RIETI Discussion Paper Series 08-E-039

Aid Allocation across Sectors: Does aid fit well with recipients' development priorities?

KASUGA Hidefumi
Kansai University

RIETI
Research Institute of Economy, Trade & Industry, IAA

The Research Institute of Economy, Trade and Industry
http://www.rieti.go.jp/en/

Aid allocation across sectors: Does aid fit well with recipients' development priorities?*

Hidefumi Kasuga†

Kansai University

November 18, 2008

Abstract

This paper investigates whether aid flows to developing countries fit well with their development priorities. In particular, we examine aid allocation across sectors in a given recipient country by using sectoral data on aid and indicators that measure the recipient's need for aid in each sector. The data show that inter-recipient aid allocation reflects the recipient's need. However, we found no evidence that inter-sectoral allocation fits with national priorities except in high- and middle-income East Asian countries. Our evidence shows that the quality of bureaucracy and corruption in recipient countries impede efficient inter-sectoral allocation.

keywords: Aid allocation; Donor performance; Foreign aid; Aid coordination

JEL classification: F35; O10; O19

*This research is a part of the project "Economics of Foreign Aid" undertaken at the Research Institute of Economy, Trade and Industry (RIETI). The author would like to thank RIETI for generous financial support toward the project. The author is also grateful to Yasuyuki Sawada and members of the project for helpful comments and suggestions. The opinions expressed and arguments employed in this paper are the sole responsibility of the author and do not necessarily reflect those of RIETI or the Ministry of Economy, Trade and Industry of Japan.

†Faculty of Economics, Kansai University, 3-3-35 Yamatecho, Suita, Osaka 564-8680, Japan, Phone:+81 6 6368 0622, E-mail address: hkasuga @ ipcku.kansai-u.ac.jp

1 Introduction

The core purpose of giving aid is to contribute to improving economic welfare and stimulate growth in recipient countries. However, many recent studies such as Easterly et al. (2004) and Roodman (2004) find little evidence of the positive impact of aid.[1] While it remains an open question whether aid can promote growth, one of the tentative answers to this question is that aid can be effective only if donors select aid projects appropriately. In this sense, aid allocation matters. In this paper, we suppose that good donors should care about aid allocation.

The allocation of aid has been studied extensively. For example, Alesina and Dollar (2000), Dollar and Levin (2004) and Sawada et al. (2007) focus on the determinants of aid allocation across countries and examine whether donors are selective on poverty and whether they give aid to countries with a good policy environment.[2] These papers provide empirical evidence that some donors are selective on poverty while the results for the large donors such as Japan and the United States are mixed. Note that these studies use aggregate data on aid and do not take into account differences in aid projects. It is likely that using aggregate data is partially responsible for the mixed results because there are many kinds of aid projects. Each project has its own purpose; aid in some sectors such as food, health and education does not necessarily contribute to income growth in a short period (Clemens et al., 2004).

In this paper, we take into account differences in the purposes of aid by using sectoral data on aid so that we can consider two types of aid allocation in a manner to be described. Suppose that there are two types of aid: food aid and infrastructure investment; if the total budget for food aid is given, the ideal donor gives more aid to countries that need more food; and if the donor's budget for road construction is limited, the donor should give more aid to countries that need more road projects. This is the issue of aid allocation across recipient countries in a given sector (Thiele et al., 2006, 2007; Kasuga, 2007). The other issue is aid allocation across sectors

[1] While Burnside and Dollar (2000) suggest that the impact of aid on growth is positive only if recipients have good policies, most of the recent studies find that their results are not robust.

[2] While these papers employ regression analysis to explore the determinants of aid allocation, Baulch (2006) use a different approach to evaluate donor performance. His paper constructs aid concentration curves, which graphically demonstrate the extent to which different donors are distributing aid to the poorest countries. To examine whether donors contribute to achieving the Millennium Development Goals, he constructs aid concentration curves not only for monetary poverty but also for child malnutrition, primary school enrollments and under-five mortality while using only aggregate data on aid.

in a given recipient country. For example, if a recipient has enough food but suffers from a lack of infrastructure, donors should spend more money on infrastructure to improve the welfare of the recipient. Although aid allocation across sectors may play an important role in improving aid effectiveness, it has to our knowledge not been explored.

It is debatable whether donors should provide economic infrastructure to stimulate growth or place a high priority on poverty-oriented projects.[3] At the moment, there is no clear answer to this question. However, we can predict that the optimal inter-sectoral allocation varies across recipient countries. Canning and Bennathan (2000) provide empirical evidence that infrastructure (electricity generating capacity and paved roads) has diminishing returns and is highly complementary with physical and human capital.[4] This suggests that, to make aid more effective, donors should increase infrastructure investment in needed sectors. Similarly, allocation between infrastructure investment and poverty-oriented projects also matters because protecting public health and the people vulnerable to unforeseen shocks improves the productivity of capital.[5] Hence, aid will be most effective if it fits well with the recipient's priorities.

In reality, there are too many aid projects and too many donors (both countries and agencies) for each recipient. Without coordination among donors, aid can be misallocated and then not effective in a recipient country. It is widely believed that the proliferation of donors and aid channels has adverse effects on aid quality (Morss, 1984; Cassen and Associates, 1994; Acharya et al., 2006; Roodman, 2006). While donors have been talking about the problem of proliferation for a long time, progress to date is very limited.[6] While there are too many projects and donors, there is no apparatus that can allocate aid resources in a recipient country; hence, the lack of coordination surely causes misallocation across sectors. Nevertheless, we do not know how much aid is misallocated in a recipient country. This paper investigates whether aid allocation is efficient. In particular, we investigate whether donors strike a balance between infrastructure investment and poverty-oriented projects, taking into account the recipient's development

[3]For recent theoretical work on the impact of aid on growth, see Chatterjee and Turnovsky (2007) and Kalaitzidakis and Kalyvitis (2008).

[4]For theoretical work, see Barro (1990) and Futagami et al. (1993).

[5]Strauss and Thomas (1998) provide a comprehensive review of evidence for the link between health and productivity.

[6]Acharya et al. (2006) show how donors have been trying to tackle the problem. Conventional approaches are coordination, sector-wide approaches, budget support, and sector specialization.

priorities.

2 Assessment procedure and data

In this paper, we evaluate aid allocation by examining whether donors provide much-needed aid projects. When we use aggregate data on aid flows as in many earlier studies, one natural way to evaluate donors is to examine whether their aid is directed to poor countries. However, once we use sectoral data on aid, we can consider other types of aid allocation. One is aid allocation across recipients within a sector and the other is aid allocation across sectors in a recipient country. While the empirical evidence on the former is reviewed in Section 3, the main purpose of the paper is to evaluate aid allocation across sectors.

To examine inter-sectoral allocation, we have to make an assumption about donors' decision making. As discussed in Section 1, since there are too many aid projects for a recipient, the lack of coordination among donors causes misallocation. We suspect that donors pay little attention to the recipient's priorities when they determine the inter-sectoral aid allocation; although we need to specify the aid allocation model to estimate the true parameter value of the model, unfortunately, there is no a priori information regarding the inter-sectoral allocation model.[7] Even if we have information on a donor's decision rule for allocating aid, it may vary across donors. Hence, it is difficult to estimate the true value of the model parameter. In Section 5, we use regression analysis but it does not intend to estimate the true parameter value.

