 0.77 |
| 4 | 2.19 | 0.99 | 4.88 | 1.00 | 4.68 | 1.00 | 2.10 | 0.98 | 3.18 | 1.00 |
| Differences: CIPS test with drift | | | | | | | | | | |
| Variable | Tax | | Aid | | Grants | | Loans | | TA | |
| Lags | Z*t*bar | *p* | Z*t*bar | *p* | Z*t*bar | *p* | Z*t*bar | *p* | Z*t*bar | *p* |
| 0 | -34.41 | 0.00 | -37.85 | 0.00 | -40.27 | 0.00 | -39.82 | 0.00 | -39.44 | 0.00 |
| 1 | -23.15 | 0.00 | -25.74 | 0.00 | -28.69 | 0.00 | -25.70 | 0.00 | -23.61 | 0.00 |
| 2 | -14.45 | 0.00 | -15.57 | 0.00 | -17.11 | 0.00 | -15.08 | 0.00 | -13.54 | 0.00 |
| 3 | -8.59 | 0.00 | -11.86 | 0.00 | -14.33 | 0.00 | -10.16 | 0.00 | -11.29 | 0.00 |
| 4 | -3.90 | 0.00 | -7.23 | 0.00 | -10.61 | 0.00 | -7.05 | 0.00 | -4.65 | 0.00 |

*Notes:* Tax revenue (Tax), Net ODA (Aid), Grants, Loans and Technical Assistance (TA); all as percentages of GDP.

**Table B3: The effect of aid on taxes excluding one country at a time**

| Country | Coefficient | *p*-value | Country | Coefficient | *p*-value |
|---|---|---|---|---|---|
| Algeria | 0.079*** | 0.004 | Kenya | 0.080*** | 0.003 |
| Angola | 0.081*** | 0.003 | Kiribati | 0.079*** | 0.004 |
| Argentina | 0.077*** | 0.005 | Laos | 0.075*** | 0.006 |
| Bangladesh | 0.081*** | 0.003 | Lesotho | 0.079*** | 0.005 |
| Belize | 0.080*** | 0.004 | Madagascar | 0.075*** | 0.007 |
| Benin | 0.072*** | 0.008 | Malawi | 0.082*** | 0.002 |
| Bhutan | 0.072*** | 0.008 | Maldives | 0.071*** | 0.009 |
| Botswana | 0.080*** | 0.004 | Mali | 0.071*** | 0.009 |
| Burkina Faso | 0.072*** | 0.008 | Mauritania | 0.080*** | 0.004 |
| Burundi | 0.076*** | 0.007 | Mauritius | 0.075*** | 0.007 |
| Cameroon | 0.076*** | 0.006 | Mexico | 0.079*** | 0.004 |
| Cape Verde | 0.081*** | 0.002 | Morocco | 0.078*** | 0.005 |
| Central Africa | 0.072*** | 0.009 | Mozambique | 0.078*** | 0.005 |
| Chad | 0.071*** | 0.009 | Nepal | 0.072*** | 0.008 |
| Chile | 0.080*** | 0.004 | Nicaragua | 0.081*** | 0.003 |
| China | 0.078*** | 0.005 | Niger | 0.076*** | 0.007 |
| Colombia | 0.072*** | 0.008 | Pakistan | 0.080*** | 0.004 |
| Comoros | 0.074*** | 0.008 | Panama | 0.072*** | 0.008 |
| Congo, Dem. Rep. | 0.074*** | 0.007 | Papua New Guinea | 0.071*** | 0.009 |
| Congo, Rep. | 0.077*** | 0.005 | Paraguay | 0.079*** | 0.004 |
| Costa Rica | 0.078*** | 0.005 | Peru | 0.075*** | 0.007 |
| Cote d'Ivoire | 0.078*** | 0.005 | Philippines | 0.079*** | 0.005 |
| Dominica | 0.074*** | 0.007 | Rwanda | 0.080*** | 0.004 |
| Dominican Republic | 0.080*** | 0.003 | Sao Tome & Principe | 0.080*** | 0.003 |
| Ecuador | 0.078*** | 0.005 | Senegal | 0.071*** | 0.009 |
| Egypt | 0.077*** | 0.006 | Seychelles | 0.075*** | 0.007 |
| El Salvador | 0.080*** | 0.003 | Sierra Leone | 0.073*** | 0.007 |
| Eq. Guinea | 0.070*** | 0.009 | Solomon Islands | 0.078*** | 0.005 |
| Ethiopia | 0.076*** | 0.006 | Sri Lanka | 0.073*** | 0.008 |
| Fiji | 0.075*** | 0.007 | St. Vincent | 0.077*** | 0.006 |
| Gabon | 0.076*** | 0.006 | Sudan | 0.072*** | 0.008 |
| Gambia | 0.070*** | 0.009 | Swaziland | 0.079*** | 0.004 |
| Ghana | 0.071*** | 0.009 | Tanzania | 0.082*** | 0.002 |
| Guatemala | 0.072*** | 0.008 | Thailand | 0.080*** | 0.004 |
| Guinea | 0.071*** | 0.007 | Togo | 0.075*** | 0.007 |
| Guinea-Bissau | 0.074*** | 0.008 | Tonga | 0.078*** | 0.004 |
| Honduras | 0.071*** | 0.009 | Turkey | 0.079*** | 0.004 |
| India | 0.080*** | 0.004 | Uganda | 0.076*** | 0.006 |
| Indonesia | 0.079*** | 0.004 | Uruguay | 0.076*** | 0.007 |
| Iran | 0.080*** | 0.004 | Vanuatu | 0.079*** | 0.004 |
| Jamaica | 0.078*** | 0.004 | Venezuela | 0.080*** | 0.003 |
| Jordan | 0.072*** | 0.008 | Zambia | 0.079*** | 0.005 |

