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# A Micro-Level Analysis of the Effects of Aid Fragmentation and Aid Alignment

*Hannes Öhler*

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## Abstract

Aid fragmentation and the lack of aid alignment to recipients' policies and processes pose serious challenges to many recipient countries. Consequently, donors have committed themselves to more coordination and alignment in the Paris Declaration (2005) and the Accra Agenda for Action (2008). However, evidence on favourable effects of donors' compliance with these principles is scarce. We contribute to closing this research gap by investigating the effects of aid fragmentation and alignment with the recipient country on infant mortality at the sub-national level within Cambodia. Combining micro panel data on infant mortality and sub-national aid data, our results indicate that the degree of aid fragmentation is of no consequence for development in the health sector. By contrast, common arrangements within programme-based approaches led to positive effects in terms of an improved health situation in the Cambodian provinces. However, the analysis does not point to any beneficial effects of the use of recipient country systems.

**Keywords:** aid fragmentation, aid alignment, donor coordination, health aid, infant mortality, DHS, Cambodia

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Hannes Öhler

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## Abbreviations

CDHS	Cambodia Demographic and Health Survey
CRDB/CDC	Cambodian Rehabilitation and Development Board of the Council for the Development of Cambodia
DAC	Development Assistance Committee
DHS	Demographic and Health Survey
GNI	gross national income
IMF	International Monetary Fund
NGO	non-governmental organisation
ODA	official development assistance
PBA	programme-based approach
PFM	public financial management
SWAp	sector-wide approach
SWiM	sector-wide management
USD	US dollar

## 1 Introduction

Aid fragmentation and the lack of donor coordination and alignment to recipients' policies and processes pose serious challenges to many aid-recipient countries. Well-known problems with regard to the highly fragmented aid landscape are high transaction costs (Acharya, Fuzzo de Lima, & Moore, 2006; Anderson 2012; Klingebiel, Mahn, & Negre, 2016), the administrative burden for recipient countries (Kanbur, 2006; Lawson, 2009; Roodman, 2006), the public administration being deprived of its best staff, leading to the erosion of the bureaucratic quality (Knack & Rahman, 2007), and blurred responsibilities among donors, leading to a tragedy of the commons, moral hazard and free rider behaviour (Dreher & Michaelowa, 2010).

Likewise, the lack of alignment and harmonisation of aid can overburden recipient country systems with multiple reporting requirements and procedures (Knack & Rahman, 2007).<sup>1</sup> Conversely, aligned aid relationships and, in particular, the use of recipient country systems can strengthen the public sector and thereby improve public service delivery (Knack, 2012). For instance, the use of domestic public financial management (PFM) systems can help establish accepted PFM standards, making the management of all public resources more effective.<sup>2</sup> Furthermore, an inclusion of foreign aid into the national budget is supposed to lead to higher transparency and accountability between government, parliament and citizens.<sup>3</sup>

Consequently, at the High Level Fora in Paris (2005) and Accra (2008), the international development community has agreed on principles to make aid more effective. Much emphasis has been put on the reduction of aid fragmentation, the division of labour, the alignment of foreign aid to the national development priorities of recipient countries, in particular through the use of programme-based approaches (PBA), and the use of recipient country systems.<sup>4</sup> Most prominently, the Paris Declaration on Aid Effectiveness in 2005 has listed harmonisation and alignment among the five fundamental principles to make aid more effective.<sup>5</sup>

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1 According to the Paris Declaration in 2005, alignment means that “donors base their overall support on partner countries’ national development strategies, institutions and procedures”. (§16) The principle of harmonisation strives after more harmonised, transparent and collectively effective aid efforts by donors (§32-42). See OECD. The Paris Declaration on Aid Effectiveness and the Accra Agenda for Action.

2 For PFM standards see International Public Sector Accounting Standards (<https://www.ipsasb.org/>), IMF Fiscal Transparency code (<http://www.imf.org/external/np/fad/trans/>); PEFA framework (<https://pefa.org/>).

3 See OECD. Task force on Public Financial Management: Policy Brief 1.

4 A PBA is characterised by “(a) leadership by the host country or organisation; (b) a single comprehensive programme and budget framework; (c) a formalised process for donor co-ordination and harmonisation of donor procedures for reporting, budgeting, financial management and procurement; (d) efforts to increase the use of local systems for programme design and implementation, financial management, monitoring and evaluation” (OECD, 2006, p. 37). The more narrowly defined sector-wide approaches (SWAp) are programme-based approaches operating at the level of an entire sector.

