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Lukasz Marc

Faculty of Economics and Business, VU University Amsterdam, and Tinbergen Institute.

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NEW EVIDENCE ON FUNGIBILITY AT THE AGGREGATE LEVEL

Łukasz Marć*

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Abstract

This study examines the fungibility of foreign aid and makes three contributions to the existing literature. Firstly, fungibility of aid at the aggregate level is reexamined on a richer panel dataset of 91 developing countries for 1980-2009, taking into account endogeneity of aid and autocorrelation in residuals. Results indicate that aid is strongly fungible: around 80 % is substituting rather than increasing government spending in the short run. There is also substantial heterogeneity in the sample, with aid being more fungible for countries with a low share of aid in GDP. Secondly, aid is disaggregated into bilateral and multilateral components. Despite substantial differences between both components, there are only very small indications that multilateral aid is less fungible than bilateral aid and estimates are volatile when aid is instrumented. Thirdly, this study attempts to distinguish between off- and on-budget aid at the aggregate level using the value of technical cooperation as a proxy for off-budget aid. While on-budget aid is strongly fungible, off-budget aid is non-fungible. In the long run, around 50 % of aid increases government expenditures, although results are not stable. High levels of fungibility (except for off-budget aid) suggest that resources spent on earmarking may be wasted and donors should rethink the way aid is distributed.

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1 Introduction

Over the last 30 years aid has accounted for around 9% of developing countries' GDP[1] and has been one of the main sources of government revenues in those countries. Empirical literature has been trying (especially from the mid 1990's) to quantify aid's impact on growth and well-being in developing countries. However, results have been mixed (for reviews and discussion see, for example, Tarp 2006; Roodman 2007; Arndt *et al.* 2010). One of the factors that may explain the lower impact of aid on growth (than expected in the 1970's or 1980's) is fungibility.

Fungibility occurs when recipients respond to aid by changing the way they use their own resources. When one euro of aid ends up financing (on the margin) provision of services or goods other than intended, aid is said to be fungible.[2] On the aggregate level, aid is fungible when one euro of aid increases government expenditure by less than one euro, and fully fungible when government spending does not rise at all. It can happen for at least two reasons: (i) aid substitutes rather than complements the budget, therefore the government is able to decrease taxes, decrease borrowing needs or increase surplus (which may result in lower taxes in the future), (ii) aid is stolen and ends up in private pockets. Thus, if aid is fungible on the macro level, it finances on the margin private consumption and savings via taxes or corruption.

One of the main reasons of fungibility are the differences in preferences between donors and recipients. Donors may favor different regions or sectors than recipients, and in response recipient's government may shift its own expenditures to other regions or sectors, or limit total government's spending, favoring private consumption. In the latter case, fungibility at the aggregate level will be recorded.

Fungibility is more likely when monitoring the actual disbursement of aid is costly (Chatterjee *et al.*, 2007). As Feyzioglu *et al.* (1998) suggest, it may seem that avoiding fungibility should be easy from a donor's perspective. Donors usually impose strict and carefully chosen conditions and a large part of aid is earmarked. Additionally, pre-intervention levels of government spending in aid-recipient countries are usually available to donors and those could

[1] My own calculations of unweighted average for a sample of 91 countries (details in data section). When countries are weighted by the size of economy (GDP) average drops to 0.98%, driven by China (0.11%) and India (0.38%), and to 2.18% if those two countries are excluded.

[2] A theoretical discussion of fungibility is presented in McGillivray & Morrissey (2000, 2001b).

be used as an imperfect measure of what would happen if a particular aid package was not given. However, there are cases when this kind of monitoring is difficult. Usually countries receive aid from multiple sources and donor coordination is still poor. At the same time, in developing nations, domestic resources fluctuate significantly within short periods of time and therefore past spending (and especially its composition) may not be informative.

Summing up, high donor monitoring costs and different preferences may cause governments to use diversion of funds as a way to limit the effect of diminishing returns to government spending, both at the aggregate level and in specific sectors.

The arguments presented above suggest that aid is expected to be partially fungible. This prediction is confirmed in simple theoretical models. Assume that if aid is not given, national income y is equal to GDP and equals sum of consumption c and government expenditures g: $GDP = y = c + g$. When aid arrives and is channeled through the budget, national income increases by amount of aid a and equals $y = c + g + a$ while GDP remains constant, since it is balanced by increased import or financial flows. In most (dynamic) models it is optimal to increase both current and future consumption in response to an increase in income due to consumption smoothing. If agents have homothetic preferences for private and merit goods, an increase in income will be divided so that the shares of consumption and government spending remain constant. In table 2 in the data section share of government expenditures in GDP equals around 21-25% which means that, if the simple theoretical models are correct, one euro of aid should increase government expenditures by around 21-25 cents while the rest will substitute for government spending.

Aid fungibility is not necessarily a bad thing for development. On the aggregate level, when aid substitutes rather than increases government spending, it potentially reduces tax levels. Tax relief may have a very high rate of return (at least in the short run) because in most developing countries distortions caused by taxes are very high (Devarajan *et al.*, 1999; Feyzioglu *et al.*, 1998).[3] Increases in private consumption or investment (even over a short period of time) may also have a very beneficial impact on lives of people around the poverty line (where returns to consumption are high).[4] On the sectoral, regional or micro level, funds

[3]Conversely, it may also have negative macroeconomic consequences due to the fact that aid is more volatile and unpredictable than national revenues. Increasing aid dependence reduces incentives for governments to introduce good policies and efficient institutions. Moreover, tax exemptions may be granted only to interest groups (Pivovarsky *et al.*, 2003).

[4]Of course, whether it is the most efficient use of resources, is a relevant question.

may be reallocated to more productive investments. Furthermore, there is potential value for a country to make its own spending decisions.

What are the consequences of fungibility? When fungibility is present, assessing the effects of aid is more difficult. On the macro level, aid's impact is the sum of the impact of increased spending as well as the impact of increased private consumption and savings (due to a tax decrease or corruption). What is more, if aid is fungible at the aggregate level it finances projects that would have been undertaken anyway which rises question about wasted money spent on earmarking. As a solution, Devarajan & Swaroop (1998) suggest to use direct budgetary support conditional on an agreement about composition and quality of government spending instead of directly financing chosen sectors or regions. Both arguments suggest that measuring and understating fungibility is important for donor strategies and may lead to more cost-efficient ways of aid distribution.

There is consensus neither about the extent of fungibility, nor about its importance. The first contribution of this study is to provide additional evidence on cross-country fungibility. I test the hypothesis that aggregated aid flows are fungible using a rich dataset of 91 countries in 1980-2009 and accounting for the endogeneity of aid and the autocorrelation of residuals in the model. Aid is often determined at the same time as government expenditures and it may also be channeled to countries that fail to provide merit goods. In both cases, aid will be endogenous. What is more, public expenditures may be persistent and that should be taken into account to get a consistent estimate of the impact of aid on government expenditure. Arellano-Bond's (1991) system estimator is used to address the problems of endogeneity and dynamic misspecification of the model.

Fungibility of aid has been tested on aggregate, sectoral and regional level. Aid can also be disaggregated into bilateral and multilateral aid, and to my knowledge no one has tested fungibility of these major components. Ram (2003) points out that bilateral and multilateral aid differ at least for three reasons: (i) donor motives, (ii) aid conditionalities and (iii) closeness of the relationship between the donor and the recipient. Furthermore, Ram (2003, 2004) showed that bilateral aid has a significantly different impact on growth than multilateral aid does, hence assuming equality of coefficients may not be appropriate also in fungibility analysis. This study attempts to fill this gap.

Whenever a part of aid is not recorded in the budget and the distinction between off- and

on-budget aid is not accounted for, fungibility estimates will be biased. Van de Sijpe (2010) made the first attempt at distinguishing between recorded (on-budget) and unrecorded (off-budget) aid flows at the sectoral level. I follow his approach at the aggregate level and try to estimate the fungibility of on- and off-budget aid.

Differences in fungibility of bilateral and multilateral aid, as well as off- and on-budget aid, may have policy implications if recipients are reluctant to cooperate with donors on the division of total government spending or donors do not trust budget support. If donors want to avoid fungibility, they may use less fungible types of aid.

While the focus of this study is on the response of government expenditures to aid in given year (similarly to the literature), inclusion of the lag dependent variable allows also to estimate long term fungibility.

The paper proceeds as follows. The next section presents a literature review, the third section describes the data, the fourth focuses on methodology, the fifth discusses the choice of controls. Afterwards, results for the aggregate aid are presented. Seventh section discusses and presents results for bilateral and multilateral aid, and eight for off- and on-budget aid. Robustness of the results is tested in Section 9. The study ends with conclusions.

2 Literature review

As noted before, there is no consensus about the importance and extent of fungibility. Pack & Pack (1990) find that foreign aid does not replace government expenditures in Indonesia, but it even stimulates further spending. The same authors show that in the Dominican Republic development expenditures are used to finance deficit reduction, debt service and taxes, and as a result aid is highly fungible (Pack & Pack, 1993). Swaroop *et al.* (2000) report that aid in India is financing projects that would have been undertaken anyway, and the freed resources are spent on non-development purposes. On the aggregate level, Feyzioglu *et al.* (1998) report that for their basic sample of 14 countries aid is not fungible at the aggregate level, and that there is no tax relief that could be associated with fungibility. However, this result suffers greatly from sample selection problems, as when the number of countries is increased, aid appears to be fungible.[5] Devarajan *et al.* (1999) find that each dollar of

[5]McGillivray & Morrissey (2000) point out concerns about this study.

aid leads to a 90 cent increase in government expenditures in a sample of 18 Sub-Saharan countries in 1971-1995, so only little fungibility is present. Pivovarsky *et al.* (2003) find (sample of 107 countries in 1970-2000) that concessional loans increase domestic revenue, whereas grants are fungible. Chatterjee *et al.* (2007) for a panel of 67 countries in 1972-2000 find that 70% of aid is fungible at the aggregate level. They suggest that since there is no significant effect of foreign aid on growth in the presence of fungibility, fungibility can be the missing link that explains the mixed results of growth regressions. A wide review of the fiscal effects of aid (in particular fungibility and fiscal response studies) is provided by McGillivray & Morrissey (2001b).

Another question debated in the literature is whether aid earmarked to one sector is financing expenditures also in other sectors. For example, Feyzioglu *et al.* (1998) find that concessional loans going to agriculture, education and energy are fungible, while those to the transport and communication sectors are spent according to the donor's wishes. Devarajan *et al.* (1999) show that aid going to the transport and communication sector and the energy sector is fungible, and that for the agriculture, health, and industry sectors the hypothesis of full fungibility cannot be rejected. Pettersson (2007a) finds that over 70% of sectoral aid is fungible. Conversely, Van de Sijpe (2010), using data that distinguishes between off- and on-budget aid, shows that off-budget aid (approximated by technical cooperation) has a very small impact on government expenditures in health and education sectors, while results for on-budget aid (approximated by a sector programme) are mixed and no firm conclusion can be drawn.

Aid may have indirect effects on government spending. For example, investments in bed nets may result in decreased malaria morbidity and, in the long term, decreased health spending. However, the focus of (almost) the whole fungibility literature is on short term impact of aid on government expenditures. What is tested is whether aid disbursed in a given year is increasing government expenditures in the same year. This study also focuses on the short term fungibility, however thanks to the inclusion of the lagged dependent variable I attempt to investigate also medium or long term fungibility.