*Notes:* The table shows the ECM estimated for all countries in the sample, dropping one country at a time as a test of robustness to outliers. *, **, *** indicate significance at 10%, 5% and 1% respectively.

**Table B4. Net aid and accountability costs**

| | Vertical Accountability Index | | Executive Constraints | |
|---|---|---|---|---|
| Accountability costs | High | Low | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.020 | 0.120*** | 0.052 | 0.117*** |
| | [0.046] | [0.035] | [0.040] | [0.044] |
| *Short-Run* | | | | |
| Aid/GDP | -0.007 | 0.044** | -0.007 | 0.048** |
| | [0.016] | [0.019] | [0.015] | [0.021] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.469*** | -0.529*** | -0.462*** | -0.544*** |
| | [0.045] | [0.047] | [0.041] | [0.049] |
| $t$-statistic | -10.34 | -11.38 | -11.13 | -11.07 |
| *Diagnostics* | | | | |
| RMSE | 0.066 | 0.112 | 0.075 | 0.108 |
| $CD$ test | 1.96 | 0.66 | -0.48 | -0.16 |
| ($p$-value) | (0.051) | (0.512) | (0.634) | (0.870) |
| Observations ($N$) | 1066 (39) | 1171 (40) | 1109 (40) | 1128 (39) |

| | Donors' Accountability Costs (1) | | Donors' Accountability Costs (2) | |
|---|---|---|---|---|
| Accountability costs | High | Low | High | Low |
| *Additional covariates* ϱ | | | *gdppc* | |
| *Long-Run* | | | | |
| Aid/GDP | 0.079** | 0.151*** | 0.057 | 0.091** |
| | [0.031] | [0.038] | [0.036] | [0.041] |
| *Short-Run* | | | | |
| Aid/GDP | 0.012 | 0.021*** | -0.009 | 0.034* |
| | [0.013] | [0.007] | [0.015] | [0.017] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.508*** | -0.532*** | -0.516*** | -0.480*** |
| | [0.033] | [0.123] | [0.045] | [0.043] |
| $t$-statistic | -15.33 | -4.30 | -11.45 | -11.28 |
| *Diagnostics* | | | | |
| RMSE | 0.088 | 0.110 | 0.085 | 0.097 |
| $CD$ test | -0.81 | 0.69 | -0.91 | 1.55 |
| ($p$-value) | (0.420) | (0.488) | (0.362) | (0.120) |
| Observations ($N$) | 2000 (71) | 177 (6) | 1034 (37) | 1137 (47) |

*Notes:* Error correction models are estimated for all countries in the sample with net aid/GDP as the regressor of primary interest and with the sample split according to high/low accountability costs of aid and tax. ϱ The CCEMG estimator is implemented with two lags of cross-section averages and cross-section averages of other variables (gdppc – GDP *per capita* in constant $2010 values, in logs) as indicated – see main text for details. *, **, *** denote significance at 10%, 5% and1% respectively.