5 In the health sector, the International Health Partnership (IHP+), created in 2007, has also put emphasis on these principles, encouraging donors to align to the national health plans and use in-country systems. See: <http://www.internationalhealthpartnership.net/en/>. The other three principles of the Paris Declaration are: local ownership, focus on results and mutual accountability. We did not assess these principles, as the respective indicators relate to a country’s overall development strategy, results-oriented frameworks and mechanism for mutual assessment of progress. Nevertheless, the alignment of aid to the



With respect to aid fragmentation, it is, however, not clear a priori whether the aforementioned negative effects outweigh the potentially positive effects of a relatively large pool of donors in a country. A larger number of donors may come up with more innovative ideas and put the recipient governments in a position to choose those foreign aid projects that are in line with the national development strategy, thereby enhancing ownership (Gehring, Michaelowa, Dreher, & Spörri, 2015). Moreover, the larger the pool of donors, the lower is the exposure to negative aid shocks, which, in turn, decreases the likelihood of violent political conflict (Gutting & Steinwand, 2017). A further aspect which has to be taken into account is that aid fragmentation is a many-faceted phenomenon and it is not clear at the outset whether, for instance, it is the sheer number of donors or the absence of dominant donors who may lead the coordination activities among donors that is responsible for potential negative effects (Gehring et al., 2015). Concerning aid alignment, the benefits of using recipient country systems are likely to depend on the quality of the systems. For instance, the use of weak PFM systems can lead to corruption and failure to achieve development objectives (Knack, 2013). Arguably, donors are reluctant to use country systems of poor quality because of fiduciary risk (OECD, 2009).

Against this backdrop, it is open to question whether the compliance with the Paris/Accra agenda leads to improvements in development outcomes and the effectiveness of aid. The existing evidence is scarce and the few empirical studies examining the impact of aid fragmentation and (lack of) donor coordination on aid effectiveness come to contradictory conclusions: whereas early studies find aid fragmentation to have a harmful effect (Annen & Kosempel, 2009; Djankov, Montalvo, & Reynal-Querol, 2009; Kimura, Mori, & Sawada, 2012), the most recent and comprehensive study by Gehring et al. (2015) does not find a robust negative effect.<sup>6</sup> Notably, all studies assess the effect of fragmentation in the context of cross-country aid-growth regressions, which brings with it several limitations.<sup>7</sup> Most relevant in our context, duplication of aid efforts mainly occurs at the regional and sectoral level within recipient countries.<sup>8</sup> Importantly, cross-country measures of fragmentation fail to take coordination efforts within recipient countries into account; the costs of aid fragmentation could be overestimated if coordination at the regional–sectoral level within countries actually occurs. On the other hand, “if donors are not only failing to coordinate at a national level, but also sub-nationally, the costs of failed coordination could

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national development strategy and the use of country systems are supposed to also increase local ownership.

- 6 Furukawa (2016) assesses the effect of aid fragmentation on infant and child mortality and primary school completion and finds that a reduction of aid fragmentation has a better chance of improving education outcomes than health outcomes. However, his cross-country regressions are likely to suffer from multicollinearity because of the inclusion of multiple interaction and quadratic terms at the same time (see Chatelein & Ralf (2014) and Roodman (2008)). Furthermore, Gehring et al. (2015) analyse the effect of fragmentation on primary school enrolment and do not find any negative impact.
- 7 The different types of aid are typically aggregated into one aid variable, not taking into account that aid is given for a variety of motives (e.g., emergency needs, political and commercial interests), only part of it meant to foster economic development. Furthermore, aid funds may have been too small to have a measurable effect on country-level GDP levels (Dreher & Lohmann, 2015). See also Roodman (2008) for a comprehensive discussion of econometric problems with respect to cross-country aid-growth regressions.
- 8 Lawson (2010) provides some examples: oversupply of insecticide-treated bed nets in one region while the people in another region receive none; or geological surveys for a road or water project in a specific region conducted by more than one donor.