To my knowledge, the fungibility of aid disaggregation into bilateral and multilateral components has not been tested. This study aims at filling this gap. Additionally, following Van de Sijpe (2010) who analysed separately off- and on-budget aid, I include off-budget aid

into the analysis.

3 Data

The analysis was initially limited to 49 Least Developed Countries and 12 Other Low Income Countries (both described as LDCs afterwards) and 49 Lower and Middle Income Countries and Territories (LMICs). Countries were classified according to the 'DAC (the Development Assistance Committee) List of ODA Recipients' for 2009 and 2010 from the Organization for Economic Co-operation and Development (OECD) (see Appendix A for definitions of the main concepts used in this paper, Appendix C for the list of countries). For 19 countries there are missing observations for either the dependent variable or controls for all years, therefore those countries are excluded so that the final sample consists of 91 countries. The data covers the period 1980-2009.

Out of the 91 countries, the majority comes from Africa (44) and Asia (26) (see Table 1). Of 51 LDCs, 35 come from Africa. All countries from Latin America and Europe are in the group of Lower and Middle Income Countries and Territories.

Table 1: Countries by continent and income group

	All countries	Africa	Asia	Europe	Oceania	Latin America
LDC	51	35	12	0	4	0
LMIC	40	9	14	5	1	11
All	91	44	26	5	5	11

The data and sources are described in more detail in Appendix B. In general, the variables used in this study can be divided into three classes: a public spending variable, an aid variable, and a set of control variables.

The dependent variable is total government spending as a share of GDP from the International Monetary Fund's (IMF) World Economic Outlook (WEO). There are plenty of missing observations in the 1980's, but from 1990 onwards the data are relatively complete for most countries. On average, a country included in the sample has 16.5 observations of government expenditures and a median country has 15.

Among the independent variables, of main interest is the Official Development Assistance

(ODA). The data for aggregate aid disbursements, as well as for bilateral aid, multilateral aid, non-DAC aid and technical cooperation (all in current dollars) come from the Development Assistance Committee of the OECD (DAC2a Table[6]). All aid variables are expressed as a share of the aid-recipient's GDP, where GDP (in current dollars) is taken from IMF's WEO. The data on disbursements are complete and, for almost all countries, cover the years 1980-2009. Regarding the control variables used in this study, the majority of them come from

Table 2: Unweighted (Un) and weighted (W) share of government expenditures and aid for various groups of countries

	Gov. exp. in GDP(%)		Aid in GDP (%)		Bil aid in GDP (%)		Mul aid in GDP(%)	
	Un	W	Un	W	Un	W	Un	W
All	26.32	21.59	9.62	0.98	5.74	0.62	3.56	0.34
LDCs	25.71	22.18	12.81	5.39	7.53	3.22	4.98	2.11
LMICs	27.15	21.52	4.87	0.44	3.08	0.30	1.46	0.13
Africa	25.72	27.73	12.35	4.52	7.17	2.81	4.88	1.65
Asia	26.13	20.43	5.38	0.47	3.09	0.29	1.82	0.17
Europe	39.05	41.04	6.97	1.82	3.90	1.05	2.82	0.71
Oceania	29.66	31.22	15.80	8.95	12.29	7.66	3.40	1.26
Latin America	23.07	22.09	4.46	1.10	3.00	0.83	1.45	0.27
1980-1989	27.09	22.25	10.17	1.19	5.87	0.74	3.40	0.43
1990-1999	26.27	19.95	10.21	1.19	6.19	0.75	3.87	0.42
2000-2009	26.21	22.23	8.76	0.86	5.28	0.55	3.40	0.31
China	19.53	18.75	0.23	0.11	0.15	0.08	0.07	0.04
India*	24.60	24.78	0.44	0.38	0.24	0.20	0.20	0.18

Source: own calculations based on IMF and OECD data

* data cover 1980-2006

the World Development Indicators (WDI): i.e. agricultural value added as a share of the aid-recipient's GDP, annual growth of GDP(%), GDP per capita in constant dollars (PPP), literacy rate, annual population growth(%), population and a trade variable (sum of exports and imports of goods and services as a share of GDP). Furthermore, the annual inflation rate (%) is obtained from the WEO and finally, U.S. Census Bureau's international database (IDB) provides the data on infant mortality rates.

Table 2 reports the means of the variables of main interest. The unweighted share of

[6]Available at http://stats.oecd.org/ under Development → Other

government expenditures in GDP is similar among all groups (with the exception of the 5 European countries) and constant over time. As expected, Least Developed countries receive almost 13% of their GDP in the form of aid, which is 2.6 times as much as LMICs. Furthermore, since the majority of LDCs are located in Africa, this is also the continent with the highest average share of aid in GDP. Around 60% of aid is received from bilateral DAC donors, 37% from multilateral organizations and the rest from non-DAC donors.[7] Oceania receives relatively more aid from bilateral donors (82%) than the average in the sample, patterns for other continents are close to the whole sample.

Unweighted averages do not account for the fact that the biggest (both in terms of population and size of economy) countries receive less per capita aid. For example, India's share of aid surpassed 1% of GDP only in the early 1980s, while for China the highest share was in 1992 and equaled 0.6%. Right columns in Table 2 presents calculations weighted by total GDP. When the size of countries is taken into account, aid accounts for 0.98% of aid-recipients' GDP (and for 2.18% if China and India are excluded). The difference between LDCs and LMICs is even more significant: aid constitutes more than 5.39% of GDP in Least Developed Countries, which is more than 10 times as much as the percentage it constitutes in Lower and Middle Income Countries (which include China and India). In addition, differences between continents are substantial: Europe, South America and Asia – continents with almost exclusively LMICs – have low shares of aid in GDP, whereas Africa – that groups the majority of LDCs – and Oceania relatively high. To account for different patterns of the distribution of aid with respect to size of the country, regression weighted by population will be analyzed as a robustness check.

4 Methodology and model predictions

The following section presents the model used to evaluate the extent of fungibility of aggregated aid and aid disaggregated to bilateral and multilateral components.

[7] Due to the uncertainty about the quality of data from non-DAC donors aid from that group is not included as a separate component when aid is disaggregated. See appendix B for details and discussion.

4.1 Fixed effects model

Firstly, following the approach used most widely in the literature, a model with fixed effects for country and year is estimated. Additionally, pooled OLS model with the time fixed effects is included. For the aggregate aid equation, those models are of the form:

$$GovExp_{it} = \alpha AID_{it} + \beta X_{it} + \gamma_t + (\delta_i) + \varepsilon_{it} \tag{1}$$

where $GovExp_{it}$ represents the share of government expenditures in GDP, AID_{it} the share of ODA in GDP. X_{it} is a set of controls, γ_t is year fixed effects and δ_i represents recipient's country fixed effects (only for country fixed effects model). ε_{it} is an error term. Subscript 'i' refers to a country and 't' to time. In this model, α is the coefficient of main interest: if the estimated α is equal to 1, aid is non-fungible. An estimated α less than 1 but greater than 0 means that aid is partially fungible and α equal to 0 indicates that aid is fully fungible. Finally, an estimated α bigger than 1 provides evidence for the so-called "flypaper effect", the situation in which one euro of aid leads to a more than proportional increase in government expenditures.[8].

For aid disaggregated into a bilateral and a multilateral component, the equations to be estimated change to:

$$GovExp_{it} = \alpha_b BIL\_AID_{it} + \alpha_m MUL\_AID_{it} + \beta X_{it} + \gamma_t + (\delta_i) + \varepsilon_{it} \tag{2}$$

where BIL_AID_{it} and MUL_AID_{it} are the shares of bilateral and multilateral aid from DAC donors in aid-recipient's GDP. Interpretation of the coefficients of main interest, which are α_b and α_m, is the same as for aggregated aid.

Bertrand *et al.* (2004) point out that in panel data, outcomes are serially correlated which is often ignored by researchers. When serial correlation in errors is not accounted for, standard errors are underestimated and the null hypothesis that there is no effect is rejected too frequently. Following Van de Sijpe (2010), I apply a Wald test to check for serial

[8] The 'flypaper effect' is a tendency of resources coming from higher levels of government to 'stick where it hits', and not be passed on as tax relief (Hines & Thaler, 1995) This effect is associated with increased government spending, i.e. with tax or borrowing increases.McGillivray & Morrissey (2001a) offer 5 scenarios where the inflow of aid leads to greater than proportional increases in public expenditures in recipient countries.

correlation of errors in the linear panel-data model. The null hypothesis of no correlation is equivalent to the residuals having -0.5 autocorrelation in the first difference model. For all specifications, the hypothesis of no serial correlation is rejected. Results are confirmed by Arellano-Bond's (1991) autocorrelation test. Bertrand *et al.* (2004) suggest, on the basis of Monte Carlo simulations, as a solution to this problem to estimate a variance-covariance matrix which is consistent in the presence of any autocorrelation. Furthermore, it is noted that this solution works well when the number of groups is sufficiently large, which is the case in this sample consisting of 91 countries. Therefore, to account for autocorrelation I include the Newey-West correction of standard errors which is an estimator satisfying the criteria mentioned above. Additionally, this estimator is robust to heteroscedasticity.

4.2 Dynamic panel model

Van de Sijpe (2010) points out that the presence of serial correlation may indicate that the model is dynamically misspecified. A second indication that the model may be dynamically misspecified comes from the comparison of fixed effects estimates (within-estimator) and the first difference (FD) model. Results of estimates for variables of the main interest are presented in Table 3. Both for aggregated aid and aid disaggregated into components first difference estimates are smaller than fixed effects and this difference may suggest violation of the strict exogeneity assumption. Then, as a result, both FD and FE estimates would be inconsistent and have different probability limits.

Both findings suggest that there may be some dynamics in the determination of public expenditures and spending are likely to be persistent. Indeed, the correlation of current and lagged values of government expenditures is very high and equals 70% when fixed effects are accounted for. Inclusion of the lagged dependent variable may solve the problem and remove autocorrelation in errors.

Roodman (2006) points out that when the number of periods is large, dynamic panel bias becomes insignificant and a more straightforward fixed effects estimator works (that requires fewer assumptions and the results of which are less sensitive to the researcher's choices). Therefore, in addition to a standard fixed effects model presented in the previous section also a fixed effects model with a lagged dependent variable will be used (as well as,

Table 3: Fixed effects results (FE) compared to first difference OLS (FD OLS)

	FE	FD OLS	FE	FD OLS	FE	FD OLS
Aid	0.225***	0.081*				
	(0.06)	(0.03)				
Bil Aid			0.183	0.06		
			(0.10)	(0.04)		
Mul Aid			0.299*	0.143*		
			(0.15)	(0.06)		
Off-budget aid					0.520***	0.226
					(0.07)	(0.12)
On-budget aid					0.181***	0.076*
					(0.02)	(0.03)

FD denotes first difference model estimated by OLS (with difference year effects included). Dependent variable is the share of government expenditures in GDP(%) (or difference of it). Fixed country and year effects included, not presented. The same coefficients as in the result section used, not presented. Newey-West correction of standard errors used, presented in parenthesis. $*p < 0.05, **p < 0.01, ***p < 0.001$

for comparison, pooled OLS). For the aggregate aid equation, those models are of the form:

$$GovExp_{it} = \rho GovExp_{it-1} + \alpha AID_{it} + \beta X_{it} + \gamma_t + (\delta_i) + \varepsilon_{it} \tag{3}$$

And for disaggregated aid:

$$GovExp_{it} = \rho GovExp_{it-1} + \alpha_b BIL\_AID_{it} + \alpha_m MUL\_AID_{it} + \beta X_{it} + \gamma_t + (\delta_i) + \varepsilon_{it} \tag{4}$$

Endogeneity of aid allocation and disbursement is another problem that has been ignored in many studies on the fungibility of foreign aid. Donors may focus on the provision of merit goods in countries that fail to provide them. Then, aid flows may be connected to poor institutional quality and bad policies. Furthermore, as Tamura (2005) argues, recipient countries may develop the trait of aid dependency, and additionally due to poor economic performance and weak institutions may have lower preferences for goods that are associated with economic growth. Those preferences are correlated with aid received but at the same time unobserved or impossible to measure. If they change over time or change with the level of aid, fixed effects will be insufficient to account for them.

