# Aid fragmentation and effectiveness: what do we really know?

Gehring, Kai ; Michaelowa, Katharina ; Dreher, Axel ; Spörri, Franziska

Abstract: Aid fragmentation is widely recognized as being detrimental to development outcomes. We reinvestigate the impact of fragmentation in the context of growth, bureaucratic policy, and education, focusing on a number of conceptually different indicators of fragmentation, and paying attention to potentially heterogeneous effects across countries, sectors, and channels of influence. Our systematic and detailed reexamination of existing empirical studies shows that this differentiation is crucial. In some sectors—such as primary education—donor concentration or limiting donor numbers appear to be detrimental rather than beneficial for development outcomes. In other areas, we find the expected negative effect, but only when we conceptualize fragmentation as a lack of lead donors (too limited concentration), rather than in terms of donor numbers. In all cases, sufficient initial administrative capacity in recipient countries prevents the negative and reinforces the positive effects of fragmentation. This stresses the importance of questioning the sweeping conclusions drawn by much of the previous literature. Based on what we currently know, generalizing judgments about the effect of aid fragmentation may be misleading.

# Aid fragmentation and effectiveness:

# What do we really know?

Kai Gehring [a]

Katharina Michaelowa [b]

Axel Dreher [c]

Franziska Spörri [d]

March 2017

[a] University of Zurich, Center for Comparative and International Studies (CIS), Switzerland (mail@kai-gehring.net). Postal address: Affolternstrasse 56, 8050 Zurich, Switzerland.

[b] University of Zurich, Center for Comparative and International Studies (CIS), Switzerland (katja.michaelowa@pw.uzh.ch). Postal address: Affolternstrasse 56, 8050 Zurich, Switzerland.

[c] Heidelberg University, CESifo, University of Goettingen, Germany; CEPR, United Kingdom; KOF Swiss Economic Institute, Switzerland (mail@axel-dreher.de). Postal address: University of Heidelberg, Alfred-Weber-Institute for Economics, Bergheimer Strasse 58, 69115 Heidelberg, Germany, phone: +49 6221 54 2921, fax: +49 6221 54 3649 (*corresponding author*).

[d] University of Zurich, Center for Comparative and International Studies (CIS), and State Secretariat for Economic Affairs (SECO), Switzerland (franziskaspoerri@gmx.ch). Postal address: Staatssekretariat für Wirtschaft SECO, Holzikofenweg 36, CH-3003 Bern, Switzerland.

1

**Abstract**

Aid fragmentation is widely recognized as being detrimental to development outcomes. We re-investigate the impact of fragmentation in the context of growth, bureaucratic policy, and education, focusing on a number of conceptually different indicators of fragmentation, and paying attention to potentially heterogeneous effects across countries, sectors, and channels of influence. Our systematic and detailed reexamination of existing empirical studies shows that this differentiation is crucial. In some sectors—such as primary education—donor concentration or limiting donor numbers appears to be detrimental rather than beneficial for development outcomes. In other areas, we find the expected negative effect, but only when we conceptualize fragmentation as a lack of lead donors (too limited concentration), rather than in terms of donor numbers. In all cases, sufficient initial administrative capacity in recipient countries prevents the negative and reinforces the positive effects of fragmentation. This stresses the importance of questioning the sweeping conclusions drawn by much of the previous literature. Based on what we currently know, generalizing judgements about the effect of aid fragmentation may be misleading.

**Highlights**

- Generalizing judgements about the effect of aid fragmentation can be misleading.

- While we observe a negative effect of fragmentation on growth, this effect depends on the lack of lead donors, rather than on the number of donors.

- In some sectors—such as primary education—donor fragmentation appears to be beneficial rather than detrimental for development outcomes.

- When the recipients' administrative capacity is sufficiently high, negative effects are prevented, and positive effects are reinforced.

## 1. Introduction

The academic literature widely recognizes aid fragmentation as a significant problem for effective development cooperation. With many donors and projects in a given country or sector, transaction costs should rise (Acharya, Fuzzo de Lima, and Moore 2006; Anderson 2012), developing country administrative capacities can be overburdened (Kanbur 2003; Roodman 2006), and administrations might be deprived of their best staff (Knack and Rahman 2007), so that aid supposedly becomes less effective in terms of its impact on economic development (Annen and Kosempel 2009; Djankov, Montalvo, and Reynal-Querol 2009; Kimura, Mori, and Sawada 2012).

To mitigate such problems, donors and recipients committed to reducing fragmentation in the Paris Declaration (PD) in 2005, the Accra Agenda for Action (AAA) in 2008, and the Busan Declaration in 2011. The consensus that fragmented aid is generally "bad" aid is, however, based on a surprisingly small number of systematic studies. These studies had a remarkable effect on development scientists and practitioners alike. Given the general fragility of results in the aid effectiveness literature (see Docouliagos 2016, Dreher et al. 2017), the unanimous acceptance of the principle "less is more" is surprising. It is also questioned by the recipients themselves (Eyben 2007: 642; OECD 2014: 27; Greenhill, Prizzon, and Rogerson 2016: 143). Our systematic reexamination—in much more detail than any previous study provides—will shed some light on the general results as well as on the specific conditions under which they may hold.

By providing this reexamination, we follow a turn in the more recent literature that tries to assess the effect of aid fragmentation in a more differentiated way. In a formal model,

Bourguignon and Platteau (2015) for instance emphasize the differences between the case in which donor and recipient preferences are aligned and the case in which they are not—with a particular focus on the recipients' potential to exploit the donors' generosity. In addition, authors now tend to consider a more complete picture by taking into account donor coordination (Pietschmann 2016: 2017), which is the focus of studies, e.g., by Steinwand (2015), Bigsten and Tengstam (2015) and Bourguignon and Platteau (2015) (for an earlier study, see Torsvik 2005). The concept of donor cooperation or harmonization is related to fragmentation in various ways, but even more difficult to operationalize in empirical studies (for a possible approximation, see Bigsten 2006, and Bigsten and Tengstam 2015). The collection of recent studies by Klingebiel, Mahn, and Negre (2016) provides multiple perspectives on the fragmentation of the aid system as a whole, including a balanced discussion of both costs and benefits, mostly on the basis of detailed case-study analyses.

The most recent traditional econometric study examining the effect of aid fragmentation is Kimura, Mori, and Sawada (2012). While focusing on the positive effect of donor concentration on aid effectiveness and, eventually, economic growth, an interesting remark at the end of the paper explains that their result holds only for countries receiving a sufficiently large amount of aid. The authors suggest that this may be due to the fact that there could also be some negative effect of concentration related to less competition or less peer monitoring among donors (Kimura, Mori, and Sawada 2012: 6). The authors' earlier discussion paper (Kimura, Sawada, and Mori 2007: 16) is even more explicit in this respect. For the specific case of fragile states, where aid inflows are often limited, Gutting and Steinwand (2015) also find a positive effect of higher donor numbers. Other authors show similar results in their regression tables, but do not discuss the issue due to their focus on the interaction term with aid rather than the

fragmentation variable itself (e.g., Djankov, Montalvo, and Reynal-Querol 2009: Tables 6, 7 and 8). Generally, this indicates that a greater degree of differentiation is required than the conclusions in most of these papers would suggest.

To provide this differentiation, we extend the work of Kimura, Mori, and Sawada (2012) in various ways: Based on theoretical considerations about plausible differences in the impact of fragmentation, we distinguish between (1) different indicators of fragmentation, (2) different aid outcomes, (3) different recipient country contexts, (4) different levels of donor alignment, (5) different time periods, and (6) different channels through which fragmentation could affect development in recipient countries.

Our main focus is on the distinction between different indicators of fragmentation (in Section 2). We show that they are conceptually different, notably due to the relationship between the effect of fragmentation and donor coordination, and the way donor coordination can be expected to work. In terms of outcome variables, we consider not only economic growth, but also school enrolment (since education is a sector which traditionally includes a particularly high number of donors), and bureaucratic quality (as many studies suggest that the overall negative effect of fragmentation is due to the strain it imposes on local administrations). To capture potentially important differences in recipient country characteristics, we further differentiate between their initial levels of administrative capacity. Regarding the alignment of donor preferences, we consider that common government ideology may facilitate coordination, even if the number of donors is high, thereby mitigating potential problems implied by fragmentation. Similarly, the distinction between different time periods may be relevant given that attempts to move towards greater coordination among

donors are fairly recent. Finally, we differentiate between the direct effect of fragmentation and the moderating effect of fragmentation via its interaction with the amount of aid received. Both of these are used in the extant literature, but they are never compared and the choice appears rather arbitrary so far.

In Section 3 we test econometrically whether there is a robust significant relation between these fragmentation indicators and the different potential aid outcomes—economic growth, school enrolment, and bureaucratic quality. We differ from Kimura, Mori, and Sawada (2012) in that we avoid to set up our own preferred estimation models. Rather, for each of our dependent variables, we replicate a well-known earlier study and add the different indicators of fragmentation. This strategy—also followed by Djankov, Montalvo, and Reynal-Querol (2009)—enables us to avoid any influence a discretionary choice of control variables and methods of estimation could have on the coefficient estimates related to fragmentation. In a nutshell, we find no robust pattern across our different specifications. While our results confirm that fragmentation negatively affects aid effectiveness with respect to growth, this effect is driven solely by recipients with low bureaucratic capacity, and by the lack of lead donors rather than by a multitude of small donors. In addition, sectoral differentiation is essential. We do not find any systematic effects on bureaucratic quality, and we even find significant positive effects in the education sector.

In our concluding Section 4 we argue that sweeping conclusions on the harmful effects of fragmentation should rather be avoided. We believe that the systematic and differentiated re-estimation of the relationship between fragmentation and development outcomes is relevant, not only from a scientific, but also from a policy perspective. Fragmentation indicators are

used in donor rankings, e.g., rankings by the OECD's Development Assistance Committee (DAC) or rankings by the Center for Global Development, and in DAC peer reviews, and can lead to substantial pressure to adjust aid allocation and to focus on only a few core recipients. Since the evidence we have is less robust than generally perceived, such pressures may be premature. In some cases, they might lead donors to unnecessarily give up aid relationships that could have been highly beneficial for the recipient.

## 2. Theoretical considerations

It is intuitively plausible that a growing number of intervening partners in development cooperation raises transaction costs and represents a burden on developing countries' administrative capacities. At the same time, a greater number of donors active in a country may bring up more innovative ideas, allow the recipient government to benefit from a variety of experiences, and put the recipient government in a more powerful position to take its own decisions, thereby enhancing ownership. Do the negative consequences of fragmentation always outweigh the benefits? If not, under which conditions does this happen? And which type of indicators best capture these effects? In the following, we provide some theoretical considerations in this respect.

### 2.1. Relevant context factors

Differences in the impact of fragmentation may be driven by differences in the countries or sectors to which aid is allocated as well as to differences in the way a given number of donors cooperates within this setting. We discuss these areas one by one, starting with possible sectoral differences reflected in different aid outcomes under consideration.

*2.1.1. Differentiating between aid outcomes*

It is well known that aid fragmentation varies considerably across sectors, with many more donors (and individual aid activities) in social sectors than in sectors such as economic infrastructure (Frot and Santiso 2010: 21-22; OECD 2009b: 45-52). In health and education, the average project is comparably small, in other areas such as industrial infrastructure or electricity generation, aid interventions are traditionally much larger.

As a consequence, the social sectors are often perceived as sectors in which the need to reduce fragmentation is particularly strong. However, it may also be the case that the natural project size in these sectors is smaller, and that recipient countries have developed strategies to deal with the multiplicity of small interventions so that the way they translate into transaction costs differs from other sectors. This is indeed what sector-specific interviews in Burkina Faso suggest (Dreher and Michaelowa 2010: 25-26). In fact, in some sectors, five donors may appear to be many, in others, 15 donors may be a number dealt with easily. Apart from differences driven by experience with typical project size and donor numbers, coordination of small projects or their insertion into a national sector level plan may be genuinely easier in some sectors than in others. If coordination is easy, fragmentation should not be too much of a concern. Difficulties for donor coordination can be expected primarily where the donors' own national interests such as trade or investment opportunities are concerned, i.e., notably in fields such as industry, infrastructure, or resource extraction. These problems should arise much less in sectors such as health or education.

We further consider that some areas should be more directly affected by fragmentation than others. As most of the negative effects of fragmentation are expected to arise due to increased

transaction costs imposed on the recipient country's government (e.g., Acharya, Fuzzo de Lima, and Moore 2006), the country's administration should be affected most directly. Other sectors as well as economic development as a whole may then suffer indirectly from the inefficiency of the overburdened bureaucracy.

In the empirical part of this study, we will try to capture the relevant differences between sectors by a corresponding differentiation in outcome variables. Given the above arguments on the transaction cost imposed on the recipient country administration, we would expect the most clearly detrimental effect of fragmentation on bureaucratic quality. Regarding other aid outcomes, we will distinguish between economic growth on the one hand, and primary school enrolment on the other, in order to contrast the role of fragmentation for aid in general with its role in the context of a social sector known for its traditionally high level of fragmentation. According to the above discussion, either of these areas could suffer more from fragmentation, so we leave this question to the empirical test.

### 2.1.2. Differentiating between recipients

Let us now turn to differences in recipient country characteristics. Various recipient characteristics could be relevant for the impact of fragmentation, notably the level of existing resources, the economic and geopolitical relevance for the donors, and administrative capacity. These factors are all related in that they provide the recipient with some strength vis-à-vis the donors, greater capacity to formulate its own policy, and a greater chance to get this policy respected and to rally the donors around this policy. Since we do not have the space to analyze each of these variables in detail, let us focus on administrative capacity for illustration.

A high-capacity government should be more confident about taking its own independent decision on how many and which donors to cooperate with in the first place. India, for instance, declared in 2003 that it would not accept any tied aid in the future, and that no more than a handful of bilateral donors would be welcome in the country anymore (Agrawal 2007: 4).

Furthermore, a high-capacity country should be able to handle a given number of donors more easily than a low-capacity country. In the former, appropriate management processes should be up and running and lower-level administrative staff should be enabled to carry out the day-to-day business, so that it is not left to the ministers and secretaries of state or other high-level politicians to welcome every donor mission. This reflects the situation we experienced when carrying out comparative case studies in Burkina Faso and Vietnam (Dreher and Michaelowa 2010). In Vietnam, a number of senior bureaucrats selected as potential interview partners indicated that they had better things to do than to talk to us about aid fragmentation. This may have been a highly efficient decision on their part. In addition, some Vietnamese officials directly stated that they did not regard the multitude of different donors as a disadvantage, but rather as an opportunity to collaborate with international partners, in terms of development cooperation and beyond.

Overall, the above arguments suggest that recipient countries with higher administrative capacity may be able to absorb (or to even benefit from) a degree of fragmentation that may be far too high for other aid recipients. The greater their administrative capacity, the less negative should be the effect of fragmentation.

## 2.1.3. Differentiating between donor cooperation styles

In addition to relevant differentiations related to country and sector characteristics, the effect of aid fragmentation cannot be duly examined without taking into account the different modes of delivery, including the degree of donor coordination (see also Aldasoro, Nunnenkamp, and Thiele 2010). When donors cooperate well with one another, so that they essentially speak with one voice, the number of donors involved should no more be of any concern for the recipient country. From this perspective, donor coordination could be a substitute for the concentration of aid flows. Unfortunately information on the degree of coordination is not directly available (Bingsten 2006: 89f.). However, there are more indirect measures that capture some of the related aspects. Bingsten and Tengstam (2015) for instance use program based aid (PBA) as an indicator. However, this category of aid—separately computed by the DAC since the mid-2000s—includes host country leadership as a defining criterion (OECD 2010). This is an advantage when it comes to measuring the overall alignment with the objectives of Paris, Accra and Busan (such as in Bingsten and Tengstam 2015), which do not only consider coordination among donors per se, but also the role of the recipient governments. However, including this into the definition when assessing the specific effect of fragmentation appears to be a disadvantage since one of the most strongly voiced concerns regarding donor concentration is precisely that the influence of the recipient may be significantly reduced. It then becomes difficult to disentangle the different effects.

Another indirect way to get at donor coordination should be to consider how close different donors are ideologically. As Dreher, Minaysan and Nunnenkamp (2015) find that the ideological distance between a donor and a recipient country can erode trust and complicate cooperation, the same could be true for coordination among the donors within a given host

country. Ideological alignment between donor preferences should improve their collaboration. Considering donor cooperation as a potential substitute for the concentration of aid flows, we hence expect that the negative effects of fragmentation are greater for recipient countries in which donors' preferences are less aligned.

Apart from a differentiation between host countries with a different degree of donor alignment, in the empirical part of this study, we will also consider a simple time split of the sample so as to take into account that significant efforts regarding donor cooperation have only taken place fairly recently. Clearly, this measure will, however, also capture the totality of potential effects of the Paris Agenda and even the effects of the end of the Cold War.

In addition, as we will show in the next section, the appropriate choice of the fragmentation indicator itself is not independent of the type of coordination expected between donors.

## 2.2. Different indicators of fragmentation and their implications

In addition to relevant differentiations related to country and sector characteristics, we should expect the choice of the fragmentation indicator itself to play a relevant role for the effects we are going to measure. This is because due to their computational properties each possible fragmentation indicator captures a different facet of what is usually conceived as "fragmentation." Some indicators primarily focus on the lack of lead donors—one or a few dominant donors who may become natural leaders and take over responsibility for the bulk of the coordination activities. Others focus on the sheer number of donors, or on marginal donors that provide only little financial support while adding to the overall number of development partners and, arguably, to the needs of coordination. Whether the lack of a lead

donor or the large number of small donors are more relevant for potential problems related to fragmentation depends on how cooperation concretely works among donors, and to what extent cooperation can mitigate problems related to fragmentation.[1] For this reason, the appropriate choice of the fragmentation indicator is directly related to the role of donor coordination, and different indicators should not be expected to show the same effects.

The most frequently used indicator in the academic literature is based on the Herfindahl index (see, e.g., Djankov, Montalvo, and Reynal-Querol 2009; Easterly 2007; Knack and Rahman 2007). It originally stems from the industrial organization literature, where it is used as a measure of the degree of competition among firms in an industry. In our case, it measures the probability that in two random draws of 1 USD from overall aid finance in a country (or sector), one would draw these two dollars from the same donor. Formally, the Herfindahl index (*HI*) can be expressed as:

$$HI = \sum_{i=1}^{N} \pi_i^2 \ ,$$

(1)

---

[1] See Steinwand (2015) for a detailed discussion of the relationship between fragmentation and coordination. He also introduces the concept of a lead donor, but with a focus on historical ties such as by the former colonizer, thereby inducing a specific form of aid ('private good aid') with often negative consequences for the recipient.

where $i=1,\ldots,N$ indicates the different donors, and $\pi_i$ indicates the share of donor $i$ in overall aid finance.[2] The Herfindahl index belongs to the larger group of concentration indices, which also include concentration ratios (*CR*). The latter simply add up the shares of a predefined number of largest donors.

$$CR(N) = \sum_{i=1}^{N} \pi_i \; .$$ (2)

For an analysis based on CR1—aid by the single largest donor as a percentage of total aid— see, e.g., Djankov, Montalvo, and Reynal-Querol (2009: 227). Concentration indices focus on the existence of one or a few large donors and indicate high fragmentation when no dominant donors exist. As opposed to the Herfindahl index, a shift in proportions among the preselected large donors does not alter concentration ratios. However, any change from other donors towards these large donors will do so. The first few big donors will be considered in concert. This index may therefore be useful if we consider that up to a small number of donors additional donors pose no problem, but may be even an advantage. We would then start counting fragmentation only when the number of donors exceeds this predefined threshold.