be even higher than currently estimated” (Powell & Findley, 2012, p. 3).<sup>9</sup> Hence, a sub-national analysis appears to be important to complement cross-country analyses of the effects of aid fragmentation and donor coordination. On the question of whether alignment of aid to the national development strategy and a more frequent use of in-country systems improve development outcomes and the effectiveness of aid, no rigorous quantitative analysis has been conducted. Rather, advocacy for compliance with the principle on alignment is based on theoretical arguments and anecdotal and qualitative evidence (Knack, 2012).<sup>10</sup>

We contribute to closing these research gaps by examining the effects of fragmentation and alignment of health aid on a specific health outcome – infant mortality – at the regional level within Cambodia.<sup>11</sup> It is particularly appropriate to analyse the effects of donors’ compliance with the principles of alignment and harmonisation in the health sector, since health aid plays an important role in the aid budgets of most donors.<sup>12</sup> This typically leads to a highly fragmented aid landscape, which makes the issue of coordination and alignment particularly relevant in this sector. Cambodia is not an exception in this regard, with 25 official donors active in the health sector between 2005 and 2012. At the same time, the health sector in Cambodia appeared to be a front runner in the implementation of the Paris Declaration principles (Keijzer, 2014).<sup>13</sup>

Methodologically, we employ micro panel data on infant mortality, i.e., we use retrospective information in the Demographic and Health Survey (DHS) on the births and, eventually, deaths of children born to the women interviewed in the survey. Geographic information on the interview locations enables us to match the women of a certain province to foreign aid in the respective province.<sup>14</sup> To assess the effects of aid fragmentation, coordination and alignment on infant mortality, we employ different indicators at the province level, as explained in Section 2.

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9 See Öhler (2013) for an analysis of donor coordination within Cambodia. Nunnenkamp, Rank, & Thiele (2016) and Nunnenkamp, Sotirova, & Thiele (2016) provide case studies for Uganda and Malawi.

10 Anecdotal evidence is provided, for instance, by World Bank (2003, ch. 11). Leiderer (2015) offers a more in-depth descriptive study on health and education outcomes in Zambia. A qualitative evaluation by Wood et al. (2011) find that the implementation of the Paris Declaration principles has contributed to better development results in the health sector in most of the 21 recipient countries taking part in the evaluation.

11 With respect to the effectiveness of health aid, cross-country studies on the impact on infant and child mortality come to contradictory results (Chauvet, Gubert, & Mesplé-Somps, 2013; Mishra & Newhouse, 2009; Williamson, 2008; Wilson, 2011). The sub-national analysis by De and Becker (2015) finds a significant and negative effect of health aid on the employment days lost due to illness. However, the analysis has been conducted at the level of traditional authorities in Malawi by using data from the Integrated Household Survey not representative at that level. More reliably, Odokonyero, Ijjo, Marty, Muhumuza, & Moses (2015) employ panel survey data of Uganda and estimate fixed effects difference-in-differences regressions to identify the effect of health aid on the number of days suffering from illness and the number of employment days lost due to illness. They find significant and negative effects of health aid on both variables, although the impact turns out to be more robust in the case of days lost due to illness.

12 In 2014, the share of aid going to the health sectors corresponded to almost 7 percent of total ODA (Compare your country: Aid statistics by donor, recipient and sector)

13 See Section 3 for more details about aid fragmentation and the implementation of the Paris Declaration principles in the health sector in Cambodia.

14 Note that we exploit the within-mother information on the survival of infants to identify the impact of aid. The method is explained in more detail below.

To preview our major results, we find that aid fragmentation at the regional level did not have a negative influence on infant mortality. By contrast, common arrangements within a PBA led to positive effects in terms of an improved health situation in the Cambodian provinces. However, the analysis does not point to any beneficial effects of the use of recipient countries' PFM and procurement systems.

The structure of the paper is as follows. In Section 2 we discuss the indicators employed to measure aid fragmentation and alignment. Section 3 gives an overview of aid fragmentation and alignment in Cambodia and outlines the data and method used in the empirical analysis. Our results are presented in Section 5, while Section 6 concludes.