McGillivray & Morrissey (2000) suggest that often the recipient can decide on the timing of aid disbursement. This means that aid inflow may be determined simultaneously with

the level of government expenditures, which clearly leads to endogeneity. Additionally, Pettersson (2007b) argues that endogeneity may arise also due to the fact that countries with good policies may be allowed to treat part of its aid as fungible.

Problems of endogeneity and potential dynamic misspecification of the model are addressed by Arellano-Bond's difference and system GMM. Dynamic panel estimators allow the left hand side variable to be dynamic and dependent on past realizations, and they allow independent variables that are correlated with past and current realizations of the error (so variables that are not strictly exogenous), and allow heteroscedasticity and autocorrelation within individuals but not across them (Roodman, 2006). It allows estimation of models (3) and (4).

As suggested by Roodman (2006), to account for autocorrelation across individuals, time dummies are included (and they are treated as strictly exogenous variables, hence are included as additional instruments). All lagged variables are predetermined. Lagged aid and growth are included to instrument current aid and growth levels (the only two independent variables that are not lagged).

Panel data provide a large number of instruments that can be used in a GMM framework (Arellano & Bond, 1991). For difference GMM, lags of dependent variables can be used as instruments; system GMM adds additional moment conditions instrumenting the level equation with differences under the assumption of stationarity.

Roodman (2006) points out that the number of instruments increases quadratically in the time dimension, therefore for long panels there is a risk of overfitting which also weakens Hansen test. However, there is no consensus on what number of instruments brings overidentification, Roodman notes that the threshold of 100 implemented in *Stata* is generous. A first attempt to bring down the number of instruments is to collapse or limit the number of lags that can be used as instruments.[9] Each method makes the instrument count linear in time dimension, which brings down instrument count to at least 64 instruments (29 for each time dummy, 29 for collapsed or lag limited instrument set and 6 for independent variables). As for example Windmeijer (2005) shows, given the number of time periods and panels results may still be biased. In Monte Carlo tests of difference GMM, Mehrhoff (2009) shows that GMM estimator with the instrument set being both collapsed and limited, has both

[9]For reference see Roodman (2006, 2009).

a lower bias and a lower root mean squared error compared to the unrestricted instrument set, collapsed instrument set or lagged limited instrument set. This makes also the instrument count invariant in the number of time periods and solves the problem of too many instruments. I follow this approach in my analysis which limits the number of instruments to around 40. Thus, Hansen test of overidentification restriction is more reliable.

There is no straightforward way to choose between Arellano-Bond's difference estimator or system estimator. As Van de Sijpe (2010) notes, in the difference GMM weak instruments problem may be present if lagged values are for example persistent over time, which in turn may lead to a bias. Then additional equations in levels for the system estimator may overcome the problem. Also, in all specifications, coefficients of both the variables of main interest and other controls are relatively stable for the system estimator, when different lags are used, but not for the difference estimator. In all specifications, the coefficient of the lagged dependent variable is smaller than one which does not raise concerns regarding stationarity (although this assumption cannot be tested). Therefore, system GMM estimator is used.

Inclusion of the lagged dependent variable not only solves dynamic misidentification problem, but allows also to estimate long-run effect of foreign aid on government expenditures. It also changes the way fungibility coefficients should be analyzed. α estimates now short term effect of aid on government expenditures, whereas long-run effect can be derived from $\alpha_{LR} = \alpha/(1-\rho)$.[10]

5 Controls

For the set of controls I am looking for variables that may explain the size of government expenditures, and hence make an estimate of the main interest variable more precise, and/or variables that are correlated with aid and cause estimates to be biased when excluded.

Following Feyzioglu *et al.* (1998); Pivovarsky *et al.* (2003) and Chatterjee *et al.* (2007) controls that account for government expenditures in some sectors are tested. Agricultural

[10]This is a first step to estimate long-run fungibility. In the further step, which will be the topic of my next study, long term fungibility can be analyzed using 4 or 5 year average of data, similarly to the parallel literature on the impact of aid on growth. That may be a superior method to estimate medium and long term fungibility.

value-added is used to control for spending in the agriculture sector and, additionally, for the level of development. Literacy rate controls for spending in education sectors. Infant mortality rate, population growth and dependency ratio serve as proxies for health-care and social security spending.

Chatterjee *et al.* (2007) suggest that real per capita GDP proxies for income, and thus can be used to control for the size of the government. Feyzioglu *et al.* (1998) refer to Wagner's law which states that development is accompanied by an increase of share of government expenditures in GDP. Moreover, according to Van de Sijpe (2010) aid expressed as a share of GDP is very likely to be correlated with GDP per capita. In my sample the correlation between GDP per capita and the share of aid in GDP is rather small, hence the risk of spurious regression, when GDP per capita is not controlled for, is relatively small. Therefore, the latter argument is less valid. Additionally, Feyzioglu *et al.* (1998) point out that per capita GDP is correlated with the share of agriculture in GDP, infant mortality rate and school enrollment (so also with literacy rate). As a result the estimated coefficients of the latter variables may be affected if GDP per capita is not controlled for.

The growth variable should control for the response of government spending to short-run shocks in GDP per capita (Van de Sijpe, 2010). As has been noted before, McGillivray & Morrissey (2000) suggest that recipients tend to have a large freedom of choice over the extent to which committed aid is disbursed in a a single year. Hence, any shock to expenditures would also affect the amount of aid disbursed, and aid would be correlated with the error term. Therefore, the growth rate should serve as a proxy for shocks to government expenditures.

A ratio of a sum of imports and exports to GDP (described as trade) is used to capture the effect of openness of the economy on government expenditures. Rodrik (1996) shows that the size of government has been larger in the most open economies due to the risk of shocks of external origin. Alesina & Wacziarg (1998) argue that this positive correlation is rather due to the country size, since trade openness and government expenditures are negatively correlated with the share of public consumption in GDP. This result was questioned recently by Ram (2009) who using fixed-effects format to account for cross-country heterogeneity that was not taken into account by Alesina & Wacziarg (1998) suggests that Rodrik's (1996) explanation may be the correct one.

Population accounts for the fact that bigger countries receive less aid per capita and usually also less aid in relation to GDP. The inflation rate is included as a factor that has been found to be significantly related to cross-country variations in domestic revenues (Pivovarsky *et al.*, 2003).

Other controls include fixed effects that account for time-invariant factors like geography, colonial history or legal origin. Additionally, fixed effects should account for differences in reporting scopes of government expenditures (if reporting quality is constant over time). Year fixed effects are used to control for events that had an impact on all recipients in a given year.

Undoubtedly, aid may have impact on some of the control variables. For example, aid to the health sector may decrease infant mortality rate, aid financing educational projects may increase literacy rate. To account for potential simultaneity problems, lagged values of controls are used. The only exception is made for growth of GDP since it accounts for immediate responses of government expenditures to shocks and the lagged growth variable (although correlated at 46%) is not good enough as a proxy.

The controls presented above were tested in various configurations, both for aggregated and for disaggregated aid. Population, annual population growth, GDP per capita in constant USD and dependency ratio were found to be statistically insignificant (at a 5% significance level) and they did not affect the estimate of interest nor the precision of the estimates, therefore they are excluded from the remainder of this analysis.[11] The literacy rate among adults affects results. However, this is likely caused by the fact that for many countries this rate is constant over time (increases slightly over decades). When the literacy rate is not controlled for, it is captured by fixed effects, which causes it to be highly collinear with the recipient's fixed effects (VIF equals 270) and therefore the literacy rate should not be included as a regressor.

In the end, five variables are used as controls – annual GDP growth (in %) (denoted GDP growth), lagged annual inflation rate (L.Infl), lagged agricultural value added as a share of GDP (L.Agr VA), lagged sum of imports and exports of goods and services as share of GDP

[11] Additionally, the Variance Inflation Factor (VIF) for projection of dependency ratio on the other variables equals 49, which is above usually assumed cut off values proposed in the literature (5 or 10), therefore the dependency ratio should not be included as a regressor. Multicollinearity is discussed further in the robustness section.

(L. Trade), and lagged infant mortality rate per 1000 births (L.IMR). Those controls are plugged into equations (1)-(4) to answer the following research questions: are aggregated and disaggregated aid fungible and what is the fungibility of off- and on-budget aid?

6 Aggregated aid

In the first stage of the analysis it is tested whether aggregated aid is fungible. As noted before, an estimated coefficient of the share of aid smaller than 1 means that aid is fungible (fully fungible when 0), so that part of the aid is either financing tax reductions (or decreasing borrowing needs, or increasing surplus) or that it is stolen.[12] As can be seen from Table 4, in the basic fixed effects specification used in other fungibility studies fungibility of aggregated aid is high for the sample of all countries and equals around 0.78, which means that when the share of aid in GDP increases by 1 percentage point (pp) government expenditures as share of GDP increase by around 0.22 pp and the remaining 0.78 pp substitute expenditures, are used to decrease taxes, borrowing needs, or it is stolen in given year. Compared to the pooled OLS model, fixed effect estimate is smaller.

However, Arellano-Bond's test of autocorrelation rejects the null hypothesis of no autocorrelation for both models, which means that Newey-West standard errors do not solve that problem and there may still be dynamic misspecification. As expected, including lagged dependent variable solves the autocorrelation problem - both the test for first and for second order serial correlation fail to reject the null of no autocorrelation in all three specifications with the lagged dependent variable.[13] As has been noted before, even when strict exogeneity is violated due to the inclusion of lagged dependent variable, for a long panel dynamic bias becomes insignificant and the fixed effects estimator can be used.

When lagged dependent variable is included, short term fungibility is underestimated by pooled OLS model compared to preferred fixed effects and Arellano-Bond's estimates. For fixed effects model, around 87% of aid is fungible when endogeneity of aid is not taken into

[12] As will be argued later, estimates may suggest fungibility due to the fact that not all aid is recorded in the budget. When off-budget aid is not properly accounted for, fungibility results may be biased.

[13] Please note that for equations in levels (so for fixed effects and IV regressions) Arellano-Bond test checks average autocovariance in residuals of order 1 (for ABAR(1)) or 2 (for ABAR(2)) is 0. If the test fails to reject the null, there are no sign of autocorrelation. However, for the system GMM estimator due to differencing ABAR(1) should be rejected when there is no autocorrelation.