While high concentration has a negative notation in industrial organization, it has a positive notation when it comes to development assistance and is simply interpreted as the flipside of high fragmentation. This is reflected in the way in which the measure of fragmentation is

---

[2] To stress the relationship with the variance in the volume of aid flows across donors ($\sigma^2$) the Herfindahl index can also be reformulated as: $HI = N \cdot \sigma^2 + \dfrac{1}{N}$ . The higher the variance, the higher will be HI; for identical donor shares HI=1/N (Kimura, Mori, and Sawada 2012: 2).

computed. Based on either of the above measures of concentration, fragmentation indicators *(F)* are computed by subtracting the concentration index from one, i.e., *F(HI)=1-HI,* or *F(CR)=1-CR*. In our empirical analysis below, we include the fragmentation indices based on both HI and CR3. The decision to use CR3 rather than, say, CR4 is arbitrary, but since the conceptual idea is the same, we restrict the discussion to only one of these indicators.[3]

Compared to fragmentation measures using concentration indices, measures based on a simple count of donors (N) in a given country and year are more straightforward and easier to understand. The DAC has widely used the donor count either directly or in its refined form which only considers "non-significant" aid relationships (OECD 2009a; Ericsson and Steensen 2016). While it introduces a binary distinction between large and small donors, it neglects more precise information on the donors' relative shares.

Hence the existence of lead donors remains unconsidered, and the problem is conceived as being reflected in the multitude of those donors that want to be part of all discussions and decision-making processes without delivering any significant input. To ensure that the efforts of small donor countries with correspondingly small aid budgets do not appear as "non-significant" and hence potentially undesirably everywhere, "significance" is defined by the DAC not only as a share of the recipients' overall aid inflows, but also in relationship to the individual donor's average aid outflows (OECD 2011, pp. 5f.). We ignore the latter part of the definition here, as it arguably represents a concession necessary to make the indicator

---

[3]The correlations of CR3 with CR2 and CR4 are 0.982 and 0.991, respectively. As a consequence, our main results are unchanged when using CR2 or CR4.

acceptable within the donor community, and dilutes the conceptual idea of the indicator. To determine whether a donor's contribution is "significant" for the recipient country, the DAC considers whether the donor is among the largest donors that cumulatively account for at least 90% of aid inflows. We denote the remaining number of donors, i.e., the number of donors that are not significant according to this definition, as N(<10%). We will refer to this measure as the "number of small donors" whereby "small" is defined with respect to aid to a specific recipient or sector independently of the total aid budget of the donor agency.

Apart from measures based on concentration ratios and donor counts, some authors have suggested the use of inequality measures such as the Theil index (Acharya, Fuzzo de Lima, and Moore 2006; Fløgstad and Hagen 2016). The latter has the advantage of being decomposable, so that the variance between donors can be compared to the variance within donors (e.g., regarding the sectoral spread as in Fløgstad and Hagen 2016). However, like other inequality measures such as the coefficient of variation or the Gini coefficient, the Theil index does not vary with a change in population size (here the number of donors) as long as all proportions remain the same. In terms of inequality, whether two donors provide 50% each or ten donors provide 10% each does not matter—in both cases the Theil index or the Gini coefficient will be zero because proportions are equal. This is a central characteristic that distinguishes inequality measures from measures of concentration (Ray 1998: 184-192), and makes inequality measures less suitable for the measurement of fragmentation.

For our analysis, the Herfindahl index and the concentration ratio for a reasonable number of key donors, as well as the two measures of donor counts appear to be theoretically plausible. However, as already mentioned above, they reflect different types of potential problems as

they give different weights to donors at the high end and the low end of the aid distribution. The DAC index places greater emphasis to donors at the low end of the distribution. In contrast, the Herfindahl index and the CR3 value the existence of a few dominant donors and do not (or only marginally) consider the addition of small donors at the tail of the distribution.[4] The latter would be appropriate if, for instance, small donors tended to align themselves more easily with existing procedures or even used delegated cooperation, thus adding very little to existing transaction costs (Dreher and Michaelowa 2010: 23). The former would be appropriate if, even for such small donors, transaction costs for the recipients remain high or at least too high in relation to the donors' small contributions.


Figure 1 about here

Table 1 about here

Figure 2 about here


We illustrate these differences between the indicators in Figure 1, which provides maps for the most recent period for which data were available (2010-2013). It is noticeable that some countries like Brazil or India completely change their positions from the lowest to the highest end of the country ranking, depending on the indicator used. Table 1 and Figure 2 provide additional descriptive statistics as well as bivariate correlations for each indicator and for the

---

[4] Note that when adding a small donor, the concentration ratio will generally not remain fully unchanged, but change to the extent that this small donor reduces the share of the large donors within the overall aid flows to the recipient country. It will only remain completely unchanged if new small donors just happen to balance out reductions in the flows by other small donors.

whole sample period. During the periods observed, the average number of donors in the different recipient countries varies between 7.67 and 47 (decimals due to averaging over 4-year periods). As expected, the bivariate correlation coefficient between the two indices based on concentration measures is rather high (rho=87%), as is the one between the two DAC indices N(<10%) and N (rho=94%). The latter indicates that the overall number of donors is largely driven by the number of small donors.

The correlation across these two groups of indicators is much smaller, and never exceeds 42%. For N(<10%), the correlation is smallest with rho=9% and rho=11% for F(HI) and F(CR3) respectively. This implies that a strong dominance of a few big donors can coincide with numerous activities of multiple small donors. Whether the activity of small donors as such is a problem, or whether it is the lack of dominant lead donors (or neither of the two) hence appears to be an important question to be examined.

The key additional information in Figure 2 is the distribution of the data. For the Herfindahl-based fragmentation index, the distribution appears quite skewed due to outliers with an unusually high donor concentration. This is due to some cases with just one or two extremely large lead donors since all other indicators including F(CR3) show a much more balanced distribution. The other indicators are more normally distributed and exhibit no clear outliers.

Figure 3 finally shows that whatever indicator we choose, we observe a considerable increase in fragmentation since the early 1970s. Noticeably, there has not been any reduction after the Paris Agreement in 2005, either.

Figure 3 about here

## 2.3. Different channels for the influence of fragmentation

Apart from the different contexts and indicators that should have an impact on the results we obtain for the effect of fragmentation, the way in which the effect of fragmentation is modelled should also be relevant. In the extant literature, two distinct models can be observed. In the first case, fragmentation is considered to directly affect the outcome variables, e.g., growth or bureaucratic quality (direct channel) (e.g., Knack and Rahman 2006). In the second, fragmentation is considered not by itself, but as having a negative effect on the effectiveness of aid (moderating channel) (e.g., Djankov, Montalvo, and Reynal-Querol 2009). While the corresponding analysis refers to something rather different, the choice of one of these channels over the other has never been discussed in any paper we are aware of. While the distinction obviously collapses for developing countries not receiving any aid, it is important in all other cases.

Modelling the direct channel supposes that there could be a (negative or positive) effect of fragmentation independently of the amount and consequences of aid given. Even if recipients wasted all money flowing in the country, or used it only for consumtive purposes, they might benefit from the exchange with different donor agencies present in the country. Indeed, some recipients seem to make use of the international contacts established in the field of development cooperation for other purposes, e.g., in the areas of international trade and foreign direct investment, so that there could be an effect on growth independently of the amount of aid received (Dreher and Michaelowa 2010: 28-31). Other scholars also report about recipient country officials stating a preference for new additional donors, rather than more

funding from the existing ones (Tatrallyay and Stadelmann 2011). In these situations, clearly, fragmentation in itself is seen as a valuable asset, independently of the amount of aid.

Similar examples can be found for a negative direct effect of fragmentation. This is what Knack and Rahman (2006) have in mind in their paper: Independently of the effect of aid itself, their model suggests a negative effect of each additional donor on the functioning of local bureaucracies. This could happen, for instance, if donors poach key advisors from the government or private sector, or if they give conflicting advice.

In contrast, the moderating channel ignores any effects other than through aid. Hence the focus is on the effect of aid on diverse outcome variables, and on how this effect is in turn altered by donor fragmentation. Econometrically, this leads to the focus on the interaction term between aid and fragmentation while the modelling of the direct channel examines the marginal effect of fragmentation instead. In our empirical analysis, we will present both perspectives, but focus on the moderating channel, which has been more frequently examined in the extant literature.

## 3. The effect of fragmentation on aid outcomes

After some general information on data and methods, this section presents the empirical results for the relationship between fragmentation and the different outcome variables growth, bureaucratic quality, and primary enrolment, for both the direct and the moderating channel, and for the different contexts discussed above.

### 3.1. Data and methods

As mentioned above, our intention in the econometric part is to provide a maximum of comparability with widely accepted existing studies. There is hence no subjective adjustment of the original studies in order to obtain a regression specification with better fit (or any other reason). With respect to the relationship between aid and growth, we replicate the study by Burnside and Dollar (2000), based on the permutations in Clemens et al. (2012). Our benchmark regression uses Clemens et al.'s preferred specification—dismissing invalid instruments, differencing the regression equation (or, equivalent in expectation, using country fixed effects), including period fixed effects, and clustering standard errors at the country level. Following Clemens et al., we also lag aid by one period, so that aid can more reasonably be expected to cause growth rather than being its effect. Our model hence corresponds to the Clemens et al. specification and only adds the fragmentation indicator (equally lagged by one period) and its interaction with aid, and data for more recent years.[5] With respect to the relationship of aid to bureaucratic quality, we base our analysis on Knack and Rahman (2007). And finally, with respect to aid effectiveness in the education sector, we follow the analyses by Michaelowa and Weber (2007) and Dreher, Thiele, and Nunnenkamp (2008), based on the update by Birchler and Michaelowa (2016).

Since the regressions for growth, bureaucratic quality, and education correspond to the original specifications of the different authors, they differ with respect to controls, estimation

---

[5] There is one minor difference requested by a referee, namely the omission of Burnside and Dollar's index of economic policy that considerably reduces the available number of observations. Since the index is always insignificant, this does not change any of the results. For the exact replication of Clemens et al. (2013) including economic policy (and also with respect to the time period covered by them), see the discussion paper version of this article (Gehring et al. 2015).

methods, and time periods covered, and are thus difficult to compare to each other. As suggested by a reviewer, we hence provide additional specifications, in which all data are updated to the most recent year available (i.e., until 2013), and all models based on the specification by Clemens et al. (2013) outlined above. The tables presented in the main text all refer to these specifications with fixed effects, lagged aid, a common set of control variables, and coverage of all available years until 2013. The original models are presented in the appendix. To reduce clutter, we do not present the coefficients for the control variables, but list the variables included in each model with their definitions, descriptive statistics, and sources in Table A1 in the appendix.[6]

For both the aid variable and our computation of the aid fragmentation indices, we use data for Official Development Assistance (ODA) from the OECD/DAC's (2016) Creditor Reporting System (CRS). Following the traditions of the aid effectiveness literature, we use disbursements rather than commitments because only funds that are disbursed can be expected to become effective in terms of development outcomes.

Since not all types of ODA can be expected to have a direct impact on growth, some of the regressions in Clemens et al. (2012) are based on what they call "early-impact aid," in order to improve the precision of the estimated effect of aid. As our primary intention is to estimate the

---

[6] Full regression results are available on request.

relationship with fragmentation rather than the effect of aid, however, it appears relevant in our context to capture aid flows in their entirety.[7]

There is only one part of aid that we would ideally want to exclude from the computation of fragmentation indicators—the part of aid that does not flow to recipient countries such as financial support for students and refugees in donor countries, debt relief, and administrative costs for donor agencies (see also Mürle 2007). To do so, the OECD (2009a) suggests the use of Country Programmable Aid (CPA). However, CPA data are only available for the most recent decade, so that their use would have greatly reduced the number of observations for our analysis. This problem is aggravated in the present analytical setting as sensible panel regressions in models with large fluctuations in the dependent variable (such as growth) and/ or very limited change in the explanatory variables (aid disbursements and fractionalization) need to combine the information over several years by taking averages. Following the above-mentioned econometric studies, we therefore accept the lack of precision in the ODA data in order to obtain longer time-series.

We do not claim to necessarily estimate causal effects of aid and fragmentation with the regressions in this paper. However, readers who are convinced by the identification strategies in the existing papers replicated here can confidently interpret the results of our paper as

---

[7] Furthermore, early-impact aid has been shown not to be a robust predictor of growth (Rajan and Subramanian 2008; Bjørnskov 2013), and to not differ in effectiveness compared to all aid (Roodman 2015). A major drawback with this measure is that disaggregated aid disbursements are not available for the entire period, so that disbursements have to be estimated based on commitments. Data on commitments in the earlier periods also suffer from severe underreporting (see OECD/DAC 2014).

causal effects as well. It should also be noted that, even if the main effects of aid and fragmentation cannot be interpreted as causal, the endogeneity problem does not need to extend to the interaction between these variables. The respective coefficient, which is at the center of our interest here, is biased only if the change in the effect of aid that comes about through changes in fragmentation is affected by omitted variables or reverse causality (after controlling for the main effects and all other variables in the model). The conditions under which this is true are different from and somewhat weaker than the assumptions that need to hold for the exogeneity of the main effects. The relevant conditions are usually met, in particular, when at least one of the two interacted variables is exogenous (for a detailed discussion, see Appendix S4 in Dreher, Eichenauer and Gehring 2016).

While most authors consider aid as endogenous, we are not aware of any studies discussing potential endogeneity problems of fragmentation. However, one might, for instance, imagine that there could be some reverse causality, with growth, bureaucratic quality, and functioning education, influencing the number of donors providing aid. To provide a plausibility check for this eventuality, Table A2 in the appendix shows the results of a regression of the different fragmentation indices on various lags of our three outcome variables. Only three out of 32 coefficients are significant at conventional levels, indicating no systematic trends. This increases our confidence that fragmentation in a specific country and year is not endogenous to our outcome variables or at least not to a significant extent.

None of the studies in the aid fragmentation literature can claim to avoid any remaining risk of endogeneity.[8] GMM estimation, which until a few years ago was widely considered as providing suitable internal instruments, has now been demonstrated to be no solution to such problems. Bazzi and Clemens (2013) point out that testing the power of (internal) instruments in GMM-type regressions is as important as in any instrumental variables setting. Still, tests for instrument power in GMM-type models are rarely reported, leaving substantial doubts about the reliability of these studies' results. Equally important are the difficulties with respect to the exclusion restriction. Using lagged values (in differences or levels) of aid to instrument current aid implies the exclusion restriction that past levels of aid affect contemporaneous growth exclusively via current aid. Given the various lags involved for aid to potentially affect growth this assumption seems as strict as simply assuming that aid affects (or does not affect) growth. Similarly, past levels of fragmentation could affect growth as easily as contemporaneous fragmentation. For example, high fragmentation when planning a project or designing a sector-specific aid strategy can affect growth many years later, even holding fragmentation at the later point in time constant. The same problems arise when bureaucratic quality or educational enrolment rather than growth are used as dependent variables.

---

[8] See Dreher and Langlotz (2015), Dreher and Lohmann (2015), and Galiani et al. (2017) for recent attempts to identify causal effects of aid on growth (but with no reference to fragmentation).

**3.2. The effect of aid fragmentation on growth**

Table 2 presents our results for the growth rate of real GDP per capita based on Clemens et al. (2012) as described above.[9] The interaction term between aid and fragmentation is significant, negative, and sizeable for F(HI) and F(CR3) suggesting that the largest possible increase in fragmentation from 0 to 1 would reduce the effect of aid on growth by more than half a percentage point (columns 2 and 3). Within our sample, the marginal effect of aid at low fragmentation (20th percentile) is more than twice as high as for high fragmentation (80th percentile). For the other two indicators–N and N(<10%)–these differences are smaller and not significant at conventional levels (columns 3 and 4). When reproducing the analysis with a further interaction between fragmentation with aid squared (appendix, Table A3) the contrast between the two sets of fragmentation indicators becomes even clearer. Arguably, if the relationship between aid and growth is conditioned on fragmentation, the whole relationship is conditioned, and not merely its linear component. In this more complete specification, fragmentation computed on the basis of the two concentration indices shows a similarly negative effect on aid effectiveness as before. In contrast, fragmentation as measured by the count of donors does not seem to make any difference for aid effectiveness (column 3) or to even influence aid effectiveness positively (column 4). In fact, for both of these indicators, aid becomes positively significant only at higher levels of fragmentation. Small additional donors may adjust and at the same time provide more ideas that are beneficial for aid effectiveness as

---

[9] The regression we build upon is presented by Clemens et al. (2012) in Table 7, column 7. The data are updated for the 2006-2013 period using the World Development Indicators and OECD DAC. Note that differences as compared to the analysis in our discussion paper (Gehring et al. 2015) are primarily driven by the longer time series used here, and the corresponding changes in our sample as well as the greater precision of all point estimates.

a whole. However, since the effects for N and N(<10%) are far from robust, we should not be too quick with any such interpretation. What is clear from both tables is only the difference between the two sets of indicators. Substantially, these results suggest that any negative effect fragmentation may have, is driven by the lack of lead donors, rather than by the sheer number of donors or an exceedingly high number of small donors.

Table 2 about here

While we hence find partial evidence for a moderating effect of fragmentation on the effect of aid, the direct effect of fragmentation (for aid at the median) is not significant anywhere. This confirms the necessity to examine the direct and moderating effects separately, and to highlight the differences between them.

On the basis of the specification in Table 2, we further proceed by splitting the sample with respect to bureaucratic quality, donor alignment, and the time period covered by the data. In each case, the sample is divided at the $50^{th}$ percentile. Bureaucratic quality is measured based on the International Country Risk Guide (PRS Group 2013), while donor alignment is measured via the standard deviation of donor ideology on a left to right scale using the chief executive party orientation from the database of political institutions (Cruz, Keefer, and Scartascini 2016). The latter corresponds to the operationalization used by Dreher, Minasyan, and Nunnenkamp (2015) for their comparison of donor and recipient ideology.

Table 3 presents the results. While it restricts the presentation to the coefficients of the most relevant variable, namely the interaction term between aid and fragmentation, the coefficients

for all variables related to aid and fragmentation are presented in Table A4 in the appendix. Furthermore, Table 3 provides the p-value for a Wald test of the equality of means for each of the two groups compared. The Wald tests are obtained using Seemingly Unrelated Regression Estimation (SURE), which allows the error terms of different regressions to be related via a joint variance-covariance matrix.

There is clear evidence for the relevance of this differentiation. Only in countries with low bureaucratic quality do we observe the previously discussed negative influence of fragmentation on aid effectiveness; in this subset of recipient countries, however, the interaction terms with F(HI) and F(CR3) are very high. It is thus this subset of countries that drives the overall effect reported above.

In contrast, the differentiations with respect to political alignment and time periods do not show any consistent patterns. There is hence no statistical support for the expectation that ideological closeness between donors or coordination efforts in later years may mitigate the problems related to fragmentation.

Table 3 about here

Taken together, the evidence examined so far does not reveal any general effect of fragmentation. Yet, our results suggest that fragmentation reduces aid effectiveness in recipient countries with low levels of administrative capacity. In the latter case, especially the lack of strong lead donors appears to be detrimental to growth. In contrast, the number of donors does not seem to play a major role.

### 3.3. The effect of aid fragmentation on bureaucratic quality

To assess whether we find similar results for different outcome variables we next turn to bureaucratic quality. As mentioned before, this is the area in which fragmentation is usually expected to have the most immediate negative effect. The reason is that the transaction costs supposedly induced by fragmentation should primarily hit the overburdened recipient country's bureaucracy in charge of coordinating the different aid inflows and donor demands.