## 2 Measuring aid fragmentation and alignment

In order to take the different dimensions of aid fragmentation into account, we employ various measures of fragmentation, following closely Gehring et al. (2015). Ultimately, it is an empirical question which aspects of aid fragmentation are (more) relevant in the context of development and aid effectiveness. The Development Assistance Committee (DAC) has frequently used the simple count of donors to measure aid fragmentation (OECD, 2011a). Arguably, the bureaucratic burden for recipient countries is higher if national and sub-national administrations have to administer the aid projects of dozens of donors.<sup>15</sup> Furthermore, the fragmentation of aid among a large number of donors implies that a large share of overall aid is spent on the management of aid, i.e., the transaction costs of aid are relatively high. Finally, coordination is arguably more difficult, with many development actors being active in a country.

A related indicator is the number of non-significant aid relationships (OECD, 2011a). To determine whether aid contributions are “significant”, the DAC considers whether the donors are among the largest donors who together contribute at least 90 percent of aid flows to a specific recipient country.<sup>16</sup> The remaining donors are considered to provide insignificant contributions to the overall aid funds.<sup>17</sup> These donors are perceived as just burdening the national and sub-national administrations with additional bureaucratic requirements and procedures without offering significant financial funds. On the other hand, small donors may align more easily to existing procedures or even use delegated cooperation (Dreher & Michaelowa, 2010).

An indicator of aid fragmentation widely used in the academic literature is the Herfindahl index (HI) (see, e.g., Djankov et al., 2009; Easterly, 2007; Gehring et al., 2015; Knack & Rahman 2007), which is part of the larger family of concentration indices. Applied to our

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15 Throughout the paper, we use the term “aid project” for any aid intervention and not exclusively for so-called “project aid”.

16 Applied to our case, the “significant” health donors in a province are the largest donors who together contribute at least 90 percent of health aid to the respective province.

17 More precisely, the DAC also considers aid contributions of donors to be significant if the share of aid to the recipient country exceeds the donor’s overall share of global aid (OECD, 2011a, p. 5). We ignore this part of the definition since it arguably presents a concession to the donor community and dilutes the conceptual idea of the indicator (Gehring et al., 2015).

case, it measures the probability that two random draws of 1 USD from the basket of total health aid spent in a given province come from the same donor. Formally,

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

where  $i=1, \dots, N$  indicates the donors present in a given province, and  $\pi_i$  is the share of aid funds of donor  $i$  in total health aid. Note that index values decrease with a higher number of donors and with greater equality among donors in terms of aid funds. Conversely, high values indicate a small number of donors or the domination of some donors. Apparently, in the context of aid a high concentration has a positive notation and reflects low fragmentation.

The last indicators we use are based on the importance of lead donors in each development sector (European Commission, 2007; OECD, 2011a).<sup>18</sup> In particular, Knack & Rahman (2007) state that the presence of a dominant donor increases donor accountability, as the reputation of a dominant donor depends to a greater extent on the overall development success.<sup>19</sup> Nevertheless, some scholars argue that dominant donors tend to take over state operations (ODI, 2005) and may have an excessive influence on recipient countries' policies (Frot & Santiso, 2010). All the same, according to Knack (2012), dominant donors are more likely to use recipient country systems as they internalise to a greater extent the benefits resulting from the use of these systems.<sup>20</sup> Following Steinwand (2015), we use the share of health aid coming from the largest donor and, alternatively, the difference between the aid shares of the largest and second-largest donor to measure the presence or absence of a dominant health donor in the Cambodian provinces.<sup>21</sup>

In particular, a high number of donors per country (and sector) has been identified as an indicator of coordination failure among donors (e.g., OECD, 2011a). However, this conclusion may be misleading if donors actually coordinate their aid interventions within countries and sectors. In particular, the use of common arrangements within PBAs should, at least in theory, enhance the harmonisation of aid. Notably, the Paris Declaration lists the share of aid disbursed within PBAs as one of the indicators measuring harmonisation.<sup>22</sup> In addition, PBAs are perceived as a means to improve alignment, as the recipient countries

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18 The presence of lead donors as an important element to enhance aid effectiveness has also been highlighted by a group of recipient countries at a workshop at the Third High Level Forum on Aid Effectiveness (OECD & World Bank, 2008).

19 Congruously, Knack & Smets (2013) find that dominant donors tie less of their aid to purchases from their home country as they are more interested in the development impact of their aid.

20 The use of country systems is likely to be sub-optimal if using the systems does strengthen them. A donor using the country systems bears the full short-term costs of exposing its projects to higher reputational and fiduciary risks, while all donors benefit from stronger aid management systems in the long term. In other words, donors using country systems provide public goods for other donors (Knack, 2012).