Table 4: Results for aggregated aid

	Pooled OLS	FE	Pooled OLS	FE	GMM
Aid	0.319***	0.225***	0.076***	0.128***	0.206*
	(0.08)	(0.05)	(0.01)	(0.02)	(0.08)
L.Gov exp			0.876***	0.625***	0.627***
			(0.02)	(0.03)	(0.15)
GDP growth	-0.203**	-0.170**	-0.070*	-0.114*	-0.590
	(0.07)	(0.05)	(0.03)	(0.05)	(0.55)
L.Infl	0.007	-0.004	-0.011***	-0.012***	-0.008
	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
L.IMR	-0.030	0.055*	-0.006	0.023*	-0.004
	(0.02)	(0.02)	(0.00)	(0.01)	(0.02)
L.Trade	0.078***	0.026	0.011***	0.014	0.039*
	(0.01)	(0.01)	(0.00)	(0.01)	(0.02)
L.Agr VA	-0.199***	0.049	-0.030**	0.021	-0.098*
	(0.04)	(0.07)	(0.01)	(0.04)	(0.05)
Constant	26.245***	47.141***	5.071***	17.540***	10.933*
	(1.82)	(1.68)	(0.72)	(2.07)	(4.59)
F-stat	4.86	127.57	233.97	530.54	
Obs	1369	1369	1309	1309	1305
Nr of instr					36
ABAR(1)	0.00	0.00	0.290	0.340	0.030
ABAR(2)	0.00	0.00	0.610	0.440	0.460
Sargan p-val					0.87
Hansen p-val					0.93
$\beta \leq 0$	0.00	0.00	0.00	0.00	0.01
$\beta \geq 1$	0.00	0.00	0.00	0.00	0.00
β^{LR}			0.61	0.34	0.55

Dependent variable is the share of government expenditures in GDP (%). Mean equals 26.33%. Aid describes share of aid in GDP (%). Year fixed effects included in all models, country fixed effects in fixed effects and GMM models, both not presented. Newey-West standard errors used for pooled OLS and fixed effects model, presented in parentheses. Two-step GMM system estimator using Windmeijer's(2005) correction. GMM-style instrument set both collapsed and lag limited to one lag. Sargan p-val and Hansen p-val show p-value of Sargan and Hansen's J-test on instrument validity, AB AR(1) and AB AR(2) show p-values for Arellano and Bond's (1991) test of first- and second-order serial correlation in the differenced residuals. L. denotes lagged variable. $\beta \leq 0$ is p-value for the test of full fungibility, $\beta \geq 1$ of no fungibility. β^{LR} is the estimate of long-term fungibility of aggregated aid. $*p < 0.05, **p < 0.01, ***p < 0.001$

account (4th column). For the system GMM, when lagged government expenditures are instrumented with GMM-style instruments and aid is instrumented with lagged values of aid, 80% of aid is fungible. However some significance is lost. Both the Sargan test (that is robust to the number of instruments, but not robust to heteroscedasticity) and the Hansen

Table 5: Results for subgroups

	FE	FE	GMM		FE	FE	GMM
		Africa				High Aid	
Aid	0.199***	0.114***	0.241*	Aid	0.205***	0.140***	0.263**
	(0.05)	(0.02)	(0.10)		(0.05)	(0.02)	(0.10)
L.Gov exp		0.618***	0.576***	L.Gov exp		0.617***	0.489**
		(0.04)	(0.15)			(0.04)	(0.17)
		Asia				Low aid	
Aid	0.156	0.144	0.221	Aid	0.290*	0.054	0.138
	(0.13)	(0.08)	(0.13)		(0.12)	(0.07)	(0.16)
L.Gov exp		0.614***	0.460**	L.Gov exp		0.622***	0.742**
		(0.06)	(0.15)			(0.05)	(0.28)
		Latin America					
Aid	0.169	0.219	-0.068				
	(0.10)	(0.13)	(0.09)				
L.Gov exp		0.574***	0.859***				
		(0.09)	(0.13)				

Dependent variable is the share of government expenditures in GDP (%). Mean equals 26.33%. Aid describes share of aid in GDP (%). Fixed country and year effects included in all models, not presented. Newey-West standard errors used for fixed effects model, presented in parentheses. The same controls as in all specifications used, coefficients not presented. Number of observations for models with lagged dependent variable. $*p < 0.05, **p < 0.01, ***p < 0.001$

test (that can be weakened by large number of instruments) do not raise concerns with regard to instrument validity. Furthermore, in all models the estimate of the coefficient of lagged dependent variable is similar and always statistically significant.

In the long run, fungibility is much smaller and around half of aid substitutes, rather than increases government expenditures. However, estimates are not very precise.

Table 5 presents additional evidence on fungibility. Fungibility for countries in Africa, Asia and Latin America is tested.[14] The same level of fungibility as for the whole sample is found among 44 African countries, whereas both for Asia and Latin America the null of full fungibility cannot be rejected. In additional regressions (not presented), aid is partly fungible for Least Developed Countries and for countries in Oceania, while the null of full fungibility cannot be rejected for Lower and Middle Income Countries.

Table 2 in the data section show that groups of countries where the null of full fungibility

[14]There are only 5 countries from Europe and 5 from Oceania, therefore results for these continents are not presented.

cannot be rejected are characterized by low share of aid in GDP, whereas in countries with higher share of aid in GDP (Africa, LDCs, Oceania) results are significantly different from zero and only partial fungibility is recorded. To further test that result, for each country the average share of aid in GDP was calculated. Then countries were divided into two groups: those with an average share of aid below 9.81% (which is the mean of average share for all countries) were labeled low aid countries, whereas those with a share of aid in GDP equal to or above 9.81% as high aid countries. Results of the regression for both groups are presented in the right part of Table 5 and confirm previous findings. For high share countries aid is partly fungible, while for low share countries full fungibility cannot be rejected.[15] What can explain this finding? Holmqvist (2000) offers as a possible explanation the hypothesis that when aid constitutes a large share of recipient's budget, the donor's priorities determine budget decisions and the opportunities to divert aid are limited. While this is plausible at the sectoral level, it seems to be unlikely on an aggregated scale. Countries receive aid from a large number of donors and donor coordination is poor (Feyzioglu *et al.*, 1998; McGillivray & Morrissey, 2001a), hence it is difficult to prevent diversion of aid. It is more likely that richer countries usually have better access to financial markets and better institutions, so that tax incomes and borrowing conditions are more stable. As a result, full diversion of relatively low inflows of aid (even if it is volatile) is possible. Conversely, poorer countries not only experience high and often volatile inflows of aid, but have also limited access to financial markets and tax revenues that are also often unstable. Hence diversion of funds is less likely. Pettersson (2007b) examines country-specific sectoral fungibility for 57 countries and finds that the level of aid in GDP is positively correlated with a measure of fungibility, which suggests that the higher a country's dependence on aid, the higher fungibility is. He discusses three possible explanations. Countries that treat aid as fungible can use it badly, therefore these countries will be in need of further aid (reverse causality). However, his analysis does not support that explanation since he finds no evidence that fungible funds work worse than non-fungible. Alternatively, if 'trusted' countries (with good policies) that may be allowed to treat aid as fungible are also the ones with high shares of aid, then a negative sign of the squared term is expected. Additionally, higher aid levels may also be correlated with the number of donors, and since the coordination among different donors is

[15] When median share of aid (which is lower than the mean) is used the difference is even bigger.

usually poor, monitoring capabilities of donors may actually decrease.[16]

Since cross-country fungibility has been tested before, the results presented above can be compared to other studies. All studies listed below estimate equation 1 (with different set of controls), so results should be compared to the first column of Table 4. Since the lagged dependent variable is not included and the error structure is not modeled, it is very likely that these studies suffer from autocorrelation problems.

Devarajan *et al.* (1999) finds for a small sample of 18 Sub-saharan countries in the period 1971-1995 that around 10% of aid is used as tax relief (or bypasses budget). Basic results of Feyzioglu *et al.* (1998) confirm that result: on a sample of 14 countries in period 1970-1990 only 5% of aid is fungible. However, when the sample size is extended to 38 countries 67% of aid is fungible. Feyzioglu *et al.* (1998) argue that this finding suggests that there is a lot of heterogeneity depending on the sample which is consistent with the evidence on the tax relief. This concept of heterogeneity in the data is confirmed in my analysis: fungibility differs between groups of countries. It also shows that for fungibility analysis, it is important to have a large sample that allows analysis on subsamples, and that special attention should be paid to observations numerically distant from others.

The study that is closest to this study in terms of period of analysis, sample and estimated equation is Chatterjee *et al.* (2007). They find that around 70% of aid is fungible (also when aid is instrumented), which is lower than the numbers found in this study. Although this difference is not statistically significant, there are a few reasons that can explain the difference. Their sample includes countries that in 2009 are no longer listed as DAC recipients, for example Argentina, Brazil, Slovenia or Russia, and their sample covers the period 1972-2000. One of the reasons the 1970s are not included in the dataset used in this study is that the data of this period, particularly on government expenditures, are highly incomplete (this is still the case for the 80s, although to a lesser extent). Indeed, their dataset is strongly unbalanced since they have 620 observations out of a potential 1943 (for the present

[16]The finding that fungibility is lower for countries that receive relatively more aid raises the question whether fungibility is a linear phenomenon. Pack & Pack (1993) suggest that fungibility may be inversely related to the share of aid in government expenditures since large aid flows decrease monitoring costs. To test that, I include squared aid as a regressor. For all specifications coefficient of squared aid is negative, however always insignificant (results available upon request). Contrary to what Pack & Pack (1993) suggest, I do not find evidence of non-linearity, and negative sign suggest that fungibility can be higher for high amounts of aid.

study, this ratio is 1412 to 2730). The authors use IMF's Government Financial Statistics to obtain data on government expenditures.[17] Similar to my study, lagged infant mortality, lagged agricultural value added and lagged trade are used as controls, but in addition the authors also use the lagged literacy rate, dependency ratio and real GDP per capita (which is non-stationary). As has been argued in Section 5, the first two variables are relatively stable over time and therefore strongly multicollinear with country-fixed effects. This may lead to unstable coefficient estimates and a high risk of overfitting, and it may also explain a very high adjusted R^2 statistic of 0.90. When I run the regression with the same independent variable on my sample the R^2 increases to over 0.7 and only 13% of aid is fungible. This is a highly unlikely result given the theoretical consideration and the fact that part of aid may not be recorded in the budget.

To sum up, fungibility at the aggregate level has been reexamined on a rich panel of 91 countries for 30 year. Results from a fixed effects model that has been used widely in the fungibility literature were complemented by models with a lagged dependent variable, that solves dynamic misspecification, and instrumented aid, which accounts for endogeneity problems. Aid in all specifications is found to be highly fungible in the short run and each euro of aid results in approximately 20 cents increase of government expenditures. In the long run, around half of aid replaces government expenditures. In groups of countries with high aid GDP ratio aid is partially fungible, while in groups of countries with low share of aid the hypothesis of full fungibility cannot be rejected.

7 Multilateral and bilateral aid

The extent of fungibility may differ for different types of aid. Many studies focus on sectoral disaggregation of aid and found significant differences in the extent of fungibility. However, to my knowledge no one has tested a major dimension of disaggregation: one into bilateral and multilateral aid.

Ram(2003) notes 3 main differences between bilateral and multilateral aid:

[17] Chatterjee *et al.* (2007) do not include military expenditure in government spending since they are "unlikely to be affected by the social and economic indicators included in the model". Feyzioglu *et al.* (1998) takes different approach, they include a neighboring country's military expenditure as a proxy for a country's own defence expenditures.