Knack and Rahman's (2007) influential and widely cited original study focuses on the theoretical links between fragmentation and bureaucratic quality while the empirical testing is less comprehensive. In a simple cross-sectional analysis they then estimate how average donor fragmentation over the 1980s and 1990s relates to bureaucratic quality in 2001.[10] While the study is known for the evidence it provides on the negative effect of fragmentation, the careful reader notices that the authors differentiate, and do not claim such an effect for all countries. Indeed they state that for many recipients—those receiving little aid, which are typically also the wealthier ones with better administrations—there is little reason to expect a detrimental effect of fragmentation (Knack and Rahman 2007: 190). They thereby focus on the direct effect of fragmentation and do not analyze the interaction term with aid.

---

[10] Knack and Rahman separately discuss results for aid volumes and project numbers. As discussed in Knack and Rahman (2007: 186f.), but also, for instance, in Kilby (2011) and Dreher and Michaelowa (2010), measuring project level fragmentation has several advantages, but also disadvantages, notably the severely reduced data availability for early years. In line with the discussion of the growth regression above, we only consider aid volumes here.

When replicating their cross-section results for the full set of recipients while adding an interaction term with aid in order to also examine the moderating effect of fragmentation (see Table A6 in the appendix),[11] we confirm that the general results do not appear robust. While the marginal effect of fragmentation is always negative, it is significant only when using the total number of donors as the indicator of fragmentation (column 3). Similarly, the interaction term is negative throughout, but significant only in the third column. Yet, in Knack and Rahman's cross sectional setting, when fragmentation is very high, the marginal effect of aid on bureaucratic quality almost always becomes significantly negative, while this is not the case at low levels of fragmentation. This lends some empirical support to the negative effect of fragmentation.

However, when adding additional data and adjusting the specification to the model in Table 2—thereby transforming the cross-sectional analysis into a fixed effects panel model—any evidence for such an effect completely disappears (see Table 4). The interaction term is never statistically significant and varies in sign. Correspondingly, the marginal effect of aid does not depend on the level of fragmentation (in fact, it remains insignificant throughout). The direct effect of fragmentation at median aid is even positively significant in one regression (column 2) and insignificant otherwise.[12]

---

[11] The replication is based on Knack and Rahman (2007, Table 1, equation 1).

[12] We again reproduced the regressions including an interaction of fragmentation with aid squared (not shown). This did not change our results.

The sample split presented in Table 5 does not identify any negative effect of fragmentation either.[13] Just as for the case of growth, we observe a difference between recipients with different levels of administrative capacity, and this difference is significant for both F(HI) and F(CR3). However, even for the sub-sample of recipients with low bureaucratic quality, the interaction term between aid and fragmentation is never significant at conventional levels.

As before, we find no consistent pattern for the other two differentiations. We obtain a number of significant interaction terms for the period prior to 1994 (with values that are significantly different from those for the later period), but the signs of the estimators point in opposing directions. While we did expect that different fragmentation indicators would show different effects, these virtually opposite effects appear rather puzzling.

In summary, while the results based on the initial sample and cross-sectional specification by Knack and Rahman (2007) show some—albeit not robust—evidence for a negative effect of fragmentation, both directly and in a moderating function through a negative influence of the effect of aid, these results do not hold in our panel models. Thus right in the area in which

[13] See also Table A5 in the appendix for the presentation of all main effects. For the regressions of Table A6, we do not reproduce the sample splits given that the original analysis is at the cross-sectional level using country data averaged over almost 20 years. Using such long-term averages to define the sub-samples does not appear useful, especially for those recipients that developed significantly over time. In addition, sub-samples would become very small since the full sample only includes 83 observations to begin with.

scholars usually expect the most direct negative effect of fragmentation, results are ambiguous and difficult to reconcile with theoretical expectations. There is no systematic effect on bureaucratic quality, no matter which perspective we adopt to measure fragmentation.

**3.4. The effect of aid fragmentation on education**

The education sector is one of the social sectors which were characterized above as typically accommodating for a much higher number of donors than other sectors. According to Frot and Santiso (2010: 22) the education sector is the most fragmented of all sectors. We are thus interested to test what effect fragmentation has on outcomes in this sector, and how it affects the relationship between aid and educational outcomes. The first studies investigating the effectiveness of education aid were Michaelowa and Weber (2007) and Dreher, Thiele, and Nunnenkamp (2008). Both studies find a generally positive relationship between aid and primary school enrolment, albeit their interpretation somewhat differs with respect to the size and robustness of the effect. In a recent update, Birchler and Michaelowa (2016) confirm these results based on the more comprehensive sectoral DAC disbursement data now available. In their Table 1, regression 2, Birchler and Michaelowa (2016: 40) use a regression specification of aid on education similar to the work of Clemens et al. (2012), and hence most easily comparable to the analysis in section 3.2. The dependent variable is the net primary enrolment rate (in %). Tables A8-A10 in the appendix are based on the original specification, with data covering the 1996-2010 period, aggregated to three periods over five years each, only adding the variables related to fragmentation. Tables 6 and 7 below present the results with further updated data and the specifications in analogy to those in Table 2 for the growth regressions.

Table 6 about here

The outcomes for this sector are clear: There is no evidence for a negative effect of fragmentation. If at all, fragmentation seems to have a positive effect on education. In Table 6, the interaction term between education aid and fragmentation is always positive, and significant in three out of four regressions. In all four regressions, aid is positively significant for high levels of fragmentation, while it is mostly insignificant with a lower point estimate of the marginal effect at low levels of fragmentation. It seems that greater donor fragmentation hence increases rather than decreases aid effectiveness in the education sector.

There is no evidence for a direct effect of fragmentation on educational enrolment either. Fragmentation at median aid is mostly insignificant, and in one case even positively significant. Clearly, this evidence points towards a positive, rather than a negative effect of fragmentation.[14]

A skeptical reader might argue that the positive results for fragmentation could be an artifact of a potentially misspecified regression (using the set-up and the variables of the Burnside-Dollar model for education). However, the corresponding Table A8 in the appendix, which is based on the original specification, points in the same direction, although less strikingly so.

---

[14] Following the advice of a reviewer, we also tested whether our results are robust to replacing aid disbursements with commitments. Based on the specification of Table 6, Table A11 in the appendix shows substantially the same results. Note that we again also reproduced the regressions including an interaction of fragmentation with aid squared (not shown). This did not change our results.

Table 7 shows the break down by bureaucratic quality and donor alignment. (The split into the period before and after 1994 is not possible due to limited data availability for education aid and the correspondingly shorter overall time series.) Once more, the sample split confirms the relevance of bureaucratic quality. For three out of our four fragmentation indicators, the interaction term is significantly lower in the sub-sample of recipients with poor administrative capacity. While fragmentation appears to be rather positive for the education sector overall, this effect is driven by those countries with better bureaucratic quality. In the comparison group, the interaction term is always insignificant. As opposed to bureaucratic quality, political alignment between donors does not seem to have any relevant effect.

Table 7 about here

As before, Table 7 is reproduced in the appendix with some more information regarding the coefficients of the other relevant variables (Table A7). The appendix also shows a replication of the sample split based on the original data (Tables A9 and A10). The main message is that there is no evidence for a negative effect of fragmentation in the education sector, whatever the sample split and the fragmentation indicator selected.

This suggests that education may indeed be a field where neither the lack of lead donors, nor the overall number of donors negatively affect outcomes—possibly because there is enough experience with high donor numbers in the sector (which also include multiple NGOs not even included in the discussion here), and hence the government authorities may have grown used to take over a stronger leadership position in this sector than elsewhere. The relevant

coordinating framework may be in place. In this case, more donors can simply add new ideas with positive rather than negative consequences for educational outcomes.

Overall, these results support our earlier skeptical and cautious conclusions: There is no systematic pattern that supports a generally negative effect of fragmentation, and the results differ depending on the sector, the specific country context, the choice of the respective indicator, and on whether we consider the direct or the moderating channel. Generally, the moderating channel seems to dominate, i.e., there is little evidence for any direct effects, but there is some evidence for a conditioning effect of fragmentation on aid effectiveness. This effect is significantly negative when we look at economic growth, but only when conceiving fragmentation primarily as a lack of lead donors. Noticeably, the negative relationship does not hold for recipients above a certain level of administrative capacity.

The effect of fragmentation is largely insignificant when looking at bureaucratic quality rather than growth. No systematic pattern can be observed apart from the fact that again, initial administrative capacity seems to play some role.

In the education sector, we tend to observe a positive rather than a negative relationship between fragmentation and aid effectiveness, independently of the indicator used. The general features of this sector are very different from other sectors such as economic infrastructure or administrative capacity building, and this apparently finds its reflection in a greater capacity of recipient countries to deal with fragmented donor structures in an appropriate way. As before, initial bureaucratic quality is important, however: The positive effect of fragmentation does not emerge when bureaucratic quality is low.

In sum, this implies that with the evidence currently available generalizing statements on the negative effect of fragmentation appear problematic. We need greater differentiation and a more detailed analysis before we can safely draw firm conclusions.

## 4. Conclusions

This paper set out to question the apparent consensus that fragmented aid is generally "bad" aid. Our systematic and detailed reexamination of the literature shows that theoretically, we should expect differences related to (i) the different concepts of fragmentation when using different indicators, (ii) the different recipient country contexts, (iii) the different outcomes under consideration, and (iv) the channels considered for fragmentation to affect these outcomes (directly or via reduced aid effectiveness). The relevance of this differentiation finds clear support in our empirical analysis.

At the example of the education sector, we show that a reduction of fragmentation (i.e., a decrease in donor numbers or an increase in donor concentration) can have a negative effect. We conjecture that education is an area in which recipient governments have anyway acquired long-term experience in coordinating multiple interventions that include a large number of actors—even beyond the bi- and multilateral donors considered here.

The evidence in the education sector contrasts with the evidence in other areas: Our evidence on economic growth largely confirms the standard expectations of a negative effect of fragmentation on aid effectiveness. However, we find significant effects only when we

conceptualize fragmentation as a lack of concentration (no lead donors). Regarding bureaucratic quality, we do not find any systematic effect of donor fragmentation.

In all these cases, initial administrative capacity matters. The effect of fragmentation on aid effectiveness is generally less positive (or more negative) for recipient countries with low bureaucratic quality. The positive effects of fragmentation that we observe (i.e., with respect to education) are driven by the subset of recipients with high bureaucratic quality, while negative effects (i.e., with respect to growth) are driven by the subset of recipients with low bureaucratic quality. In the respective comparison group, the effect of fragmentation is generally insignificant.

Overall, we conclude that the generally expected negative effect of fragmentation is less robust than commonly assumed. Given the theoretically relevant differentiations outlined above, this should not come as a surprise. In any case, the differences we observe and the lack of a systematic overall pattern should lead us to a more cautious interpretation of the available evidence. Based on the evidence presented in this paper, any generalizing judgements about the effect of aid fragmentation may be misleading.

# References

Acharya, A., Fuzzo de Lima, A. T., & Moore, M. (2006). Proliferation and Fragmentation: Transaction Costs and the Value of Aid. *Journal of Development Studies, 42*(1), 1-21.

Agrawal, S. (2007). *Emerging Donors in International Development Assistance: The India Case*. International Development Research Center, Ottawa.

Aldasoro, I., Nunnenkamp P., & Thiele, R. (2010). Less Aid Proliferation and More Donor Coordination? The Wide Gap Between Words and Deeds. *Journal of International Development,* 22(7), 920-940.

Anderson, E. ( 2012). Aid Fragmentation and Donor Transaction Costs. *Economics Letters, 117*(3), 799-802.

Anderson, T. W., & Hsiao, C. (1982). Formulation and Estimation of Dynamic Models Using Panel Data. *Journal of Econometrics, 18*(1), 47-82.

Annen, K., & Kosempel, S. (2009). Foreign Aid, Donor Fragmentation, and Economic Growth. *The B.E. Journal of Macroeconomics, 9*(1), 1-30.

Banks, A. S., & Wilson, K. A. (2007 & 2014). *Cross-National Time-Series Data Archive*, Databanks International, Jerusalem.

Bazzi, S. & Clemens, M. (2013). Blunt Instruments: Avoiding Common Pitfalls in Identifying the Causes of Economic Growth. *American Economic Journal: Macroeconomics*, 5(2), 152-86.

Bigsten, A. ( 2006). Coordination et Utilisations des Aides. *Revue d'économie du Développement, 20*(2), 77-103.

Bigsten, A., & Tengstam, S. (2015). International Coordination and the Effectiveness of Aid. *World Development, 69*, 75-85.

Birchler, K., & Michaelowa, K. (2016). Making Aid Work for Education in Developing Countries: An Analysis of Aid Effectiveness for Primary Education Coverage and Quality. *International Journal of Educational Development*, 48, 37-52.

Bjørnskov, C. (2013). *Types of Foreign Aid*. University of Aarhus: Economic Working Paper No. 2013/08.

Bourguignon, F., & Platteau, J.-P. (2015). The Hard Challenge of Aid Coordination. *World Development, 69*, 86-97.

Burnside, C., & Dollar, D. (2000). Aid, Policies and Growth. *American Economic Review, 90*(4), 847-868.

Clemens, M. A., Radelet, S., Bhavnani, R. R., & Bazzi, S. (2012). Counting Chickens When They Hatch: Timing and the Effects of Aid on Growth. *Economic Journal, 122*(561), 590-617.

Cruz, C., Keefer, P., & Scartascini, C. (2016). *Database of Political Institutions Codebook, 2015 Update*. Inter-American Development Bank. [updated version of Beck, T., Clarke, G., Groff, A., Keefer, P., & Walsh, P. (2001). New Tools in Comparative Political Economy: The Database of Political Institutions. *World Bank Economic Review,* 15:1, 165-176].

Djankov, S., Montalvo, J. & and Reynal-Querol, M. (2009). Aid with Multiple Personalities. *Journal of Comparative Economics, 37*(2), 217-229.

Doucouliagos, H. (2016). The Politics of International Aid. In: R. Congleton, B. Grofman, & S. Voigt (Eds.), *Oxford Handbook of Public Choice* (forthcoming). Oxford: Oxford University Press.

Dreher, A., Eichenauer, V., & Gehring, K. (2016). Geopolitics, Aid, and Growth: the Impact of UN Security Council Membership on the Effectiveness of Aid. *World Bank Economic Review,* forthcoming.

Dreher, A., Lang, V., & Ziaja, S. (2017). *Foreign Aid in Areas of Limited Statehood*, CESifo Working Paper 6340.

Dreher, A., & Langlotz, S. (2015). *Aid and Growth. New Evidence Using an Excludable Instrument.* University of Heidelberg: CEPR Discussion Paper No. 10811.

Dreher, A., & Lohmann, S. (2015). Aid and Growth at the Regional Level. *Oxford Review of Economic Policy, 31*, 420-446.

Dreher, A., & Michaelowa, K. (2010). *Methodology to Measure Progress Towards In-Country Division of Labor*. Göttingen, & Zürich: Study on behalf of GTZ, Final Report.

Dreher, A., Minasyan, A., & Nunnenkamp, P. (2015). Government Ideology in Donor and Recipient Countries: Does Political Proximity Matter for the Effectiveness of Aid? *European Economic Review, 79*, 80-92.

Dreher, A., Thiele, R. & Nunnenkamp, P. (2008). Does Aid for Education Educate Children? Evidence From Panel Data. *World Bank Economic Review, 22*(2), 291-314.

Easterly, W. (2007). Are Aid Agencies Improving? *Economic Policy, 22*(52), 633-678.

Easterly, W., & Levine, R. (1997). Africa's Growth Tragedy: Policies and Ethnic Divisions. *Quarterly Journal of Economics, 112*(4), 1203-1250.

Ericsson, F., & Steensen, S. (2016). Measuring Fragmentation: The Financial Significance of Aid Relations. In: S. Klingebiel, T. Mahn, & M. Negre (Eds.), *The Fragmentation of Aid: Concepts, Measurements and Implications for Development Cooperation* (21-32). London: Palgrave Macmillan.

Eyben, R. (2007). Harmonisation: How Is the Orchestra Conducted? *Development in Practice*, 17(4/5), 640-646.

Fløgstad, C., & Hagen, R. J. (2016). *Aid Dispersion: Measurement in Principle and Practice*. Mimeo, University of Bergen.

Freedom House (2011). *Freedom in the World 2011*. Retrieved September 14, 2015, from https://freedomhouse.org/report/freedom-world/freedom-world-2011.

Frot, E., & Santiso, J. (2010). *Crushed Aid: Fragmentation in Sectoral Aid*. Paris: OECD Development Centre Working Paper No. 284.

Galiani, S., Knack, S., Xu, L., & Zou, B. (2017). The Effect of Aid on Growth: Evidence From a Quasi-Experiment. *Journal of Economic Growth 22(1)*, 1-33.

Gehring, K., Michaelowa, K., Dreher, A., & Spörri, F. (2015). *Do We Know What We Think We Know? Aid Fragmentation and Effectiveness Revisited*. Courant Research Centre Discussion Paper No. 185. University of Göttingen.

Greenhill, R., Prizzon, A., & Rogerson, A. (2016). The Age of Choice: Developing Countries in the New Aid Landscape. In S. Klingebiel, T. Mahn, & M. Negre (Eds.), *The Fragmentation of Aid: Concepts, Measurements and Implications for Development Cooperation* (137-152). London: Palgrave Macmillan.

Gutting, R., & Steinwand, M. (2017). Donor Fragmentation, Aid Shocks, and Violent Political Conflict. *Journal of Conflict Resolution 61(3)*, 643-670.

Heston, A., Summers, R., & Aten, B. (2006). *Penn World Table Version 6.2*. University of Pennsylvania. Center for International Comparisons of Production, Income, and Prices, Philadelphia, PA.

Kanbur, R. (2003). The Economics of International Aid. In: S.-C. Kolm, & J. Mercier-Ythier (Eds.), *The Economics of Giving, Reciprocity, and Altruism*. Amsterdam: Elsevier.

Kimura, H., Mori, Y., & Sawada, Y. (2012). Aid Proliferation and Economic Growth: A Cross-Country Analysis. *World Development, 40*(1), 1-10.

Kimura, H., Sawada, Y., & Mori, Y. (2007). *Aid Proliferation and Economic Growth: A Cross-Country Analysis*. RIETI Discussion Paper 07-E-044, Research Institute of Economy, Trade and Industry, Tokyo.

Kilby, C. (2011). What Determines the Size of Aid Projects? *World Development, 39*(11), 1981-1994.

Klingebiel, S., Mahn, T., & Negre, M. (Eds.). (2016). *The Fragmentation of Aid: Concepts, Measurements and Implications for Development Cooperation*. London: Palgrave Macmillan.

Knack, S., & Rahman, A. (2007). Donor Fragmentation and Bureaucratic Quality in Aid Recipients. *Journal of Development Economics, 83*(1), 176-197.

Michaelowa, K., & Weber, A. (2007). Aid Effectiveness in the Education Sector: A Dynamic Panel Analysis. In S. Lahiri (Ed), *Theory and Practice of Foreign Aid* (357-385). Amsterdam: Elsevier.

Mürle, H. (2007). *Towards a Division of Labour in European Development Co-Operation: Operational Options.* Bonn, German Development Institute: Discussion Paper 6/2007.

OECD (2008). *The Paris Declaration on Aid Effectiveness and the Accra Agenda for Action.* Paris: OECD. Retrieved June 3, 2014, from www.oecd.org/dataoecd/11/41/34428351.

OECD (2009a). *2009 OECD Report on Division of Labour: Addressing Fragmentation and Concentration of Aid Across Countries.* Paris: OECD. Retrieved January 13, 2012 from http://www.oecd.org/dataoecd/18/52/44318319.pdf.