21 To be more precise, Steinwand (2015) uses a combination of the two and the Herfindahl index to identify lead donors. Since the Herfindahl index is used in other studies on aid fragmentation as a separate indicator, we decided to consider each of these measures separately.

22 See OECD. The Paris Declaration on Aid Effectiveness and the Accra Agenda for Action for a list of the Paris Declaration indicators.

are responsible for defining a country-owned program and establishing a single budgetary framework in the context of a PBA (OECD, 2011b).

As a further proxy for alignment, the Paris Declaration lists the share of aid funds that are included in the government's budget preparation process and in the final budget of the respective fiscal year. When aid projects are adequately included in the national budget, aid is supposed to be in line with country policies and processes (OECD, 2011b). When providing funding "on budget", donors may further align their projects to the recipient by using in-country PFM systems for budget execution, financial reporting and auditing and procurement systems.<sup>23</sup> However, the Paris Declaration acknowledges that the decision to bypass them can be justified by the weakness of country systems and the related fiduciary risk: country systems should only be used "where these provide assurance that aid will be used for agreed purposes" (§17). Knack (2013) shows that donors have, in fact, adhered to this guideline, as the frequency of the use of recipient countries' PFM systems increases the higher the quality of these systems. We come back to this later when interpreting the results.

### 3 Data, descriptive statistics and method

#### *Aid fragmentation and alignment in Cambodia*

As a response to the Paris Declaration in 2005, the Cambodian Rehabilitation and Development Board of the Council for the Development of Cambodia (CRDB/CDC) has established a very detailed and comprehensive dataset on development aid in Cambodia (CRDB/CDC ODA database). Over the period 2005 to 2012, the average share of net official development assistance (ODA) in gross national income (GNI) is 7.3 percent (World Bank WDI).<sup>24</sup> The aid landscape is highly fragmented: between 2005 and 2012, 14 UN organisations, three international financial institutions (World Bank, IMF, Asian Development Bank), the Global Fund, Gavi, the EU, and 22 bilateral donors (20 DAC donors plus China and Russia) were active in Cambodia. At the same time, the survey monitoring the progress in implementing the Paris Declaration shows progress in nine out of 14 indicators between 2005 and 2010. In particular, the quality of the PFM systems at the national and sub-national level improved and the frequency of the use of PFM and procurement systems increased (OECD, 2011b).

Between 2005 and 2012, aid commitments amounted to more than 8 billion USD, of which 1.7 billion USD were associated with the health sector.<sup>25</sup> Out of all aid projects about half were not nationwide projects, but were implemented in one or more provinces.<sup>26</sup> The health sector has been, next to the transportation sector, the most

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23 The share of aid that uses in-country PFM systems and the share of aid that uses in-country procurement systems are also included in the list of indicators of the Paris Declaration.

24 In our empirical analysis, we use aid data for 2005–2012 (see below for explanation).

25 Note that the CRDB/CDC database often assigns projects to more than one sector. In the empirical analysis, we consider all projects with "health" being mentioned as either the only sector or one of the sectors.

26 Cambodia consisted of 24 provinces until 31 December 2013, when the province Kampong Cham was split in two. The share of province-specific projects is approximately the same when considering only

important sector for international development cooperation in Cambodia, although there has been a decrease of funds since 2008. At the same time, the health sector is also one of the most fragmented sectors in Cambodia, with 34 official donors having conducted 272 projects in 2005 to 2012.<sup>27</sup> Contributing substantially to the fragmentation of health aid, large parts of official aid have been channelled through non-governmental organisations (NGOs), and a large number of international NGOs (86 in 2005–2012) have implemented their own health projects. Nevertheless, the health sector is considered, next to the education sector, as a front runner in terms of the government's promotion of the Paris Declaration principles on harmonisation and alignment. As an intermediary step to a sector-wide approach (SWAp), a so-called sector-wide management (SWiM) approach was introduced in 2000, fostering sector-wide cooperation between donors and the government, but at the same time leaving donors some discretion in the management of their projects (Keijzer, 2014). According to VBNK/RBMG (2010) the SWiM approach has been in the process of evolving towards a fully developed SWAp.

