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Aid and Sectoral Growth: Evidence from Panel Data

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ABSTRACT *This article examines empirically the proposition that aid to poor countries is detrimental for external competitiveness, giving rise to Dutch disease type effects. At the aggregate level, aid is found to have a positive effect on growth. A sectoral decomposition shows that the effect is (i) significant and positive in the tradable and the nontradable sectors, and (ii) equally strong in both sectors. The article thus provides no empirical support for the hypothesis that aid reduces external competitiveness in developing countries. A possible reason for this finding is the existence of large idle labour capacity that prevents the real exchange rate from appreciating.*

I. Introduction

The empirical literature on the macroeconomic effects of aid has produced contrasting results. While some authors claim that the effects of aid on growth and development have been historically very close to zero (Rajan and Subramanian, 2008a), or even negative (Easterly, 2007), others (like Clemens, Radelet and Bhavnani, 2004; Roodman, 2007; Hansen and Tarp, 2000) conclude that on average aid has had a positive effect on growth.

Given the actual size of aid transfers, these mixed findings are to some extent disappointing, but conceivably also not surprising '[. . .] given the heterogeneity of aid motives, the limitations of the tools of analysis, and the complex causality chain linking external aid to final outcomes.' (Bourguignon and Sundberg, 2007: 316). One way in which most of the recent empirical studies reflect the fact that the causality chain linking aid to outcomes is complex, is the common conclusion that the effects of aid are highly dependent on idiosyncratic characteristics of the recipient countries. This is also the starting point of this article, where we reformulate the fundamental question on aid's effectiveness in a way that helps to identify specific mechanisms at work, and the individual country characteristics that matter.

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Some papers already go along this line by trying to identify factors directly undermining aid's capacity to increase growth. The arguments advanced in these papers basically belong to one of two different strands. The first is concentrated on the negative incentives and effects that aid may have on the institutional quality of the recipient countries (see for example Rajan and Subramanian, 2007; Bräutigam and Knack, 2004). The basic idea is that foreign aid may reduce the pressure to embark on necessary institutional reforms in the recipient countries. Some of the reasons are that aid appears as a windfall of resources alleviating structural deficits for irresponsible fiscal authorities, or that aid tends to spur corruption and competition for the rents it might create among special-interest groups.[1]

The second strand is related to possible detrimental macroeconomic effects of aid (see for example Adam and Bevan, 2006; Gupta et al., 2006; de Renzio, 2007). The main argument in these studies is that the capacity to 'absorb' the aid influx in an effective manner can be severely restricted. The combination of a lack of absorption capacity and a relatively large size of aid receipts can translate into inflationary pressures and a tendency of the domestic currency to appreciate. This hurts exportable sectors directly, and may affect aggregate output growth and employment if the effects are sustained over a certain period. The prospect of effects like these may rise even further as donors have promised a substantial scaling-up of financial aid to the poorest countries.

This article belongs to the second strand. The main question we pose is to which extent foreign aid to poor countries has effectively limited the growth of exportable sectors.[2] In particular, the article presents an empirical assessment of the effects of aid on growth rates at the aggregate level, and a disaggregation of this effect between the impact on the tradable (exportable) sector and the nontradable sector. A comprehensive empirical analysis of this issue at the cross-country level is absent in the existing literature on foreign aid. The currently available estimates of the impact of aid on sectoral competitiveness rely on highly stylized simulations (Adam and Bevan, 2006), have been purely concentrated on the manufacturing sector (Rajan and Subramanian, 2005), or on the agricultural and industrial sector (Feeny and Ouattara, 2009).

Our main results show significant positive effects of aid on growth in both sectors. The size of the coefficients is not significantly different between tradable and nontradable sectors, which points to the absence of negative effects of aid on competitiveness. This finding is robust to different econometric specifications, conditioning factors and the endogenous nature of the relationship between donors' aid disbursements and recipients' economic growth.

The remainder of the article is organized as follows. Section II reviews the link between aid and external competitiveness and explains how we analyze it. Section III discusses methodological issues. Section IV presents the empirical results, and Section V concludes.

II. Aid, Real Appreciation and External Competitiveness

To explain what undermines the effect of aid on growth, Rajan and Subramanian (2005) postulate that a plausible reason is that the benefits of aid are reduced by negative side-effects. They present evidence indicating that one of these stems from the possibility that the aid inflows cause overvaluation of the real exchange rate (RER) in

the recipient country, and a consequent loss of competitiveness in the exporting sectors, reflected by 'systematic adverse effects on growth, wages, and employment in labour intensive and export sectors' (Rajan and Subramanian, 2005: 22).

The overall idea resembles closely the mechanics of the Dutch disease problem after an influx of any type of foreign resources. The Dutch disease model predicts that in an economy producing two types of goods (traded and nontraded), a large inflow of foreign resources tends to push up the nominal exchange rate and make the value of the domestic currency stronger. Additionally, the windfall of foreign resources tends to expand the demand for nontraded goods, raising the price of nontraded goods if they have a relatively limited supply, which in turn tends to put upward pressure on the domestic rate of inflation. If both effects (the nominal appreciation and the increase in domestic inflation) appear combined, the real price of nontraded goods increases relative to the price of traded goods, which is equivalent to saying that the real exchange rate (RER) gets overvalued. This is detrimental for growth in the traded sector if wages and other production costs do not adjust downwards in that sector. If the slowdown in the traded sector is long-lasting, it may also retard growth in the whole economy, especially if the production of tradable goods exhibits substantial side effects for the economy such as the adoption of new technology and the opening of new markets.