OECD (2009b). *Development Co-operation Report 2009*. Paris: OECD.

OECD (2010). *New Typology—Frequently Asked Questions.* Retrieved October 12, 2016 from www.oecd.org/dac/stats/46822237.pdf.

OECD (2011). *2011 OECD Report on Division of Labour: Addressing Cross-Country Fragmantation of Aid.* Paris: OECD. Retrieved January 13, 2011 from http://www.oecd.org/dataoecd/6/14/49106391.pdf.

OECD (2014). *The New Development Finance Landscape: Developing Countries' Perspective.* Paris: OECD.

OECD/DAC (2012). *Creditor Reporting System* (CRS). Paris: OECD.

OECD/DAC (2014). *CRS Guide: Coverage Ratios.* Retrieved March 3, 2014 from http://www.oecd.org/dac/stats/crsguide.htm.

OECD/DAC (2016). *International Development Statistics.* Retrieved January 16, 2012 from http://www.oecd.org/dataoecd/50/17/5037721.htm.

Pietschmann, E. (2016). Managing Diversity: A Partner Country Perspective. In: S. Klingebiel, T. Mahn, & M. Negre (Eds.), *The Fragmentation of Aid: Concepts, Measurements and Implications for Development Cooperation* (217-230). London: Palgrave Macmillan.

PRS Group (2013). *International Country Risk Guide.* Retrieved June 03, 2014, from http://www.prsgroup.com.

Rajan, R. G., & Subramanian, A. (2008). Aid and Growth. *Review of Economics and Statistics, 90*(4), 643-665.

Ray, D. (1998). *Development Economics.* Princeton: Princeton University Press.

Roodman, D. (2015). A Replication of "Counting Chickens When they Hatch" (Economic Journal 2012). *Public Finance Review, 43,* 282-286.

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

Roeder, P. G. (2001). *Ethnolinguistic Fractionalization (ELF) Indices, 1961 and 1985*. Retrieved September 14, 2015 from http://weber.ucsd.edu/ proeder/elf.htm.

Steinwand, M. (2015). Compete or Coordinate? Aid Fragmentation and Lead Donorship. *International Organization, 69(2),* 443-472.

Tatrallyay, N., & Stadelmann, M. (2011). *Removing Barriers for Climate Change Mitigation—Vietnam*. University of Zurich: Report on Behalf of the Swiss State Secretariat of Economic Affairs (SECO).

Torsvik, G. (2005). Foreign Economic Aid: Should donors cooperate? *Journal of Development Economics*, 77, 503–515.

World Bank (2004, 2007, 2012 & 2016). *World Development Indicators*. World Bank, Washington.

**Figure 1: Fragmentation of ODA according to four indicators (2010-2013)**
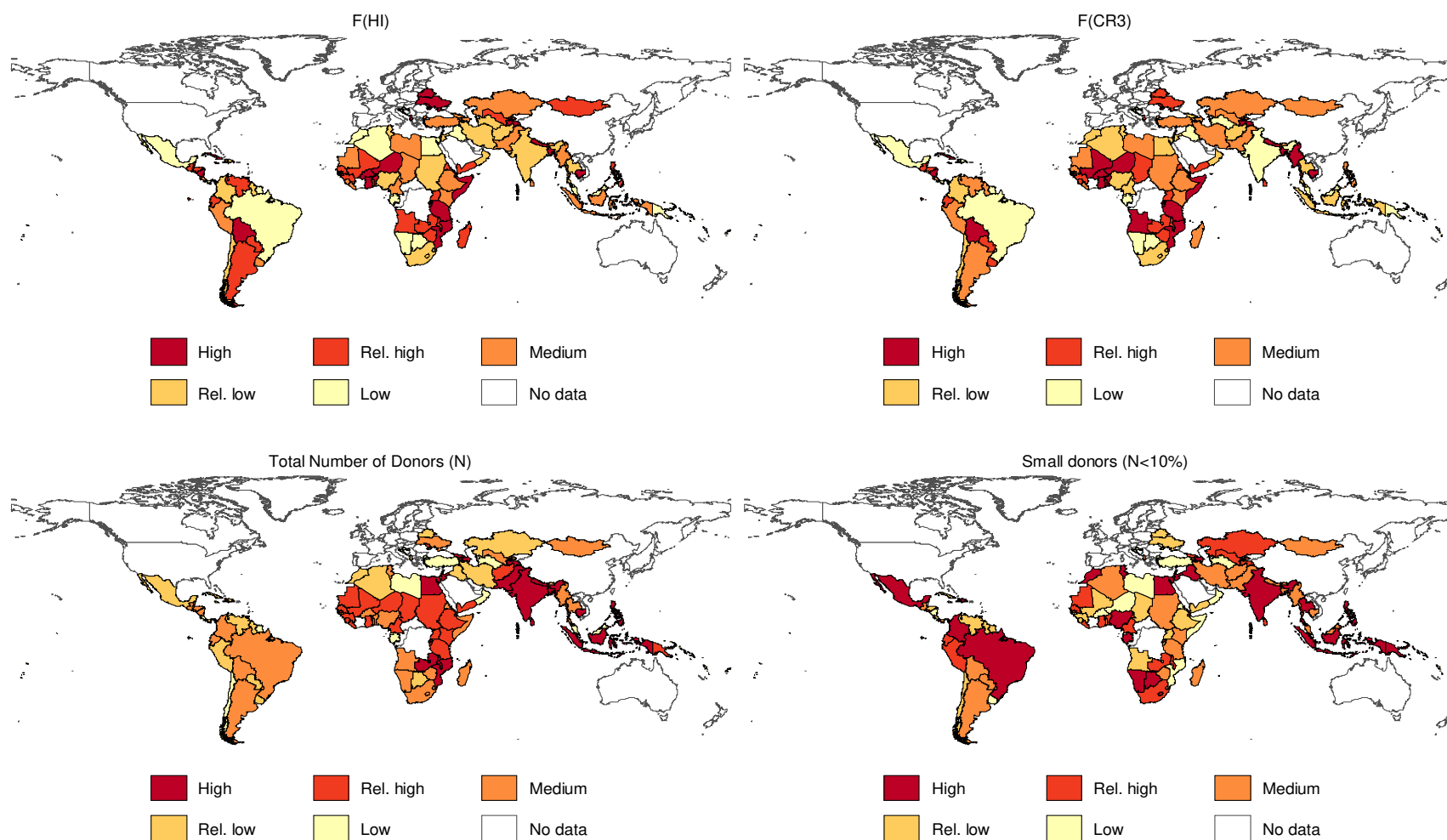


F(HI)

F(CR3)

| | | |
|---|---|---|
| High | Rel. high | Medium |
| Rel. low | Low | No data |

Total Number of Donors (N)

Small donors (N<10%)

| | | |
|---|---|---|
| High | Rel. high | Medium |
| Rel. low | Low | No data |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; Small donors (N<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. Each of the five categories corresponds to a quintile of the distribution for the respective indicator. Data include all 122 countries for which information on donors is available (indicators averaged over the four-year period).

**Figure 2: Violin plots of fragmentation indices**
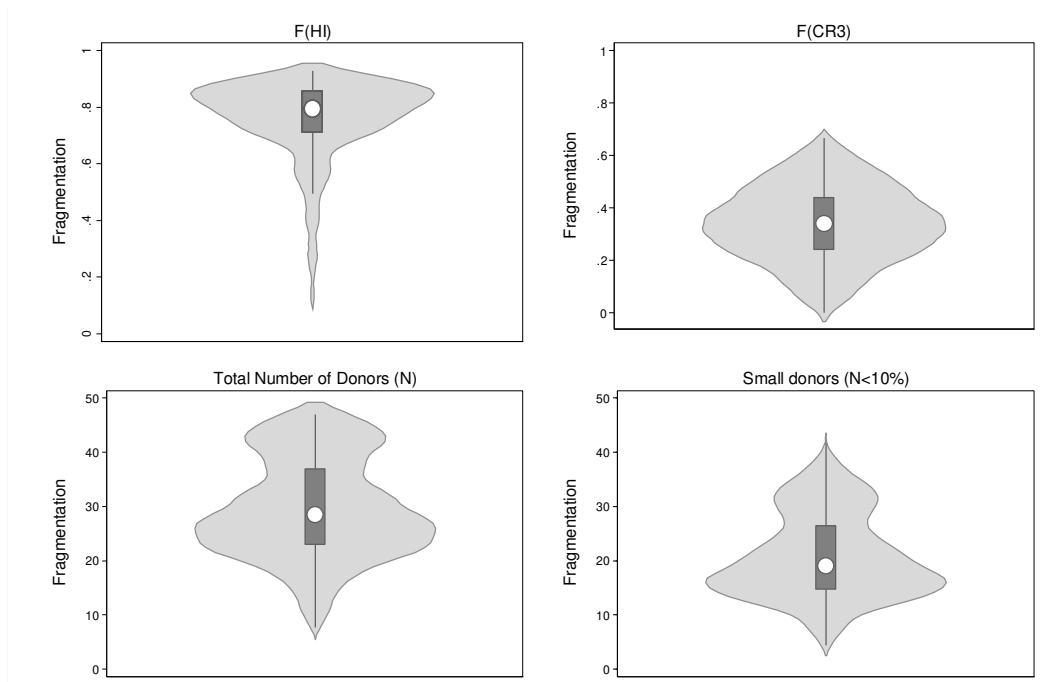


Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The violin plots combine a box-plot diagram and a density trace. The white dot indicates the median value, the shaded area the density and the black bar shows the range that contains 50% of the observations (from the 25th to the 75th percentile). The black line ends at 1.5 times this range above and below this interval. Points beyond the black line are defined as outliers. Data based on the sample in Table 2.

**Figure 3: Fragmentation trends over time (1974-2013)**



Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N: Total number of donors; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. Data based on the sample in Table 2, but yearly rather than averaged over four-year periods.

**Table 1: Descriptive statistics for the fragmentation indicators**

|  | Obs. | Mean | Std. Dev. | Min | Max | Correlation coefficients F(HI) | F(CR3) | N | N(<10%) |
|---|---|---|---|---|---|---|---|---|---|
| F(HI) | 715 | 0.75 | 0.15 | 0.11 | 0.93 | 1 | | | |
| F(CR3) | 715 | 0.34 | 0.14 | 0.00 | 0.67 | 0.87 | 1 | | |
| N | 715 | 29.60 | 9.15 | 7.67 | 47.00 | 0.37 | 0.42 | 1 | |
| N(<10%) | 715 | 20.81 | 7.73 | 4.33 | 41.75 | 0.09 | 0.11 | 0.94 | 1 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N: Total number of donors; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. Sample and fragmentation data as in Table 2 based on the extended Burnside-Dollar data averaged over four years, starting in 1974 until 2013.

**Table 2: Aid, fragmentation and growth (based on Burnside and Dollar), 1974-2013**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **Dependent variable: GDP p.c. growth** | | | | |
| Aid | 0.542** | 0.354** | 0.229 | 0.174 |
| | [0.265] | [0.140] | [0.140] | [0.122] |
| Aid^2 | 0.001 | 0.000 | 0.001 | 0.000 |
| | [0.001] | [0.001] | [0.001] | [0.001] |
| Fragmentation | -0.124 | -0.042 | -0.071 | 0.000 |
| | [1.656] | [1.877] | [0.063] | [0.057] |
| Aid x Fragmentation | -0.527* | -0.525** | -0.004 | -0.003 |
| | [0.285] | [0.209] | [0.004] | [0.005] |
| Adj. R-Squared | 0.260 | 0.260 | 0.250 | 0.240 |
| Number of observations | 715 | 715 | 715 | 715 |
| Number of countries | 78 | 78 | 78 | 78 |
| Marginal effect of Aid at | | | | |
| Frag. 20th percentile | 0.215** | 0.261** | 0.164** | 0.144* |
| | [0.098] | [0.105] | [0.081] | [0.077] |
| Frag. 50th percentile | 0.136** | 0.189** | 0.144** | 0.134** |
| | [0.064] | [0.079] | [0.065] | [0.064] |
| Frag. 80th percentile | 0.092* | 0.108** | 0.111** | 0.115** |
| | [0.054] | [0.054] | [0.052] | [0.054] |
| Marginal effect of Frag. at | -1.280 | -1.195 | -0.078 | -0.006 |
| Aid 50th percentile | [1.315] | [1.775] | [0.064] | [0.059] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The control variables are defined in the appendix, Table A1. The sample is based on 4-year periods. Both aid and fragmentation are lagged by one period. All regressions include period- and country-

fixed effects, and use the Anderson-Hsiao correction for initial GDP per capita to adjust for the Nickell bias (Anderson and Hsiao 1982). The marginal effect of aid refers to the change in growth for a one percentage point increase in aid as a percentage of GDP at different levels of fragmentation ("Frag.") and average aid values. Standard errors clustered at the country level are reported in brackets. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

**Table 3: Aid, fragmentation and growth (based on Burnside and Dollar), 1974-2013, sample splits**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| **Dependent variable: GDP p.c. growth** | | | | | | |
| Aid x F(HI) | -0.074 | -2.248* | -0.851** | -0.442 | -0.131 | -1.084 |
| | [0.389] | [1.267] | [0.392] | [0.356] | [0.444] | [0.746] |
| p-value equal coefficients | | 0.051 | | 0.375 | | 0.197 |
| Aid x F(CR3) | -0.208 | -1.442* | -0.422 | -0.591** | -0.274 | -0.656 |
| | [0.492] | [0.768] | [0.358] | [0.288] | [0.392] | [0.533] |
| p-value equal coefficients | | 0.114 | | 0.660 | | 0.527 |
| Aid x Total number of donors (N) | -0.011 | -0.010* | 0.005 | -0.012 | -0.023 | -0.006 |
| | [0.008] | [0.005] | [0.003] | [0.011] | [0.020] | [0.006] |
| p-value equal coefficients | | 0.895 | | 0.065 | | 0.341 |
| Aid x Small donors (N<10%) | -0.015 | -0.007 | 0.005* | -0.002 | -0.022 | -0.005 |
| | [0.011] | [0.005] | [0.003] | [0.015] | [0.021] | [0.005] |
| p-value equal coefficients | | 0.440 | | 0.578 | | 0.352 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The regressions are based on Table 2. Samples are split at the 50th percentile. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality of coefficients for split samples. *p<0.10, ** p<0.05, *** p<0.01.

**Table 4: Aid, fragmentation and bureaucratic quality, 1986-2013**

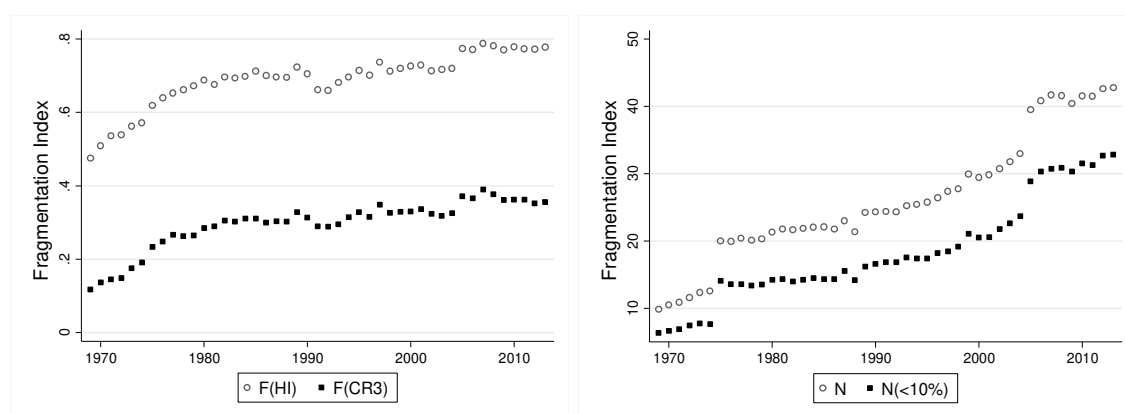| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **Dependent variable: ICRG bureaucratic quality** | | | | |
| Aid | -0.022 | 0.009 | -0.006 | -0.005 |
| | [0.067] | [0.028] | [0.021] | [0.019] |
| Aid^2 | 0.000 | 0.000 | 0.000 | 0.000 |
| | [0.000] | [0.000] | [0.000] | [0.000] |
| Fragmentation | 1.041 | 1.027* | -0.004 | -0.011 |
| | [0.672] | [0.609] | [0.014] | [0.016] |
| Aid x Fragmentation | 0.026 | -0.025 | 0.000 | 0.000 |
| | [0.082] | [0.043] | [0.001] | [0.001] |
| Adj. R-Squared | 0.08 | 0.07 | 0.06 | 0.06 |
| Number of observations | 485 | 485 | 485 | 485 |
| Number of countries | 78 | 78 | 78 | 78 |
| Marginal effect of Aid at | | | | |
| Frag. 20th percentile | -0.003 | 0.004 | -0.007 | -0.005 |
| | [0.021] | [0.022] | [0.020] | [0.020] |
| Frag. 50th percentile | 0.000 | 0.001 | -0.007 | -0.005 |
| | [0.019] | [0.020] | [0.021] | [0.021] |
| Frag. 80th percentile | 0.002 | -0.003 | -0.008 | -0.006 |
| | [0.021] | [0.020] | [0.024] | [0.025] |
| Marginal effect of Frag. at | 1.099 | 1.019* | -0.012 | -0.015 |
| Aid 50th percentile | [0.684] | [0.602] | [0.019] | [0.018] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total

aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The control variables are defined in

the appendix, Table A1. The sample is based on 4-year periods. Both aid and fragmentation are lagged by one period. All regressions include period- and country-fixed effects and instrument initial GDP per capita with its first lag. The marginal effect of aid refers to the change in bureaucratic quality if aid per GDP increases by one percentage point at different levels of fragmentation ("Frag.") and average aid values. Standard errors clustered at the country level are reported in brackets. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

**Table 5: Aid, fragmentation and bureaucratic quality, 1986-2013, sample splits**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| **Dependent variable: ICRG bureaucratic quality** | | | | | | |
| Aid x F(HI) | 0.341 | -0.101 | -0.143 | 0.061 | 0.253* | -0.050 |
| | [0.215] | [0.095] | [0.158] | [0.131] | [0.134] | [0.063] |
| p-value equal coefficients | | 0.015 | | 0.183 | | 0.007 |
| Aid x F(CR3) | 0.451** | -0.072 | -0.166* | 0.017 | 0.198** | -0.055 |
| | [0.203] | [0.076] | [0.097] | [0.089] | [0.078] | [0.048] |
| p-value equal coefficients | | 0.002 | | 0.077 | | 0.000 |
| Aid x Total number of donors (N) | 0.001 | -0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| | [0.001] | [0.005] | [0.002] | [0.001] | [0.001] | [0.004] |
| p-value equal coefficients | | 0.171 | | 0.959 | | 0.412 |
| Aid x Small donors (N<10%) | 0.001 | 0.000 | 0.000 | 0.000 | -0.007* | 0.000 |
| | [0.006] | [0.001] | [0.001] | [0.003] | [0.004] | [0.001] |
| p-value equal coefficients | | 0.826 | | 0.807 | | 0.014 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The regressions are based on the specifications in Table 4. The samples are split at the 50th percentile, except for the period split that uses the same cut-off year as in Table 3 to facilitate comparison. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality of coefficients for split samples. * p<0.10, ** p<0.05, *** p<0.01.