The CRDB/CDC database includes, next to project-related information on committed funds, the provinces where the projects are implemented, the sector(s) and the approval, starting and completion dates, and information on some of the indicators of the Paris Declaration. In particular, the data include information on whether a project was embedded in a PBA, included in the national budget, and whether it used the recipient country's PFM and procurement systems. Quantitatively, the share of health aid disbursed within the sector PBA (SWiM/SWAp) amounted to 42.1 percent in the 2005–2012 period, whereas 81.3 percent of health aid had been included in the national budget. The proportion of aid using in-country systems, however, was very low (5.3 and 6.6 percent of health aid used PFM and procurement systems, respectively), in particular in the first years of our period of observation. According to VBNK/RBMG (2010), aid agencies of donor countries face a tension between working together with the recipient country's government by using local systems, and responding to the differing priorities and fiduciary concerns of their home governments.

In our empirical analysis, we consider aid data of the 2005–2012 period, since a comparison between the CRDB/CDC data and those of AidData reveals that aid figures from CRDB/CDC are only complete after 2000.<sup>28</sup> We decided to exclude the years 2000–2004 in our empirical analysis to avoid measurement errors. For these years, the database does not include many relevant projects, approved before the year 2000 and active in the years thereafter.<sup>29</sup> In the case of projects being implemented in more than one province, we assume that aid is allocated in proportion to the provinces' population.<sup>30</sup> Note that,

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projects in the health sector. Note also that the share of budget support in total aid funds is negligible in the case of Cambodia (CRDB/CDC 2014, Chart 5).

27 It should be noted that the duration of many of these projects only partly overlaps with the period of observation. China, as a donor of health aid in Cambodia, is included in the empirical analysis. By contrast, Russia was not active in the health sector during the 2005–2012 period.

28 AidData is the most comprehensive dataset on foreign official aid, which combines different sources (OECD CRS, annual reports for aid by multilateral development banks and non-DAC bilateral donors etc.).

29 Note that the average duration of health projects is 3.6 years.

30 We do not exclude nationwide projects from the empirical analysis but split their funds across the provinces according to their population. Population data come from Gridded Population of the World, Version 3 (GPWv3).

given the unavailability of disbursement data, we use commitments and split them equally over the years in which a project is active.<sup>31</sup>

### *Dependent variable and method*

Micro data on infant mortality (and the other variables related to the babies used in the empirical analysis) come from the 2014 Cambodia Demographic and Health Survey (CDHS).<sup>32</sup> In the survey, a national representative sample of women of childbearing age (15–49) were interviewed about the date of birth and, eventually, death of up to 20 children to whom they given birth. This enables us to construct a panel dataset of children, with the mothers being the individual dimension and the year of child birth given by each mother being the time dimension. To measure infant mortality at the individual level, a dummy variable is set equal to one if a child died before the age of one year, and zero otherwise. It should be noted that the birth and eventual death of children are significant events in the life course of women so that measurement errors are likely to be relatively small.<sup>33</sup> We exclude the babies born in 2013 whose mothers were interviewed within 12 months of their birth date, since we do not know whether these children reached the age of one year.<sup>34</sup> We use geographic information on the 611 DHS clusters (villages or towns) in which households have been interviewed to assign each woman to a province.<sup>35</sup>

In the period 2006 to 2013, the data include 11,203 children born to 7,617 mothers.<sup>36</sup> The average infant mortality rate (measured in deaths per 1,000 live births) is 36.8, which is significantly lower than the average of the yearly infant mortality rate in Cambodia for the same time period (39.8) published by the UN Inter-agency Group for Child Mortality Estimation (CME Info). The fact that children born to women who died before the interview date are not included in our data is likely to be the explanation: children born to women who are vulnerable to death have, arguably, a lower chance of survival themselves.

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31 It should be noted that we do not consider the time between the approval and starting date of the projects.

32 Appendix A shows the infant mortality rate by province. What is striking are the large differences between the provinces: whereas children in the capital, Phnom Penh, have the highest probability of surviving their first year (infant mortality rate measured in deaths per 1,000 live births = 13), the highest mortality rate is found in the northern provinces Preah Vihear and Stung Treng (95). Comparing infant mortality rates and per-capita aid across provinces reveals that provinces with high infant mortality do not receive more aid than provinces with low infant mortality. In fact, the correlation between the two variables is basically zero (-0.02). See Appendix C for the definition of the variables used in the empirical analysis, and Appendix D for descriptive statistics.