The papers that have analyzed the case of Dutch disease and RER overvaluation after an influx of foreign aid arrive at varying conclusions. Yano and Nugent (1999) find that between 1970 and 1990 aid was associated with an appreciation of the real exchange rate in about half of 44 aid-dependent countries, and find the reverse for the other half. Elbadawi (1999) estimates for a panel of 62 developing countries that aid on average leads to RER rate overvaluation. Mixed evidence is also obtained at the country level: While Nyoni (1998), for instance, finds that aid led to a depreciated exchange rate in Tanzania, Atingi-Ego and Sebudde (2000) find the opposite for Uganda. Among the papers that focus on sectoral outcomes rather than on the real exchange rate, Arrelano et al. (2005) find a significant negative relationship between aid and the share of manufacturing exports in total exports for a panel of 73 recipients over the period 1981–2000. Prati and Tressel (2006), also using a panel framework, show that aid has a negative effect on overall exports in normal times, but not in periods of shocks such as droughts and falling commodity prices.

This inconclusive evidence notwithstanding, there appears to be a certain consensus that the negative effects of aid on the RER are difficult to avoid completely, given that recipient countries tend to be limited in their ability to contain the RER overvaluation (for example, with contractionary monetary policies), or to expand domestic supply (for example, due to problems of absorptive capacity). Foster and Killick (2007) argue that the doubling of aid to Africa, for example, will be difficult to manage for the recipient countries in ways that 'do not disadvantage producers of tradeable goods and the private sector generally'. A second point of emerging consensus is that any aid-induced RER overvaluation tends to be present mainly during the short run. This happens because, after the aid inflow has been received, the economy has the possibility of effectively expanding the domestic supply over the medium and longer run (Adam and Bevan, 2006). An expansion in domestic supply can happen, for example, when aid is used to build infrastructure such as new rural roads that tends to benefit the nontradable sector relatively more.

This helps to contain the tendency of the domestic price level to increase, and the tendency of the RER to get overvalued over the long run.

Against this background, this article presents a comprehensive econometric assessment of the effects of aid on growth rates at the aggregate level, and a sectoral disaggregation of this effect, distinguishing the effect of aid on the tradable from the nontradable sectors. Our basic hypothesis is that, if aid causes real appreciation and a reduction in external competitiveness, that is Dutch disease type problems, an inflow of aid should have a negative effect on growth of sectors producing most of the tradable goods, and a positive effect on sectors producing most of the nontradable goods.

Our results show no evidence of Dutch disease type effects. We explore one particular mechanism that might account for this finding. The exploration is based on the theoretical work from Nkusu (2004), who argues that developing countries may exhibit particular characteristics that reduce the probability of having RER overvaluation and Dutch disease type of problems after an influx of aid, or characteristics that even allow them to benefit when the RER gets overvalued. One of these characteristics is the existence of idle capacity. When a developing country with idle capacities receives foreign aid resources, the associated expansion in aggregate demand can be met relatively fast by an expansion of aggregate supply. This reduces the upward pressures on the level of inflation and, thus, also reduces the pressure for RER overvaluation. A second characteristic reducing risks related to Dutch disease is that production in developing countries is typically highly dependent on imported inputs. This implies that, with input costs largely denominated in foreign currency, a RER overvaluation lowers total costs of production. We explore the relevance of this argument by testing whether changes in the real exchange rate have an impact on growth.

Our empirical analysis proceeds in four steps along the lines of the empirical aid-growth literature. The only deviation from the standard aid-growth literature is that we follow Rajan and Subramanian (2008b) and look at absolute growth rather than growth per worker. This allows us to analyse the impact of aid on sectoral competitiveness without relying on the strong assumption of constant sectoral employment shares.[3] First we seek to identify the marginal effect of aid on aggregate growth, defined as the average growth rate of output (GDP or Total Value Added), and denoted by g^p_{it}. That is, we specify a regression of growth in output on the size of aid effectively disbursed, a, the direct effects of macro policies' quality, $\mathbf{p}$, geographical country-specific determinants, $\mathbf{d}$, conditional effects of a, $\mathbf{p}$ and $\mathbf{d}$ on g^p_{it} (captured by a vector Γ containing interaction terms between a, $\mathbf{p}$ and $\mathbf{d}$ with the level of aid disbursed),[4] and other determinants of aggregate growth, Z:

$$g^p_{it} = f(a, \mathbf{p}, \mathbf{d}, \Gamma, Z). \tag{1}$$

The second step in the empirical analysis involves a sectoral decomposition of the aggregate effect. We estimate the same type of model, but using measures of growth in the tradable (exportable) and the nontradable sectors, $g^p_{it,k}$:

$$g^p_{it,k} = f(a, \mathbf{p}, \mathbf{d}, \Gamma, Z_k), \tag{2}$$

where $k \in \{\text{tradables, nontradables}\}$ and Z_k is a vector of other exogenous determinants of sectoral growth.

These first two steps are aimed to give an answer to the question of whether foreign aid causes a relative loss of external competitiveness (Dutch disease) or not. The following steps are aimed to explore whether changes in the real exchange rate provide a relevant part of the explanation. The next steps require then (a) extending the aggregate models in Equation (1) and (2) to account for the effects of the real exchange rate, and (b) decomposing again this effect into its sectoral components. Accordingly, we estimate

$$g_{it}^{p} = f(a, \mathbf{p}, \mathbf{d}, \Gamma, Z, Z_i^{re}) \tag{3}$$

and

$$g_{it,k}^{p} = f(a, \mathbf{p}, \mathbf{d}, \Gamma, Z_k, Z_i^{re}), \tag{4}$$

where Z_i^{re} includes variables controlling for the RER evolution in country i.