In this paper, without specifying the aid allocation rule, we examine whether aid for a sector is associated with recipients' need for the sector. In Sections 3 and 4, we compute Spearman's rank correlation coefficient, which does not require the assumption that the relationship between the variables is linear. In Sections 5 and 6, we use the Tobit model; we test the null hypothesis that aid flows are not associated with the need. We do not specify the allocation model but instead consider as many specifications as possible. To be more precise, we test the hypothesis that the ratio of infrastructure investment to poverty-oriented projects varies negatively with

[7]For inter-recipient allocation, some donors have their own aid allocation formula. See, for example, IDA's performance-based allocation system (http://siteresources.worldbank.org/IDA/Resources/Seminar%20PDFs /73449-1172525976405/3492866-1172527584498/PBAformula.pdf).

nonnecessity in infrastructure investment and positively with nonnecessity in poverty-oriented projects. Since there are several types of infrastructure investments (transport, communications, energy, education) and poverty-oriented projects (food, health, humanitarian aid), we need to test the hypothesis for every pair. Although there is no information on donors' allocation models, if we reject the null hypothesis for all of the specifications, it is reasonable to conclude that the donor's aid allocation reflects the recipient's need.

We use data on bilateral aid from the OECD's Creditor Reporting System (CRS), which reports aid commitments for about 200 distinct purposes for all donors and recipients annually since 1973 (Data Appendix A lists 22 member countries of the OECD's Development Assistance Committee).[8] We aggregate project-level data to the sector level, and examine the following sectors: 1) Food; 2) Health; 3) Humanitarian aid; 4) Transport and storage; 5) Communications; 6) Energy generation and supply; 7) Education; and 8) Action relating to debt. Data Appendix B lists the CRS codes for the eight sectors. Table 1 lists the five largest donors in each sector. We focus on these sectors because they receive a high proportion of total aid flows, and because indicators that measure the recipient's need are available for each of the sectors. Table 2 shows the share of each donor's total aid per sector. Note that while each of the sectors in Table 2 has a relatively large share, most of them are much smaller than 10 percent (because there are about 200 CRS purpose codes). Tables 1 and 2 demonstrate that donors have their own preference over aid purposes; the share of economic infrastructure investment (sectors 4-6) is very large for Japanese aid but relatively small for U.S. aid. These tables show Japanese strength in economic infrastructure investment and the U.S strength in poverty-oriented projects (sectors 1-3). While earlier studies such as Alesina and Dollar (2000) show that aid allocation across countries varies across donors, aid allocation across sectors also varies.

To measure the recipient's need for each sector, we use indicators from the World Bank's World Development Indicators (WDI). For example, the recipient's need for sectors 1 (food) and 2 (health) are measured by prevalence of undernourishment and birth attended by skilled health staff, respectively. Note that these two sectors are closely related to the Millennium Development

[8] We use commitments rather than disbursements and use the total amount of aid rather than grant equivalent because our purpose is to investigate whether the selection of projects reflects the recipient's need rather than how much money a donor generously grants.

Goals (MDGs) and the indicators are actually used in the MDGs to monitor progress. Data Appendix B lists indicators for each of the eight sectors.

In the following sections, using sectoral data on aid, we examine the association between aid flows and the recipient's development need. Section 3 examines aid allocation across countries and reviews the literature that uses sectoral data on aid. Section 4 focuses on allocation across sectors in a recipient country. In Section 5, we test whether the ratio of infrastructure investment to poverty-oriented projects is associated with the recipient's development priorities. In Section 6, we investigate whether inter-sectoral allocative efficiency differs across recipient countries. Section 7 concludes.

3 Allocation across countries

Before turning to inter-sectoral allocation, we review inter-recipient allocation as in most of the literature on aid allocation (that uses aggregate data). We investigate whether aid flows are associated with the recipient's need using sectoral data on aid by each donor. If we find a significant association, then it suggests that the inter-recipient allocation of aid is consistent with the need. As shown in Data Appendix B, we use indicators from WDI to measure the recipient's need. Using the 20 quantiles of each indicator, we create a categorical variable for each sector's need from 1 (the minimum among the recipients) to 20 (the maximum among the recipients). We calculate Spearman's rank correlation coefficient (ρ), which is nonparametric and does not require the assumption that the relationship between the variables is linear, to measure the association between the recipient's need and the recipient's share of total aid from each donor. The share is denoted by $aid_{p,r}/aid_p$, where p is a subscript for each purpose of aid and r is a subscript for each recipient. We use Spearman's ρ instead of the common parametric correlation coefficient because we assume that good donors should give more aid to the recipient with a worse environment, but the amount of aid does not have to increase linearly with the measure for the recipient's need (we simply assume that a recipient with the ith-worst environment should receive the ith-largest aid).

Table 3 shows the number of cases where Spearman's ρ is significantly positive (at the 10

percent level) for 22 donors and for seven five-year periods. The number is relatively small in the 1970s and 1980s because of the limited availability of the indicators of need. After 1990, major donors are selective in many sectors. For example, in the period 1991-1995, Switzerland (CHE), Germany (DEU), Italy (ITA) and the United States (USA) have a significantly positive coefficient in seven or eight sectors. In most of the sectors, we find a significant association, which implies that donors allocate more aid to countries with a worse environment. The results also show that the inter-recipient allocation is consistent with the need not only for poverty-oriented projects (sectors 1-3) but also for infrastructure investment (sectors 4-6). For example, in the period 2001-2005, Germany, France (FRA) and the United Kingdom (GBR) have a significant ρ in six sectors except education and action relating to debt; Japan (JPN) in five sectors except education, action relating to debt and humanitarian aid; the United States in five sectors except education, action relating to debt, and communications; Sweden (SWE) and Denmark (DNK) in five sectors except education, food and action relating to debt. While aid for education is not associated with the need in all the periods for most donors, action relating to debt by some donors is associated with the need.

Earlier studies that use sectoral data also show that aid for education is not closely associated with the need. For example, using control variables such as income, population and democracy indices, and some alternative indicators of education (such as persistence to Grade 5 and literacy rate), Kasuga (2007) shows that aid for education by most donors, except France, is not associated with the recipient's need. For other sectors such as food, health and STD control, the previous studies demonstrate that, to some extent, inter-recipient aid allocation reflects the recipient's need as in Table 3. Kasuga (2007) shows that the majority of donors give aid to poorer countries; Thiele et al. (2006) shows that the indicators of the need affect the donor's decision to provide or not to provide aid to a particular country.

4 Allocation across sectors: rank correlation coefficient

We now proceed to the investigation of allocation across sectors. We use the same data as above but need a variable that represents recipient priorities. By using the indicator of need for each

sector in Section 3, which ranges from 1 to 20, we construct a new variable that represents the recipient's relative need across sectors. We prioritize the sectors using the above rank order (among the recipients) as follows: for example, if a country has 2 for food, 13 for transport and storage, and 10 for education, then the first priority among the three sectors is transport and storage, the second is education and the third is food.