Donor motives – Economic and strategic interests are likely to be more important for bilateral aid. For example, Todaro & Smith (2003) note that, starting with the Marshall Plan, US aid closely followed changes in strategic points on the world map, switching its focus to East Asia, Middle East or Latin America conditional on the geopolitical situation. Japan concentrates its aid on East Asia, on the neighbouring economies that are also major recipients of Japanese foreign direct investments and on major trade partners (Todaro & Smith, 2003; Ram, 2003). Great Britain and France allocate their aid in their former colonies, while the OPEC supports Arab League countries (Boone, 1996). Berthelemy (2006) finds that all donors (except for Switzerland) allocate more aid to their main trading partners and Younas (2008) confirms this by stating that OECD countries allocate more aid to recipient nations who import goods in which the donor nation has a comparative advantage in production. As Alesina & Dollar (2000) summarize evidence for bilateral aid: "*there is considerable evidence that the direction of foreign aid is dictated as much by political and strategic considerations, as by the economic needs and policy performance of the recipients. Colonial past and political alliances are major determinants of foreign aid*" (page 33). Conversely, multilateral aid seems to be more policy and poverty oriented (Dollar & Levin, 2006) and is allocated to countries with good policies (Burnside & Dollar, 2000).

Aid conditionalities – Ram (2003) and Berthelemy (2006) point out that multilateral and bilateral aid packages differ in the conditions attached. Multilateral institutions, like the World Bank and the International Monetary Fund, have for a long time conditioned their aid on so called *structural adjustment and reform programs*. Bilateral donors usually did not use this type of requirement.

Closeness of the relationship between the donor and the recipient – Bilateral donors often have long-lasting relationships with recipients (dating back to colonial times) and therefore often have similar institutions, the same language, history of personal and commercial interactions and country-specific knowledge. These factors may facilitate interactions and lead to a better understanding of recipient's needs (Ram, 2003 after Cassen & associates, 1994). However, as has been argued (Alesina & Dollar, 2000; Burnside & Dollar, 2000) multilateral institutions seem to pay more attention to the recipient's needs than bilateral donors. Furthermore, in the parallel literature on aid effectiveness, Ram (2003, 2004) showed that when the constraint of the equality of bilateral and multilateral aid parameters

Table 6: Results for bilateral and multilateral aid

	Pooled OLS	FE	Pooled OLS	FE	GMM
Bil aid	0.213*	0.183*	0.060*	0.115**	-0.221
	(0.09)	(0.08)	(0.02)	(0.04)	(0.95)
Mul aid	0.526*	0.299*	0.109**	0.147**	0.887
	(0.23)	(0.12)	(0.04)	(0.05)	(1.57)
L.Gov exp			0.876***	0.627***	0.761
			(0.02)	(0.03)	(0.44)
GDP growth	-0.204**	-0.171**	-0.070*	-0.114*	-0.780
	(0.07)	(0.05)	(0.03)	(0.04)	(1.10)
L.Infl	0.007	-0.005	-0.011***	-0.012***	-0.012
	(0.01)	(0.00)	(0.00)	(0.00)	(0.02)
L.IMR	-0.031	0.056*	-0.006	0.024*	0.005
	(0.02)	(0.02)	(0.00)	(0.01)	(0.05)
L.Trade	0.078***	0.028*	0.011***	0.014	0.036
	(0.01)	(0.01)	(0.00)	(0.01)	(0.02)
L.Agr VA	-0.207***	0.049	-0.032**	0.021	-0.106
	(0.04)	(0.07)	(0.01)	(0.04)	(0.06)
Constant	26.397***	47.027***	5.091***	17.406***	7.699
	(1.80)	(1.69)	(0.71)	(2.09)	(11.92)
F-stat	4.77	111.13	229.45	526.59	
Obs	1369	1369	1309	1309	1305
Nr of instr					37
ABAR(1)	0.00	0.00	0.31	0.29	0.42
ABAR(2)	0.00	0.00	0.58	0.41	0.50
Sargan p-val					0.16
Hansen p-val					0.68
Equal coeff	0.24	0.51	0.37	0.71	0.67
$\beta_{BIL} \leq 0$	0.01	0.01	0.01	0.00	0.59
$\beta_{BIL} \geq 1$	0.00	0.00	0.00	0.00	0.11
$\beta_{MUL} \leq 0$	0.01	0.01	0.00	0.00	0.29
$\beta_{MUL} \geq 1$	0.02	0.00	0.00	0.00	0.47

Dependent variable is the share of government expenditures in GDP (%). Mean equals 26.33%. Aid describes share of aid in GDP (%). Year fixed effects included in all models, country fixed effects in fixed effects and GMM models, both not presented. Newey-West standard errors used for pooled OLS and fixed effects model, presented in parentheses. Two-step GMM system estimator using Windmeijer's(2005) correction. GMM-style instrument set both collapsed and lag limited to one lag. Sargan p-val and Hansen p-val show p-value of Sargan and Hansen's J-test on instrument validity, AB AR(1) and AB AR(2) show p-values for Arellano and Bond's (1991) test of first- and second-order serial correlation in the differenced residuals. L. denotes lagged variable. *Equal coeff.* presents p-value of an F-test on equality of coefficients of Bil aid and Mul aid. $\beta_{BIL} \leq 0$ and $\beta_{MUL} \leq 0$ are p-values for the test of full fungibility, $\beta_{BIL} \geq 1$ and $\beta_{MUL} \geq 1$ of no fungibility. $*p < 0.05, **p < 0.01, ***p < 0.001$

is relaxed, both parameters are significant and sizeable, and have opposite signs. It may suggest that the small and usually statistically insignificant impact of aid on growth can be decomposed into two statistically significant effects: a strong positive effect of bilateral aid which is offset by a strong negative effect of multilateral aid on growth.

The aforementioned reasons suggest important differences between bilateral and multilateral aid, hence even at this level of aggregation the degree of fungibility may be different. *A priori* it is not clear whether multilateral aid is more or less fungible than bilateral. As was discussed in the introduction, one of the main reasons of fungibility are the conflicting preferences between donors and recipients. There are arguments for multilateral aid being less fungible. Under the (idealistic) assumption that governments care about pro-poor actions, since – as argued before – multilateral agencies seem to pay more attention to poverty, one could expect small diversion of funds from multilateral agencies. Additionally, due to attached conditions, that may require a recipient's government own contribution multilateral funds may be less likely to substitute government spending. However, Morrissey (2004) provides a review of the literature and points out that there is a consensus that aid conditionality does not work, despite conditions attached governments do not undertake reforms required. And if governments are planning to undertake the reforms, then imposing conditionality may be unnecessary and sometimes even damaging.

Bilateral aid is also often used as a way to promote products from the donor's country. Tied aid packages[18] (that satisfy all ODA requirements) require recipients to purchase goods or services produced in the donor's country. Around half of the aid channeled to the Least Developed Countries is tied (OECD, 2001). It is being argued that tied aid tends to favor projects that require capital intensive imports or donor-based technical cooperation instead of smaller and more poverty-focused programmes, at the same time being 15-30% more costly[19] for the recipient than untied aid (OECD, 2001). On the sectoral level, if products provided by the donor are not prioritized by the recipient, diversion of funds is very likely. However, it is not clear what effect tied aid has on the aggregate level. If donors provide products that would not be bought otherwise, then, paradoxically, aid should be non-fungible since an optimizing government would allocate all other resources as if no aid was present.

[18] Definition of untied, partially untied, and tied aid in glossary (See Appendix A).

[19] Compared to the situation in which a recipient can purchase similar products or services at world prices. Effectively, tied aid is a way to subsidize the donor's domestic industry.

Given the considerations presented above, the assumption of the equality of coefficients of bilateral and multilateral aid is relaxed and equations (2) and (4) are estimated with the same set of controls as the aggregated equation. To test for equality of coefficients of bilateral and multilateral aid an F-test is used. Under the null hypothesis both coefficients are equal, in which case the constraint is binding. Row *Equal coeff.* in the tables shows p-values of this test.

The null hypothesis of equal coefficients cannot be rejected at the 10% level for any specification (see Table 6). There are some small indications that bilateral aid may be more fungible than multilateral aid for basic model and model with lagged dependent variable (this result hold for other sets of coefficients, as well as for some subgroups). In the 5th column aid and lagged government expenditures are instrumented. Neither the Sargan nor the Hansen test raise any concerns regarding instrument validity. However, results become statistically insignificant and very imprecise. Additionally, for the system GMM estimator there is autocorrelation in residuals. Regression on subgroups confirm the findings. There are small indications that multilateral aid is less fungible than bilateral aid for African countries and countries with high share of aid, however when aid is instrumented results become imprecise.

To sum up, there are only very small indications that substantial differences between both components presented in the first part of the chapter may result in multilateral aid being less fungible that bilateral aid. However, results may be biased if bilateral and multilateral aid have different shares of off- and on-budget. The question of off-budget aid will be investigated in the next section.

8 Off- and on-budget aid

The problem of the off-budget aid has been noted by Devarajan *et al.* (1999), Holmqvist (2000), McGillivray & Morrissey (2000), and analyzed extensively by Van de Sijpe (2010). Part of goods and services are provided by donors directly to final recipients (regions, sectors, groups of people) and are not recorded in the recipient government's budget. For example, a training of the educational personnel can be organized directly by the foreign organization.

The presence of off-budget aid changes the way the fungibility coefficient should be

interpreted. The left hand side of fungibility equations (1)-(4) – the share of government expenditures in GDP – includes only on-budget aid, whereas aid that is on the right hand side includes both on- and off-budget aid reported by donors. Therefore, by definition, if off-budget aid is not accounted for, the fungibility coefficient is expected to be biased downwards since off-budget aid is not directly increasing budget expenditure.[20] Therefore, a marginal effect smaller than 1 may be a result of the fact that part of the aid is not recorded as government spending. Van de Sijpe (2010) shows in a simple analytical framework that when off-budget aid is not accounted for, estimates of fungibility may be biased. Under reasonable assumptions that off-budget spending is financed exclusively by off-budget aid and that this type of aid cannot be diverted, non-divertible off-budget aid is fungible if it results in a decrease of the government's own spending (so when the coefficient next to off-budget aid is smaller than 0). Similarly, interpretation of on-budget aid stays the same as for previous models – aid is fungible if one euro of aid results in less than a one euro increase in government spending.[21]

Van de Sijpe (2010) uses technical cooperation (TC) as a proxy for off-budget aid and the value of sector programme aid as a proxy for on-budget aid and investigates fungibility in health and educational sectors. Results for off-budget aid are robust and at most aid is substituting a small part of own government expenditures. Results for on-budget aid are not stable and no firm conclusion can be drawn.

Using Van de Sijpe's (2010) methodology, I ask the question whether off-budget aid is non-fungible at the aggregate level and whether not accounting for off-budget aid biases fungibility estimated. Technical cooperation is used as a proxy for off-budget aid. In the DAC2 OECD Table I am using – the data on sector programme aid are not available[22]

[20] Now, assuming that aid is not fungible, so that it does not change the way aid recipients spend their own resources, then if all aid is channeled through the budget, one euro of aid increases government expenditures by exactly one euro. However, when half of aid bypasses the budget, then one euro of aid increases government spending only by 50% (so by the amount of on-budget aid), while the other 50% is not recorded in the budget. If no distinction between off- and on-budget aid is made, the estimate of the fungibility coefficient (0.5) will be biased downwards compared to true estimate that equals 1.