III. Method and Data

Model Specification

The basic econometric specification for the model in Equation (1) is

$$g_{it}^{p} = (a_{it}\ \mathbf{p}_{it}\ \mathbf{d}_i)\left(\beta_a\ \beta_p\ \beta_d\right)' + a_{it} \times (a_{it}\ \mathbf{p}_{it}\ \mathbf{d}_i)\left(\beta_{aa}\ \beta_{ap}\ \beta_{ad}\right)' + Z_{it}'\beta_Z + \tau'\beta_\tau + \varepsilon_{it}^{p}, \tag{5}$$

where g_{it}^{p} is a measure of growth in output in country i during period t; a_{it}, is the size of effective aid in terms of GDP;[5] $\mathbf{p}_{it}$ is the Burnside and Dollar (2000) index of good macro policies; $\mathbf{d}_i$ is a measure of structural characteristics (Dalgaard et al., 2004), proxied by the share of tropical area in the country from Gallup, Sachs and Mellinger (1999); τ is a vector of time-dummies (to control for common shocks); ε_{it}^{p} is a zero-mean error component; and Z_{it} is a vector containing other exogenous determinants of output per worker growth, specifically: (a) the degree of financial depth, measured as the (lagged) ratio of M2 to GDP, (b) the level of output at the beginning of every period t, (c) the degree of ethno-linguistic fractionalization in the country (Easterly and Levine, 1997), (d) the number of conflicts in which the government is involved (UCDP/PRIO, 2006), and (e) an interaction term between these last two.

In a similar way, the econometric specification for the sectoral decomposition proposed in Equation (2) is

$$g_{it,k}^{p} = (a_{it}\ \mathbf{p}_{it}\ \mathbf{d}_i)\left(\lambda_a\ \lambda_p\ \lambda_d\right)' + a_{it} \times (a_{it}\ \mathbf{p}_{it}\ \mathbf{d}_i)\left(\lambda_{aa}\ \lambda_{ap}\ \lambda_{ad}\right)' + Z_{it,k}'\lambda_{Z_k} + \tau'\lambda_\tau + \varepsilon_{it}^{p_k}, \tag{6}$$

Where $g_{it,k}^{p}$ is a measure of output in sector k, $k \in \{\text{tradables, nontradables}\}$, and the new estimated coefficients are the λ's. A major conceptual difference between aggregate and sectoral specifications is that we do not allow for sector-specific conditional convergence given the lack of a theoretical basis. This implies dropping initial sectoral value added from the sectoral regressions. Rather, following Rajan and Subramanian (2008b), we include initial per-capita income as a control variable in each of the regressions. The rationale for doing so is that differences in per capita

incomes are supposed to be a key factor behind differences in sectoral growth rates, i.e. structural change.[6]

To estimate the models in Equations (3) and (4), which are extensions of the previous two regressions meant to identify as directly as possible the presence of RER overvaluation and Dutch disease, it is necessary to extend the vector Z_{it} with variables reflecting the evolution of the RER. The variables considered for this extension are the rate of RER devaluation and the square of it. The square of the RER devaluation is included to model the idea that there exists an 'equilibrium RER', or a RER level that keeps the balance between keeping exports competitive and keeping the level of inflation controlled.

The central econometric concern for the estimation of all these regressions is the endogenous character of aid: aid disbursements are obviously determined to some extent by the recipient country's growth process itself (Berthélemy, 2006; Nunnenkamp and Thiele, 2006). All the recent empirical literature on foreign aid effectiveness has turned to the use of instrumental variables (IV) to address the problem of endogeneity. We follow this line and perform regressions by means of the GMM-SYS estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998), using the set of instruments in Dalgaard and Hansen (2001) and Dalgaard, Hansen and Tarp (2004).[7] Compared to the GMM-DIF estimator suggested by Arellano and Bond (1991), the GMM-SYS estimator tends to have better small sample properties in terms of bias and precision when the dependent variable is persistent. It has therefore become an estimator of choice in growth regressions using country level panel data (e.g. Levine et al., 2000).

Data

Our estimations require measures of value added in the tradable (exportable) and the nontradable sectors. We build these measures with data from the World Bank's World Development Indicators on sectoral real Value Added (defined as the net output of a sector – measured in constant USD – after adding up all outputs and subtracting intermediate inputs). The proxies we constructed for measuring growth in the *tradable* (exportable) sector are (a) the non-services GDP and (b) the sum of Agricultural and Industrial Value Added. The proxy constructed for the *nontradable* sector is based on Value Added in the Services sector.

This distinction between tradables and nontradables sectors is made under the assumptions that the overall production in the economy comes from activity in agriculture, industry and the services sectors, and that production of nontradables is concentrated in the services sector, while production of tradables takes place primarily in the agricultural and industrial sectors. This assumption is supported by the survey in Tica and Družić (2006, see Table 1), who review a large number of empirical papers analyzing the effects of productivity gaps in terms of trade, and report that none of those studies treats the services sector as producing tradables (the 58 papers reviewed by them treat production of tradables as taking place in the agricultural sector, or the industrial sector, or both). The argument gathers a lot of strength when it is placed in the context of developing countries, where trade in agricultural and manufacturing goods (containing for example exports of raw agricultural commodities, agro-industrial products, minerals, and so forth) tends to be much higher than trade in services.