**Table B5. Net aid and bureaucratic costs**

| | SARA | | ERM | |
|---|---|---|---|---|
| Bureaucratic costs | Present | Absent | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.044 | 0.090*** | 0.041 | 0.158*** |
| | [0.049] | [0.033] | [0.073] | [0.053] |
| *Short-Run* | | | | |
| Aid/GDP | 0.015 | 0.011 | -0.013 | 0.075** |
| | [0.031] | [0.013] | [0.023] | [0.030] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.503*** | -0.494*** | -0.491*** | -0.540*** |
| | [0.048] | [0.040] | [0.050] | [0.061] |
| $t$-statistic | -10.39 | -12.41 | -9.84 | -8.79 |
| *Diagnostics* | | | | |
| RMSE | 0.083 | 0.095 | 0.074 | 0.113 |
| $CD$ test | 0.39 | -1.45 | 1.10 | 0.18 |
| ($p$-value) | (0.693) | (0.147) | (0.270) | (0.861) |
| Observations ($N$) | 715 (25) | 1656 (59) | 622 (22) | 789 (27) |

| | Donors Fragmentation Index (1) | | Donors Fragmentation Index (2) | |
|---|---|---|---|---|
| Bureaucratic costs | High | Low | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.087** | 0.102** | 0.053 | 0.110** |
| | [0.034] | [0.054] | [0.040] | [0.045] |
| *Short-Run* | | | | |
| Aid/GDP | 0.009 | 0.023 | -0.0009 | 0.039** |
| | [0.012] | [0.025] | [0.019] | [0.019] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.462*** | -0.572*** | -0.530*** | -0.516*** |
| | [0.042] | [0.048] | [0.045] | [0.046] |
| $t$-statistic | -10.89 | -11.89 | -11.87 | -11.21 |
| *Diagnostics* | | | | |
| RMSE | 0.082 | 0.095 | 0.078 | 0.093 |
| $CD$ test | -0.68 | 0.68 | -0.91 | 0.84 |
| ($p$-value) | (0.495) | (0.495) | (0.362) | (0.400) |
| Observations ($N$) | 1163 (42) | 1208 (42) | 1034 (37) | 1337 (47) |

*Notes:* Error correction models are estimated for all countries in the sample with net aid/GDP as the regressor of primary interest and with the sample split according to high/low bureaucratic costs of aid and tax. ϱ The CCEMG estimator is implemented with two lags of cross-section averages and cross-section averages of other variables (*gdppc* – GDP *per capita* and *agriculture* – the share of agriculture value added in GDP; both variables in logs) as indicated *, **, *** denote significance at 10%, 5% and1% respectively.

**Table B6. Grants and accountability costs**

| | Vertical Accountability Index | | Executive Constraints | |
|---|---|---|---|---|
| Accountability costs | High | Low | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.061** | 0.075*** | 0.078*** | 0.056** |
| | [0.029] | [0.026] | [0.029] | [0.026] |
| *Short-Run* | | | | |
| Aid/GDP | 0.008 | 0.020 | 0.013 | 0.014 |
| | [0.010] | [0.015] | [0.011] | [0.014] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.476*** | -0.558*** | -0.473*** | -0.564*** |
| | [0.045] | [0.040] | [0.042] | [0.044] |
| $t$-statistic | -10.46 | -14.04 | -11.15 | -12.82 |
| *Diagnostics* | | | | |
| RMSE | 0.067 | 0.114 | 0.075 | 0.110 |
| $CD$ test | 4.94 | -0.66 | -0.71 | -0.20 |
| ($p$-value) | (0.000) | (0.511) | (0.479) | (0.845) |
| Observations ($N$) | 1103 (39) | 1176 (40) | 1139 (40) | 1140 (39) |

| | Donors' Accountability Costs (1) | | Donors' Accountability Costs (2) | |
|---|---|---|---|---|
| Accountability costs | High | Low | High | Low |
| *Additional covariates* † | | | | *gdppc, agriculture* |
| *Long-Run* | | | | |
| Aid/GDP | 0.056*** | 0.123* | 0.077*** | 0.006 |
| | [0.020] | [0.068] | [0.024] | [0.032] |
| *Short-Run* | | | | |
| Aid/GDP | 0.010 | 0.033 | 0.015 | 0.006 |
| | [0.009] | [0.032] | [0.010] | [0.014] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.540*** | -0.429*** | -0.539*** | -0.584*** |
| | [0.032] | [0.088] | [0.044] | [0.048] |
| $t$-statistic | -16.97 | -4.88 | -12.25 | -12.16 |
| *Diagnostics* | | | | |
| RMSE | 0.087 | 0.114 | 0.086 | 0.088 |
| $CD$ test | 0.42 | 0.25 | -0.58 | 1.23 |
| ($p$-value) | (0.676) | (0.806) | (0.565) | (0.218) |
| Observations ($N$) | 2028 (71) | 180 (6) | 1067 (37) | 1347 (47) |

Notes: Error correction models are estimated for all countries in the sample with grants/GDP as the regressor of primary interest and with the sample split according to high/low accountability costs of aid and tax. *, **, *** denote significance at 10%, 5% and1% respectively.