**Table 6: Aid, fragmentation and primary enrolment, 1994-2013**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **Dependent variable: Net enrolment rate (%)** | | | | |
| Aid | 1.108 | 2.062*** | 1.149** | 0.744 |
| | [0.720] | [0.626] | [0.558] | [1.096] |
| Aid^2 | -0.158*** | -0.141*** | -0.154*** | -0.175*** |
| | [0.042] | [0.042] | [0.038] | [0.043] |
| Fragmentation | 0.791 | 23.849 | 1.230** | -8.489 |
| | [4.524] | [15.797] | [0.515] | [5.398] |
| Aid x Fragmentation | 2.843** | 1.946 | 0.097** | 2.884* |
| | [1.185] | [2.163] | [0.046] | [1.554] |
| Adj. R-Squared | 0.473 | 0.515 | 0.572 | 0.463 |
| Number of observations | 208 | 208 | 208 | 208 |
| Number of countries | 69 | 69 | 69 | 69 |
| Marginal effect of Aid at | | | | |
| Frag. 20% perc. | 0.863 | 1.481** | 0.707 | 0.503 |
| | [0.695] | [0.618] | [0.565] | [1.114] |
| Frag. 50% perc. | 1.720*** | 1.544** | 0.998* | 1.484** |
| | [0.611] | [0.600] | [0.511] | [0.705] |
| Frag. 80% perc. | 2.360*** | 1.817*** | 1.651*** | 2.228*** |
| | [0.740] | [0.658] | [0.583] | [0.710] |
| Marginal effect of Frag. at | 3.446 | 25.666 | 1.321** | -5.795 |
| Aid 50th percentile | [5.284] | [17.736] | [0.612] | [6.220] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on education aid by the three largest donors as a percentage of total education aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The control variables are defined in the appendix, Table A1. The sample is based on 4-year periods. Both aid and fragmentation are lagged by one period. All regressions include period-

and country-fixed effects and instrument initial GDP per capita with its first lag. The marginal effect of aid refers to the change in the net enrolment rate if aid per capita increases by one percentage point at different levels of fragmentation ("Frag.") and average aid values. Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.

**Table 7: Aid, fragmentation and primary enrolment, 1994-2013, sample splits**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| **Dependent variable: Net enrolment rate (%)** | | | | |
| Aid x F(HI) | 12.446*** | 2.515 | 1.724 | 1.594 |
| | [3.508] | [2.036] | [2.136] | [3.009] |
| p-value equal coefficients | | 0.000 | | 0.953 |
| Aid x F(CR3) | 23.729*** | 0.154 | 2.363 | -2.933 |
| | [3.810] | [3.020] | [3.068] | [12.599] |
| p-value equal coefficients | | 0.000 | | 0.538 |
| Aid x Total number of donors (N) | 0.412 | 0.017 | 0.078 | -0.028 |
| | [0.307] | [0.076] | [0.056] | [0.277] |
| p-value equal coefficients | | 0.011 | | 0.567 |
| Aid x Small donors (N<10%) | 12.223 | 2.158 | 1.734 | 0.106 |
| | [14.025] | [3.437] | [3.288] | [1.530] |
| p-value equal coefficients | | 0.158 | | 0.503 |

F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The regressions are based on the specifications in Table 6. Samples are split at the 50th percentile. The split with respect to period was not possible given that data are available only from 1994. P-values refer to a Wald test of the equality of coefficients for split samples. Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.

# Online Appendix (NOT FOR PUBLICATION)

**Table A1: Definition of variables and descriptive statistics**

| Burnside & Dollar (Table 2 and 3) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variable name** | **Obs.** | **Mean** | **Std. Dev.** | **Min** | **Max** | **Definition** | **Sources** |
| GDP p.c. growth | 715 | 1.79 | 3.62 | -32.42 | 17.05 | Average over annual growth rates of real GDP p.c. based on constant local currency (in %). | World Bank (2007, 2016)* |
| Net ODA (% of GDP) | 715 | 5.31 | 8.17 | -0.13 | 82.39 | ODA total net in % of GDP (high maximum value is Liberia over the 2006-2009 period). | OECD/DAC (2016) |
| F(HI) | 715 | 0.75 | 0.15 | 0.11 | 0.93 | Fragmentation index based on Herfindahl index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 715 | 0.34 | 0.14 | 0.00 | 0.67 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 715 | 29.60 | 9.15 | 7.67 | 47.00 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 715 | 20.81 | 7.73 | 4.33 | 41.75 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Bureaucratic quality | 547 | 1.77 | 0.94 | 0.00 | 4.00 | Bureaucracy quality indicator, higher scores indicate better quality (only used to split samples in Table 3). | PRS Group (2013) |

| Log initial GDP/capita | 715 | 2.10 | 0.12 | 1.65 | 2.42 | Logarithm of initial GDP p.c. in international prices. | Heston, Summers, and Aten (2006), World Bank (2016)* |
|---|---|---|---|---|---|---|---|
| Assassinations | 715 | 0.33 | 1.04 | 0.00 | 11.50 | Number of assassinations. | Banks and Wilson (2007, 2014)* |
| Ethnolinguistic fractionalization | 715 | 0.46 | 0.30 | 0.00 | 0.93 | Ethnolinguistic fractionalization. | Easterly and Levine (1997), Roeder (2001)* |
| Assassinations x ethnolinguistic fractionalization | 715 | 0.12 | 0.45 | 0.00 | 7.36 | Interaction between assassinations and ethnolinguistic fractionalization. | Banks (2007, 2014), Easterly and Levine (1997), Roeder (2001)* |
| M2 (% of GDP) | 715 | 9.54 | 24.61 | 0.04 | 243.64 | Money and quasi-money (M2) in % of GDP. | World Bank (2007, 2016)* |

* Data source is Clemens et al. (2012), http://www.cgdev.org/doc/Working%20Papers/CRBB-Replication-Files.zip, accessed 06.06.2012. More details are provided

in "Technical appendix to counting chickens when they hatch: Timing and the effects of aid on growth,"

http://www.cgdev.org/doc/Working%20Papers/counting_chickens_technical_appendix.pdf, accessed 06.06.2012. For more recent years, we use data from the

World Development Indicators (World Bank 2016).

| Knack & Rahman (Table 4 and 5) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variable name** | **Obs.** | **Mean** | **Std. Dev.** | **Min** | **Max** | **Definition** | **Sources** |
| Bureaucratic quality | 485 | 1.76 | 0.95 | 0.00 | 4.00 | Bureaucracy quality indicator, higher scores indicate better quality; value for the year following the four-year period covered by the right-hand side variables. | PRS Group (2013) |
| Net ODA (% of GDP) | 485 | 5.92 | 9.28 | -0.13 | 82.39 | ODA total net in % of GDP. | OECD/DAC (2016) |
| F(HI) | 485 | 0.78 | 0.14 | 0.11 | 0.93 | Fragmentation index based on Herfindahl index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 485 | 0.37 | 0.14 | 0.01 | 0.67 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- Sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 485 | 33.72 | 7.90 | 7.67 | 47.00 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 485 | 24.08 | 7.07 | 4.33 | 41.75 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Bureaucratic quality | 1.78 | 0.91 | 0.00 | 4.00 | 1.78 | Bureaucracy quality indicator, higher scores indicate better quality (only used to split samples in Table 5). | PRS Group (2013) |
| Log initial GDP/capita | 2.10 | 0.12 | 1.65 | 2.34 | 2.10 | Logarithm of initial GDP p.c. in International prices. | Heston, Summers, and Aten (2006), World Bank (2016)* |
| Assassinations | 0.32 | 0.95 | 0.00 | 11.50 | 0.32 | Number of assassinations. | Banks (2007, 2012)* |
| Ethnolinguistic fractionalization | 0.46 | 0.30 | 0.00 | 0.93 | 0.46 | Ethnolinguistic fractionalization. | Easterly and Levine (1997), Roeder (2001)* |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Assassinations x ethnolinguistic fractionalization | 0.11 | 0.33 | 0.00 | 3.04 | 0.11 | Interaction between assassinations and ethnolinguistic fractionalization. | Banks (2007, 2014), Easterly and Levine (1997), Roeder (2001)* |
| M2 (% of GDP) | 13.95 | 28.87 | 0.04 | 243.64 | 13.95 | Money and quasi-money (M2) in % of GDP. | World Bank (2007, 2016)* |

* Data source is Clemens et al. (2012), http://www.cgdev.org/doc/Working%20Papers/CRBB-Replication-Files.zip, accessed 06.06.2012. More details are provided

in "Technical appendix to counting chickens when they hatch: Timing and the effects of aid on growth,"

http://www.cgdev.org/doc/Working%20Papers/counting_chickens_technical_appendix.pdf, accessed 06.06.2012. For more recent years, we use data from the

World Development Indicators (World Bank 2016).

| Birchler & Michaelowa (Tables 6 and 7) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variable name** | **Obs.** | **Mean** | **Std. Dev.** | **Min** | **Max** | **Definition** | **Sources** |
| Net primary enrolment rate (%) | 228 | 81.51 | 18.37 | 22.39 | 100.00 | Net enrolment rate for primary education (%). | WDI (World Bank 2007, 2016)* |
| Aid for education | 228 | 3.23 | 4.12 | 0.00 | 23.33 | ODA per capita allocated to education (disbursement, constant 2000 US$ million). | OECD/DAC (2016) |
| F(HI) | 228 | 0.50 | 0.27 | 0.00 | 0.89 | Fragmentation index based on Herfindahl Index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 228 | 0.14 | 0.13 | 0.00 | 0.52 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- Sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 228 | 9.84 | 6.87 | 1.00 | 26.00 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 228 | 0.58 | 0.29 | 0.00 | 0.92 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Bureaucratic quality | 228 | 1.77 | 0.78 | 0.00 | 3.55 | Bureaucracy quality indicator, higher scores indicate better quality (only used to split samples in Table 7). | PRS Group (2013) |
| Log initial GDP/capita | 228 | 2.08 | 0.11 | 1.65 | 2.27 | Logarithm of initial GDP p.c. in international prices. | Heston, Summers, and Aten (2006), World Bank (2016)* |
| Assassinations | 228 | 0.41 | 1.19 | 0.00 | 11.50 | Number of assassinations. | Banks (2012, 2007)* |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ethnolinguistic fractionalization | 228 | 0.47 | 0.29 | 0.00 | 0.93 | Ethnolinguistic fractionalization. | Easterly and Levine (1997), Roeder (2001)* |
| Assassinations x ethnolinguistic Fractionalization | 228 | 0.13 | 0.34 | 0.00 | 3.04 | Interaction between assassinations and ethnolinguistic Fractionalization. | Banks (2012, 2007), Easterly and Levine (1997), Roeder (2001)* |
| M2 (% of GDP) | 228 | 12.03 | 27.03 | 0.05 | 239.67 | Money and quasi-money (M2) in % of GDP. | World Bank (2007, 2016)* |

* Data source is Clemens et al. (2012), http://www.cgdev.org/doc/Working%20Papers/CRBB-Replication-Files.zip, accessed 06.06.2012. More details are provided

in "Technical appendix to counting chickens when they hatch: Timing and the effects of aid on growth,"

http://www.cgdev.org/doc/Working%20Papers/counting_chickens_technical_appendix.pdf, accessed 06.06.2012. For more recent years, we use data from the

World Development Indicators (World Bank 2016).

| Variable name | Obs. | Mean | Std. Dev. | Min | Max | Definition | Sources |
|---|---|---|---|---|---|---|---|
| **Knack & Rahman (Table A6)** | | | | | | | |
| Bureaucratic quality | 83 | 2 | 1 | 0 | 4 | Bureaucratic quality indicator, higher scores indicate better quality; value in 2001. | PRS Group (2013) |
| F(HI) | 83 | 0.76 | 0.14 | 0.30 | 0.91 | Fragmentation index based on Herfindahl Index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 83 | 0.36 | 0.14 | 0.08 | 0.61 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- Sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 83 | 27.58 | 2.41 | 20.90 | 31.05 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 83 | 18.55 | 2.39 | 13.42 | 25.85 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Initial bureaucratic quality | 83 | 2.26 | 1.21 | 0.00 | 6.00 | Bureaucratic quality indicator, higher scores indicate better quality; value in 1982. | PRS Group (2013)* |
| Population change/ initial population | 83 | 1.89 | 1.07 | -0.80 | 3.98 | Change in population divided by initial population. | World Bank (2004)* |
| GDP p.c. change/ Initial GDP p.c. | 83 | 1.16 | 2.22 | -4.54 | 8.69 | Change in GDP p.c. divided by initial GDP. | World Bank (2004)* |
| No. of years covered | 83 | 15.88 | 4.99 | 3.00 | 19.00 | Number of years covered by the cross-section (varies by recipient since not all countries were covered by ICRG over the whole period of the cross sectional analysis). | PRS Group (2013)* |
| Aid/GNI | 83 | 7.11 | 9.00 | 0.05 | 50.56 | Aid flows as percentage of gross national income (GNI). | World Bank (2004)* |

* Data source is Knack and Rahman (2007).

| Birchler & Michaelowa (Tables A8 and A9) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Variable name | Obs. | Mean | Std. Dev. | Min | Max | Definition | Sources |
| Net primary enrolment rate (%) | 166 | 81.86 | 16.25 | 27.04 | 100.00 | Net enrolment rate for primary education (%). | World Bank (2012)* |
| Aid for education | 166 | 51.78 | 73.35 | 0.09 | 494.18 | Aid allocated to education (disbursement, constant 2000 US$ million). [Birchler and Michaelowa (2016) mistakenly identify this variable as "Education aid per capita," but have in fact not used per capita data.] | OECD/DAC (2012)* |
| F(HI) | 166 | 0.57 | 0.21 | 0.03 | 0.90 | Fragmentation index based on Herfindahl Index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 166 | 0.15 | 0.13 | -0.29 | 0.54 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- Sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 166 | 10.40 | 6.06 | 1.20 | 25.20 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 166 | 6.29 | 4.35 | 0.00 | 17.00 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Initial Bureaucratic quality | 166 | 1.65 | 0.83 | 0.00 | 3.92 | Initial bureaucracy quality indicator, higher scores indicate better quality (only used to split samples in Table A9). | PRS Group (2013) |
| Log initial GDP p.c. | 164 | 4509.39 | 4735.63 | 239.07 | 23362.07 | Logarithm of initial GDP p.c. in international prices. | World Bank (2012)* |

| Education expenditure | 166 | 16.62 | 4.13 | 6.35 | 32.78 | Public spending on education (% of government expenditure). | World Bank (2012)* |
|---|---|---|---|---|---|---|---|
| PTR | 166 | 34.77 | 13.48 | 11.14 | 79.98 | Pupil-teacher ratio in primary education. | World Bank (2012)* |
| Young population | 166 | 37.59 | 7.92 | 14.80 | 49.64 | Population aged 0-14 (% of total population). | World Bank (2012)* |
| GDP per capita | 166 | 4485.21 | 4712.06 | 239.07 | 23362.07 | GDP per capita (constant 2000 US$). | World Bank (2012)* |
| Budget (surplus) | 166 | -1.46 | 4.23 | -18.40 | 35.14 | Cash surplus/deficit (% of GDP). | World Bank (2012)* |
| Inflation | 166 | 19.17 | 81.97 | -4.07 | 1008.95 | Inflation (consumer prices, % annual). | World Bank (2012)* |
| Openness | 166 | 75.14 | 35.77 | 22.36 | 206.43 | Openness (export+import in % of GDP). | World Bank (2012)* |
| Freedom | 166 | 4.04 | 1.57 | 1.00 | 7.00 | Freedom House (mean of political rights and civil liberties; lowest freedom=7, highest=1). | Freedom House (2011)* |

* Data source is Birchler and Michaelowa (2016).

**Table A2: Pre-trends in fragmentation**

| | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **Dependent variable: Fragmentation index (t)** | | | | |
| GDP p.c. growth (t) | 0.000 | 0.000 | 0.012 | 0.033 |
| | [0.001] | [0.001] | [0.048] | [0.040] |
| GDP p.c. growth (t-1) | 0.002* | 0.001 | 0.042 | 0.011 |
| | [0.001] | [0.001] | [0.031] | [0.034] |
| GDP p.c. growth (t-2) | 0.001 | 0.001 | 0.041 | 0.027 |
| | [0.001] | [0.001] | [0.029] | [0.030] |
| Adj. R-Squared | 0.098 | 0.153 | 0.918 | 0.880 |
| Number of observations | 653 | 653 | 653 | 653 |
| **Dependent variable: Fragmentation index (t)** | | | | |
| Bureaucratic quality (t) | 0.018 | 0.014 | -0.209 | -0.535 |
| | [0.016] | [0.013] | [0.269] | [0.348] |
| Bureaucratic quality (t-1) | -0.008 | -0.005 | -0.258 | 0.109 |
| | [0.010] | [0.011] | [0.295] | [0.435] |
| Bureaucratic quality (t-2) | 0.008 | 0.005 | -0.003 | -0.204 |
| | [0.011] | [0.012] | [0.296] | [0.381] |
| Adj. R-Squared | 0.044 | 0.045 | 0.888 | 0.842 |
| Number of observations | 418 | 418 | 418 | 418 |
| **Dependent variable: Fragmentation index (t)** | | | | |
| Primary enrolment (t) | -0.002 | 0.002 | 0.111** | 0.003 |
| | [0.003] | [0.002] | [0.043] | [0.003] |
| Primary enrolment (t-1) | 0.001 | -0.002 | -0.064* | -0.002 |
| | [0.003] | [0.002] | [0.036] | [0.003] |
| Primary enrolment (t-2) | -0.004 | -0.002 | -0.025 | 0.005** |
| | [0.003] | [0.002] | [0.057] | [0.002] |
| Adj. R-Squared | 0.760 | 0.660 | 0.930 | 0.880 |
| Number of observations | 165 | 165 | 165 | 165 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total

aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The table examines whether lagged

values of (1) growth, (2) bureaucratic quality, and (3) enrolment influence the choice of donors to select recipient countries. Control variables for each regression

are as in Table 2. The sample is based on 4-year periods. All regressions include period- and country-fixed effects and instrument initial GDP per capita with its

first lag. Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.