Table 1. Aid and average growth – sectoral decomposition

Dependent variable: growth in	GDP	Non-Services GDP	Agric. & Indus. VA	Services VA	Agricultural VA	Industrial VA
	(1)	(2)	(3)	(4)	(5)	(6)
Aid/GDP	4.12***	3.91**	4.50***	6.18*	0.36	7.17***
	[1.34]	[1.55]	[1.36]	[3.45]	[0.86]	[2.03]
Aid/GDP, squared	−0.034*	−0.036	−0.066***	−0.054	−0.061*	−0.059
	[0.020]	[0.025]	[0.020]	[0.033]	[0.031]	[0.051]
(Aid/GDP) × Policy index	−0.049	−0.069	−0.06	−0.081	0.023	−0.047
	[0.070]	[0.10]	[0.078]	[0.089]	[0.13]	[0.16]
(Aid/GDP) × Tropical area	−3.72***	−3.46**	−3.79***	−5.40*	0.29	−6.28***
	[1.35]	[1.50]	[1.27]	[3.18]	[0.89]	[2.08]
Policy index	1.23***	1.15***	1.19***	1.57***	0.27	1.84***
	[0.26]	[0.27]	[0.31]	[0.39]	[0.25]	[0.52]
Tropical area	0.63	0.29	0.8	0.84	−0.012	1.07
	[0.59]	[0.72]	[0.66]	[1.35]	[0.41]	[1.17]
(log) initial income per capita	0.21	0.0041	0.23	0.5	0.42**	0.24
	[0.22]	[0.29]	[0.37]	[0.47]	[0.16]	[0.43]
Fin. Depth (M2/GDP), lagged	−3.86**	−3.46**	−3.78**	−4.20*	−1.64	−6.43***
	[1.57]	[1.59]	[1.73]	[2.37]	[1.86]	[2.38]
Constant	−2.24	3.75	−1.41	−8.13	−5.82	0.74
	[5.41]	[6.86]	[8.44]	[11.1]	[3.53]	[9.37]
Observations	475	475	474	475	474	474
Number of countries	65	65	65	65	65	65
Number of instruments	175	175	175	175	175	175
Sargan-Hansen overid., p-value	0.000052	0.054	0.11	4.00E−07	0.67	0.0043
AR(1), p-value	0.0024	0.00061	0.0017	0.0023	0.000011	0.00081
AR(2), p-value	0.72	0.28	0.28	0.2	0.44	0.27
ME of aid > 0 (mean)	1.35***	1.31***	1.61***	2.14**	0.48**	2.53***
	[0.41]	[0.5]	[0.5]	[1.18]	[0.27]	[0.68]
ME of aid > 0 ('good' country)	2.57***	2.42***	2.91***	3.91**	0.52	4.64***
	[0.83]	[0.95]	[0.9]	[2.25]	[0.56]	[1.33]
ME of aid > 0 ('bad' country)	0.24	0.26	0.46	0.52	0.53	0.67
	[0.89]	[0.85]	[0.95]	[0.91]	[0.99]	[0.94]

Notes: GMM-SYS regressions. Robust standard errors in brackets. ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels. Aid/GDP instrumented as in Dalgaard, Hansen and Tarp (2004).

The sample covers a group of 65 developing economies over 40 years, the period between 1962 and 2001. All the variables were averaged over periods of 4 years, to capture the evolution of trends rather than the incidence of cycles, and to make the results comparable to those in previous empirical studies. Our sample does not go

beyond 2001 because many of the variables used in the regressions could not be updated further than that for many countries in the sample. The description of the countries and periods considered is given in Annex Table A1.

IV. Results

Impact of Aid in the Aggregate

The estimated effects of aid on aggregate growth, that is the results of regression (5), are displayed in Table 1, column 1. The coefficients of interest (the coefficients on the aid variable and the 3 aid-interaction terms) show that aid has a positive and direct effect on growth, that the overall effect operates with diminishing returns, and that the effect is not dependent on the quality of macro policies but that it is lower in countries where the amount of tropical area is large (Dalgaard et al., 2004). This last finding can be interpreted as indicating that aid effectiveness is limited in countries where location and climate are disadvantageous or, in particular, in countries with a large amount of tropics, where the burden of diseases is larger (as suggested by Gallup et al., 1999, for example) or where growth in agricultural productivity is restricted (see Masters and Wiebe, 2000, for example).

As concerns the further coefficients, 'good' policies turn out to be 'good' for growth by themselves, while initial conditions do not appear to matter.[8] The only puzzling effect in column 1 is the negative and significant effect of financial depth (measured by the lagged ratio of money and deposits, M2, to GDP). This can be due to an omitted variable bias, since a high M2/GDP ratio might be correlated with high levels of other sources of foreign capital – for example foreign bonds, or external debt – which act as substitutes of aid to some extent.

The last part of column 1 in Table 1 shows a test for the hypothesis that the marginal effect (ME) of aid, defined as $\frac{\partial g_{it}^{p}}{\partial a}$, is positive. Given that the ME of aid is

$$\frac{\partial g_{it}^{p}}{\partial aid_{it}} = \beta_a + 2\,\beta_{aa}\,aid_{it} + \beta_{ap}\,p_{it} + \beta_{ad}\,d_i \tag{7}$$

it is necessary to choose a fixed point to estimate the marginal effect. The most obvious point is the mean of the different variables composing it (that is, the mean levels of aid, the macro policy index, and the percentage of tropical area in the country). However, Figures 1 and 2 show that the distributions for aid and the share of tropical area are highly asymmetric.