[21] Van de Sijpe (2010) also discusses previous studies in the context of off-budget aid. Those relying on aid data provided by donors, i.e. among others McGillivray & Ouattara 2005; Osei *et al.* 2005; Pettersson 2007a,b, overestimate the extent of fungibility. That argument applies also to my analysis from the previous section. However, there are studies (e.g. Pack & Pack, 1990, 1993) that used recipient-based aid data where off-budget aid is treated as an omitted variable. Then, since usually on- and off-budget aid are correlated, the estimate of fungibility of on-budget aid is biased unless the marginal effect of off-budget aid on government expenditures is 0 (Van de Sijpe, 2010).

[22] OECD's Credit Report System (CRS) includes data spent on 'sector programme'. However, CRS dataset

Table 7: Unweighted and weighted by GDP mean of on- and off-budget aid as a percentage of aid-recipient's country GDP

	Total aid		Bilateral aid		Multilateral aid	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
On-budget	7.13	0.97	3.80	0.56	3.06	0.36
Off-budget	2.33	0.28	1.89	0.24	0.43	0.04

Total aid includes also aid from non-DAC countries

therefore the difference *Total aid − technical cooperation* is a proxy for on-budget aid. It is, admittedly, an imperfect proxy since it includes the off-budget elements as well. Hence, if indeed not accounting for off-budget aid decreases fungibility estimates, my results for fungibility of on-budget aid should be treated as an upper bound.

Even approximated only by the TC, off budget aid is sizeable in the sample (see Table 7).[23] Technical cooperation accounts for 25% of total aid. This share is even higher for bilateral aid – 33%. The large share of off-budget aid indicates that previous estimates may be substantially biased. When aid is aggregated, both off- and on-budget aid are statistically significant at a 5% level for the two basic specifications. However, the interpretation of coefficients is different. The estimate of the coefficient next to on-budget aid informs that around 82% (88% for model with lagged dependent variable) of aid is fungible (for basic fixed effect models), whereas the estimate for the off-budget aid suggests that when off-budget aid increases by one euro, government expenditures increase by around 52 cents (21 cents). Rather than fungibility, the flypaper effect is observed for these specifications.

When system GMM is used and aid is instrumented, estimates of the fungibility of on-budget aid slightly increase, which means that aid is less fungible. However, estimates of off-budget aid suggest that the null hypothesis of full fungibility cannot be rejected. Analysis on subgroups presented in Table 9 provides additional evidence. Around 80-90% of on-budget aid is fungible and the estimate is relatively stable, although not significant for all groups. The estimate of off-budget aid is less precise, but suggests that off-budget aid is either fully fungible or there is a flypaper effect (for results significant at a 5% level). [24]

is incomplete (especially in the 1980's and the early 1990's) and requires a lot of data-mining.

[23]Due to my concerns about data quality and due to the fact that off budget aid accounts for a very small (less than 0.5%) share of GDP, non-DAC members donations are not included in the analysis of disaggregated aid.

[24]Off- and on-budget aid was further divided into bilateral and multilateral components. However, results

Table 8: Results for off- and on-budget aid

	Pooled OLS	FE	Pooled OLS	FE	GMM
Off-budget aid	0.756***	0.520***	0.067	0.209**	0.127
	(0.19)	(0.11)	(0.06)	(0.08)	(0.25)
On-budget aid	0.229*	0.181***	0.078***	0.116***	0.231**
	(0.09)	(0.04)	(0.01)	(0.02)	(0.09)
L.Gov exp			0.877***	0.620***	0.627***
			(0.02)	(0.03)	(0.15)
GDP growth	-0.196**	-0.169**	-0.071*	-0.114*	-0.597
	(0.07)	(0.05)	(0.03)	(0.05)	(0.56)
L.Infl	0.009	-0.004	-0.011***	-0.012***	-0.008
	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
L.IMR	-0.026	0.057**	-0.006	0.024*	-0.006
	(0.02)	(0.02)	(0.00)	(0.01)	(0.02)
L.Trade	0.074***	0.029*	0.011***	0.014	0.039*
	(0.01)	(0.01)	(0.00)	(0.01)	(0.02)
L.Agr VA	-0.207***	0.026	-0.030**	0.015	-0.099*
	(0.04)	(0.07)	(0.01)	(0.04)	(0.04)
Constant	26.504***	47.061***	5.054***	17.750***	10.952*
	(1.78)	(1.71)	(0.73)	(2.08)	(4.62)
F-stat	5.62	133.47	227.41	524.17	
Obs	1369	1369	1309	1309	1305
Nr of instr					37
ABAR(1)	0.00	0.00	0.28	0.31	0.03
ABAR(2)	0.00	0.00	0.62	0.44	0.45
Sargan p-val					0.89
Hansen p-val					0.94
$\beta_{OFF} \geq 0$	1.00	1.00	0.90	0.69	0.34
$\beta_{OFF} \leq -1$	0.00	0.00	0.00	0.00	0.00
$\beta_{ON} \leq 0$	0.00	0.00	0.00	0.01	0.00
$\beta_{ON} \geq 1$	0.00	0.00	0.00	0.00	0.00
β_{OFF}^{LR}			0.54	0.55	0.34
β_{ON}^{LR}			0.63	0.31	0.62

Dependent variable is the share of government expenditures in GDP (%). Mean equals 26.33%. Aid describes share of aid in GDP (%). Year fixed effects included in all models, country fixed effects in fixed effects and GMM models, both not presented. Newey-West standard errors used for pooled OLS and fixed effects model, presented in parentheses. Two-step GMM system estimator using Windmeijer's(2005) correction. GMM-style instrument set both collapsed and lag limited to one lag. Sargan p-val and Hansen p-val show p-value of Sargan and Hansen's J-test on instrument validity, AB AR(1) and AB AR(2) show p-values for Arellano and Bond's (1991) test of first- and second-order serial correlation in the differenced residuals. L. denotes lagged variable. $\beta_{OFF} \leq -1$ and $\beta_{ON} \leq 0$ are p-values for the test of full fungibility, $\beta_{OFF} \geq 0$ and $\beta_{ON} \geq 1$ of no fungibility. β_{OFF}^{LR} is the estimate of long-term fungibility of off-budget aid, β_{ON}^{LR} of on-budget aid. $*p < 0.05, **p < 0.01, ***p < 0.001$

are statistically insignificant and for IV and system GMM models not robust.

Estimates of long-run fungibility are not precise, 31-62% of on-budget aid is fungible while for off-budget aid there is a fly-paper effect and one euro of aid increases off-budget and government spending by 1.34-1.55 euro.

Similarly to results presented in the previous two subsections, inclusion of a lagged dependent variable solves the autocorrelation problem and the instruments pass the instrument relevance tests.

In conclusion, while aid recorded in the budget turns out to be highly fungible, projects that bypass the budget are usually non-fungible, which would be expected given theoretical predictions. Also, as Van de Sijpe (2010) points out, recipient countries spend low amounts of their own revenues on expenditures that can be classified as technical cooperation, therefore substantial reduction that would offset inflows of aid is not possible.

Signs of the flypaper effect are a surprising result – previous considerations suggested than when distinction for on- and off-budget aid is not accounted for, fungibility coefficients are expected to have a downward bias. Unexpectedly, the opposite may be true and original suspicion that the coefficient is underestimated because of wrong measurement may be dismissed. What can explain this finding? Aid illusion regarding off-budget aid may be present. While governments are internalizing the expected size and arrival of on-budget aid and treat it (to a large extent) as a substitute for government expenditures, information regarding off-budget aid may not be available, hence there is no decrease of government spending. Additionally, technical cooperation may be pushing for other types of expenditures. For example, if doctors are taught how to do new diagnostic tests they may simultaneously increase pressure on the government to provide required equipment.

9 Robustness

The aim of this section is to test the robustness of the main results. In the first part multicollinearity is discussed, in the second part other specifications of the model are tested.

Roodman (2007) warns that regressions with collinearity can return statistically strong results – multicollinear regressors result in small unique variance, however if this unique variance is strongly correlated with the dependent variable, results significantly different

Table 9: Results for off- and on-budget aid in subgroups

	FE	FE	GMM		FE	FE	GMM
		Africa				High Aid	
Off-bud.	0.719**	0.053	0.058	Off-bud.	0.567***	0.299***	0.321
	(0.23)	(0.11)	(0.47)		(0.11)	(0.07)	(0.17)
On-bud.	0.153***	0.118***	0.282*	On-bud.	0.154***	0.119***	0.248*
	(0.04)	(0.02)	(0.13)		(0.05)	(0.02)	(0.11)
L.Gov exp		0.622***	0.572***	L.Gov exp			0.487**
		(0.05)	(0.12)				(0.16)
		Asia				Low aid	
Off-bud.	-0.152	-0.031	2.126	Off-bud.	-0.059	-0.326	-2.243
	(0.35)	(0.21)	(1.28)		(0.56)	(0.27)	(3.10)
On-bud.	0.221	0.185	-0.639	On-bud.	0.330**	0.097	0.985
	(0.12)	(0.10)	(0.59)		(0.12)	(0.08)	(1.31)
L.Gov exp		0.613***	0.694**	L.Gov exp			0.658***
		(0.06)	(0.23)				(0.14)
		Latin America					
Off-bud.	1.349	0.57	-0.983				
	(0.69)	(0.47)	(1.16)				
On-bud.	0.098	0.181	0.014				
	(0.09)	(0.12)	(0.24)				
L.Gov exp		0.555***	0.991***				
		(0.09)					

Dependent variable is the share of government expenditures in GDP (%). Mean equals 26.33%. Aid describes share of aid in GDP (%). Fixed country and year effects included in all models, not presented. Newey-West standard errors used for fixed effects model, presented in parentheses. Two-step GMM system estimator using Windmeijer's(2005) correction. GMM-style instrument set both collapsed and lag limited to one lag. The same controls as in all specifications used, coefficients not presented. Number of observations for models with lagged dependent variable. L. denotes lagged variable. $*p < 0.05, **p < 0.01, ***p < 0.001$

from 0 will be found.[25]

Correlation between the share of bilateral and multilateral aid in GDP is 60% and it varies between 40% and 60% for correlations between technical and non-technical cooperation aid. As Ram (2003) notes, for a large sample such a collinearity should not be a problem. Furthermore, the variance inflation factor (VIF) for projection of aid/GDP shares on other variables found in the dataset used in the present study is almost always below 5, and only

[25]To illustrate, the author considers an example of a daily revenue of a shoe store. If an additional right shoe is sold during the day of a particularly high revenue, the coefficient of the right shoe will be positive and highly significant, whereas for left shoes negative, even though regression on either variable alone will report little significance.

in some specifications between 5 and 10, so in both cases below cut-off values proposed in the literature. As noted before, highly correlated controls are excluded from the analysis.

In GMM system estimator instrument set was collapsed and limited to one lag. Even though Hansen and Sargan tests did not rise any concerns regarding the validity of instruments, some information might have been lost. To check the robustness of system estimator, I keep the instrument set collapsed but include more lags. Results and all the properties of the model remain the same when more lags are included for aggregated aid and for off- and on-budget aid (see Table 10). The same is true when one step estimator is used. Additionally, I check the robustness of results to limiting the number of instruments. Year dummies, used to prevent cross-individual correlation, are excluded. It brings down the number of instrument to around 10. Also in that case results are robust to changes, however Arellano-Bond's autocorrelation test shows signs of first order autocorrelation. As in the main part, results are not stable for bilateral and multilateral aid (therefore those are not presented).