**Table B7. Grants and bureaucratic costs**

| | SARA | | ERM | |
|---|---|---|---|---|
| Bureaucratic costs | Present | Absent | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.086** | 0.050** | 0.031 | 0.076** |
| | [0.042] | [0.020] | [0.048] | [0.031] |
| *Short-Run* | | | | |
| Aid/GDP | 0.022 | 0.008 | -0.011 | 0.020 |
| | [0.020] | [0.008] | [0.019] | [0.016] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.498*** | -0.531*** | -0.580*** | -0.564*** |
| | [0.054] | [0.035] | [0.051] | [0.056] |
| $t$-statistic | -9.25 | -15.08 | -11.36 | -9.99 |
| *Diagnostics* | | | | |
| RMSE | 0.086 | 0.095 | 0.072 | 0.115 |
| $CD$ test | -0.58 | 0.14 | 0.77 | -1.15 |
| ($p$-value) | (0.561) | (0.889) | (0.441) | (0.251) |
| Observations ($N$) | 725 (26) | 1688 (59) | 622 (22) | 790 (27) |

| | Donors Fragmentation Index (1) | | Donors Fragmentation Index (2) | |
|---|---|---|---|---|
| Bureaucratic costs | High | Low | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.049** | 0.063** | 0.077*** | 0.034 |
| | [0.021] | [0.031] | [0.024] | [0.028] |
| *Short-Run* | | | | |
| Aid/GDP | 0.013* | 0.008 | 0.015 | 0.013 |
| | [0.007] | [0.015] | [0.010] | [0.012] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.466*** | -0.582*** | -0.540*** | -0.506*** |
| | [0.040] | [0.043] | [0.044] | [0.040] |
| $t$-statistic | -11.66 | -13.49 | -12.25 | -12.83 |
| *Diagnostics* | | | | |
| RMSE | 0.083 | 0.101 | 0.086 | 0.097 |
| $CD$ test | 0.57 | 1.01 | -0.58 | 2.01 |
| ($p$-value) | (0.570) | (0.312) | (0.565) | (0.045) |
| Observations ($N$) | 1194 (42) | 1220 (42) | 1067 (37) | 1347 (47) |

*Notes:* Error correction models are estimated for all countries in the sample with grants/GDP as the regressor of primary interest and with the sample split according to high/low bureaucratic costs of aid and tax. *, **, *** denote significance at 10%, 5% and1% respectively.

**Table B8. Loans and accountability costs**

| | Vertical Accountability Index | | Executive Constraints | |
|---|---|---|---|---|
| Accountability costs | High | Low | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | -0.010 | 0.051* | 0.002 | 0.057 |
| | [0.023] | [0.029] | [0.018] | [0.035] |
| *Short-Run* | | | | |
| Aid/GDP | -0.003 | 0.014 | -0.009 | 0.021 |
| | [0.008] | [0.014] | [0.008] | [0.014] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.471*** | -0.531*** | -0.499*** | -0.510*** |
| | [0.046] | [0.033] | [0.042] | [0.036] |
| $t$-statistic | -10.19 | -16.19 | -11.89 | -14.21 |
| *Diagnostics* | | | | |
| RMSE | 0.065 | 0.110 | 0.071 | 0.108 |
| $CD$ test | 1.32 | -0.03 | -1.27 | -1.60 |
| ($p$-value) | (0.186) | (0.979) | (0.203) | (0.109) |
| Observations ($N$) | 1061 (39) | 1148 (40) | 1114 (40) | 1095 (39) |

| | Donors' Accountability Costs (1) | | Donors' Accountability Costs (2) | |
|---|---|---|---|---|
| Accountability costs | High | Low | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.009 | 0.003 | -0.014 | 0.034 |
| | [0.019] | [0.058] | [0.025] | [0.024] |
| *Short-Run* | | | | |
| Aid/GDP | -0.0002 | 0.007 | -0.001 | 0.008 |
| | [0.008] | [0.011] | [0.008] | [0.009] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.541*** | -0.442*** | -0.492*** | -0.540*** |
| | [0.028] | [0.053] | [0.037] | [0.038] |
| $t$-statistic | -19.00 | -8.27 | -13.31 | -14.32 |
| *Diagnostics* | | | | |
| RMSE | 0.088 | 0.108 | 0.075 | 0.099 |
| $CD$ test | -1.63 | 0.67 | -1.87 | -0.41 |
| ($p$-value) | (0.103) | (0.501) | (0.062) | (0.683) |
| Observations ($N$) | 1967 (71) | 161 (6) | 997 (37) | 1331 (47) |