Figure 1 shows that the distribution of aid is skewed to the left and has a relatively fatter right-hand side tail. This reflects the fact that countries receive in general some (relatively low level of) aid; but, with a certain frequency, countries receive a much larger amount of aid, for example in the form of humanitarian aid after a natural disaster, or for the reconstruction of an area after a period of conflict. Figure 2 shows the distribution for the amount of tropical area in the countries in the sample, which is bimodal, and reflects the fact that most of the aid-recipients are located either in highly tropical areas, or in places that are considerably far from the tropical lands. This is relevant because, with this type of distributions, the average country may not reflect the most typical characteristics, and evaluating the marginal effect at the mean

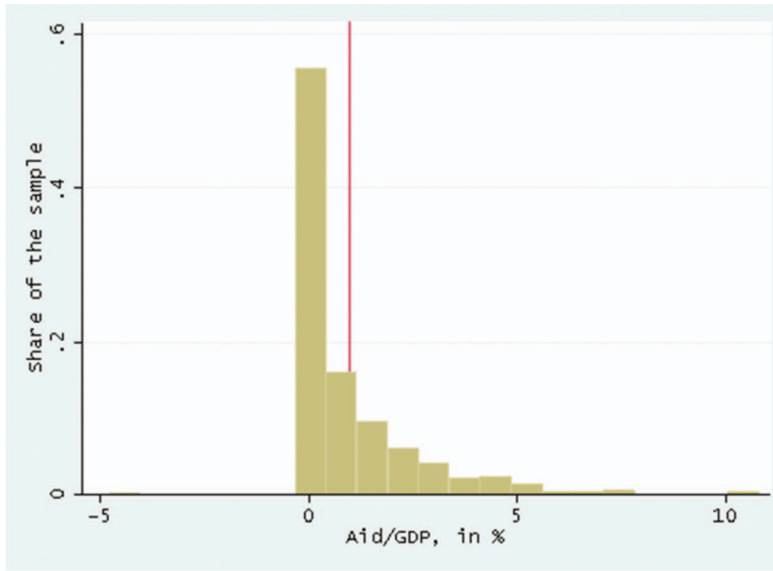

Figure 1. Aid/GDP – histogram.
Source: Aid data were kindly made available by David Roodman.

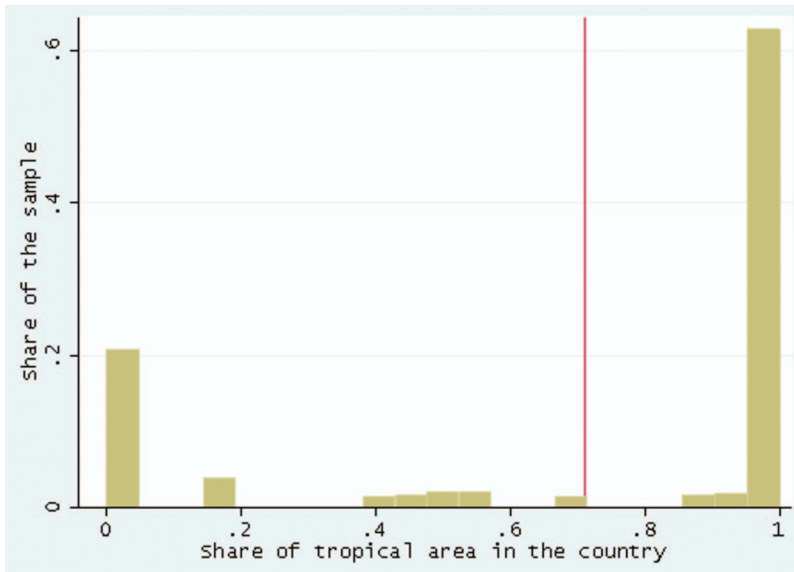

Figure 2. Tropical area index – histogram.
Source: Gallup, Sachs and Mellinger (1999).

can be misleading. Table 1 therefore also presents the marginal effects of aid evaluated at two other points. The first is defined as a hypothetical 'good country', receiving a low amount of aid (equivalent to the level at the 25th percentile in the aid distribution), being located outside the tropics (at the 25th percentile in the

distribution of tropical area), and exhibiting a high level for the quality-of-policy index (at the 75th percentile of the Burnside-Dollar policy index distribution). The second hypothetical point of evaluation is a 'bad country', or a country that receives a large amount of aid (75th percentile), has a low level for the index of good macro policies (25th percentile) and is located in a very tropical area (75th percentile). These two definitions are arbitrary, but they can be understood as an approximation of the upper and lower bounds for the 'typical' marginal effect of aid.

It turns out that aid has a net positive and highly significant effect in the average country. The effect is equally significant, but almost two times as large for a 'good country', and statistically not different from zero for a 'bad country'.

Sectoral Disaggregation of the Impact of Aid

The remainder of Table 1 presents the sectoral decomposition of the aggregate effect of aid on growth. Columns 2 and 3 contain estimates for the sectors likely to be producing most of the exportable goods (the tradables sector). The proxy for output in the tradables sector considered in column 2 is output in the non-Services sector, and the one considered in column 3 is the aggregation of Value Added in the Agricultural and the Industrial sectors.

The most important difference between these two regressions is that column 3 shows a significant coefficient for the aid-squared term, while column 2 does not. But the rest of the coefficients of interest are similar in size and significance in the two specifications. Despite the difference in the coefficient on the aid-squared term, the overall conclusion from the marginal effects remains the same. For 'average' and 'good' countries, aid is shown to have a positive marginal effect in the tradables sector in the average country and an almost two times higher effect in countries with more favourable conditions. For countries with less favourable conditions, the marginal impact is small and insignificant in both cases.