Data analysis showed that the share of aid in GDP varies substantially with country characteristics. Smaller (in terms of population) countries receive significantly more aid in relation to GDP than the most populous countries. Since in OLS or Fixed Effects models the weight of small Solomon Islands of the population of 0.5 million people is the same as weight of 155 million Nigeria, results may be driven by countries that receive tiny amounts of aid in absolute terms. Then, the results of whole cross-country study may be biased towards those small countries and hence less interesting for policy makers. To account for that, I use Weighted Least Squares regression (with recipient's and year's fixed effects) as a robustness check. Two weights (separately) are used: population and total GDP in constant dollars. Estimates in all specifications remain the same, hence results are not driven by small or by big countries or economies (results for regression weighted by total GDP in Table 11).

Additional robustness checks included limiting the sample to countries with at least 10 observations of government expenditures and using aid to GNI and government expenditures to GNI ratios (instead of using the GDP in the denominator). Results are robust to these changes.

Table 10: Robustness of the system estimator

	Aggregated aid						
	Two step estimator			One step		No year dummy	
	1 lag	2 lags	3 lags	1 lag	2 lags	1 lag	2 lags
Aid	0.206*	0.202*	0.204*	0.205*	0.202*	0.224*	0.229**
	(0.08)	(0.08)	(0.09)	(0.08)	(0.08)	(0.09)	(0.08)
L.Gov exp	0.627***	0.644***	0.637***	0.632***	0.639***	0.638***	0.604***
	(0.15)	(0.13)	(0.14)	(0.16)	(0.13)	(0.17)	(0.15)
Obs	1305	1305	1305	1305	1305	1305	1305
Nr of instr	36	37	38	36	37	9	10
ABAR(1)	0.03	0.02	0.03	0.03	0.01	0.07	0.05
ABAR(2)	0.46	0.45	0.46	0.45	0.44	0.32	0.30
Sargan p-val	0.87	0.97	0.61	0.87	0.97	0.79	0.74
Hansen p-val	0.93	0.97	0.91	0.93	0.97	0.90	0.91
	Off- and on-budget aid						
	Two step estimator			One step		No year dummy	
	1 lag	2 lags	3 lags	1 lag	2 lags	1 lag	2 lags
Off-budget aid	0.127	0.101	0.13	0.122	0.114	0.06	0.107
	-(0.25)	-(0.22)	-(0.22)	-(0.26)	-(0.22)	-(0.28)	-(0.26)
On-budget aid	0.231**	0.237**	0.231**	0.232**	0.231*	0.276**	0.263**
	-(0.09)	-(0.09)	-(0.09)	-(0.09)	-(0.09)	-(0.11)	-(0.09)
L.Gov. Exp.	0.627***	0.642***	0.631***	0.630***	0.638***	0.629***	0.602***
	-(0.15)	-(0.14)	-(0.14)	-(0.16)	-(0.14)	-(0.16)	-(0.15)
Obs	1305	1305	1305	1305	1305	1305	1305
Nr of instr	36	37	38	36	37	9	10
ABAR(1)	0.03	0.02	0.03	0.03	0.01	0.07	0.05
ABAR(2)	0.46	0.45	0.46	0.45	0.44	0.32	0.30
Sargan p-val	0.87	0.97	0.61	0.87	0.97	0.79	0.74
Hansen p-val	0.93	0.97	0.91	0.93	0.97	0.90	0.91

Dependent variable is the share of government expenditures in GDP (%). Mean equals 26.33%. Aid describes share of aid in GDP (%). Fixed country and the same controls included in all models, not presented. Year fixed effects included in all models except for the model called "No year dummy", not presented. Lagged aid used as an instrument for current aid in GMM. Two-step GMM system estimator using Windmeijer's(2005) correction. GMM-style instrument set both collapsed and lag limited to the number of lags specified at the top of the table. Sargan p-val and Hansen p-val show p-value of Sargan and Hansen's J-test on instrument validity, AB AR(1) and AB AR(2) show p-values for Arellano and Bond's (1991) test of first- and second-order serial correlation in the differenced residuals. L. denotes lagged variable. $*p < 0.05, **p < 0.01, ***p < 0.001$

10 Conclusions

This article presents new evidence on the issue of foreign aid fungibility. When aid is fungible at the aggregate level it means that it either replaces government expenditures - enabling tax

Table 11: Comparison of the fixed effects model and fixed effects results weighted by total GDP in constant dollars.

	FE	Weighted	FE	Weighted	FE	Weighted
Aid	0.128***	0.128***				
	(0.02)	(0.02)				
Bil aid			0.115**	0.116***		
			(0.04)	(0.03)		
Mul aid			0.147**	0.147**		
			(0.05)	(0.05)		
Off-budget aid					0.209**	0.208***
					(0.08)	(0.06)
On-budget aid					0.116***	0.117***
					(0.02)	(0.02)
L.Gov exp	0.625***	0.630***	0.627***	0.632***	0.620***	0.625***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)
Obs.	1309	1303	1309	1303	1309	1303

Dependent variable is the share of government expenditures in GDP (%). Mean equals 26.33%. Aid describes share of aid in GDP (%). Fixed country and year effects and the same controls as in all models included, not presented. L. denotes lagged variable. $*p < 0.05, **p < 0.01, ***p < 0.001$

decrease, decrease of borrowing needs or increase of government surplus - or that it is stolen before it reaches the budget. It may also happen, that aid bypasses the recipient's budget and is directly distributed. This study makes three contributions to the existing literature that focuses on short term fungibility.

Firstly, I reexamine the question of fungibility using a bigger and more balanced dataset than other studies. To solve the problem of autocorrelation, the lagged dependent variable is used. Endogeneity of aid is addressed in a system GMM model where the number of instruments is limited by collapsing the instrument set and limiting the number of lags used at the same time.

The results show that aid is highly fungible and around 80% of aid substitutes government expenditures in the short run. However, there is a lot of heterogeneity in the sample. Diversion of funds is lower when aid constitutes a large share of the aid-recipient's GDP, so among Least Developed Countries, mainly from Africa. In groups of countries where the share of aid is low it is treated as additional revenue and the entire amount of aid is fungible.

Secondly, aid is disaggregated into a bilateral and a multilateral component and fungibility of both parts is examined. To my knowledge this has not been done in the literature

before. As Ram (2003, 2004) suggests the two types of aid differ in at least three respects: (i) donor motives, (ii) aid conditionalities, and (iii) closeness of the relationship between the donor and the recipient. Therefore, the restriction of the equality of coefficients is relaxed. Weak evidence suggests that substantial differences between both components may result in multilateral aid being less fungible than bilateral aid. However, results are volatile when aid is instrumented.

Thirdly, I include off-budget aid into the analysis following Van de Sijpe (2010). When off-budget aid is not accounted for, fungibility estimates may be biased. I use technical cooperation as a proxy for off-budget aid, and treat the rest of aid as an (imperfect) proxy of on-budget aid. As expected, on-budget aid is found to be partially fungible. The estimate of off-budget for models that account for endogeneity is positive, but statistically insignificant, which suggest non-fungibility of off-budget aid. Using a basic fixed effects specification a surprising result is found - off-budget aid not only does not substitute government expenditures, but it increases them.

Thanks to the inclusion of lagged dependent variable, it is possible to make a first attempt to estimate long term impact of aid on government expenditures. Around half of aggregated aid and on-budget aid is increasing government expenditures, whereas for off-budget aid fly-paper effect is present.

As was noted in the introduction, fungibility is not necessarily a bad thing for development. However, its existence rises question whether amounts spent on earmarking are not wasted. The evidence shows that to a large extent aid is financing projects that would have been undertaken anyway (also in the long run). As a solution, Devarajan & Swaroop (1998) suggest that instead of financing particular sectors or programs, donors could use direct budgetary support conditional on an agreement about composition and quality of government spending. However, if recipients are reluctant to have their whole budget scrutinized or donors do not trust budget support, my analysis suggest two ways to decrease the extent of fungibility: more aid could be channeled via multilateral organizations, which would probably also improve donor's coordination, or more aid could bypass the budget since off-budget aid is not fungible.

For future research, off-budget aid should be investigated in more depth, which requires further data preparations. Creating more reliable proxies for off- and on-budget requires

combining data on aid disbursement with OECD's Credit Reporting System (CRS), taking into account that CRS is not complete and that some types of projects may be both channeled through budget or bypass the budget. Both my and Van de Sijpe's (2010) analysis suggest that when the presence of off-budget aid is ignored estimates may be biased.

More attention should be paid to proper sample selection. Fungibility seems to be a heterogenous phenomenon and its extent differs significantly between groups of countries. Hence, repeating older studies on a new, richer data sets, taking into account off-budget aid, could shed new light on the extent of fungibility at the sectoral or regional level.

Roodman (2008) suggests that not enough attention is being paid to the question of endogeneity of aid, and in a parallel literature on aid-growth relationships he shows that growth is negatively Granger-causing aid. The same may be true for a link between government spending and aid.

On a final note, the focus of the fungibility literature is on short term effect of aid. It is tested whether one euro of aid increases government expenditures in a given year. However, aid may have a long term effect on the level of government expenditures. Investment in water sanitation may decrease water-related diseases and in the long term decrease health spending and total government expenditures. Additionally, since aid is usually committed for a longer period donators may be more interested in a long term impact of aid on government spending. As has been noted before, estimation that uses 4 or 5 year averages may be a superior way to asses medium and long term fungibility.

Appendix A: Basic definitions

The aim of this appendix is to provide definitions of basic terms and concepts used in the study. The source of definitions is *DAC Glossary of Key Terms and Concepts* and *OECD's Glossary of Statistical Terms* (unless marked differently).

Official Development Assistance (ODA) - "Grants or loans to countries and territories on the DAC List of ODA Recipients (developing countries) and to multilateral agencies which are: (a) undertaken by the official sector; (b) with promotion of economic development and welfare as the main objective; (c) at concessional financial terms (if a loan, having a grant element of at least 25 per cent). In addition to financial flows, technical co-operation

is included in aid. Grants, loans and credits for military purposes are excluded. Transfer payments to private individuals (e.g. pensions, reparations or insurance payouts) are in general not counted."

Bilateral aid - "Flows provided directly by a donor country to an aid recipient country." My measure of bilateral aid is limited to 24 official DAC members: Australia, Austria, Belgium, Canada, Denmark, European Commission, Finland, France, Germany, Greece, Ireland, Japan, Italy, Luxembourg, Netherlands, New Zealand, Norway, Portugal, South Korea, Spain, Sweden, Switzerland, United Kingdom, and the United States. As a robustness check (see appendix 5), I also include data from the following non-DAC countries that report aid disbursements and commitments to OECD: Chinese Taipei, Cyprus, Czech Republic, Estonia, Hungary, Iceland, Israel, Kuwait, Latvia, Liechtenstein, Lithuania, Malta, Poland, Romania, Saudi Arabia, Slovak Republic, Slovenia, Thailand, Turkey, and the United Arab Emirates.

The Development Assistance Committee (DAC) - "is one of the key forums in which the major bilateral donors work together to increase the effectiveness of their common efforts to support sustainable development. The DAC concentrates on how international development co-operation contributes to the capacity of developing countries to participate in the global economy and the capacity of people to overcome poverty and participate fully in their societies."