**Table A3: Aid, fragmentation and growth (based on Burnside and Dollar), 1974-2013, with squared interaction**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **GDP p.c. growth** | | | | |
| Aid | 0.223 | 0.19 | 0.074 | 0.024 |
| | [0.466] | [0.172] | [0.172] | [0.150] |
| Aid^2 | 0.015 | 0.006 | 0.004 | 0.004 |
| | [0.019] | [0.005] | [0.005] | [0.004] |
| Fragmentation | -0.977 | -1.191 | -0.082 | -0.013 |
| | [2.182] | [2.255] | [0.060] | [0.054] |
| Aid x Fragmentation | -0.132 | -0.112 | 0.001 | 0.004 |
| | [0.573] | [0.395] | [0.005] | [0.006] |
| Aid^2 x Fragmentation | -0.017 | -0.013 | 0.000 | 0.000 |
| | [0.023] | [0.013] | [0.000] | [0.000] |
| Adj. R-Squared | 0.260 | 0.270 | 0.250 | 0.250 |
| Number of observations | 715 | 715 | 715 | 715 |
| Number of countries | 78 | 78 | 78 | 78 |
| Marginal effect of Aid at | | | | |
| Frag. 20th percentile | 0.181* | 0.207** | 0.117 | 0.097 |
| | [0.098] | [0.098] | [0.076] | [0.071] |
| Frag. 50th percentile | 0.133** | 0.172** | 0.115* | 0.108* |
| | [0.062] | [0.072] | [0.062] | [0.061] |
| Frag. 80th percentile | 0.106* | 0.132** | 0.114** | 0.126** |
| | [0.062] | [0.066] | [0.053] | [0.058] |
| Marginal effect of Frag. at | -1.411 | -1.278 | -0.014 | 0.031 |
| Aid 50th percentile | [1.350] | [1.800] | [0.053] | [0.053] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. Besides the squared interaction term, the regressions are identical to those in Table 2. Standard errors clustered at the country level are reported in brackets. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

**Table A4: Aid, fragmentation and growth (based on Burnside and Dollar), 1974-2013, sample splits (all main effects)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| **GDP p.c. growth** | | | | | | |
| | | | F(HI) | | | |
| Aid | 0.543 | 2.237* | 0.859** | 0.463 | 0.313 | 1.011 |
| | [0.507] | [1.251] | [0.363] | [0.331] | [0.445] | [0.728] |
| Aid^2 | -0.017* | -0.002 | 0.000 | 0.000 | -0.005 | 0.000 |
| | [0.010] | [0.003] | [0.001] | [0.002] | [0.004] | [0.002] |
| F(HI) | -2.734 | 13.903 | 0.861 | -0.445 | -3.300 | 2.875 |
| | [2.750] | [9.009] | [2.527] | [2.331] | [3.193] | [3.083] |
| Aid x F(HI) | -0.074 | -2.248* | -0.851** | -0.442 | -0.131 | -1.084 |
| | [0.389] | [1.267] | [0.392] | [0.356] | [0.444] | [0.746] |
| p-value equal coefficients | | 0.051 | | 0.375 | | 0.197 |
| | | | F(CR3) | | | |
| Aid | 0.589 | 1.067* | 0.349 | 0.364** | 0.33 | 0.434 |
| | [0.403] | [0.583] | [0.214] | [0.182] | [0.257] | [0.385] |
| Aid^2 | -0.019* | -0.003 | 0 | 0 | -0.004 | -0.001 |
| | [0.010] | [0.004] | [0.001] | [0.001] | [0.004] | [0.002] |
| F(CR3) | -2.76 | 8.774 | 0.38 | 0.724 | -3.836 | 3.578 |
| | [3.985] | [7.971] | [2.696] | [3.313] | [4.090] | [2.889] |
| Aid x F(CR3) | -0.208 | -1.442* | -0.422 | -0.591** | -0.274 | -0.656 |
| | [0.492] | [0.768] | [0.358] | [0.288] | [0.392] | [0.533] |
| p-value equal coefficients | | 0.114 | | 0.660 | | 0.527 |

**Table A4 (continued)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| | | | Total Number of Donors (N) | | | |
| Aid | 0.746** | 0.610 | 0.052 | 0.460 | 0.836 | 0.260 |
| | [0.367] | [0.385] | [0.128] | [0.349] | [0.557] | [0.240] |
| Aid^2 | -0.016* | 0.000 | -0.001 | -0.001 | -0.006 | 0.000 |
| | [0.010] | [0.002] | [0.001] | [0.002] | [0.004] | [0.002] |
| Total Number of Donors (N) | -0.054 | 0.480 | -0.178 | -0.032 | -0.159 | 0.120** |
| | [0.102] | [0.345] | [0.118] | [0.109] | [0.154] | [0.050] |
| Aid x Total Number of Donors (N) | -0.011 | -0.010* | 0.005 | -0.012 | -0.023 | -0.006 |
| | [0.008] | [0.005] | [0.003] | [0.011] | [0.020] | [0.006] |
| p-value equal coefficients | | 0.895 | | 0.065 | | 0.341 |
| | | | Small Donors (N<10%) | | | |
| Aid | 0.706** | 0.448 | 0.078 | 0.174 | 0.617 | 0.178 |
| | [0.340] | [0.360] | [0.121] | [0.322] | [0.429] | [0.201] |
| Aid^2 | -0.015 | -0.001 | -0.001 | -0.002 | -0.007 | 0.000 |
| | [0.010] | [0.003] | [0.001] | [0.002] | [0.004] | [0.002] |
| Small Donors (N<10%) | -0.015 | 0.239 | -0.046 | -0.057 | 0.000 | 0.127** |
| | [0.088] | [0.200] | [0.102] | [0.108] | [0.188] | [0.063] |
| Aid x Small Donors (N<10%) | -0.015 | -0.007 | 0.005* | -0.002 | -0.022 | -0.005 |
| | [0.011] | [0.005] | [0.003] | [0.015] | [0.021] | [0.005] |
| p-value equal coefficients | | 0.440 | | 0.578 | | 0.352 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. This is the extended form of the regressions in Table 3, displaying all main effects. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality of coefficients for split samples. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

**Table A5: Aid, fragmentation and bureaucratic quality, 1986-2013, split sample (all main effects)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| **ICRG Bureaucratic quality** | | | | | | |
| | | | F(HI) | | | |
| Aid | -0.334** | 0.099 | 0.097 | -0.052 | -0.152 | -0.334** |
| | [0.135] | [0.085] | [0.124] | [0.105] | [0.106] | [0.135] |
| Aid^2 | 0.009 | 0.000 | 0.000 | 0.000 | -0.001* | 0.009 |
| | [0.009] | [0.000] | [0.000] | [0.001] | [0.001] | [0.009] |
| F(HI) | -0.690 | 3.164*** | 1.238 | 0.954 | -0.465 | -0.690 |
| | [1.230] | [0.910] | [0.791] | [1.422] | [0.472] | [1.230] |
| Aid x F(HI) | 0.341 | -0.101 | -0.143 | 0.061 | 0.253* | 0.341 |
| | [0.215] | [0.095] | [0.158] | [0.131] | [0.134] | [0.215] |
| p-value equal coefficients | 0.015 | | | 0.183 | | 0.007 |
| | | | F(CR3) | | | |
| Aid | -0.269* | 0.046 | 0.055 | -0.015 | -0.037 | 0.015 |
| | [0.136] | [0.047] | [0.041] | [0.049] | [0.044] | [0.017] |
| Aid^2 | 0.009 | 0.000 | 0.000 | 0.000 | -0.001* | 0.000 |
| | [0.008] | [0.000] | [0.000] | [0.000] | [0.001] | [0.000] |
| F(CR3) | -0.45 | 2.285* | 1.454*** | 1.111 | -0.354 | 0.051 |
| | [1.296] | [1.194] | [0.525] | [1.276] | [0.591] | [0.266] |
| Aid x F(CR3) | 0.451** | -0.072 | -0.166* | 0.017 | 0.198** | -0.055 |
| | [0.203] | [0.076] | [0.097] | [0.089] | [0.078] | [0.048] |
| p-value equal coefficients | 0.002 | | | 0.077 | | 0.000 |

**Table A5 (continued)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| | | | **Total Number of Donors (N)** | | | |
| Aid | -0.351 | 0.001 | -0.033 | -0.021 | 0.091 | -0.014 |
| | [0.228] | [0.024] | [0.046] | [0.115] | [0.099] | [0.017] |
| Aid^2 | 0.013 | 0.000 | 0.000 | 0.000 | -0.001 | 0.000 |
| | [0.009] | [0.000] | [0.000] | [0.000] | [0.001] | [0.000] |
| Total number of donors (N) | -0.031 | 0.043 | -0.054 | 0.006 | 0.038 | 0.003 |
| | [0.026] | [0.038] | [0.037] | [0.034] | [0.039] | [0.005] |
| Aid x Total number of donors (N) | 0.007 | 0.000 | 0.000 | 0.000 | -0.002 | 0.000 |
| | [0.007] | [0.001] | [0.001] | [0.004] | [0.004] | [0.000] |
| p-value equal coefficients | | 0.171 | | 0.959 | | 0.412 |
| | | | **Small Donors (N<10%)** | | | |
| Aid | -0.217 | 0.001 | -0.024 | -0.011 | 0.169** | -0.014 |
| | [0.256] | [0.022] | [0.037] | [0.066] | [0.080] | [0.014] |
| Aid^2 | 0.013 | 0.000 | 0.000 | 0.000 | -0.001 | 0.000 |
| | [0.010] | [0.000] | [0.000] | [0.000] | [0.001] | [0.000] |
| Small Donors (N<10%) | -0.020 | -0.031 | -0.037 | -0.011 | 0.028 | 0.008 |
| | [0.024] | [0.035] | [0.024] | [0.029] | [0.034] | [0.006] |
| Aid x Small Donors (N<10%) | 0.001 | 0.000 | 0.000 | 0.000 | -0.007* | 0.000 |
| | [0.006] | [0.001] | [0.001] | [0.003] | [0.004] | [0.001] |
| p-value equal coefficients | | 0.826 | | 0.807 | | 0.014 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total

aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. This is the extended form of the

regressions in Table 4, displaying all main effects. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality

of coefficients for split samples. * p<0.10, ** p<0.05, *** p<0.01.

**Table A6: Aid, fragmentation, and bureaucratic quality (based on Knack and Rahman), cross-section 1982-2001**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **ICRG bureaucratic quality** | | | | |
| Aid | 0.011 | -0.003 | 0.218* | 0.008 |
| | [0.135] | [0.061] | [0.112] | [0.162] |
| Fragmentation | -0.362 | -0.215 | -0.077 | 0.007 |
| | [1.113] | [1.180] | [0.062] | [0.063] |
| Aid x Fragmentation | -0.055 | -0.069 | -0.009** | -0.003 |
| | [0.162] | [0.133] | [0.004] | [0.009] |
| Adj. R-Squared | 0.250 | 0.250 | 0.310 | 0.240 |
| Number of observations | 83 | 83 | 83 | 83 |
| Number of countries | 83 | 83 | 83 | 83 |
| Marginal effect of Aid at | | | | |
| Frag. 20% percentile | -0.025 | -0.020 | -0.019 | -0.036* |
| | [0.032] | [0.031] | [0.015] | [0.019] |
| Frag. 50% percentile | -0.032* | -0.027 | -0.037** | -0.042** |
| | [0.018] | [0.020] | [0.015] | [0.020] |
| Frag. 80% percentile. | -0.037** | -0.037** | -0.048*** | -0.045 |
| | [0.018] | [0.017] | [0.018] | [0.029] |
| Marginal effect of Frag. at | -0.560 | -0.463 | -0.109** | -0.003 |
| Aid 50% percentile | [0.691] | [0.888] | [0.054] | [0.042] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The control variables are defined in Table A1. Both aid and fragmentation are lagged by one period. The marginal effect of aid refers to the change in bureaucratic quality for a one percentage point

increase in aid as a percentage of GNI at different levels of fragmentation ("Frag."). Standard errors clustered at the country level are reported in brackets.

* p<0.10, ** p<0.05, *** p<0.01.

**Table A7: Aid, fragmentation and primary enrolment, 1994-2013 (all main effects)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| **Net enrollment rate (%)** | | | | |
| | | F(HI) | | |
| Aid | -5.786* | 1.321 | -0.696 | -1.319 |
| | [2.942] | [1.785] | [1.533] | [2.306] |
| Aid^2 | -0.001 | -0.150** | -0.042 | 0.240 |
| | [0.112] | [0.061] | [0.050] | [0.326] |
| F(HI) | -11.555* | 7.638 | -5.506 | 7.103 |
| | [6.633] | [11.009] | [12.473] | [9.232] |
| Aid x F(HI) | 12.446*** | 2.515 | 1.724 | 1.594 |
| | [3.508] | [2.036] | [2.136] | [3.009] |
| p-value equal coefficients | | 0.000 | | 0.953 |
| | | F(CR3) | | |
| Aid | -2.618 | 2.611** | -0.180 | 0.267 |
| | [1.572] | [1.098] | [0.948] | [2.013] |
| Aid^2 | -0.014 | -0.141** | -0.037 | 0.106 |
| | [0.064] | [0.064] | [0.032] | [0.286] |
| F(CR3) | -27.627** | 40.583 | 8.831 | 30.804 |
| | [12.490] | [25.067] | [29.574] | [48.560] |
| Aid x F(CR3) | 23.729*** | 0.154 | 2.363 | -2.933 |
| | [3.810] | [3.020] | [3.068] | [12.599] |
| p-value equal coefficients | | 0.000 | | 0.538 |

**Table A7 (continued)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| | | Total Number of Donors (N) | | |
| Aid | -1.737 | 2.028 | -0.944 | -0.010 |
| | [2.530] | [1.251] | [0.920] | [1.812] |
| Aid^2 | -0.179 | -0.136 | -0.037 | 0.125 |
| | [0.144] | [0.082] | [0.041] | [0.346] |
| Total Number of Donors (N) | -0.370 | 1.921 | 0.191 | 1.166 |
| | [0.776] | [1.161] | [0.871] | [1.429] |
| Aid x Total Number of Donors (N) | 0.412 | 0.017 | 0.078 | -0.028 |
| | [0.307] | [0.076] | [0.056] | [0.277] |
| p-value equal coefficients | | 0.011 | | 0.567 |
| | | Small Donors (N<10%) | | |
| Aid | -5.871 | 1.543 | -1.961 | -0.267 |
| | [8.581] | [2.916] | [3.271] | [2.012] |
| Aid^2 | -0.450 | -0.167** | 0.005 | 0.163 |
| | [0.441] | [0.064] | [0.040] | [0.317] |
| Small Donors (N<10%) | -6.789 | -13.802 | 4.211 | -2.957 |
| | [9.051] | [16.074] | [16.056] | [6.263] |
| Aid x Small Donors (N<10%) | 12.223 | 2.158 | 1.734 | 0.106 |
| | [14.025] | [3.437] | [3.288] | [1.530] |
| p-value equal coefficients | | 0.427 | | 0.404 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. This is the extended form of the regressions in Table 7, displaying all main effects. Standard errors clustered at the country level are reported in brackets. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

**Table A8: Aid, fragmentation and primary enrolment (based on Birchler and Michaelowa), 1996-2010**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **Net enrolment rate (%)** | | | | |
| Aid | -0.041 | 0.024 | 0.015 | 0.126* |
| | [0.049] | [0.025] | [0.064] | [0.073] |
| Fragmentation | -1.451 | 8.621 | 1.001** | 0.859 |
| | [6.414] | [11.634] | [0.450] | [0.554] |
| Aid x Fragmentation | 0.135* | 0.125 | 0.001 | -0.006 |
| | [0.079] | [0.116] | [0.003] | [0.005] |
| Adj. R-Squared | 0.490 | 0.490 | 0.490 | 0.490 |
| Number of observations | 257 | 258 | 258 | 258 |
| Number of countries | 110 | 110 | 110 | 110 |
| Marginal effect of Aid at | | | | |
| Frag. 20th percentile | 0.007 | 0.026 | 0.017 | 0.116 |
| | [0.034] | [0.032] | [0.071] | [0.090] |
| Frag. 50th percentile | 0.039* | 0.036 | 0.019 | 0.098 |
| | [0.023] | [0.024] | [0.052] | [0.073] |
| Frag. 80th percentile | 0.061** | 0.056** | 0.023 | 0.068 |
| | [0.029] | [0.026] | [0.028] | [0.045] |
| Marginal effect of Frag. at | 0.586 | 10.506 | 1.009* | 0.767 |
| Aid 50th percentile | [8.247] | [14.611] | [0.605] | [0.756] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on education aid by the three largest donors as a percentage of total education aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The control variables are defined in the appendix, Table A1. Both aid and fragmentation are lagged by one period. The sample is based on 5-year periods. All regressions include period- and country-fixed effects. The marginal effect of aid refers to the change in the net primary enrolment rate if education aid increases by one dollar at different levels of fragmentation ("Frag."). Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.

**Table A9: Aid, fragmentation and primary enrolment (based on Birchler and Michaelowa), 1996-2010, sample splits**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| Aid x F(HI) | 0.771* | 0.214 | -0.042 | 0.257 |
| | [0.403] | [0.910] | [0.348] | [0.528] |
| p-value equal coefficients | | 0.182 | | 0.298 |
| Aid x F(CR3) | 0.524 | 0.748 | -0.079 | 0.016 |
| | [0.356] | [0.977] | [1.410] | [0.456] |
| p-value equal coefficients | | 0.598 | | 0.745 |
| Aid x Total number of donors | 0.020 | 0.033** | 0.003 | -0.002 |
| | [0.013] | [0.015] | [0.046] | [0.015] |
| p-value equal coefficients | | 0.171 | | 0.558 |
| Aid x Small donors (N<10%) | 0.006 | 0.025 | 0.043 | -0.020 |
| | [0.020] | [0.019] | [0.047] | [0.020] |
| p-value equal coefficients | | 0.163 | | 0.000 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The regressions are based on Table A8. Samples are split at the 50th percentile. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality of coefficients for split samples. * p<0.10, ** p<0.05, *** p<0.01.

**Table A10: Aid, fragmentation and primary enrolment (based on Birchler and Michaelowa), 1996-2010, sample splits (all main effects)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| **Net enrollment rate (%)** | | | | |
| | | F(HI) | | |
| Aid | -0.444* | -0.075 | -0.344 | -0.089 |
| | [0.248] | [0.629] | [0.423] | [0.409] |
| F(HI) | 1.827 | -16.091 | -91.680 | 8.256 |
| | [11.816] | [55.018] | [191.732] | [12.908] |
| Aid x F(HI) | 0.771* | 0.214 | -0.042 | 0.257 |
| | [0.403] | [0.910] | [0.348] | [0.528] |
| p-value equal coefficients | | 0.182 | | 0.298 |
| | | F(CR3) | | |
| Aid | -0.049 | -0.152 | -0.328 | 0.092 |
| | [0.063] | [0.306] | [1.217] | [0.166] |
| F(CR3) | 19.898 | -81.436 | -206.873 | 18.937 |
| | [35.647] | [89.387] | [1332.585] | [20.460] |
| Aid x F(CR3) | 0.524 | 0.748 | -0.079 | 0.016 |
| | [0.356] | [0.977] | [1.410] | [0.456] |
| p-value equal coefficients | | 0.598 | | 0.745 |

**Table A101 (continued)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| | | Total Number of Donors (N) | | |
| Aid | -0.438 | -0.652 | -0.419 | 0.127 |
| | [0.291] | [0.412] | [1.632] | [0.369] |
| Total Number of Donors | 1.694* | -0.444 | 6.541 | 0.736 |
| | [0.943] | [1.093] | [27.742] | [1.190] |
| Aid x Total Number of Donors | 0.020 | 0.033** | 0.003 | -0.002 |
| | [0.013] | [0.015] | [0.046] | [0.015] |
| p-value equal coefficients | | 0.171 | | 0.558 |
| | | Small Donors (N<10%) | | |
| Aid | -0.105 | -0.185 | -1.307 | 0.435 |
| | [0.360] | [0.386] | [1.157] | [0.375] |
| Small Donors (N<10%) | 1.889 | -3.161 | 14.956 | -0.483 |
| | [1.261] | [3.905] | [10.545] | [1.845] |
| Aid x Small Donors (N<10%) | 0.006 | 0.025 | 0.043 | -0.020 |
| | [0.020] | [0.019] | [0.047] | [0.020] |
| p-value equal coefficients | | 0.163 | | 0.000 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. This is the extended form of the regressions in Table A9, displaying all main effects. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality of coefficients for split samples. * p<0.10, ** p<0.05, *** p<0.01.