Column 4 shows the estimates of the effects of aid in the Services sector, which is taken as a proxy for the sector producing most of the nontradable goods in a developing economy. This column reveals a similar pattern as columns 2 and 3. To arrive at a more precise conclusion, we formally test whether the impact of aid on

Table 2. Wald test for differences in sectoral aid effects

	Services VA vs.			
Dependent variable: diff. in growth of	Non-Services GDP (1)	Agric.& Indus.VA (2)	Agricultural VA (3)	Industrial VA (4)
Joint significance of aid terms (p value):				
a) Basic Specification	0.42	0.12	0.21	0.0061
b) Specification including RER	0.85	0.58	0.64	0.044

Notes: GMM-SYS regressions. Aid/GDP instrumented as in Dalgaard et al. (2004).

growth differs between tradable and nontradable sectors. In doing so, we perform regressions using the differences in sectoral growth rates as dependent variables and test whether in these regressions all aid terms are jointly significant (see Table 2). For both definitions of tradable sectors, we reject the hypothesis that the aid effects are jointly significant at conventional levels (columns 1 and 2 in Table 2). Furthermore, in both regressions all coefficients of the aid terms turn out to be insignificant individually (not shown).

Overall, these findings do not point to systematic differences in the impact of aid on tradable and nontradable production. This is the main result of this article. It can be interpreted as providing empirical evidence against the hypothesis that aid is detrimental for external competitiveness, or that it causes Dutch disease. If aid was a cause of Dutch disease, two 'symptoms' after an inflow of aid would have to be a decline in the growth of the exportable (or tradables) sector, and a relative increase in the growth rate of the nontradables sector. The estimates of the marginal effects of aid in Table 1 and the corresponding tests in Table 2 suggest otherwise. While this result is not directly comparable with those of previous studies because of different methodologies and sample periods, it may at least partly reflect Prati and Tressel's (2006) finding that aid has no adverse effect on competitiveness during shocks, taking into account that shocks occur frequently in developing countries. In case of negative shocks, aid exerts less upward pressure on the RER, which is in line with what Yano and Nugent (1999) found for a number of aid-dependent countries.

Decomposing further the effect in column 3 (that is, decomposing the proxy for the tradables sector), columns 5 and 6 indicate that the positive effects of aid on growth of the exportables sector actually come from the Industrial sector rather than the Agricultural sector.[9] The test results in Table 2, column 4 show that aid has a significantly different impact on the Industrial sector as compared to the Services sector. The sector may thus have benefited more than proportionately, which implies that the external competitiveness of manufactures, minerals and agro-industrial products (all activities within the Industrial sector) is unlikely to deteriorate in response to an inflow of foreign aid.

Accounting for Real Exchange Rate Changes

Table 3 reports results for the extended specification that additionally considers the role of the RER. Columns 2 and 3 in Table 3 account for the effects of changes in the RER at the aggregate level. The rate of RER devaluation is treated as endogenous within the model. After controlling for it, the estimated marginal effects of aid drop considerably compared to the ones in the basic specification (reproduced in column 1), but they remain strongly significant for 'average' and 'good' countries. The square of RER devalued is included in column 3 to capture the idea that countries may benefit from a devalued RER (because that tends to increase exports' competitiveness), but that after a certain point a too fast rate of RER devaluation can be passed to higher inflation rates, which starts to limit the (initial) benefits of RER devaluation. The real exchange rate exhibits a non-linear impact on economic growth, but the effects are insignificant. We thus do not corroborate Rodrik's (2008) assertion that undervaluation tends to stimulate growth in developing countries, but neither do we find support for the hypothesis that overvaluation may be beneficial

Table 3. Aid, growth and the real exchange rate

Dependent variable: growth in	GDP (1)	GDP (2)	GDP (3)	Non-Services GDP (4)	Agric.& Indus. VA (5)	Services VA (6)	Agricultural VA (7)	Industrial VA (8)
Aid/GDP	4.12***	2.52*	3.21***	3.70***	4.16**	2.87	−0.8	5.93**
	[1.31]	[1.30]	[0.99]	[1.43]	[1.87]	[1.82]	[1.72]	[2.52]
Aid/GDP, squared	−0.034*	−0.040*	−0.038*	−0.047**	−0.053**	−0.0073	−0.045**	−0.026
	[0.019]	[0.021]	[0.021]	[0.024]	[0.023]	[0.027]	[0.020]	[0.063]
(Aid/GDP) × Policy index	−0.049	−0.056	−0.041	−0.14	−0.17*	−0.18	−0.038	−0.075
	[0.068]	[0.068]	[0.074]	[0.13]	[0.093]	[0.22]	[0.16]	[0.18]
(Aid/GDP) × Tropical area	−3.72***	−2.01*	−2.76***	−3.07**	−3.51**	−2.61	1.3	−5.28**
	[1.32]	[1.21]	[0.92]	[1.35]	[1.60]	[1.67]	[1.56]	[2.36]
Policy index	1.23***	1.15***	0.96***	1.40***	1.32***	1.58***	0.3	1.59***
	[0.25]	[0.24]	[0.28]	[0.51]	[0.35]	[0.56]	[0.24]	[0.56]
Tropical area	0.63	0.71	0.72	−0.15	0.49	0.58	−0.38	0.98
	[0.57]	[0.69]	[0.60]	[0.83]	[0.73]	[0.90]	[0.58]	[1.10]
(log) initial income per capita	0.21	0.47**	0.50***	0.096	0.13	0.61**	0.48**	0.61
	[0.22]	[0.21]	[0.19]	[0.34]	[0.27]	[0.28]	[0.21]	[0.42]
Fin. depth (M2/GDP), lagged	−3.86**	−1.25	−2.65*	−2.41	−2.48	−1.67	0.99	−4.77
	[1.53]	[1.62]	[1.57]	[2.07]	[1.93]	[2.29]	[2.20]	[3.43]
Real exch. rate devaluation		0.012	0.3	−0.51	−0.097	0.14	−0.097	0.46
		[0.18]	[0.34]	[0.66]	[0.50]	[0.41]	[0.56]	[0.67]
Real exch. rate devaluation, squared			−0.011	0.012	0.0023	−0.00051	0.00049	−0.013
			[0.0099]	[0.018]	[0.012]	[0.0098]	[0.018]	[0.015]
Constant	−2.24	−8.59*	−9.23*	6.64	2.42	−11.8	−15.7*	−6.77
	[5.26]	[5.10]	[4.83]	[7.95]	[7.87]	[7.27]	[8.89]	[9.79]