We also need to measure a donor's relative effort across sectors of the recipient. Note that the sector's share in a recipient $aid_{p,r}/aid_r$, where p is a subscript for each sector (purpose of aid) and r is a subscript for each recipient, does not accurately capture a donor's effort to allocate aid according to the recipient's priorities. Some sectors need more money than other sectors; generally speaking, an infrastructure project is more costly than a program for food. Hence, $aid_{p,r}/aid_r$ does not reflect the donor's relative effort in sector p. For example, by comparing the share of food aid with that of investment in infrastructure, we cannot measure the donor's relative effort to save people from starvation because the actual share for food aid is small on average (see Table 2). To address this issue, we construct a new variable that represents the donor's relative effort across sectors as follows. First, using the 10 quantiles of each donor's sector share in recipient r ($aid_{p,r}/aid_r$), we create a categorical variable for each donor's effort, which ranges from 1 (the least among the donors) to 10 (the greatest among the donors). Using this variable measuring the donor's effort in each sector, we determine the donor's relative effort across sectors. For example, if a donor has 9 for food, 5 for transport and storage and 8 for education, then we suppose that this donor makes the greatest effort for food among the three sectors, the 2nd greatest effort for education and the least effort for transport and storage.

As in Section 3, we now calculate rank correlation coefficients between the donor's relative effort across sectors and the recipient's relative need across sectors. Table 4 shows the number of cases where Spearman's ρ is significantly positive (at the 10 percent level) for 22 donors and for seven five-year periods. For each donor, there are at most 125 recipients in each period. However, there are at most 12 cases where Spearman's ρ is significant.[9] This result implies that donors' relative effort across sectors does not fit well with the national development priorities of most recipients. For example, in the period 2001-2005, the United States gave aid to 124

[9]Note that, as in Table 3, the availability of the indicators of need is limited in the 1970s and 1980s.

countries, but we find a significant ρ only in 12 of those countries. Germany gave aid to 121 countries, but we find a significantly positive ρ only in three countries. Other major donors such as Japan, France and the United Kingdom also gave aid to over 100 countries, but there are at most nine cases where the coefficient is significant.

Note that the results above do not necessarily imply the inter-sectoral allocation is inefficient. The assessment procedure is based on the ranking of donors in terms of effort ($aid_{p,r}/aid_r$) and does not use information on the efficient inter-sectoral allocation (which is not available). For example, suppose that the optimal ratio of food to transport is 1:2 for a recipient; Donor A chooses this optimal allocation 1:2 and Donor B chooses 1:3. In this example, Donor A's allocation is optimal and Donor B overinvests in transport. However, our assessment procedure may appreciate Donor B in the case where the recipient's first priority is transport because we appreciate intensive efforts to the sector that needs the most urgent assistance. Thus, even if the inter-sectoral allocation is optimal in many recipients, we may not find a significant correlation coefficient. Moreover, donors may not have to achieve a recipient's optimal allocation independently; in reality, because there are so many donors for each recipient, what matters most for a recipient is the inter-sectoral allocation of aid by all donors.

5 Allocation across sectors: regression results

As discussed above, there are difficulties in assessing inter-sectoral allocation by each donor. In this section, we focus on aid flows from all the donors to each recipient to examine whether aid allocation fits well with the recipient's development priorities. Using cross-country data on aid flows to recipient r in period t (1996-2000, 2001-2005), we estimate

$$\frac{aid_{i,r}}{aid_{j,r}} = \beta_0 + \beta_1 index(i)_r + \beta_2 index(j)_r + \beta_3 \frac{aid_{i,r}}{aid_{j,r}}(t-1) + e_r \tag{1}$$

where $index(i)_r$ and $index(j)_r$ are measures of recipient r's need (nonnecessity) for sectors i and j, respectively, and e_r is an error term. The dependent variable is the ratio of aid i (infrastructure investment: sector 4, 5, 6 or 7) to aid j (poverty-oriented projects: sector 1, 2 or

3).[10] We test whether the dependent variable reflects the need in each sector of the recipient. For example, if the numerator of the dependent variable ($aid_{i,r}$) is aid for education, then we examine whether school enrollment ratio, which is an indicator for the measure of need for education, has a significant effect on the dependent variable. The measure of need for recipient r is calculated as the deviation from the worst environment: $index(p)_r = (|\underline{indicator(p)} - indicator(p)_r|)/\underline{indicator(p)}$, where p represents sector p and the underlined term represents the worst environment measured by the indicator for p.[11] Hence, $index(p)_r$ actually reflects nonnecessity (0 represents the worst environment and large values correspond to good conditions) in sector p; then $\beta_1 < 0$ and $\beta_2 > 0$ imply that allocation between infrastructure investment and poverty-oriented projects reflects the relative needs. The indicators for each sector are listed in Data Appendix B. To avoid the problem of endogeneity, we use lagged values of each indicator. To control for unobserved factors, we include the lagged dependent variable $aid_{i,r}/aid_{j,r}(t-1)$.

We employ the Tobit model to estimate equation (1) because there are many observations where the numerator of the dependent variable $aid_{i,r}$ is zero (recipient r does not receive aid for sector i). We cannot use observations if the denominator of the dependent variable $aid_{j,r}$ is zero. Note that, while both the numerator and the denominator can be zero, aid for sectors 1-3 is less likely to be zero in our sample. We use observations after the mid-1990s because of the data available on $index(p)_r$. Unlike the analysis in Section 4, we can examine only a pair of sectors at a time. However, this approach does not use information on the ranking of donors in terms of effort, and hence does not make the incorrect assessment discussed in Section 4. In this sense, this assessment procedure complements the analysis in Section 4. Using data on aid from all the donors to each recipient, we test the hypothesis that aid allocation between infrastructure investment ($i = 4, 5, 6, 7$) and poverty-oriented projects ($j = 1, 2, 3$) reflects the recipient's relative need.

One possible drawback of this procedure is that estimation results depend on the aid pair i and j and may not be robust to alternative specifications. To avoid this problem, we test

[10] See Data Appendix B for sectors.

[11] Note that if p is education, we use school enrollment ratio as an indicator and then small values of $indicator(p)_r$ correspond to bad environments; on the other hand, if p is food, prevalence of undernourishment is an indicator and then small values of $indicator(p)_r$ correspond to good environments.

the hypothesis for every aid pair i and j. If we find a significantly negative effect of $index(i)_r$ on $aid_{i,r}/aid_{j,r}$ ($\beta_1 < 0$), we reestimate equation (1) using alternative denominators and their indices (if we obtain $\beta_1 < 0$ for $j = 1$, then we reestimate (1) for $j = 2, 3$). We conclude that $index(i)_r$ has a significant effect only when the result is robust to alternative specifications. We do the same for $index(j)_r$ using alternative numerators and their indices (if we obtain $\beta_2 > 0$ for $i = 4$, then we reestimate (1) for $i = 5, 6, 7$). In this manner we can cover the shortcoming of this approach. We also use alternative indicators in Data Appendix B.

In this section, we focus on seven aid categories while there are about 200 CRS purpose codes. We aggregate infrastructure investments into four categories and poverty-oriented projects into three categories. Each of the categories represents a major sector, and its share is relatively large among other sectors (however, as shown in Table 2, these seven categories amount to only about 30 percent of total aid flows on average). We use this level of aggregation (codes 12110-12281 for health, codes 21010-21081 for transport and storage, codes 22010-22040 for communications, etc.) because each category has an appropriate indicator of the need. For example, since road complements rail services, it is possible to use one indicator to measure the need of aid for these two sectors; however, we cannot measure the need for road and energy generation using a single indicator because road does not complement energy generation. Similarly, we cannot measure the need for food and health using a single indicator; hence, we should not aggregate these two into one sector.