33 See Kudamatsu (2012, Appendix A.4) for a detailed discussion of possible bias in the infant mortality variable.

34 The interview dates of the survey are spread over the whole year 2014. We do not consider the year 2014 at all as all the babies born in 2014 had not reached the age of one year at the time of the interviews.

35 See Appendix B for the location of the clusters.

36 Among these mothers, 881 experienced the death of at least one of their children.

Empirically, we estimate a linear probability model as follows:<sup>37</sup>

$$y_{imapt} = \alpha_m + \beta_{at} + \theta'X_{imapt} + \gamma Aid_{pt-1} + \delta Fragmentation_{pt-1} + \varepsilon_{imapt}$$

where the dependent variable  $y_{imapt}$  is a dummy variable indicating whether the child  $i$  died before the age of one year.  $\alpha_m$  are mother fixed effects and  $\beta_{at}$  fixed effects combining the children's birth-year ( $t$ ) with the different birth cohorts of mothers ( $a$ ).  $X_{imapt}$  is a vector of control variables comprising a dummy variable for girls, a dummy indicating multiple births (i.e., twins, triplets etc.) and dummy variables for the birth order (one dummy for each birth order up to the ninth and an additional dummy for the tenth and higher birth order), the first birth as the omitted category.<sup>38</sup>  $Aid_{pt-1}$  is the logarithm of per-capita aid and  $Fragmentation_{pt-1}$  is one of the indicators capturing aid fragmentation in province  $p$  and year  $t-1$ .<sup>39</sup>  $\varepsilon_{imapt}$  is the error term and standard errors are clustered by province-year pairs. In subsequent estimations, we include our indicators of aid alignment.

By including mother fixed effects, only the within-mother information of the survival of infants is explored to identify the effects of our variables of interest, i.e., the indicators of aid fragmentation and alignment, on infant mortality. Hence, the estimated effects are robust to the possibility that changes over time in the characteristics of the women giving birth to children drive both infant mortality and foreign aid. Note also that mother fixed effects control for any (fairly) time-invariant differences across provinces (e.g., distance to capital, climate, proportion of the population living in urban areas), which may determine both the level of infant mortality and foreign aid.<sup>40</sup> We further mitigate endogeneity concerns, in particular with respect to reverse causality, by lagging aid and our indicators of fragmentation and alignment by one year. Arguably, health aid needs at least one year to show some effects on infant mortality.<sup>41</sup>

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37 The linear probability model is preferred over a conditional fixed effects logit model as the latter is not consistent in the presence of serial correlation in the error term, which is likely to occur in the present context (Kudamatsu, 2012). We use the `reghdfe` Stata package to estimate the model.

38 In most parts of the world, infant mortality is higher for boys than for girls. This has been explained by a genetic and biological makeup (e.g., Wandron, 1983). At the same time, excess female infant mortality has been observed in South Asia (e.g., Sawyer, 2012) and sub-Saharan Africa (Klasen (1996) and, more recently, Flatø & Kotsadam (2015)) due to gender discrimination. With respect to multiple births, various studies find a higher likelihood of twins dying before the age of one year compared to singletons (e.g., Pison (1992) in sub-Saharan Africa and Hong (2006) in Bangladesh). The birth order is also likely to matter for the probability of dying before the age of one year. On the one hand, children of higher birth order need to compete for household resources with a larger number of siblings (e.g., Behrman 1988). On the other hand, mothers may be less experienced in child-bearing in the case of children of lower birth order and in particular in the case of their first child (Kudamatsu, 2012).

39 Note that we use the projects active in a given province and year to calculate the respective values of the various indicators.

40 Province fixed effects would apparently also control for time-invariant variables at the provincial level. We replace mother fixed effects by province fixed effects in a robustness test in Table 3. Note also that, in another robustness test, we tentatively control for economic development at the provincial level.

41 Apparently, this depends on the nature of the health intervention (e.g., medical supply versus construction of hospitals). We also consider an extended lag structure of the three previous years (see next section).