(*continued*)

Table 3. (*Continued*)

Dependent variable: growth in	GDP (1)	GDP (2)	GDP (3)	Non-Services GDP (4)	Agric.& Indus. VA (5)	Services VA (6)	Agricultural VA (7)	Industrial VA (8)
Observations	475	397	397	397	396	397	396	396
Number of countries	65	61	61	61	61	61	61	61
Number of instruments	175	219	263	263	263	263	263	263
Sargan-Hansen overid., p-value	0.000052	0.00054	0.00037	0.11	0.35	0.000052	0.84	0.21
AR(1), p-value	0.0024	0.01	0.012	0.0019	0.004	0.019	0.00022	0.0026
AR(2), p-value	0.72	0.61	0.87	0.17	0.19	0.3	0.64	0.17
ME of aid > 0 (mean)	1.35***	0.96**	1.14***	1.29***	1.39**	0.84*	0.01	2.05***
	[0.4]	[0.45]	[0.36]	[0.51]	[0.68]	[0.6]	[0.59]	[0.87]
ME of aid > 0 ('good' country)	2.57***	2.06**	2.66***	2.88***	3.19**	2.05*	−0.67	4.89***
	[0.81]	[1.1]	[0.86]	[1.2]	[1.51]	[1.41]	[1.27]	[2.1]
ME of aid > 0 ('bad' country)	0.24	0.34*	0.31*	0.32	0.27	0.00	0.34	0.49
	[0.19]	[0.22]	[0.19]	[0.27]	[0.28]	[0.28]	[0.33]	[0.4]

Notes: GMM-SYS regressions. Robust standard errors in brackets. ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels. Aid/GDP instrumented as in Dalgaard et al. (2004).

for growth by rendering imports cheaper. Columns 4 to 8 show the results for the sectoral decomposition. For 'average' and 'good' countries, marginal effects are shown to be significantly positive throughout, whereas for 'bad' countries the coefficients are very low and in most cases insignificant. Like in the basic specification discussed above, there is no support for the case that aid causes Dutch disease: the test results reported in Table 2 reveal the same pattern as before. Again it is the Industrial sector where the impact appears to be strongest. These findings strengthen our evidence on the absence of Dutch disease type of problems caused by aid, because it turns out to be robust to the inclusion of the effects of changes in the RER.

V. Summary and Conclusion

This article presents an empirical assessment of the hypothesis that aid is detrimental for external competitiveness and growth in recipient countries. The evidence is based on a sectoral decomposition of the effects of aid on aggregate growth, and on an extension of the typical aid-growth econometric specification to control for the effects of changes in the RER.

Our main results point to the absence of Dutch Disease effects: aid is found to have a positive marginal effect on growth of output, at the aggregate level, and in both the tradable and the nontradable sectors, with no significant difference in the size of coefficients. This finding is robust to different specifications, conditioning factors, and the endogenous nature of aid disbursements. One possible explanation for this finding is that the existence of idle capacity in the recipient countries helps to promptly meet the increase in aggregate demand caused by aid inflows without exerting upward pressure on the real exchange rate.

Taken together, the finding that aid may not cause Dutch disease type of problems and that the marginal effects of aid in countries with 'bad' policies and 'weak' structural characteristics are close to zero and insignificant in most cases suggests that the success of the planned scaling-up of aid to the poorest countries does not primarily depend on recipient countries' macroeconomic management capacities, but rather on whether it is possible to find a way to maintain incentives in the recipient countries and to overcome structural bottlenecks such as low agricultural productivity in tropical areas.

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Notes

1. See Svensson (2000) and Djankov, Montalvo and Reynal-Querol (2006), for example.
2. Our empirical analysis employs aggregate aid data averaged over 4-year periods. In doing so, we miss two important recent developments in the aid effectiveness literature. First, aid heterogeneity has been shown to matter for aid effectiveness (e.g., Clemens et al., 2004; Ouattara and Strobl, 2008). In the

present context, aid for infrastructure may, for example, exert only limited pressure on the real exchange rate to the extent that it helps expand productive capacity. Second, the volatility of foreign aid may have a negative impact on economic growth (e.g., Lensink and Morrissey, 2000; Hudson and Mosley, 2009). In particular, volatile aid is likely to impair macroeconomic management, including management of the real exchange rate. Accounting for aid heterogeneity and aid volatility would thus definitely constitute a promising extension of the present analysis.