Table 5 shows estimation results for the case where the numerator of the dependent variable is aid for transport and storage ($i = 4$). In Tables 5-8, the denominator is aid for food ($j = 1$) in Columns 1 and 2, aid for health ($j = 2$) in Columns 3 and 4 and humanitarian aid (HA, $j = 3$) in Columns 5 and 6. Thus, we examine every pair of infrastructure investment and poverty-oriented projects. In Table 5, none of the results show that $index(i)_r$ has a significantly negative effect on the dependent variable. Using the alternative indicator in Data Appendix B does not alter the results (not reported). Thus, we find no evidence that the need for transport and storage affects aid in this sector. Moreover, we find no evidence that $index(j)_r$ has a significantly positive effect except in Column 6 ($j = 3$), yet the positive effect of $index(j)_r$ in Column 6 is not robust to

alternative numerators, as will be seen in Tables 6-8. We obtain similar results using alternative indices. Overall, the results in Table 5 provide no evidence that inter-sectoral allocation reflects the need.

Table 6 shows the estimation results for the case where the numerator of the dependent variable is aid for communications ($i = 5$). None of the results show that $index(i)_r$ has a significantly negative effects on the dependent variable. Using the alternative indicator in Data Appendix B does not alter the results (not reported). Thus, we find no evidence that the need for communications affects aid in this sector. The indices for food, health and humanitarian aid have no significant effects. Again, the results in Table 6 provide no evidence that aid allocation across sectors reflects the need.

Table 7 shows the estimation results for the case where the numerator of the dependent variable is aid for energy generation and supply ($i = 6$). Again, the results do not show that the index for energy generation and supply has a significantly negative effect on the dependent variable; none of the results show that $index(j)_r$ have a significantly positive effect. Using the alternative indices does not alter the results (not reported). Thus, the results in Table 7 provide no evidence that aid allocation across sectors reflects the need.

Table 8 shows the estimation results for the case where the numerator of the dependent variable is aid for education ($i = 7$). The results do not show that the index for education has a significantly negative effect on the dependent variable. Using the alternative index does not alter the results (not reported). Thus, we find no evidence that the need for education affects aid in this sector. The indices for food, health and humanitarian aid have no significant effects in most cases. While in Column 4 the index for health has a significantly positive effect, the result is not robust to alternative numerators in Tables 5-7 and to the alternative indicator in Data Appendix B. Only when we use refugee population as an alternative indicator, the index for humanitarian aid has a significantly positive effect in both periods (not reported). Overall, however, the results in Table 8 provide no clear evidence that aid allocation across sectors reflects the need.

As shown in Tables 5-8, we have examined every pair of infrastructure investment and

poverty-oriented project. However, the results provide no evidence for the efficient allocation across sectors. The fact that aid flows to recipient countries do not reflect the relative need of the sector is consistent with the results of Table 4. As discussed earlier, the analysis of Section 4 cannot eliminate the possibility that aid flows by all donors reflect the need (as a result of effective coordination among donors) even if each donor's inter-sectoral allocation does not reflect the need. However, the results in this section suggest that aid flows from all donors to each recipient are not efficient in the sense that allocation between infrastructure investment and poverty-oriented projects does not fit well with the recipient's national development priorities.

Of course, some donors may still care about aid allocation across sectors, even if the donors cannot coordinate their activities. To examine this possibility, we estimate equation (1) using data for each donor. The results for the five largest donors in each sector ($i = 4, 5, 6, 7$) do not qualitatively alter our conclusions on inter-sectoral allocation. There are only two cases where we obtain $\beta_1 < 0$ and $\beta_2 > 0$ (at the 10 percent level of significance): Germany ($i = 6$, $j = 1$) and Japan ($i = 7$, $j = 3$) in the period 1996-2000. There are also some cases where we obtain only $\beta_1 < 0$: in the period 1996-2000, Germany ($i = 4$, $j = 3$), Japan ($i = 6$, $j = 1$), France ($i = 6$, $j = 3$) and the United States ($i = 7$, $j = 2$); in the period 2001-2005, Germany ($i = 4$, $j = 3$; $i = 7$, $j = 1$). There are several cases where we obtain only $\beta_2 > 0$: in the period 1996-2000, Japan ($i = 7$, $j = 1$) and the United Kingdom ($i = 7$, $j = 2$); in the period 2001-2005, Germany ($i = 4$, $j = 1$; $i = 7$, $j = 1$), Spain ($i = 4$, $j = 3$), Japan ($i = 6$, $j = 1$), France ($i = 7$, $j = 2$) and the United States ($i = 7$, $j = 3$). Although these results seem to suggest that some donors care about inter-sectoral allocation in some of the sectors, each of the results is not robust to alternative numerators and denominators except $\beta_2 > 0$ for Germany ($j = 1$) in the period 2001-2005. Overall, the results demonstrate that no major donors care about inter-sectoral aid allocation. The fact that inter-sectoral allocation does not fit well with the recipient's development priorities can explain (at least partially) why it is so difficult to find the positive effect of aid on growth.

6 Does allocative efficiency differ across recipients?

Our empirical evidence in Section 5 suggests that donors do not care about the recipient's priorities as a whole. However, it does not necessarily imply that inter-sectoral allocation is inefficient for all of the recipient countries. Allocation can be efficient for some recipients because, in reality, recipient countries can affect aid allocation. Recently, multilateral and bilateral donors have considered that national ownership and leadership of development plans are crucial for aid to be effective.[12] If some countries have a good development strategy and institution, donors can support their policies by providing aid to those countries that can be effective. In this section, we investigate whether allocative efficiency differs across recipient countries, and if so, illustrate the relationship between allocative efficiency and country characteristics.

Answering these questions will help us understand what determines aid effectiveness. First, as discussed in Section 1, better allocation between infrastructure investment and poverty-oriented projects can promote growth because there are diminishing returns to infrastructure investment and complementarity between infrastructure and human capital. Hence, by investigating inter-sectoral allocation, we can find countries where aid is effective in accelerating growth. Second, the donor community recently began placing greater emphasis on country ownership of development programs and prioritization (International Monetary Fund, Independent Evaluation Office, 2004). This implies that recipients are supposed to make lists of what to do and prioritize projects to meet their own goals; donors are supposed to support country-owned strategies for growth and poverty reduction. In this new approach, allocation depends more on recipient countries. Since allocation can affect aid effectiveness, to improve the quality of aid it is important to know what characteristics of recipient countries affect allocative efficiency.