*Notes:* Error correction models are estimated for all countries in the sample with loans/GDP as the regressor of primary interest and with the sample split according to high/low bureaucratic costs of aid and tax. *, **, *** denote significance at 10%, 5% and1% respectively.

**Table B9. Loans and bureaucratic costs**

| | SARA | | ERM | |
|---|---|---|---|---|
| Bureaucratic costs | Present | Absent | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.091*** | -0.019 | 0.036 | 0.023 |
| | [0.034] | [0.019] | [0.038] | [0.037] |
| *Short-Run* | | | | |
| Aid/GDP | 0.021** | -0.010 | 0.008 | 0.014 |
| | [0.010] | [0.008] | [0.016] | [0.016] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.561*** | -0.498*** | -0.581*** | -0.555*** |
| | [0.043] | [0.033] | [0.062] | [0.051] |
| $t$-statistic | -12.96 | -15.11 | -9.42 | -10.95 |
| *Diagnostics* | | | | |
| RMSE | 0.078 | 0.094 | 0.073 | 0.116 |
| $CD$ test | -0.02 | -1.05 | 0.60 | 0.86 |
| ($p$-value) | (0.986) | (0.295) | (0.547) | (0.389) |
| Observations ($N$) | 714 (25) | 1614 (59) | 619 (22) | 768 (27) |

| | Donors Fragmentation Index (1) | | Donors Fragmentation Index (2) | |
|---|---|---|---|---|
| Bureaucratic costs | High | Low | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | -0.005 | 0.041 | -0.014 | 0.034 |
| | [0.020] | [0.032] | [0.025] | [0.025] |
| *Short-Run* | | | | |
| Aid/GDP | -0.002 | 0.009 | -0.001 | 0.008 |
| | [0.007] | [0.012] | [0.008] | [0.009] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.502*** | -0.538*** | -0.492*** | -0.540*** |
| | [0.033] | [0.042] | [0.037] | [0.038] |
| $t$-statistic | -15.05 | -12.87 | -13.31 | -14.32 |
| *Diagnostics* | | | | |
| RMSE | 0.074 | 0.102 | 0.075 | 0.099 |
| $CD$ test | 0.44 | 1.26 | -1.87 | -0.41 |
| ($p$-value) | (0.662) | (0.208) | (0.062) | (0.683) |
| Observations ($N$) | 1127 (42) | 1201 (42) | 997 (37) | 1331 (47) |

*Notes:* Error correction models are estimated for all countries in the sample with loans/GDP as the regressor of primary interest and with the sample split according to high/low bureaucratic costs of aid and tax. *, **, *** denote significance at 10%, 5% and1% respectively.

**Table B10. Technical assistance and bureaucratic costs**

| | SARA | | ERM | |
|---|---|---|---|---|
| Bureaucratic costs | Present | Absent | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.105** | 0.064 | 0.004 | 0.139* |
| | [0.053] | [0.054] | [0.068] | [0.071] |
| *Short-Run* | | | | |
| Aid/GDP | 0.033 | 0.007 | 0.014 | 0.008 |
| | [0.034] | [0.021] | [0.037] | [0.045] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.519*** | -0.497*** | -0.611*** | -0.500*** |
| | [0.053] | [0.043] | [0.066] | [0.064] |
| $t$-statistic | -9.83 | -11.63 | -9.24 | -7.85 |
| *Diagnostics* | | | | |
| RMSE | 0.078 | 0.088 | 0.068 | 0.112 |
| $CD$ test | 1.01 | -0.00 | 1.09 | -1.62 |
| ($p$-value) | (0.310) | (0.996) | (0.277) | (0.106) |
| Observations ($N$) | 726 (25) | 1686 (59) | 622 (22) | 790 (27) |