**Table A11: Aid, fragmentation and primary enrolment, 1994-2013, commitments**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **Net enrollment rate (%)** | | | | |
| Aid | 0.039 | 0.041 | 0.001 | -0.059 |
| | [0.048] | [0.040] | [0.047] | [0.132] |
| Aid^2 | -0.000*** | -0.000** | -0.000*** | -0.000** |
| | [0.000] | [0.000] | [0.000] | [0.000] |
| Fragmentation | 4.238 | 12.515 | 0.639 | -5.123 |
| | [4.864] | [10.865] | [0.554] | [5.231] |
| Aid x Fragmentation | 0.151** | 0.322*** | 0.008** | 0.215 |
| | [0.075] | [0.114] | [0.004] | [0.166] |
| Adj. R-Squared | 0.519 | 0.585 | 0.558 | 0.482 |
| Number of observations | 208 | 208 | 208 | 208 |
| Number of countries | 69 | 69 | 69 | 69 |
| Marginal effect of Aid at | | | | |
| Frag. 20th percentile | 0.050 | 0.036 | -0.001 | -0.036 |
| | [0.049] | [0.047] | [0.054] | [0.133] |
| Frag. 50th percentile | 0.096** | 0.046 | 0.023 | 0.037 |
| | [0.039] | [0.044] | [0.044] | [0.069] |
| Frag. 80th percentile | 0.130*** | 0.091*** | 0.077** | 0.092** |
| | [0.043] | [0.034] | [0.035] | [0.040] |
| Marginal effect of Frag. at | 5.587 | 13.246 | 0.931 | -3.453 |
| Aid 50th percentile | [6.064] | [12.846] | [0.726] | [7.588] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The table is identical to Table 6, but with commitments instead of disbursements for education aid. Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.

# Online Appendix (NOT FOR PUBLICATION)

**Table A1: Definition of variables and descriptive statistics**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Burnside & Dollar (Tables 2 and 3)** | | | | | | | |
| **Variable name** | **Obs.** | **Mean** | **Std. Dev.** | **Min** | **Max** | **Definition** | **Sources** |
| GDP p.c. growth | 715 | 1.79 | 3.62 | -32.42 | 17.05 | Average over annual growth rates of real GDP p.c. based on constant local currency (in %). | World Bank (2007, 2016)* |
| Net ODA (% of GDP) | 715 | 5.31 | 8.17 | -0.13 | 82.39 | ODA total net in % of GDP (high maximum value is Liberia over the 2006-2009 period). | OECD/DAC (2016) |
| F(HI) | 715 | 0.75 | 0.15 | 0.11 | 0.93 | Fragmentation index based on Herfindahl index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 715 | 0.34 | 0.14 | 0.00 | 0.67 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 715 | 29.60 | 9.15 | 7.67 | 47.00 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 715 | 20.81 | 7.73 | 4.33 | 41.75 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Bureaucratic quality | 547 | 1.77 | 0.94 | 0.00 | 4.00 | Bureaucracy quality indicator, higher scores indicate better quality (only used to split samples in Table 3). | PRS Group (2013) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Log initial GDP/capita | 715 | 2.10 | 0.12 | 1.65 | 2.42 | Logarithm of initial GDP p.c. in international prices. | Heston, Summers, and Aten (2006), World Bank (2016)* |
| Assassinations | 715 | 0.33 | 1.04 | 0.00 | 11.50 | Number of assassinations. | Banks and Wilson (2007, 2014)* |
| Ethnolinguistic fractionalization | 715 | 0.46 | 0.30 | 0.00 | 0.93 | Ethnolinguistic fractionalization. | Easterly and Levine (1997), Roeder (2001)* |
| Assassinations x ethnolinguistic fractionalization | 715 | 0.12 | 0.45 | 0.00 | 7.36 | Interaction between assassinations and ethnolinguistic fractionalization. | Banks (2007, 2014), Easterly and Levine (1997), Roeder (2001)* |
| M2 (% of GDP) | 715 | 9.54 | 24.61 | 0.04 | 243.64 | Money and quasi-money (M2) in % of GDP. | World Bank (2007, 2016)* |

* Data source is Clemens et al. (2012), http://www.cgdev.org/doc/Working%20Papers/CRBB-Replication-Files.zip, accessed 06.06.2012. More details are provided in "Technical appendix to counting chickens when they hatch: Timing and the effects of aid on growth,"
http://www.cgdev.org/doc/Working%20Papers/counting_chickens_technical_appendix.pdf, accessed 06.06.2012. For more recent years, we use data from the World Development Indicators (World Bank 2016).

| Knack & Rahman (Tables 4 and 5) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Variable name | Obs. | Mean | Std. Dev. | Min | Max | Definition | Sources |
| Bureaucratic quality | 485 | 1.76 | 0.95 | 0.00 | 4.00 | Bureaucracy quality indicator, higher scores indicate better quality; value for the year following the four-year period covered by the right-hand side variables. | PRS Group (2013) |
| Net ODA (% of GDP) | 485 | 5.92 | 9.28 | -0.13 | 82.39 | ODA total net in % of GDP. | OECD/DAC (2016) |
| F(HI) | 485 | 0.78 | 0.14 | 0.11 | 0.93 | Fragmentation index based on Herfindahl index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 485 | 0.37 | 0.14 | 0.01 | 0.67 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- Sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 485 | 33.72 | 7.90 | 7.67 | 47.00 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 485 | 24.08 | 7.07 | 4.33 | 41.75 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Bureaucratic quality | 485 | 1.78 | 0.91 | 0.00 | 4.00 | Bureaucracy quality indicator, higher scores indicate better quality (only used to split samples in Table 5). | PRS Group (2013) |
| Log initial GDP/capita | 485 | 2.10 | 0.12 | 1.65 | 2.34 | Logarithm of initial GDP p.c. in International prices. | Heston, Summers, and Aten (2006), World Bank (2016)* |
| Assassinations | 485 | 0.32 | 0.95 | 0.00 | 11.50 | Number of assassinations. | Banks (2007, 2012)* |
| Ethnolinguistic fractionalization | 485 | 0.46 | 0.30 | 0.00 | 0.93 | Ethnolinguistic fractionalization. | Easterly and Levine (1997), Roeder (2001)* |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Assassinations x ethnolinguistic fractionalization | 485 | 0.11 | 0.33 | 0.00 | 3.04 | Interaction between assassinations and ethnolinguistic fractionalization. | Banks (2007, 2014), Easterly and Levine (1997), Roeder (2001)* |
| M2 (% of GDP) | 485 | 13.95 | 28.87 | 0.04 | 243.64 | Money and quasi-money (M2) in % of GDP. | World Bank (2007, 2016)* |

* Data source is Clemens et al. (2012), http://www.cgdev.org/doc/Working%20Papers/CRBB-Replication-Files.zip, accessed 06.06.2012. More details are provided in "Technical appendix to counting chickens when they hatch: Timing and the effects of aid on growth,"
http://www.cgdev.org/doc/Working%20Papers/counting_chickens_technical_appendix.pdf, accessed 06.06.2012. For more recent years, we use data from the World Development Indicators (World Bank 2016).

| Birchler & Michaelowa (Tables 6 and 7) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Variable name | Obs. | Mean | Std. Dev. | Min | Max | Definition | Sources |
| Net primary enrolment rate (%) | 228 | 81.51 | 18.37 | 22.39 | 100.00 | Net enrolment rate for primary education (%). | WDI (World Bank 2007, 2016)* |
| Aid for education | 228 | 3.23 | 4.12 | 0.00 | 23.33 | ODA per capita allocated to education (disbursement, constant 2000 US$ million). | OECD/DAC (2016) |
| F(HI) | 228 | 0.50 | 0.27 | 0.00 | 0.89 | Fragmentation index based on Herfindahl Index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 228 | 0.14 | 0.13 | 0.00 | 0.52 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- Sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 228 | 9.84 | 6.87 | 1.00 | 26.00 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 228 | 0.58 | 0.29 | 0.00 | 0.92 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Bureaucratic quality | 228 | 1.77 | 0.78 | 0.00 | 3.55 | Bureaucracy quality indicator, higher scores indicate better quality (only used to split samples in Table 7). | PRS Group (2013) |
| Log initial GDP/capita | 228 | 2.08 | 0.11 | 1.65 | 2.27 | Logarithm of initial GDP p.c. in international prices. | Heston, Summers, and Aten (2006), World Bank (2016)* |
| Assassinations | 228 | 0.41 | 1.19 | 0.00 | 11.50 | Number of assassinations. | Banks (2012, 2007)* |
| Ethnolinguistic fractionalization | 228 | 0.47 | 0.29 | 0.00 | 0.93 | Ethnolinguistic fractionalization. | Easterly and Levine (1997), Roeder (2001)* |

| Assassinations x ethnolinguistic Fractionalization | 228 | 0.13 | 0.34 | 0.00 | 3.04 | Interaction between assassinations and ethnolinguistic Fractionalization. | Banks (2012, 2007), Easterly and Levine (1997), Roeder (2001)* |
|---|---|---|---|---|---|---|---|
| M2 (% of GDP) | 228 | 12.03 | 27.03 | 0.05 | 239.67 | Money and quasi-money (M2) in % of GDP. | World Bank (2007, 2016)* |

* Data source is Clemens et al. (2012), http://www.cgdev.org/doc/Working%20Papers/CRBB-Replication-Files.zip, accessed 06.06.2012. More details are provided in "Technical appendix to counting chickens when they hatch: Timing and the effects of aid on growth,"
http://www.cgdev.org/doc/Working%20Papers/counting_chickens_technical_appendix.pdf, accessed 06.06.2012. For more recent years, we use data from the World Development Indicators (World Bank 2016).

| Variable name | Obs. | Mean | Std. Dev. | Min | Max | Definition | Sources |
|---|---|---|---|---|---|---|---|
| **Knack & Rahman (Table A6)** | | | | | | | |
| Bureaucratic quality | 83 | 2 | 1 | 0 | 4 | Bureaucratic quality indicator, higher scores indicate better quality; value in 2001. | PRS Group (2013) |
| F(HI) | 83 | 0.76 | 0.14 | 0.30 | 0.91 | Fragmentation index based on Herfindahl Index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 83 | 0.36 | 0.14 | 0.08 | 0.61 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- Sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 83 | 27.58 | 2.41 | 20.90 | 31.05 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 83 | 18.55 | 2.39 | 13.42 | 25.85 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Initial bureaucratic quality | 83 | 2.26 | 1.21 | 0.00 | 6.00 | Bureaucratic quality indicator, higher scores indicate better quality; value in 1982. | PRS Group (2013)* |
| Population change/ initial population | 83 | 1.89 | 1.07 | -0.80 | 3.98 | Change in population divided by initial population. | World Bank (2004)* |
| GDP p.c. change/ Initial GDP p.c. | 83 | 1.16 | 2.22 | -4.54 | 8.69 | Change in GDP p.c. divided by initial GDP. | World Bank (2004)* |
| No. of years covered | 83 | 15.88 | 4.99 | 3.00 | 19.00 | Number of years covered by the cross-section (varies by recipient since not all countries were covered by ICRG over the whole period of the cross sectional analysis). | PRS Group (2013)* |
| Aid/GNI | 83 | 7.11 | 9.00 | 0.05 | 50.56 | Aid flows as percentage of gross national income (GNI). | World Bank (2004)* |

* Data source is Knack and Rahman (2007).

| Birchler & Michaelowa (Tables A8 and A9) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Variable name | Obs. | Mean | Std. Dev. | Min | Max | Definition | Sources |
| Net primary enrolment rate (%) | 166 | 81.86 | 16.25 | 27.04 | 100.00 | Net enrolment rate for primary education (%). | World Bank (2012)* |
| Aid for education | 166 | 51.78 | 73.35 | 0.09 | 494.18 | Aid allocated to education (disbursement, constant 2000 US$ million). [Birchler and Michaelowa (2016) mistakenly identify this variable as "Education aid per capita," but have in fact not used per capita data.] | OECD/DAC (2012)* |
| F(HI) | 166 | 0.57 | 0.21 | 0.03 | 0.90 | Fragmentation index based on Herfindahl Index for disbursements, calculated only for donor countries (1-Herfindahl). | OECD/DAC (2016) |
| F(CR3) | 166 | 0.15 | 0.13 | -0.29 | 0.54 | Fragmentation index based on concentration ratio of disbursements for the 3 largest donors = 1- Sum of the share of largest three donors. | OECD/DAC (2016) |
| Total number of donors (N) | 166 | 10.40 | 6.06 | 1.20 | 25.20 | Total number of donors (N) (bi- and multilateral). | OECD/DAC (2016) |
| Small donors (N<10%) | 166 | 6.29 | 4.35 | 0.00 | 17.00 | Number of insignificant donors; includes all donors that are among the smallest donors and cumulatively account for less than 10% of aid (based on the OECD definition). | OECD/DAC (2016) |
| Initial Bureaucratic quality | 166 | 1.65 | 0.83 | 0.00 | 3.92 | Initial bureaucracy quality indicator, higher scores indicate better quality (only used to split samples in Table A9). | PRS Group (2013) |
| Log initial GDP p.c. | 164 | 4509.39 | 4735.63 | 239.07 | 23362.07 | Logarithm of initial GDP p.c. in international prices. | World Bank (2012)* |
| Education expenditure | 166 | 16.62 | 4.13 | 6.35 | 32.78 | Public spending on education (% of government expenditure). | World Bank (2012)* |
| PTR | 166 | 34.77 | 13.48 | 11.14 | 79.98 | Pupil-teacher ratio in primary education. | World Bank (2012)* |

| Young population | 166 | 37.59 | 7.92 | 14.80 | 49.64 | Population aged 0-14 (% of total population). | World Bank (2012)* |
|---|---|---|---|---|---|---|---|
| GDP per capita | 166 | 4485.21 | 4712.06 | 239.07 | 23362.07 | GDP per capita (constant 2000 US$). | World Bank (2012)* |
| Budget (surplus) | 166 | -1.46 | 4.23 | -18.40 | 35.14 | Cash surplus/deficit (% of GDP). | World Bank (2012)* |
| Inflation | 166 | 19.17 | 81.97 | -4.07 | 1008.95 | Inflation (consumer prices, % annual). | World Bank (2012)* |
| Openness | 166 | 75.14 | 35.77 | 22.36 | 206.43 | Openness (export+import in % of GDP). | World Bank (2012)* |
| Freedom | 166 | 4.04 | 1.57 | 1.00 | 7.00 | Freedom House (mean of political rights and civil liberties; lowest freedom=7, highest=1). | Freedom House (2011)* |

* Data source is Birchler and Michaelowa (2016).

**Table A2: Pre-trends in fragmentation**

| | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **Dependent variable: Fragmentation index (t)** | | | | |
| GDP p.c. growth (t) | 0.000 | 0.000 | 0.012 | 0.033 |
| | [0.001] | [0.001] | [0.048] | [0.040] |
| GDP p.c. growth (t-1) | 0.002* | 0.001 | 0.042 | 0.011 |
| | [0.001] | [0.001] | [0.031] | [0.034] |
| GDP p.c. growth (t-2) | 0.001 | 0.001 | 0.041 | 0.027 |
| | [0.001] | [0.001] | [0.029] | [0.030] |
| Adj. R-Squared | 0.098 | 0.153 | 0.918 | 0.880 |
| Number of observations | 653 | 653 | 653 | 653 |
| **Dependent variable: Fragmentation index (t)** | | | | |
| Bureaucratic quality (t) | 0.018 | 0.014 | -0.209 | -0.535 |
| | [0.016] | [0.013] | [0.269] | [0.348] |
| Bureaucratic quality (t-1) | -0.008 | -0.005 | -0.258 | 0.109 |
| | [0.010] | [0.011] | [0.295] | [0.435] |
| Bureaucratic quality (t-2) | 0.008 | 0.005 | -0.003 | -0.204 |
| | [0.011] | [0.012] | [0.296] | [0.381] |
| Adj. R-Squared | 0.044 | 0.045 | 0.888 | 0.842 |
| Number of observations | 418 | 418 | 418 | 418 |
| **Dependent variable: Fragmentation index (t)** | | | | |
| Primary enrolment (t) | -0.002 | 0.002 | 0.111** | 0.003 |
| | [0.003] | [0.002] | [0.043] | [0.003] |
| Primary enrolment (t-1) | 0.001 | -0.002 | -0.064* | -0.002 |
| | [0.003] | [0.002] | [0.036] | [0.003] |
| Primary enrolment (t-2) | -0.004 | -0.002 | -0.025 | 0.005** |
| | [0.003] | [0.002] | [0.057] | [0.002] |
| Adj. R-Squared | 0.760 | 0.660 | 0.930 | 0.880 |
| Number of observations | 165 | 165 | 165 | 165 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The table examines whether lagged values of (1) growth, (2) bureaucratic quality, and (3) enrolment influence the choice of donors to select recipient countries. Control variables for each regression are as in Table 2. The sample is based on 4-year periods. All regressions include period- and country-fixed effects and instrument initial GDP per capita with its first lag. Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.

**Table A3: Aid, fragmentation and growth (based on Burnside and Dollar), 1974-2013, with squared interaction**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **GDP p.c. growth** | | | | |
| Aid | 0.223 | 0.19 | 0.074 | 0.024 |
| | [0.466] | [0.172] | [0.172] | [0.150] |
| Aid^2 | 0.015 | 0.006 | 0.004 | 0.004 |
| | [0.019] | [0.005] | [0.005] | [0.004] |
| Fragmentation | -0.977 | -1.191 | -0.082 | -0.013 |
| | [2.182] | [2.255] | [0.060] | [0.054] |
| Aid x Fragmentation | -0.132 | -0.112 | 0.001 | 0.004 |
| | [0.573] | [0.395] | [0.005] | [0.006] |
| Aid^2 x Fragmentation | -0.017 | -0.013 | 0.000 | 0.000 |
| | [0.023] | [0.013] | [0.000] | [0.000] |
| Adj. R-Squared | 0.260 | 0.270 | 0.250 | 0.250 |
| Number of observations | 715 | 715 | 715 | 715 |
| Number of countries | 78 | 78 | 78 | 78 |
| Marginal effect of Aid at | | | | |
| Frag. 20th percentile | 0.181* | 0.207** | 0.117 | 0.097 |
| | [0.098] | [0.098] | [0.076] | [0.071] |
| Frag. 50th percentile | 0.133** | 0.172** | 0.115* | 0.108* |
| | [0.062] | [0.072] | [0.062] | [0.061] |
| Frag. 80th percentile | 0.106* | 0.132** | 0.114** | 0.126** |
| | [0.062] | [0.066] | [0.053] | [0.058] |
| Marginal effect of Frag. at | -1.411 | -1.278 | -0.014 | 0.031 |
| Aid 50th percentile | [1.350] | [1.800] | [0.053] | [0.053] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. Besides the squared interaction term, the regressions are identical to those in Table 3. Standard errors clustered at the country level are reported in brackets. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

**Table A4: Aid, fragmentation and growth (based on Burnside and Dollar), 1974-2013, sample splits (all main effects)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| **GDP p.c. growth** | | | | | | |
| | | | F(HI) | | | |
| Aid | 0.543 | 2.237* | 0.859** | 0.463 | 0.313 | 1.011 |
| | [0.507] | [1.251] | [0.363] | [0.331] | [0.445] | [0.728] |
| Aid^2 | -0.017* | -0.002 | 0.000 | 0.000 | -0.005 | 0.000 |
| | [0.010] | [0.003] | [0.001] | [0.002] | [0.004] | [0.002] |
| F(HI) | -2.734 | 13.903 | 0.861 | -0.445 | -3.300 | 2.875 |
| | [2.750] | [9.009] | [2.527] | [2.331] | [3.193] | [3.083] |
| Aid x F(HI) | -0.074 | -2.248* | -0.851** | -0.442 | -0.131 | -1.084 |
| | [0.389] | [1.267] | [0.392] | [0.356] | [0.444] | [0.746] |
| p-value equal coefficients | | 0.051 | | 0.375 | | 0.197 |
| | | | F(CR3) | | | |
| Aid | 0.589 | 1.067* | 0.349 | 0.364** | 0.33 | 0.434 |
| | [0.403] | [0.583] | [0.214] | [0.182] | [0.257] | [0.385] |
| Aid^2 | -0.019* | -0.003 | 0 | 0 | -0.004 | -0.001 |
| | [0.010] | [0.004] | [0.001] | [0.001] | [0.004] | [0.002] |
| F(CR3) | -2.76 | 8.774 | 0.38 | 0.724 | -3.836 | 3.578 |
| | [3.985] | [7.971] | [2.696] | [3.313] | [4.090] | [2.889] |
| Aid x F(CR3) | -0.208 | -1.442* | -0.422 | -0.591** | -0.274 | -0.656 |
| | [0.492] | [0.768] | [0.358] | [0.288] | [0.392] | [0.533] |
| p-value equal coefficients | | 0.114 | | 0.660 | | 0.527 |