We examine whether inter-sectoral allocative efficiency differs across regions. Specifically, we add two interaction terms between indices and a dummy variable for geographic regions, $region * index(i)$ and $region * index(j)$, to the regressions. Again, we conclude that a variable has a significant effect only when the results are robust to alternative specifications. Here we

[12] Ownership is one of the key principles in the Poverty Reduction Strategy Papers (PRSP) approach introduced by the IMF and the World Bank. See International Monetary Fund, Independent Evaluation Office (2004) for details.

first estimate the effect of interaction terms for the case of $j = 2$. If the effect is significant, then we examine whether the effect is significant for $j = 1, 3$. We consider three regions that receive the bulk of aid flows: East Asia and the Pacific, Sub-Sahara Africa, and Latin America.[13] We found the following results: for East Asia and the Pacific, the interaction term with $index(i)$ has a significant negative effect and the interaction term with $index(j)$ has a significant positive effect when $i = 6$ and $j = 2$; on the other hand, for Sub-Sahara Africa, the interaction term with $index(j)$ has a negative effect for all i (when $j = 2$) while the estimates are not necessarily significant. Although these results are not robust to alternative specifications, they may imply that allocative efficiency depends on per capita income because East Asia and the Pacific includes more middle- and high-income countries than Sub-Sahara Africa. In fact, when we add the interaction term between indices and a dummy for middle- and high-income East Asian countries (EA), it has a significant effect and the results are robust to alternative specifications.[14] Table 9 shows that $EA * index(i)$ is negative and significant in Columns 1 ($i = 4$, $j = 2$) and 2 ($i = 4$, $j = 3$), and that $EA * index(j)$ is positive and significant in Columns 1 ($i = 4$, $j = 2$) and 3 ($i = 6$, $j = 2$). We obtain qualitatively similar results in Column 4 ($i = 6$, $j = 2$) in the period 2001-2005, but the result is not robust to alternative specifications. To investigate the effect of per capita income, we add the interaction term between per capita income and indices. Using the 10 quantiles of GDP per capita, we create a categorical variable from 1 to 10 for each recipient's income ($income$). The effect of $income * index(i)$ is negative and significant, and that of $income * index(j)$ is positive and significant in Columns 5 ($i = 6$, $j = 2$) and 6 ($i = 7$, $j = 2$). While the effect of $income * index(i)$ is not robust to alternative specifications, $income * index(j)$ has a significant and positive effect both for $i = 6$ and $i = 7$. This result suggests that high-income countries have a better inter-sectoral allocation.

If allocative efficiency differs across recipient countries, it is reasonable to argue that various factors, which affect income, determine inter-sectoral allocative efficiency. In this paper, we focus on governance because, as demonstrated by Kaufmann et al. (1999), governance affects income

[13] We follow the World Bank classification. East Asia and the Pacific includes 29 countries. Sub-Sahara Africa includes 47 countries and Latin America includes 37 countries.

[14] These middle and high income East Asian countries are China, Hong Kong, Indonesia, Malaysia, Philippines, Singapore, South Korea and Thailand while Hong Kong and Singapore received no aid in the period 1996-2005.

and other development outcomes. Moreover, it is clear that the quality of the bureaucracy of recipients affects the management of aid projects. Hence, we examine whether governance determines allocative efficiency. Specifically, we use two governance indices from Kaufmann et al. (2007), corruption and government effectiveness (which measures the quality of public service and bureaucracy), because they are closely related to aid management. Using the 10 quantiles of each governance index, we create a dummy equal to 1 if the recipient ranks in the bottom 10 percent of all countries, including developed countries, and 0 otherwise. We add two interaction terms between indices and a dummy for poor governance (*corruption* and *government*) to regressions again. In Table 10, we report the results for the case $j = 2$. The results show that $corruption * index(i)$ has significant positive effects and $corruption * index(j)$ has significant negative effects; there are five cases where the interaction term with the dummy for corruption has a significant effect. Note that for $j = 2$, there are eight regression equations in total (t =1996-2000, 2001-2005; $i = 4, 5, 6, 7$). Similarly, in Table 11, $government * index(i)$ has significant positive effects and $government * index(j)$ has significant negative effects; there are four cases where the interaction term with the dummy for government effectiveness has a significant effect. Thus, the effect of poor governance is robust to alternative specifications. These results imply that countries with poor governance have a worse inter-sectoral allocation because a positive effect of $index(i)$ and the negative effect of $index(j)$ imply that allocation does not reflect the relative need. More specifically, in countries with poor governance, donors tend to give less aid to much-needed sectors; the results imply that even if there is an urgent need for aid in the health sector, donors tend to invest in economic infrastructure rather than increase aid for health because of corruption or inefficient bureaucracy in these countries. Note that in Tables 5-8, the effects of indices are not significant in most cases and we find no robust effects of the indices on inter-sectoral allocation; however, the interaction terms have significant effects.[15] Our evidence suggests that low-quality public service and corruption impede efficient inter-sectoral allocation in recipient countries.

[15]In some cases (e.g., $i = 4$, $j = 2$), after including the interaction terms, the coefficient of $index(i)$ becomes negative and the coefficient of $index(j)$ becomes positive; however, they are not significant. Overall, the results do not show that $\beta_1 < 0$ and $\beta_2 > 0$ even after controlling for governance.

7 Conclusions

The main purpose of this paper is to investigate whether aid flows to developing countries fit well with their development priorities. We focus on aid allocation across sectors. In Section 4, we examine whether the donor's relative effort across sectors is associated with the recipient's relative need across sectors by estimating rank correlation coefficients. We find little evidence that donors concentrate their aid on high-priority sectors in each recipient country. However, this assessment procedure appreciates intensive efforts to priority sectors without considering the optimal allocation, and there is a possibility that inter-sectoral allocation by all donors can be efficient even if each donor's allocation is not efficient. Hence, as a complement to the analysis in Section 4, we test the hypothesis that the ratio of infrastructure investment to poverty-oriented projects reflects the recipient's need for the sectors using data on aid flows by all donors. Again we find little evidence that the inter-sectoral allocation of aid flows (not only by all donors in aggregate, but also by each donor individually) reflects the recipient's need. On the other hand, we find some evidence that countries with poor governance have extremely inefficient inter-sectoral allocation.

In summary, using sectoral data, we have found the following: 1) inter-sectoral aid allocation does not reflect the recipient's need although inter-recipient allocation is much more efficient as shown in Section 3; 2) inter-sectoral allocative efficiency depends on the capacity of the public sector in recipient countries. It is reasonable to suppose that inter-sectoral allocation for a recipient depends more on the quality of the recipient's government, while inter-recipient allocation is solely determined by donors. If this is true, the quality of government in a recipient country plays a crucial role in improving inter-sectoral allocative efficiency, which can affect aid effectiveness.

Nevertheless, even after controlling for governance, we find little evidence that inter-sectoral allocation is associated with the recipient's relative need across sectors. This implies that co-ordination among donors fails. Successful coordination improves the quality of aid even if each donor specializes in specific sectors leaving other sectors to other donors. The contrasting results of inter-sectoral allocation and inter-recipient allocation suggest that aid coordination among

donors should focus more on alignment with the recipient's development priorities.

Data Appendix

A. List of donors

AUS	Australia	AUT	Austria	BEL	Belgium	CAN	Canada
CHE	Switzerland	DEU	Germany	DNK	Denmark	ESP	Spain
FIN	Finland	FRA	France	GBR	United Kingdom	GRC	Greece
IRL	Ireland	ITA	Italy	JPN	Japan	LUX	Luxembourg
NLD	Netherlands	NOR	Norway	NZL	New Zealand	PRT	Portugal
SWE	Sweden	USA	United States				

Note: The member countries of the OECD's Development Assistance Committee (DAC) are listed.