| | Donors Fragmentation Index (1) | | Donors Fragmentation Index (2) | |
|---|---|---|---|---|
| Bureaucratic costs | High | Low | High | Low |
| *Long-Run* | | | | |
| Aid/GDP | 0.111** | 0.002 | 0.031 | 0.080 |
| | [0.053] | [0.044] | [0.049] | [0.050] |
| *Short-Run* | | | | |
| Aid/GDP | 0.035* | -0.015 | -0.003 | 0.028 |
| | [0.018] | [0.030] | [0.025] | [0.024] |
| *EC Coefficient* | | | | |
| $y_{it-1}$ | -0.441*** | -0.475*** | -0.481*** | -0.443*** |
| | [0.043] | [0.044] | [0.053] | [0.036] |
| $t$-statistic | -10.29 | -10.71 | -9.01 | -12.29 |
| *Diagnostics* | | | | |
| RMSE | 0.074 | 0.105 | 0.080 | 0.099 |
| $CD$ test | 1.38 | -0.78 | -1.45 | -1.48 |
| ($p$-value) | (0.186) | (0.434) | (0.147) | (0.140) |
| Observations ($N$) | 1192 (42) | 1220 (42) | 1065 (37) | 1347 (47) |

*Notes:* Error correction models are estimated for all countries in the sample with technical assistance/GDP as the regressor of primary interest and with the sample split according to high/low bureaucratic costs of aid and tax. *, **, *** denote significance at 10%, 5% and1% respectively.

### *1. List of countries coded as having high vertical accountability: 39 countries*

Argentina, Bangladesh, Benin, Botswana, Cabo Verde, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Fiji, Gambia, Guatemala, Honduras, India, Indonesia, Jamaica, Malawi, Mali, Mauritius, Mexico, Nicaragua, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Sao Tome and Principe, Senegal, Solomon Islands, Sri Lanka, Tanzania, Thailand, Turkey, Uruguay, Vanuatu, Venezuela, Uganda.

*List of countries coded as having high vertical accountability: 40 countries*

Algeria, Angola, Bhutan, Burkina Faso, Burundi, Cameroon, Central African republic, Chad, China, Comoros, Democratic Republic of Congo, Congo Republic, Cote d'Ivoire, Egypt, Equatorial Guinea, Ethiopia, Gabon, Ghana, Guinea, Guinea-Bissau, Iran, Jordan, Kenya, Laos PDR, Lesotho, Madagascar, Maldives, Mauritania, Morocco, Mozambique, Nepal, Niger, Pakistan, Rwanda, Seychelles, Sierra Leone, Sudan, Swaziland, Togo, Uganda.

*List of countries with missing values on vertical accountability: 5 countries*

Belize, Dominica, Kiribati, St Vincent and the Grenadines, Tonga.

### *2. List of countries coded as having high executive constraints: 40 countries*

Argentina, Benin, Bhutan, Botswana, Cameroon, Cabo Verde, Colombia, Congo Republic, Costa Rica, Ecuador, Ghana, Guatemala, India, Jamaica, Kenya, Lesotho, Malawi, Mali, Mauritius, Mexico, Morocco, Nepal, Niger, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Sao Tome and Principe, Senegal, Seychelles, Solomon Islands, Tanzania, Thailand, Turkey, Uganda, Vanuatu, Venezuela, Zambia.

*List of countries coded as having low executive constraints: 39 countries*

Algeria, Angola, Bangladesh, Burkina Faso, Burundi, Central African Republic, Chad, Chile, China, Comoros, Democratic Republic of Congo, Cote d'Ivoire, Dominican Republic, Egypt, El Salvador, Equatorial Guinea, Ethiopia, Fiji, Gabon, Gambia, Guinea, Guinea-Bissau, Honduras, Indonesia, Iran, Jordan, Laos PDR, Madagascar, Maldives, Mauritania, Mozambique, Nicaragua, Rwanda, Sierra Leone, Sri Lanka, Sudan, Swaziland, Togo, Uruguay.

*List of countries with missing values for executive constraints: 5 countries*

Belize, Dominica, Kiribati, St Vincent and the Grenadines, Tonga.