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| | | | Total Number of Donors (N) | | | |
| Aid | 0.746** | 0.610 | 0.052 | 0.460 | 0.836 | 0.260 |
| | [0.367] | [0.385] | [0.128] | [0.349] | [0.557] | [0.240] |
| Aid^2 | -0.016* | 0.000 | -0.001 | -0.001 | -0.006 | 0.000 |
| | [0.010] | [0.002] | [0.001] | [0.002] | [0.004] | [0.002] |
| Total Number of Donors (N) | -0.054 | 0.480 | -0.178 | -0.032 | -0.159 | 0.120** |
| | [0.102] | [0.345] | [0.118] | [0.109] | [0.154] | [0.050] |
| Aid x Total Number of Donors (N) | -0.011 | -0.010* | 0.005 | -0.012 | -0.023 | -0.006 |
| | [0.008] | [0.005] | [0.003] | [0.011] | [0.020] | [0.006] |
| p-value equal coefficients | | 0.895 | | 0.065 | | 0.341 |
| | | | Small Donors (N<10%) | | | |
| Aid | 0.706** | 0.448 | 0.078 | 0.174 | 0.617 | 0.178 |
| | [0.340] | [0.360] | [0.121] | [0.322] | [0.429] | [0.201] |
| Aid^2 | -0.015 | -0.001 | -0.001 | -0.002 | -0.007 | 0.000 |
| | [0.010] | [0.003] | [0.001] | [0.002] | [0.004] | [0.002] |
| Small Donors (N<10%) | -0.015 | 0.239 | -0.046 | -0.057 | 0.000 | 0.127** |
| | [0.088] | [0.200] | [0.102] | [0.108] | [0.188] | [0.063] |
| Aid x Small Donors (N<10%) | -0.015 | -0.007 | 0.005* | -0.002 | -0.022 | -0.005 |
| | [0.011] | [0.005] | [0.003] | [0.015] | [0.021] | [0.005] |
| p-value equal coefficients | | 0.440 | | 0.578 | | 0.352 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. This is the extended form of the regressions in Table 4, displaying all main effects. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality of coefficients for split samples. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

**Table A5: Aid, fragmentation and bureaucratic quality, 1986-2013, split sample (all main effects)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| **ICRG Bureaucratic quality** | | | | | | |
| | | | F(HI) | | | |
| Aid | -0.334** | 0.099 | 0.097 | -0.052 | -0.152 | -0.334** |
| | [0.135] | [0.085] | [0.124] | [0.105] | [0.106] | [0.135] |
| Aid^2 | 0.009 | 0.000 | 0.000 | 0.000 | -0.001* | 0.009 |
| | [0.009] | [0.000] | [0.000] | [0.001] | [0.001] | [0.009] |
| F(HI) | -0.690 | 3.164*** | 1.238 | 0.954 | -0.465 | -0.690 |
| | [1.230] | [0.910] | [0.791] | [1.422] | [0.472] | [1.230] |
| Aid x F(HI) | 0.341 | -0.101 | -0.143 | 0.061 | 0.253* | 0.341 |
| | [0.215] | [0.095] | [0.158] | [0.131] | [0.134] | [0.215] |
| p-value equal coefficients | | 0.015 | | 0.183 | | 0.007 |
| | | | F(CR3) | | | |
| Aid | -0.269* | 0.046 | 0.055 | -0.015 | -0.037 | 0.015 |
| | [0.136] | [0.047] | [0.041] | [0.049] | [0.044] | [0.017] |
| Aid^2 | 0.009 | 0.000 | 0.000 | 0.000 | -0.001* | 0.000 |
| | [0.008] | [0.000] | [0.000] | [0.000] | [0.001] | [0.000] |
| F(CR3) | -0.45 | 2.285* | 1.454*** | 1.111 | -0.354 | 0.051 |
| | [1.296] | [1.194] | [0.525] | [1.276] | [0.591] | [0.266] |
| Aid x F(CR3) | 0.451** | -0.072 | -0.166* | 0.017 | 0.198** | -0.055 |
| | [0.203] | [0.076] | [0.097] | [0.089] | [0.078] | [0.048] |
| p-value equal coefficients | | 0.002 | | 0.077 | | 0.000 |

14

**Table A5 (continued)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment | Prior to 1994 | Since 1994 |
|---|---|---|---|---|---|---|
| | | | Total Number of Donors (N) | | | |
| Aid | -0.351 | 0.001 | -0.033 | -0.021 | 0.091 | -0.014 |
| | [0.228] | [0.024] | [0.046] | [0.115] | [0.099] | [0.017] |
| Aid^2 | 0.013 | 0.000 | 0.000 | 0.000 | -0.001 | 0.000 |
| | [0.009] | [0.000] | [0.000] | [0.000] | [0.001] | [0.000] |
| Total number of donors (N) | -0.031 | 0.043 | -0.054 | 0.006 | 0.038 | 0.003 |
| | [0.026] | [0.038] | [0.037] | [0.034] | [0.039] | [0.005] |
| Aid x Total number of donors (N) | 0.007 | 0.000 | 0.000 | 0.000 | -0.002 | 0.000 |
| | [0.007] | [0.001] | [0.001] | [0.004] | [0.004] | [0.000] |
| p-value equal coefficients | | 0.171 | | 0.959 | | 0.412 |
| | | | Small Donors (N<10%) | | | |
| Aid | -0.217 | 0.001 | -0.024 | -0.011 | 0.169** | -0.014 |
| | [0.256] | [0.022] | [0.037] | [0.066] | [0.080] | [0.014] |
| Aid^2 | 0.013 | 0.000 | 0.000 | 0.000 | -0.001 | 0.000 |
| | [0.010] | [0.000] | [0.000] | [0.000] | [0.001] | [0.000] |
| Small Donors (N<10%) | -0.020 | -0.031 | -0.037 | -0.011 | 0.028 | 0.008 |
| | [0.024] | [0.035] | [0.024] | [0.029] | [0.034] | [0.006] |
| Aid x Small Donors (N<10%) | 0.001 | 0.000 | 0.000 | 0.000 | -0.007* | 0.000 |
| | [0.006] | [0.001] | [0.001] | [0.003] | [0.004] | [0.001] |
| p-value equal coefficients | | 0.826 | | 0.807 | | 0.014 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. This is the extended form of the regressions in Table 5, displaying all main effects. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality of coefficients for split samples. * p<0.10, ** p<0.05, *** p<0.01.

**Table A6: Aid, fragmentation, and bureaucratic quality (based on Knack and Rahman), cross-section 1982-2001**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **ICRG bureaucratic quality** | | | | |
| Aid | 0.011 | -0.003 | 0.218* | 0.008 |
| | [0.135] | [0.061] | [0.112] | [0.162] |
| Fragmentation | -0.362 | -0.215 | -0.077 | 0.007 |
| | [1.113] | [1.180] | [0.062] | [0.063] |
| Aid x Fragmentation | -0.055 | -0.069 | -0.009** | -0.003 |
| | [0.162] | [0.133] | [0.004] | [0.009] |
| Adj. R-Squared | 0.250 | 0.250 | 0.310 | 0.240 |
| Number of observations | 83 | 83 | 83 | 83 |
| Number of countries | 83 | 83 | 83 | 83 |
| Marginal effect of Aid at | | | | |
| Frag. 20% percentile | -0.025 | -0.020 | -0.019 | -0.036* |
| | [0.032] | [0.031] | [0.015] | [0.019] |
| Frag. 50% percentile | -0.032* | -0.027 | -0.037** | -0.042** |
| | [0.018] | [0.020] | [0.015] | [0.020] |
| Frag. 80% percentile. | -0.037** | -0.037** | -0.048*** | -0.045 |
| | [0.018] | [0.017] | [0.018] | [0.029] |
| Marginal effect of Frag. at | -0.560 | -0.463 | -0.109** | -0.003 |
| Aid 50% percentile | [0.691] | [0.888] | [0.054] | [0.042] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The control variables are defined in Table A1. Both aid and fragmentation are lagged by one period. The marginal effect of aid refers to the change in bureaucratic quality for a one percentage point increase in aid as a percentage of GNI at different levels of fragmentation ("Frag."). Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.

**Table A7: Aid, fragmentation and primary enrolment, 1994-2013 (all main effects)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| **Net enrollment rate (%)** | | | | |
| | | F(HI) | | |
| Aid | -5.786* | 1.321 | -0.696 | -1.319 |
| | [2.942] | [1.785] | [1.533] | [2.306] |
| Aid^2 | -0.001 | -0.150** | -0.042 | 0.240 |
| | [0.112] | [0.061] | [0.050] | [0.326] |
| F(HI) | -11.555* | 7.638 | -5.506 | 7.103 |
| | [6.633] | [11.009] | [12.473] | [9.232] |
| Aid x F(HI) | 12.446*** | 2.515 | 1.724 | 1.594 |
| | [3.508] | [2.036] | [2.136] | [3.009] |
| p-value equal coefficients | | 0.000 | | 0.953 |
| | | F(CR3) | | |
| Aid | -2.618 | 2.611** | -0.180 | 0.267 |
| | [1.572] | [1.098] | [0.948] | [2.013] |
| Aid^2 | -0.014 | -0.141** | -0.037 | 0.106 |
| | [0.064] | [0.064] | [0.032] | [0.286] |
| F(CR3) | -27.627** | 40.583 | 8.831 | 30.804 |
| | [12.490] | [25.067] | [29.574] | [48.560] |
| Aid x F(CR3) | 23.729*** | 0.154 | 2.363 | -2.933 |
| | [3.810] | [3.020] | [3.068] | [12.599] |
| p-value equal coefficients | | 0.000 | | 0.538 |

|  | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| | | Total Number of Donors (N) | | |
| Aid | -1.737 | 2.028 | -0.944 | -0.010 |
| | [2.530] | [1.251] | [0.920] | [1.812] |
| Aid^2 | -0.179 | -0.136 | -0.037 | 0.125 |
| | [0.144] | [0.082] | [0.041] | [0.346] |
| Total Number of Donors (N) | -0.370 | 1.921 | 0.191 | 1.166 |
| | [0.776] | [1.161] | [0.871] | [1.429] |
| Aid x Total Number of Donors (N) | 0.412 | 0.017 | 0.078 | -0.028 |
| | [0.307] | [0.076] | [0.056] | [0.277] |
| p-value equal coefficients | | 0.011 | | 0.567 |
| | | Small Donors (N<10%) | | |
| Aid | -5.871 | 1.543 | -1.961 | -0.267 |
| | [8.581] | [2.916] | [3.271] | [2.012] |
| Aid^2 | -0.450 | -0.167** | 0.005 | 0.163 |
| | [0.441] | [0.064] | [0.040] | [0.317] |
| Small Donors (N<10%) | -6.789 | -13.802 | 4.211 | -2.957 |
| | [9.051] | [16.074] | [16.056] | [6.263] |
| Aid x Small Donors (N<10%) | 12.223 | 2.158 | 1.734 | 0.106 |
| | [14.025] | [3.437] | [3.288] | [1.530] |
| p-value equal coefficients | | 0.427 | | 0.404 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. This is the extended form of the regressions in Table 7, displaying all main effects. Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.

**Table A8: Aid, fragmentation and primary enrolment (based on Birchler and Michaelowa), 1996-2010**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **Net enrolment rate (%)** | | | | |
| Aid | -0.041 | 0.024 | 0.015 | 0.126* |
| | [0.049] | [0.025] | [0.064] | [0.073] |
| Fragmentation | -1.451 | 8.621 | 1.001** | 0.859 |
| | [6.414] | [11.634] | [0.450] | [0.554] |
| Aid x Fragmentation | 0.135* | 0.125 | 0.001 | -0.006 |
| | [0.079] | [0.116] | [0.003] | [0.005] |
| Adj. R-Squared | 0.490 | 0.490 | 0.490 | 0.490 |
| Number of observations | 257 | 258 | 258 | 258 |
| Number of countries | 110 | 110 | 110 | 110 |
| Marginal effect of Aid at | | | | |
| Frag. 20th percentile | 0.007 | 0.026 | 0.017 | 0.116 |
| | [0.034] | [0.032] | [0.071] | [0.090] |
| Frag. 50th percentile | 0.039* | 0.036 | 0.019 | 0.098 |
| | [0.023] | [0.024] | [0.052] | [0.073] |
| Frag. 80th percentile | 0.061** | 0.056** | 0.023 | 0.068 |
| | [0.029] | [0.026] | [0.028] | [0.045] |
| Marginal effect of Frag. at | 0.586 | 10.506 | 1.009* | 0.767 |
| Aid 50th percentile | [8.247] | [14.611] | [0.605] | [0.756] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on education aid by the three largest donors as a percentage of total education aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The control variables are defined in the appendix, Table A1. Both aid and fragmentation are lagged by one period. The sample is based on 5-year periods. All regressions include period- and country-fixed effects. The marginal effect of aid refers to the change in the net primary enrolment rate if education aid increases by one dollar at different levels of fragmentation ("Frag."). Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.

**Table A9: Aid, fragmentation and primary enrolment (based on Birchler and Michaelowa), 1996-2010, sample splits**

|  | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| Aid x F(HI) | 0.771* | 0.214 | -0.042 | 0.257 |
|  | [0.403] | [0.910] | [0.348] | [0.528] |
| p-value equal coefficients |  | 0.182 |  | 0.298 |
| Aid x F(CR3) | 0.524 | 0.748 | -0.079 | 0.016 |
|  | [0.356] | [0.977] | [1.410] | [0.456] |
| p-value equal coefficients |  | 0.598 |  | 0.745 |
| Aid x Total number of donors | 0.020 | 0.033** | 0.003 | -0.002 |
|  | [0.013] | [0.015] | [0.046] | [0.015] |
| p-value equal coefficients |  | 0.171 |  | 0.558 |
| Aid x Small donors (N<10%) | 0.006 | 0.025 | 0.043 | -0.020 |
|  | [0.020] | [0.019] | [0.047] | [0.020] |
| p-value equal coefficients |  | 0.163 |  | 0.000 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The regressions are based on Table A8. Samples are split at the 50th percentile. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality of coefficients for split samples. * p<0.10, ** p<0.05, *** p<0.01.

**Table A10: Aid, fragmentation and primary enrolment (based on Birchler and Michaelowa), 1996-2010, sample splits (all main effects)**

|  | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| **Net enrollment rate (%)** | | | | |
|  | | F(HI) | | |
| Aid | -0.444* | -0.075 | -0.344 | -0.089 |
|  | [0.248] | [0.629] | [0.423] | [0.409] |
| F(HI) | 1.827 | -16.091 | -91.680 | 8.256 |
|  | [11.816] | [55.018] | [191.732] | [12.908] |
| Aid x F(HI) | 0.771* | 0.214 | -0.042 | 0.257 |
|  | [0.403] | [0.910] | [0.348] | [0.528] |
| p-value equal coefficients | | 0.182 | | 0.298 |
|  | | F(CR3) | | |
| Aid | -0.049 | -0.152 | -0.328 | 0.092 |
|  | [0.063] | [0.306] | [1.217] | [0.166] |
| F(CR3) | 19.898 | -81.436 | -206.873 | 18.937 |
|  | [35.647] | [89.387] | [1332.585] | [20.460] |
| Aid x F(CR3) | 0.524 | 0.748 | -0.079 | 0.016 |
|  | [0.356] | [0.977] | [1.410] | [0.456] |
| p-value equal coefficients | | 0.598 | | 0.745 |

**Table A10 (continued)**

| | High Bureaucratic Quality | Low Bureaucratic Quality | High Political Alignment | Low Political Alignment |
|---|---|---|---|---|
| | | Total Number of Donors (N) | | |
| Aid | -0.438 | -0.652 | -0.419 | 0.127 |
| | [0.291] | [0.412] | [1.632] | [0.369] |
| Total Number of Donors | 1.694* | -0.444 | 6.541 | 0.736 |
| | [0.943] | [1.093] | [27.742] | [1.190] |
| Aid x Total Number of Donors | 0.020 | 0.033** | 0.003 | -0.002 |
| | [0.013] | [0.015] | [0.046] | [0.015] |
| p-value equal coefficients | | 0.171 | | 0.558 |
| | | Small Donors (N<10%) | | |
| Aid | -0.105 | -0.185 | -1.307 | 0.435 |
| | [0.360] | [0.386] | [1.157] | [0.375] |
| Small Donors (N<10%) | 1.889 | -3.161 | 14.956 | -0.483 |
| | [1.261] | [3.905] | [10.545] | [1.845] |
| Aid x Small Donors (N<10%) | 0.006 | 0.025 | 0.043 | -0.020 |
| | [0.020] | [0.019] | [0.047] | [0.020] |
| p-value equal coefficients | | 0.163 | | 0.000 |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. This is the extended form of the regressions in Table A9, displaying all main effects. Standard errors clustered at the country level are reported in brackets. P-values refer to a Wald test of the equality of coefficients for split samples. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

**Table A11: Aid, fragmentation and primary enrolment, 1994-2013, commitments**

| Fragmentation index | F(HI) | F(CR3) | Total number of donors (N) | Small donors (N<10%) |
|---|---|---|---|---|
| **Net enrollment rate (%)** | | | | |
| Aid | 0.039 | 0.041 | 0.001 | -0.059 |
| | [0.048] | [0.040] | [0.047] | [0.132] |
| Aid^2 | -0.000*** | -0.000** | -0.000*** | -0.000** |
| | [0.000] | [0.000] | [0.000] | [0.000] |
| Fragmentation | 4.238 | 12.515 | 0.639 | -5.123 |
| | [4.864] | [10.865] | [0.554] | [5.231] |
| Aid x Fragmentation | 0.151** | 0.322*** | 0.008** | 0.215 |
| | [0.075] | [0.114] | [0.004] | [0.166] |
| Adj. R-Squared | 0.519 | 0.585 | 0.558 | 0.482 |
| Number of observations | 208 | 208 | 208 | 208 |
| Number of countries | 69 | 69 | 69 | 69 |
| Marginal effect of Aid at | | | | |
| Frag. 20th percentile | 0.050 | 0.036 | -0.001 | -0.036 |
| | [0.049] | [0.047] | [0.054] | [0.133] |
| Frag. 50th percentile | 0.096** | 0.046 | 0.023 | 0.037 |
| | [0.039] | [0.044] | [0.044] | [0.069] |
| Frag. 80th percentile | 0.130*** | 0.091*** | 0.077** | 0.092** |
| | [0.043] | [0.034] | [0.035] | [0.040] |
| Marginal effect of Frag. at | 5.587 | 13.246 | 0.931 | -3.453 |
| Aid 50th percentile | [6.064] | [12.846] | [0.726] | [7.588] |

Notes: F(HI): Fragmentation index based on the Herfindahl Index; F(CR3): Fragmentation index based on aid by the three largest donors as a percentage of total aid; N(<10%): Fragmentation index based on the number of donors that cumulatively account for at most 10% of aid inflows. The table is identical to Table 6, but with commitments instead of disbursements for education aid. Standard errors clustered at the country level are reported in brackets. * p<0.10, ** p<0.05, *** p<0.01.