B. The CRS purpose codes and the indicators

1. Food aid (code 52010)

Prevalence of undernourishment (% of population)

Malnutrition prevalence, weight for age (% of children under 5)*

2. Health (code 12110-12281)

Births attended by skilled health staff (% of total)

Immunization, measles (% of children ages 12-23 months)*

3. Humanitarian aid (code 72010-74010)

Death rate, crude (per 1,000 people)

Refugee population by country or territory of asylum*

4. Transport and storage (code 21010-21081)

Roads, paved (% of total roads)

Railways, goods transported (million ton-km)*

5. Communications (code 22010-22040)

Fixed line and mobile phone subscribers (per 1,000 people)

Telephone mainlines (per 1,000 people)*

6. Energy generation and supply (code 23010-23082)

Electric power consumption (kWh per capita)

Electric power transmission and distribution losses (% of output)*

7. Education (code 11110-11430)

School enrollment, primary (% gross)

Persistence to Grade 5, total (% of cohort)*

8. Action relating to debt (code 60010-60063)

Total debt service (% of exports of goods, services and income)

Note: All the variables are obtained from the World Bank's WDI CD-ROM. The asterisks indicate alternative indicators used in Section 5.

References

Acharya, A., A. T. F. de Lima, and M. Moore (2006). Proliferation and fragmentation: Transactions costs and the value of aid. *Journal of Development Studies 42*(1), 1–21.

Alesina, A. and D. Dollar (2000). Who gives foreign aid to whom and why? *Journal of Economic Growth 5*, 33–63.

Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy 98*(5), 103–125.

Baulch, B. (2006). Aid distribution and the MDGs. *World Development 34*(6), 933–950.

Burnside, C. and D. Dollar (2000). Aid, policies, and growth. *American Economic Review 90*(4), 847–868.

Canning, D. and E. Bennathan (2000). *The social rate of return on infrastructure investments*. Policy Research Working Paper Series. Washington DC: The World Bank.

Cassen, R. and Associates (1994). *Does Aid Work? Report to an Intergovernmental Task Force* (2nd ed.). Oxford: Oxford University Press.

Chatterjee, S. and S. J. Turnovsky (2007). Foreign aid and economic growth: The role of flexible labor supply. *Journal of Development Economics 84*(1), 507–533.

Clemens, M. A., S. Radelet, and R. Bhavnani (2004). *Counting chickens when they hatch: the short-term effect of aid on growth*. CGD Working Paper 44. Washington DC: Center for Global Development.

Dollar, D. and V. Levin (2004). *The increasing selectivity of foreign aid, 1984-2002*. World Bank Policy Research Working Paper 3299. Washington DC: World Bank.

Easterly, W., R. Levine, and D. Roodman (2004). Aid, policies, and growth: comment. *American Economic Review 94*(3), 774–780.

Futagami, K., Y. Morita, and A. Shibata (1993). Dynamic analysis of an endogenous growth model with public capital. *Scandinavian Journal of Economics 95*(4), 607–25.

International Monetary Fund, Independent Evaluation Office (2004). *Evaluation of the IMF's Role in Poverty Reduction Strategy Papers and the Poverty Reduction and Growth Facility*. Washington DC: International Monetary Fund.

Kalaitzidakis, P. and S. Kalyvitis (2008). On the growth implications of foreign aid for public investment co-financing. *Review of Development Economics 12*(2), 354–371.

Kasuga, H. (2007). *The Millennium Development Goals and Aid Allocation: Which donors give high-quality aid?* RIETI Discussion Paper 07-E-050. Tokyo: RIETI.

Kaufmann, D., A. Kraay, and M. Mastruzzi (2007). *Governance Matters VI: Aggregate and Individual Governance Indicators, 1996-2006*. Policy Research Working Paper Series 4280. Washington DC: The World Bank.

Kaufmann, D., A. Kraay, and P. Zoido-Lobaton (1999). *Governance Matters*. World Bank Working Paper. Washington DC: The World Bank.

Morss, E. R. (1984). Institutional destruction resulting from donor and project proliferation in Sub-Saharan African countries. *World Development 12*, 465–470.

Roodman, D. (2004). *The Anarchy of Numbers: Aid, Development, and Cross-country Empirics*. CGD Working Paper Number 32. Washington DC: Center for Global Development.

Roodman, D. (2006). *An Index of Donor Performance*. CGD Working Paper Number 67. Washington DC: Center for Global Development.

Sawada, Y., H. Yamada, and T. Kurosaki (2007). *Is aid allocation consistent with global poverty reduction? A Cross-donor Comparison*. presented at RIETI International Workshop on Economics of Foreign Aid, July 2nd.

Strauss, J. and D. Thomas (1998). Health, nutrition, and economic development. *Journal of Economic Literature 36*(2), 766–817.

Thiele, R., P. Nunnenkamp, and A. Dreher (2006). *Sectoral Aid Priorities: Are donors really doing their best to achieve the Millennium Development Goals?* Kiel Working Papers 1266. Kiel Institute for the World Economy.

Thiele, R., P. Nunnenkamp, and A. Dreher (2007). Do donors target aid in line with the Millennium Development Goals? a sector perspective of aid allocation. *Review of World Economics (Weltwirtschaftliches Archiv) 143*(4), 596–630.

Table 1: Major donors in each sector: accumulated bilateral aid in 1996-2005

	Sectors								Total
	1	2	3	4	5	6	7	8	
Largest	USA	USA	USA	JPN	JPN	JPN	FRA	JPN	USA
	(0.696)	(0.234)	(0.408)	(0.645)	(0.440)	(0.537)	(0.198)	(0.240)	(0.223)
2nd	CAN	GBR	GBR	DEU	USA	USA	DEU	FRA	JPN
	(0.073)	(0.146)	(0.096)	(0.091)	(0.126)	(0.137)	(0.155)	(0.224)	(0.205)
3rd	JPN	JPN	NLD	FRA	FRA	DEU	JPN	DEU	DEU
	(0.044)	(0.098)	(0.077)	(0.066)	(0.076)	(0.101)	(0.118)	(0.128)	(0.093)
4th	ITA	NLD	NOR	ESP	NLD	GBR	GBR	USA	FRA
	(0.039)	(0.066)	(0.050)	(0.036)	(0.052)	(0.050)	(0.081)	(0.100)	(0.093)
5th	GBR	FRA	SWE	GBR	ESP	FRA	NLD	GBR	GBR
	(0.035)	(0.064)	(0.050)	(0.031)	(0.050)	(0.035)	(0.078)	(0.092)	(0.082)

Note: Figures in parentheses are the donor's share of total bilateral aid for the sector. See Data Appendix A for the list of donor codes and Data Appendix B for the list of eight selected sectors.