### *3. List of countries coded as having high donor accountability costs (1): 71 countries*

Algeria, Angola, Bangladesh, Benin, Bhutan, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Chile, China, Colombia, Comoros, Congo Republic, Costa Rica, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Fiji, Gabon, Gambia, Ghana, Guatemala, Guinea, Guinea-Bissau, Honduras, India, Indonesia, Jamaica, Jordan, Kenya, Kiribati, Laos PDR, Lesotho, Madagascar, Malawi, Maldives, Mali, Mauritania, Mexico, Morocco, Mozambique, Nepal, Nicaragua, Niger, Pakistan, Papua New Guinea, Paraguay, Peru, Philippines, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Sri Lanka, St Vincent and the Grenadines, Sudan, Tanzania, Tonga, Uganda, Uruguay, Vanuatu, Venezuela, Zambia

*List of countries coded as having low donor accountability costs (1): 6 countries*

Democratic Republic of Congo, Cote d'Ivoire, Iran, Mauritius, Seychelles, Togo

*List of countries with missing values for donor accountability costs (1): 7 countries*

Argentina, Belize, Equatorial Guinea, Panama, Swaziland, Thailand, Turkey

### *4. List of countries coded as having high donor accountability costs (2): 47 countries*

Algeria, Angola, Argentina, Belize, Bhutan, Botswana, Central African Republic, Chad, Chile, China, Congo Republic, Costa Rica, Cote d'Ivoire, Dominica, Egypt, Equatorial Guinea, Fiji, Guinea, India, Iran, Kiribati, Maldives, Mauritius, Mexico, Nicaragua, Pakistan, Panama, Paraguay, Seychelles, Sri Lanka, St Vincent and the Grenadines, Sudan, Swaziland, Thailand, Turkey, Uruguay, Venezuela.

*List of countries coded as having low donor accountability costs (2): 37 countries*

Bangladesh, Benin, Burkina Faso, Burundi, Cameroon, Cabo Verde, Colombia, Comoros, Democratic Republic of Congo, Dominican Republic, Ecuador, El Salvador, Ethiopia, Gabon, Gambia, Ghana, Guatemala, Guinea-Bissau, Honduras, Indonesia, Jamaica, Jordan, Kenya, Laos PDR, Lesotho, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Nepal, Niger, Papua New Guinea, Peru, Philippines, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Tanzania, Togo, Tonga, Uganda, Vanuatu, Zambia.

### *5. List of countries coded as having a SARA: 25 countries*

Argentina, Botswana, Burundi, Colombia, Ecuador, Ethiopia, Gambia, Ghana, Guatemala, Jamaica, Kenya, Lesotho, Malawi, Mauritius, Mexico, Mozambique, Peru, Rwanda, Seychelles, Sierra Leone, Swaziland, Tanzania, Uganda, Venezuela, Zambia.

### *6. List of countries coded as having high ERM: 22 countries*

Bhutan, Burkina Faso, Cabo Verde, Cote d'Ivoire, Dominica, Ethiopia, Ghana, Honduras, India, Kenya, Lesotho, Malawi, Maldives, Mali, Mauritania, Mozambique, Nicaragua, Senegal, St Vincent and the Grenadines, Tanzania, Tonga, Zambia

*List of countries coded as having low ERM: 27 countries*

Angola, Bangladesh, Benin, Burundi, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Congo Republic, Gambia, Guinea, Guinea-Bissau, Kiribati, Laos PDR, Madagascar, Nepal, Niger, Pakistan, Papua New Guinea, Rwanda, Sao Tome and Principe, Sierra Leone, Solomon Islands, Sri Lanka, Sudan, Togo, Uganda.

*List of countries with missing ERM values: 35 countries*

Algeria, Argentina, Belize, Botswana, Cameroon, Chile, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Fiji, Gabon, Guatemala, Indonesia, Iran, Jamaica, Jordan, Mauritius, Mexico, Morocco, Panama, Paraguay, Peru, Philippines, Seychelles, Swaziland, Thailand, Turkey, Uruguay, Vanuatu, Venezuela.

### *8. List of countries coded as having high bureaucratic costs of aid (1): 42 countries*

Algeria, Belize, Cameroon, Central African Republic, Chad, China, Colombia, Comoros, Congo Republic, Costa Rica, Cote d'Ivoire, Dominica, Dominican Republic, Egypt, El Salvador, Equatorial Guinea, Fiji, Gabon, Honduras, Indonesia, Iran, Jamaica, Jordan, Kiribati, Madagascar, Maldives, Mauritius, Morocco, Panama, Papua New Guinea, Paraguay, Philippines, Sao Tome and Principe, Seychelles, Solomon Islands, Sri Lanka, St Vincent and the Grenadines, Thailand, Togo, Tonga, Turkey, Vanuatu.