Disbursement - "The release of funds to or the purchase of goods or services for a recipient; by extension, the amount thus spent. Disbursements record the actual international transfer of financial resources, or of goods or services valued at the cost to the donor. In the case of activities carried out in donor countries, such as training, administration or public awareness programmes, disbursement is taken to have occurred when the funds have been transferred to the service provider or the recipient. They may be recorded gross (the total amount disbursed over a given accounting period) or net (the gross amount less any repayments of a loan principal or recoveries on grants received during the same period). It can take several years to disburse a commitment."

Least Developed Countries - OECD uses a list of Least Developed Countries created by the United Nations. The following criteria are applied by the Committee for Development

Policy to identify LDCs [26]

"(i) *A low-income criterion*, based on a three-year average estimate of the gross national income (GNI) per capita (under $905 for inclusion, above $ 1,086 for graduation);

(ii) *A human capital status criterion*, involving a composite Human Assets Index (HAI) based on indicators of: (a) nutrition: percentage of population undernourished; (b) health: mortality rate for children aged five years or under; (c) education: the gross secondary school enrolment ratio; and (d) adult literacy rate; and

(iii) *An economic vulnerability criterion*, involving a composite Economic Vulnerability Index (EVI) based on indicators of: (a) population size; (b) remoteness; (c) merchandize export concentration; (d) share of agriculture, forestry and fisheries in gross domestic product; (e) homelessness owing to natural disasters; (f) instability of agricultural production; and (g) instability of exports of goods and services.

To be added to the list, a country must satisfy all three criteria. In addition, since the fundamental meaning of the LDC category, i.e. the recognition of structural handicaps, excludes large economies, the population must not exceed 75 million. To become eligible for graduation, a country must reach threshold levels for graduation for at least two of the aforementioned three criteria, or its GNI per capita must exceed at least twice the threshold level, and the likelihood that the level of GNI per capita is sustainable must be deemed high."

Least Developed Countries, other - Countries with GNI per capita below $935 not satisfying other criteria (source: *DAC List of ODA Recipients*)

Lower Middle Income Countries and Territories - Countries with GNI between $936-$3 705 (source: *DAC List of ODA Recipients*)

Multilateral agencies - "In DAC statistics, those international institutions with governmental membership which conduct all or a significant part of their activities in favor of development and aid recipient countries. They include multilateral development banks (e.g. World Bank, regional development banks), United Nations agencies, and regional groupings (e.g. certain European Union and Arab agencies). A contribution by a DAC member to such an agency is deemed to be multilateral if it is pooled with other contributions and disbursed at the discretion of the agency. Unless otherwise indicated, capital subscriptions

[26] From UN-OHRLLS website, accessed 7th of July, 2011.

to multilateral development banks are presented on a deposit basis, i.e. in the amount and as at the date of lodgment of the relevant letter of credit or other negotiable instrument. Limited data are available on an encashment basis, i.e. at the date and in the amount of each drawing made by the agency on letters or other instruments." According to DAC2a OECD table multilateral agencies that report aid disbursements (in some cases only commitments) include: AfDB (African Dev. Bank), AfDF (African Dev. Fund), Arab Agencies, AsDF (Asian Dev. Fund), CarDB (Caribbean Dev. Bank). Council of Europe, EBRD, GEF, GAVI, Global Fund, IAEA, IBRD, IDA, IDB Spec. Fund, IFAD, IMF Trust Fund, IMF (SAF, ESAF, PRGF), Montreal Protocol, Nordic Dev. Fund, UNAIDS, UNDP, UNECE, UNFPA, UNHCR, UNICEF, UNRWA, UNTA, WFP, WHO, Bill & Melinda Gates Foundation

Untied aid - "Untied aid is Official Development Assistance for which the associated goods and services may be fully and freely procured in substantially all countries."

Technical cooperation - "Includes both (a) grants to nationals of aid recipient countries receiving education or training at home or abroad, and (b) payments to consultants, advisers and similar personnel as well as teachers and administrators serving in recipient countries (including the cost of associated equipment). Assistance of this kind provided specifically to facilitate the implementation of a capital project is included indistinguishably among bilateral project and programme expenditures, and not separately identified as technical co-operation in statistics of aggregate flows."

Tied aid loans - "Bilateral loans that are linked to purchases of goods and services by the debtor country from the creditor country."

Tied aid credits - "Tied aid credits are official or officially supported loans, credits or associated financing packages where procurement of the goods or services involved is limited to the donor country or to a group of countries which does not include substantially all developing countries (or Central and Eastern European Countries (CEECs)/New Independent States (NIS) in transition)."

Partially untied aid - "Partially untied aid is Official Development Assistance (or official aid) for which the associated goods and services must be procured in the donor country or among a restricted group of other countries, which must however include substantially all developing countries (substantially all Central and Eastern European Countries (CEECs)

Table 12: Data sources

code	Description	Source
GDP growth	Annual percentage growth rate of GDP	WDI
GDP per capita	GDP per capita, thousands constant 2005$, PPP	WDI
Lit. rate	Literacy rates, adults	WDI
Agr VA	Agricultural value added (% of GDP)	WDI
Dep. Ratio	Population aged 65 and above (% of total)	WDI
Pop. Growth	Population growth (annual %)	WDI
Trade	Sum of exports and imports of goods and services as a share of GDP	WDI
IMR	Infant Mortality Rate, both sexes	IDB
Infl	Yearly inflation rate	IMF WEO
Population	Total population	IMF WEO
gov_exp_gdp	Government expenditures as a share of GDP	IMF WEO
GDP curr $	Gross Domestic Product in current prices, dollars	IMF WEO
Aid	Net ODA disbursement as a share of GDP	OECD DAC2a
Bil aid	Net ODA disbursement from bilateral donors as a share of GDP	OECD DAC2a
Mul aid	Net ODA disbursement from multilateral donors as a share of GDP	OECD DAC2a
Bil off-budget	Net ODA disbursement for Technical Cooperation from bilateral donors as a share of GDP	OECD DAC2a
Mul off-budget	Net ODA disbursement for Technical Cooperation from multilateral donors as a share of GDP	OECD DAC2a
Bil on-budget	Difference between Bil and Bil off-budget	
Mul on-budget	Difference between Mul and Mul off-budget	

and new independent states (NIS) in the case of official aid). Partially untied aid is subject to the same disciplines as tied aid credits and associated financing."

Appendix B: Data description

Table 12 presents a description of all the variables used in the paper and their source.
For government expenditure data, I would have preferred to use consolidated government expenditures from the International Financial Statistics database of the IMF. However, since this database contains many missing values, I decided to use WEO data which are more complete, although they may be of lower quality. The FAQ section of the IMF is unclear about the difference in quality and the exact differences between ISF and WEO data:

"The data appearing in the World Economic Outlook are provided to the Research Department at the time of the WEO exercise, not on a continual basis. The historical data and forecasts are based on the information gathered by the IMF country desk officers in the context of their missions to the countries and ongoing analysis of the evolving situation in member countries; forecasts are staff estimates. The data published in the Statistics Department's International Financial Statistics are gathered as part of an ongoing data collection effort, in which member country statistical agencies provide public statistics to the IMF. Because of differences in data collection techniques, methodological issues, focus, and timing, the data in the International Financial Statistics and the World Economic Outlook may differ."(Source: WEO's Frequently Asked Questions, accessed 15th of June, 2011)

The advantage of the DAC2a OECD table over the Creditor Reporting System (CRS), which is used to measure sectoral fungibility, is that the former is supposed to be more complete,[27] while CRS coverage for the 80's and the 90's is low. The DAC2a table contains data on aid disbursement from bilateral and multilateral DAC members (list of DAC countries and organizations in Appendix A under *bilateral aid* and *multilateral aid*). Additionally, the DAC2a table also provides data on bilateral aid flows from non-DAC countries that voluntary agreed to report their disbursements and commitments to the OECD (list in appendix 1 under *Bilateral aid*). I exclude bilateral non-DAC aid due to the following reasons: (i) it is not clear when the reporting process started and how complete the data are , (ii) in the literature, only bilateral aid from DAC countries is used, (iii) the share of non-DAC aid in aid-recipient's GDP is very small compared to bilateral and multilateral DAC aid (only 3% of total aid).

Arndt *et al.* (2010) argue (on the basis of information obtained from the OECD) that the majority of missing values for aid represents in fact unreported null values. Therefore, I replaced missing aid values by 0. This caused the sample size to increase by approximately 40 observations, but it did not have any impact on the results.

Since GDP data for China for the period 1998-2009 are missing, I replaced them by World Bank data (for period 1980-1998 WEO and World Bank data on China's GDP are very

[27]However, there are still some problems as noted (in an imprecise way) in OECD (2011): "While DAC statistics include the outflows from all major multilateral organizations, there is still progress to be made. Data coverage could be improved for UN specialized agencies and trust funds, and the accuracy of sectoral information could be enhanced for a number of UN funds and programmes. The Secretariat is collaborating with the United Nations Department of Economic and Social Affairs (UNDESA) in this respect".

Table 13: DAC List of ODA Recipient in 2009

Least Developed Countries	Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Rep., Chad, Comoros, Dem. Rep. Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Laos, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Samoa, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, Sudan, Tanzania, Timor-Leste, Togo, Tuvalu, Uganda, Vanuatu, Yemen, Zambia
Other Low Income Countries (per capita GNI < $935 in 2007)	Cote d'Ivoire, Ghana, Kenya, Dem. Rep. of Korea, Kyrgyz Rep., Nigeria, Pakistan, Papua New Guinea, Tajikistan, Uzbekistan, Viet Nam, Zimbabwe
Lower Middle Income Countries and Territories (per capita GNI $936-$3 705 in 2007)	Albania, Algeria, Armenia, Azerbaijan, Bolivia, Bosnia and Herzegovina, Cameroon, Cape Verde, China, Colombia, Rep. of Congo, Dominican Republic, Ecuador, Egypt, El Salvador, Former Yugoslav Republic of Macedonia, Georgia, Guatemala, Guyana, Honduras, India, Indonesia, Iran, Iraq, Jordan, Kosovo (1), Marshall Islands, Federated States of Micronesia, Moldova, Mongolia, Morocco, Namibia, Nicaragua, Niue, Palestinian Administered Areas, Paraguay, Peru, Philippines, Sri, Sri Lanka, Swaziland, Syria, Thailand, *Tokelau, Tonga, Tunisia, Turkmenistan, Ukraine, *Wallis and Futuna

*Territory, (1) This does not imply any legal position of the OECD regarding Kosovo's status.

similar). As a result of this replacement, China is included in the sample for all years (which matters for the weighted averages).

Finally, although the infant mortality rate is also available in World Development Indicators database, there are many missing values, which caused me to use U.S. Census Bureau's International Database (IDB) instead.

Appendix C: DAC List of ODA Recipients

Table 13 presents the full list of ODA Recipients for years 2009 and 2010. Due to missing variables, the following countries are excluded from the analysis: Burma, Haiti, Iraq, Kiribati, Kosovo, Kyrgyz Republic, Marshall Islands, Micronesia, Niue, North Korea, Sao Tome and Principe, States Ex-Yugoslavia, Somalia, Timor-Leste, Tokelau, Tuvalu, Wallis

and Futuna, West Bank, Zimbabwe.

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