Table 2: The share of each donor's total aid per sector

Donor	Period	Sectors							
		1	2	3	4	5	6	7	8
AUS	1996-2000	0.022	0.085	0.067	0.053	0.003	0.011	0.215	0.008
	2001-2005	0.039	0.075	0.110	0.048	0.002	0.002	0.091	0.008
AUT	1996-2000	0.003	0.080	0.028	0.007	0.000	0.009	0.205	0.324
	2001-2005	0.004	0.026	0.018	0.012	0.004	0.011	0.140	0.483
BEL	1996-2000	0.023	0.108	0.061	0.016	0.008	0.008	0.111	0.147
	2001-2005	0.007	0.072	0.045	0.020	0.004	0.006	0.101	0.285
CAN	1996-2000	0.086	0.021	0.118	0.004	0.016	0.045	0.057	0.059
	2001-2005	0.023	0.056	0.098	0.002	0.009	0.005	0.099	0.105
CHE	1996-2000	0.012	0.050	0.192	0.038	0.010	0.011	0.048	0.015
	2001-2005	0.004	0.036	0.210	0.012	0.001	0.012	0.035	0.046
DEU	1996-2000	0.011	0.026	0.037	0.127	0.005	0.074	0.108	0.142
	2001-2005	0.004	0.021	0.040	0.038	0.002	0.051	0.138	0.267
DNK	1996-2000	0.000	0.090	0.011	0.118	0.008	0.050	0.059	0.051
	2001-2005	0.000	0.064	0.012	0.076	0.004	0.039	0.060	0.027
ESP	1996-2000	0.006	0.123	0.055	0.071	0.015	0.075	0.126	0.077
	2001-2005	0.006	0.054	0.047	0.104	0.013	0.029	0.105	0.257
FIN	1996-2000	0.000	0.057	0.137	0.007	0.002	0.049	0.076	0.038
	2001-2005	0.001	0.061	0.146	0.001	0.008	0.036	0.106	0.004
FRA	1996-2000	0.000	0.028	0.004	0.071	0.015	0.040	0.141	0.258
	2001-2005	0.004	0.031	0.053	0.043	0.002	0.011	0.171	0.444
GBR	1996-2000	0.001	0.089	0.086	0.044	0.003	0.048	0.086	0.076
	2001-2005	0.013	0.071	0.097	0.018	0.006	0.024	0.066	0.244
GRC	1996-2000								
	2001-2005	0.002	0.081	0.056	0.035	0.005	0.000	0.186	0.000
IRL	1996-2000	0.010	0.108	0.113	0.050	0.002	0.001	0.156	0.057
	2001-2005	0.013	0.183	0.096	0.017	0.002	0.000	0.144	0.009
ITA	1996-2000	0.052	0.048	0.104	0.013	0.010	0.019	0.065	0.331
	2001-2005	0.029	0.040	0.050	0.019	0.001	0.054	0.043	0.473
JPN	1996-2000	0.004	0.019	0.012	0.286	0.024	0.164	0.028	0.054
	2001-2005	0.004	0.023	0.022	0.186	0.012	0.127	0.057	0.303
LUX	1996-2000								
	2001-2005	0.016	0.187	0.150	0.004	0.000	0.002	0.190	0.000
NLD	1996-2000	0.002	0.052	0.109	0.030	0.006	0.020	0.078	0.087
	2001-2005	0.002	0.039	0.084	0.022	0.007	0.012	0.098	0.039
NOR	1996-2000	0.000	0.041	0.208	0.010	0.009	0.064	0.077	0.021
	2001-2005	0.001	0.081	0.132	0.017	0.007	0.040	0.106	0.012
NZL	1996-2000								
	2001-2005	0.003	0.046	0.111	0.011	0.001	0.006	0.252	0.000
PRT	1996-2000	0.000	0.019	0.009	0.016	0.016	0.000	0.059	0.564
	2001-2005	0.000	0.024	0.018	0.060	0.006	0.003	0.139	0.365
SWE	1996-2000	0.000	0.050	0.166	0.030	0.015	0.044	0.058	0.001
	2001-2005	0.001	0.044	0.120	0.027	0.004	0.021	0.056	0.027
USA	1996-2000	0.085	0.047	0.127	0.001	0.005	0.015	0.033	0.017
	2001-2005	0.053	0.045	0.151	0.014	0.004	0.041	0.023	0.093
Average	1996-2000	0.016	0.057	0.082	0.050	0.009	0.037	0.089	0.116
	2001-2005	0.010	0.062	0.085	0.036	0.005	0.024	0.109	0.159

Note: See Data Appendix A for the list of donor codes and Data Appendix B for the list of eight selected sectors. There are no data from CRS for Greece, Luxembourg and New Zealand in the period 1996-2000.

Table 3: Aid allocation across countries in 8 sectors

Donor	1971-1975	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	Total
AUS	1	1	2	3	3	3	2	15
AUT					2	3	3	8
BEL				1	6	7	6	20
CAN	4	2	5	5	6	5	5	32
CHE	2	3	1	5	7	5	3	26
DEU	3	3	5	5	8	6	6	36
DNK		1	2	4	6	4	5	22
ESP				1	1	4	4	10
FIN			1	3	4	3	3	14
FRA	2	2	5	4	5	6	6	30
GBR	2	2	3	4	6	5	6	28
GRC							2	2
IRL						4	5	9
ITA			2	5	7	5	4	23
JPN	2	3	4	5	6	7	5	32
LUX							3	3
NLD	2	4	5	6	6	8	5	36
NOR	1	2	2	2	6	4	5	22
NZL					3		2	5
PRT					3	3	2	8
SWE	2	2	4	4	5	4	5	26
USA	2	2	3	3	7	5	5	27
Total	23	27	44	60	97	91	92	434

Note: Figures are the number of sectors with a significant correlation coefficient (Spearman's ρ). See Data Appendix A for the list of donor codes and Data Appendix B for the list of eight sectors.

Table 4: Aid allocation across sectors in recipients (at most 125 countries)

Donor	1971-1975	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	Total
AUS			3	1	2	3	3	12
AUT				1	1	3		5
BEL					3	4	3	10
CAN	1	3	4	2	4	1	5	20
CHE		3			5	3	3	14
DEU	2	3	8	2	8	6	3	32
DNK			1	1	3	2	3	10
ESP						3	5	8
FIN				1	1	3	4	9
FRA		1	3	1	4	1	9	19
GBR			1			5	2	8
GRC								0
IRL							3	3
ITA				3	2	1	1	7
JPN	2	1	1	2	7	4	8	25
LUX							3	3
NLD						6		6
NOR		1				3	5	9
NZL								0
PRT						1		1
SWE				2	2		4	8
USA	1	2	1		2	4	12	22
Total	6	14	22	16	44	53	76	231

Note: Figures are the number of recipient countries with a significant correlation coefficient (Spearman's ρ). See Data Appendix A for the list of donor codes and Data Appendix B for the list of eight sectors.

Table 5: Estimation results: Transport and storage by all donors

sector i	Transport	Transport	Transport	Transport	Transport	Transport
sector j	Food	Food	Health	Health	HA	HA
	1996-2000	2001-2005	1996-2000	2001-2005	1996-2000	2001-2005
$index(i)$	29.03	50.50	0.29	2.08	1.99	6.64
	(19.77)	(32.80)	(0.65)	(2.13)	(5.32)	(3.92)*
$index(j)$	41.38	-239.26	-0.19	0.90	41.98	55.54
	(92.41)	(195.83)	(0.48)	(2.34)	(34.01)	(24.08)**
lagged dependent	0.62	0.75	0.32	2.29	0.05	0.21
variable	(0.16)***	(0.39)*	(0.09)***	(2.29)	(0.01)***	(0.12)*
observation	76	68	57	104	106	107

Note: The Tobit model is used. All regressions include a constant. See Data Appendix B for the list of indices. The indices are lagged values and measured by deviations from the worst environment. Figures in parentheses are heteroskedasticity-robust standard errors. The superscripts *, **, *** indicate significance at 10, 5, 1 percent, respectively.