*List of countries coded as having low bureaucratic costs of aid (1): 42 countries*

Angola, Argentina, Bangladesh, Benin, Bhutan, Botswana, Burkina Faso, Burundi, Cabo Verde, Chile, Democratic Republic of Congo, Ecuador, Ethiopia, Gambia, Ghana, Guatemala, Guinea, Guinea-Bissau, India, Kenya, Laos PDR, Lesotho, Malawi, Mali, Mauritania, Mexico, Mozambique, Nepal, Nicaragua, Niger, Pakistan, Peru, Rwanda, Senegal, Sierra Leone, Sudan, Swaziland, Tanzania, Uganda, Uruguay, Venezuela, Zambia.

### *9. List of countries coded as having high bureaucratic costs of aid (2): 37 countries*

Algeria, Angola, Argentina, Belize, Bhutan, Botswana, Central African Republic, Chad, Chile, China, Congo Republic, Costa Rica, Cote d'Ivoire, Dominica, Egypt, Equatorial Guinea, Fiji, Guinea, India, Iran, Kiribati, Maldives, Mauritius, Mexico, Nicaragua, Pakistan, Panama, Paraguay, Seychelles, Sri Lanka, St Vincent and the Grenadines, Sudan, Swaziland, Thailand, Turkey, Uruguay, Venezuela.

*List of countries coded as having low bureaucratic costs of aid (2): 47 countries*

Bangladesh, Benin, Burkina Faso, Burundi, Cameroon, Cabo Verde, Colombia, Comoros, Democratic Republic of Congo, Dominican Republic, Ecuador, El Salvador, Ethiopia, Gabon, Gambia, Ghana, Guatemala, Guinea-Bissau, Honduras, Indonesia, Jamaica, Jordan, Kenya, Laos PDR, Lesotho, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Nepal, Niger, Papua New Guinea, Peru, Philippines, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Tanzania, Togo, Tonga, Uganda, Vanuatu, Zambia.

### *10. List of countries codes as having high aid uncertainty resulting from high donor fragmentation: 42 countries*

Angola, Argentina, Belize, Botswana, Cameroon, Chile, Colombia, Democratic Republic of Congo, Congo Republic, Costa Rica, Cote d'Ivoire, Dominica, Dominican Republic, Egypt, Equatorial Guinea, Ghana, Honduras, India, Indonesia, Iran, Jamaica, Madagascar, Maldives, Mauritius, Mexico, Morocco, Mozambique, Nicaragua, Panama, Paraguay, Philippines, Sao Tome and Principe, Seychelles, Sierra Leone, Solomon Islands, St Vincent and the Grenadines, Sudan, Turkey, Uruguay, Venezuela, Zambia.

*List of countries codes as having high aid uncertainty resulting from low donor fragmentation: 42 countries*

Algeria, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cabo Verde, Central African Republic, Chad, China, Comoros, Ecuador, El Salvador, Ethiopia, Fiji, Gambia, Guatemala, Guinea, Guinea-Bissau, Jordan, Kenya, Kiribati, Laos PDR, Lesotho, Malawi, Mali, Mauritania, Nepal, Niger, Pakistan, Papua New Guinea, Peru, Rwanda, Senegal, Sri Lanka, Swaziland, Tanzania, Thailand, Togo, Tonga, Uganda, Vanuatu.

### *11. List of countries codes as having high aid uncertainty resulting from high revenue vulnerability: 40 countries*

Angola, Argentina, Belize, Botswana, Cameroon, Chile, China, Democratic Republic of Congo, Congo Republic, Costa Rica, Cote d'Ivoire, Dominica, Dominican Republic, Egypt, Equatorial Guinea, Gabon, Guinea-Bissau, India, Indonesia, Iran, Jamaica, Jordan, Kiribati, Madagascar, Maldives, Mauritius, Mexico, Morocco, Mozambique, Nicaragua, Panama, Paraguay, Philippines, Sao Tome and Principe, Solomon Islands, St Vincent and the Grenadines, Turkey, Uruguay, Venezuela, Zambia.

*List of countries codes as having high aid uncertainty resulting from low revenue vulnerability: 44 countries*

Algeria, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cabo Verde, Central African Republic, Chad, Colombia, Comoros, Ecuador, El Salvador, Ethiopia, Fiji, Gambia, Ghana, Guatemala, Guinea, Honduras, Kenya, Laos PDR, Lesotho, Malawi, Mali, Mauritania, Nepal, Niger, Pakistan, Papua New Guinea, Peru, Rwanda, Senegal, Seychelles, Sierra Leone, Sri Lanka, Sudan, Swaziland, Tanzania, Thailand, Togo, Tonga, Uganda, Vanuatu.