3. We thank an anonymous referee for pointing us to this issue.
4. The interaction terms reflect the second-order effects considered in the aid-growth literature. In terms of the model in Dalgaard, Hansen and Tarp (2004), these effects correspond to Burnside and Dollar's (2000) claim that aid works with reasonable policies ($\partial^2 g/\partial a \partial \mathbf{p} > 0$); Hansen and Tarp's (2000) suggestion that aid exhibits diminishing returns ($\partial^2 g/\partial a^2 < 0$); and Dalgaard, Hansen and Tarp's (2004) finding of higher aid effectiveness with better geographic/climatic conditions ($\partial^2 g/\partial a \partial \mathbf{d} > 0$).
5. Effective aid is defined as the grant equivalent of official disbursements constructed by Chang, Fernandez-Arias and Serven (1998), calculated as the sum of official grants and the grant element in concessional loans.
6. Other factors such as changes in relative prices may of course also affect sectoral growth rates but we omitted them because reliable proxies can hardly be constructed in a panel data context.
7. These are Aid/GDP, lagged; (Aid/GDP) squared, lagged; (Policy x Aid/GDP), lagged; Policy x (log Initial GDP per capita); Policy x (log Initial GDP per capita) squared; Policy x (log Population); and a dummy for countries in the Central Francophone Africa zone. This instrumentation strategy is described and motivated in detail in Dalgaard, Hansen and Tarp (2004), but in general it is aimed to reflect donors' overall preference to send aid to the smallest and poorest countries, those with better macro policies and to account for some strategic interests of donors in specific groups of countries (former colonies, important trade partners, or political allies, for example).
8. The same is true for high levels of conflict and ethnic fractionalization. We dropped these variables from the regression shown in column 1. This helped to reduce problems of multi-collinearity, did not change the significance of the rest of the variables in the model and allowed a more precise estimation of the marginal effects.
9. Results for the Agricultural sector have to be interpreted very cautiously because of weaknesses in the specification. For example, with a p-value of 0.67, the Sargan test for over-identification strongly suggests that the set of instruments are not valid.

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Appendix

Table A.1. Sample of Recipient Countries

Country	Code	1966–1969	1970–1973	1974–1977	1978–1981	1982–1985	1986–1989	1990–1993	1994–1997	1998–2001
Algeria	DZA								x	x
Argentina	ARG		x	x	x	x	x	x	x	x
Australia	AUS			x	x	x	x	x	x	x
Bolivia	BOL		x	x	x	x	x	x	x	x
Botswana	BWA			x	x	x	x	x	x	x
Brazil	BRA	x	x	x	x	x	x	x	x	x
Bulgaria	BGR							x	x	x
Burkina Faso	BFA		x	x	x	x	x	x	x	x
Cameroon	CMR			x	x	x	x	x	x	x
Chile	CHL	x	x	x	x	x	x	x	x	x
China	CHN						x	x	x	x
Colombia	COL	x	x	x	x	x	x	x	x	x
Congo, Dem. Rep.	ZAR		x	x	x	x	x	x	x	
Congo, Rep.	COG						x	x	x	x
Costa Rica	CRI		x	x	x	x	x	x	x	x
Cote d'Ivoire	CIV				x	x	x	x	x	x
Dominican Republic	DOM					x	x	x	x	x
Ecuador	ECU	x	x	x	x	x	x	x	x	x
Egypt, Arab Rep.	EGY			x	x	x	x	x	x	x
El Salvador	SLV	x	x	x	x	x	x	x	x	x
Ethiopia	ETH					x	x	x	x	x
Gabon	GAB					x	x	x		
Gambia, The	GMB		x	x	x	x	x	x		
Ghana	GHA	x	x	x	x	x	x	x	x	x
Guatemala	GTM	x	x	x	x	x	x	x	x	x
Haiti	HTI	x	x	x	x	x	x	x	x	x
Honduras	HND	x	x	x	x	x	x	x	x	x

(*continued*)

Table A.1. (*Continued*)

Country	Code	1966–1969	1970–1973	1974—1977	1978–1981	1982–1985	1986–1989	1990–1993	1994–1997	1998–2001
Hungary	HUN					x	x	x	x	x
India	IND	x	x	x	x	x	x	x	x	x
Indonesia	IDN		x	x	x	x	x	x	x	x
Iran, Islamic Rep.	IRN			x	x	x	x	x	x	x
Jamaica	JAM			x	x	x	x	x	x	x
Japan	JPN		x	x	x	x	x	x		
Kenya	KEN		x	x	x	x	x	x	x	x
Korea, Rep.	KOR		x	x	x	x	x	x	x	
Madagascar	MDG		x	x	x	x	x	x	x	x
Malaysia	MYS		x	x	x	x	x	x	x	x
Mali	MLI						x	x	x	x
Mexico	MEX		x	x	x	x	x	x	x	x
Morocco	MAR	x	x	x	x	x	x	x	x	x
New Zealand	NZL				x	x	x	x	x	x
Nicaragua	NIC		x	x	x	x	x	x	x	x
Nigeria	NGA	x	x	x	x	x	x	x	x	x
Pakistan	PAK	x	x	x	x	x	x	x	x	x
Papua New Guinea	PNG					x	x	x	x	x
Paraguay	PRY	x	x	x	x	x	x	x	x	x
Peru	PER	x	x	x	x	x	x	x	x	x
Philippines	PHL	x	x	x	x	x	x	x	x	x
Poland	POL								x	x
Romania	ROM							x	x	x
Senegal	SEN		x	x	x	x	x	x	x	x
Sierra Leone	SLE	x	x	x	x	x	x	x	x	x
Singapore	SGP	x	x	x	x	x	x	x	x	x
South Africa	ZAF							x	x	x
Sri Lanka	LKA	x	x	x	x	x	x	x	x	x
Tanzania	TZA							x	x	x
Thailand	THA	x	x	x	x	x	x	x	x	x
Togo	TGO			x	x	x	x	x	x	x
Trinidad and Tobago	TTO			x	x	x	x	x	x	
Tunisia	TUN		x	x	x	x	x	x	x	x
Turkey	TUR		x	x	x	x	x	x	x	x
Uganda	UGA					x	x	x	x	x
Uruguay	URY	x	x	x	x	x	x	x	x	x
Venezuela, RB	VEN	x	x	x	x	x	x	x	x	x
Zambia	ZMB	x	x	x	x	x	x	x	x	x