Table 6: Estimation results: Communications by all donors

sector i	Telecom	Telecom	Telecom	Telecom	Telecom	Telecom
sector j	Food	Food	Health	Health	HA	HA
	1996-2000	2001-2005	1996-2000	2001-2005	1996-2000	2001-2005
$index(i)$	3.83	1.47	-0.23	0.07	-0.64	2.80
	(2.62)	(0.99)	(0.14)	(0.04)	(1.21)	(2.83)
$index(j)$	25.44	0.81	0.99	-0.04	11.23	-30.24
	(27.68)	(2.23)	(0.62)	(0.12)	(17.64)	(53.00)
lagged dependent	-0.00	-0.00	0.42	0.01	0.32	-0.00
variable	(0.00)	(0.01)	(0.18)**	(0.01)	(0.02)***	(0.01)
observation	83	74	60	113	116	114

Note: The Tobit model is used. All regressions include a constant. See Data Appendix B for the list of indices. The indices are lagged values and measured by deviations from the worst environment. Figures in parentheses are heteroskedasticity-robust standard errors. The superscripts *, **, *** indicate significance at 10, 5, 1 percent, respectively.

Table 7: Estimation results: Energy generation and supply by all donors

sector i	Energy	Energy	Energy	Energy	Energy	Energy
sector j	Food	Food	Health	Health	HA	HA
	1996-2000	2001-2005	1996-2000	2001-2005	1996-2000	2001-2005
$index(i)$	-27.15	12.67	0.45	-0.04	-3.75	6.83
	(39.51)	(7.91)	(0.31)	(0.33)	(2.50)	(5.54)
$index(j)$	1030.06	-11.72	-2.01	0.57	59.85	-111.72
	(899.60)	(31.96)	(0.96)**	(0.69)	(43.35)	(127.30)
lagged dependent	0.58	-0.00	0.15	-0.00	0.06	0.36
variable	(0.64)	(0.00)	(0.04)***	(0.00)***	(0.01)***	(0.27)
observation	57	49	39	70	75	73

Note: The Tobit model is used. All regressions include a constant. See Data Appendix B for the list of indices. The indices are lagged values and measured by deviations from the worst environment. Figures in parentheses are heteroskedasticity-robust standard errors. The superscripts *, **, *** indicate significance at 10, 5, 1 percent, respectively.

Table 8: Estimation results: Education by all donors

sector i	Education	Education	Education	Education	Education	Education
sector j	Food	Food	Health	Health	HA	HA
	1996-2000	2001-2005	1996-2000	2001-2005	1996-2000	2001-2005
$index(i)$	80.62	150.66	-0.75	-5.32	-401.66	90.13
	(140.91)	(154.38)	(1.04)	(6.14)	(487.13)	(68.26)
$index(j)$	2701.58	116.74	1.23	12.34	-305.19	-105.86
	(2638.09)	(104.68)	(1.18)	(5.45)**	(1446.49)	(253.94)
lagged dependent	-1.26	0.01	0.79	-0.00	8.69	0.00
variable	(1.42)	(0.00)*	(0.24)***	(0.00)	(1.52)***	(0.00)***
observation	75	70	55	103	103	106

Note: The Tobit model is used. All regressions include a constant. See Data Appendix B for the list of indices. The indices are lagged values and measured by deviations from the worst environment. Figures in parentheses are heteroskedasticity-robust standard errors. The superscripts *, **, *** indicate significance at 10, 5, 1 percent, respectively.

Table 9: Estimation results: Differences across regions

sector i	Transport	Transport	Energy	Energy	Energy	Education
sector j	Health	HA	Health	Health	Health	Health
	1996-2000	1996-2000	1996-2000	2001-2005	2001-2005	2001-2005
$index(i)$	0.43	3.70	0.44	-0.04	1.73	7.82
	(0.59)	(4.79)	(0.31)	(0.32)	(0.55)***	(6.08)
$EA * index(i)$	-4.66	-104.69	-3.97	-16.92		
	(0.57)***	(44.63)***	(1.78)**	(8.06)**		
$income * index(i)$					-0.43	-5.63
					(0.18)**	(3.22)*
$index(j)$	-0.23	21.66	-2.03	0.58	-1.85	-3.47
	(0.47)	(23.64)	(0.96)**	(0.70)	(0.93)**	(3.88)
$EA * index(j)$	9.00	781.03	6.49	31.55		
	(1.57)***	(269.85)***	(3.05)**	(14.72)**		
$income * index(j)$					0.73	4.34
					(0.35)**	(2.23)**
lagged dependent	0.29	0.05	0.16	0.00	0.00	-0.00
variable	(0.09)***	(0.01)***	(0.05)***	(0.00)	(0.00)	(0.00)
observation	57	106	39	70	66	99

Note: The Tobit model is used. All regressions include a constant. See Data Appendix B for the list of indices. EA includes eight middle or high income recipients in East Asia. The indices are lagged values and measured by deviations from the worst environment. Figures in parentheses are heteroskedasticity-robust standard errors. The superscripts *, **, *** indicate significance at 10, 5, 1 percent, respectively.

Table 10: Estimation results: Corruption and allocative efficiency

sector i	Transport	Energy	Telecom	Energy	Education
sector j	Health	Health	Health	Health	Health
	1996-2000	1996-2000	2001-2005	2001-2005	2001-2005
$index(i)$	-0.29	0.37	0.03	-0.28	-11.85
	(0.47)	(0.31)	(0.06)	(0.44)	(8.84)
$corruption * index(i)$	2.47	9.27	0.41	1.45	15.68
	(1.49)*	(4.58)**	(0.24)*	(0.71)**	(8.48)*
$index(j)$	-0.07	-2.03	0.10	1.13	15.48
	(0.52)	(0.95)**	(0.16)	(0.90)	(6.97)**
$corruption * index(j)$	-4.32	-12.53	-0.61	-1.80	-15.07
	(2.38)*	(6.26)**	(0.35)*	(0.96)*	(6.98)**
lagged dependent	0.37	0.15	0.01	-0.00	-0.00
variable	(0.08)***	(0.04)***	(0.01)	(0.00)**	(0.00)
observation	57	39	112	70	101

Note: The Tobit model is used. All regressions include a constant. See Data Appendix B for the list of indices. The indices are lagged values and measured by deviations from the worst environment. Figures in parentheses are heteroskedasticity-robust standard errors. The superscripts *, **, *** indicate significance at 10, 5, 1 percent, respectively.

Table 11: Estimation results: Low-quality public service and allocative efficiency

sector i	Transport	Education	Energy	Education
sector j	Health	Health	Health	Health
	1996-2000	1996-2000	2001-2005	2001-2005
$index(i)$	-0.31	-2.15	-0.28	-9.76
	(0.44)	(1.48)	(0.41)	(7.96)
$government * index(i)$	4.17	2.31	2.12	11.82
	(1.63)***	(1.86)	(0.89)**	(7.83)
$index(j)$	-0.04	2.10	0.90	13.68
	(0.53)	(1.78)	(0.81)	(6.06)**
$government * index(j)$	-6.29	-2.32	-2.57	-12.05
	(2.07)***	(1.29)*	(1.10)**	(6.62)*
lagged dependent	0.38	0.78	-0.00	-0.00
variable	(0.08)***	(0.24)***	(0.00)**	(0.00)
observation	57	55	70	101

Note: The Tobit model is used. All regressions include a constant. See Data Appendix B for the list of indices. The indices are lagged values and measured by deviations from the worst environment. Figures in parentheses are heteroskedasticity-robust standard errors. The superscripts *, **, *** indicate significance at 10, 5, 1 percent, respectively.