## 4 Results

In Table 1, we present our results with respect to the first set of variables of interest, i.e., the indicators reflecting aid fragmentation.<sup>42</sup> First, we briefly outline the findings on the control variables and the effect of health aid in general. We find that girls are less likely to die in the first 12 months than are boys. This indicates that the genetic and biological advantages of girls are not (completely) offset by female discrimination in Cambodia. In line with the demography literature (e.g., Pison, 1992), twins, triplets etc. are more likely to die in their first year than are singletons. Furthermore, the likelihood of dying decreases with increasing birth order. According to this finding, the growing experience of mothers in child-bearing appears to be more important than the fact that children of higher birth order have to compete for household resources with a larger number of siblings. With respect to the effect of health aid on infant mortality, the coefficient of per-capita aid turns out to be insignificant at conventional levels in column (1).<sup>43</sup>

In columns (2)–(6) of Table 1, we turn to our first set of variables of interest, i.e., the indicators reflecting aid fragmentation. In column (2), the coefficient on the number of health donors turns out to be insignificant. Likewise, the number of donors who contributed an insignificant share of aid does not have a significant impact on infant mortality (column 3). Arguably, the administrative burden and the coordination problems evoked by a high number of (“insignificant”) donors are not severe enough to cause negative effects on the health situation in the Cambodian provinces.

In columns (4)–(6), we include the other three indicators of aid fragmentation, respectively. Similar to the results on the number of (“insignificant”) donors, all three variables, i.e., the Herfindahl index, the share of the largest donor and the difference in the shares of the largest and second-largest donor turn out to be insignificant. All three making part of the larger family of concentration indices, the results indicate that a high concentration of aid is not particularly favourable for the development of the health situation in the Cambodian provinces. In summary, the fragmentation of aid does not appear to be a serious concern when looking at the sub-national allocation of health aid in Cambodia. Notably, this finding complements the country-level study by Gehring et al. (2015), which finds no robust negative effects of aid fragmentation on economic growth. A possible explanation for our finding may lie in the fact that the health sector in Cambodia has been a front runner in the implementation of the Paris Declaration principles of alignment and harmonisation, in particular with the coordination of donor funds through the SWiM/SWAp. This may have mitigated the potentially negative effects of the high fragmentation of health aid.

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42 Note that the number of observations in the estimations with mother fixed effects is only 6,338 because singleton groups, i.e., mothers having given birth to only one child in the 2006–2013 period are excluded from the estimations as they do not provide any within information.

43 However, when we consider an extended lag structure, i.e., per-capita aid of the previous three years, per-capita aid becomes significant at the 10 percent level (not shown). However, this also restricts the time period of estimation to 2008–2013, which seems to be too short to identify significant effects of the alignment indicators (see below).

<b>Table 1: Aid fragmentation</b>						
	(1)	(2)	(3)	(4)	(5)	(6)
Log per-capita aid	-0.004	-0.011	-0.013	-0.004	-0.004	-0.010
	(0.023)	(0.024)	(0.025)	(0.024)	(0.023)	(0.024)
Number of donors		0.003				
		(0.006)				
Number of insignificant donors			0.007			
			(0.007)			
Herfindahl index				0.203		
				(0.278)		
Share of largest donor					0.013	
					(0.113)	
Largest – second-largest donor						-0.105
						(0.080)
Girl	-0.020**	-0.020**	-0.020**	-0.020**	-0.020**	-0.020**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Multiple birth	0.166***	0.167***	0.165***	0.165***	0.166***	0.167***
	(0.052)	(0.052)	(0.053)	(0.052)	(0.053)	(0.052)
Birth order: one (reference category)						
Birth order: two	-0.082***	-0.082***	-0.082***	-0.082***	-0.082***	-0.081***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Birth order: three	-0.162***	-0.162***	-0.161***	-0.162***	-0.162***	-0.161***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Birth order: four	-0.245***	-0.245***	-0.244***	-0.245***	-0.245***	-0.242***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Birth order: five	-0.348***	-0.348***	-0.348***	-0.348***	-0.348***	-0.345***
	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)
Birth order: six	-0.409***	-0.409***	-0.408***	-0.409***	-0.409***	-0.406***
	(0.073)	(0.073)	(0.073)	(0.073)	(0.073)	(0.073)
Birth order: seven	-0.398***	-0.397***	-0.396***	-0.397***	-0.398***	-0.395***
	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)
Birth order: eight	-0.508***	-0.508***	-0.506***	-0.506***	-0.508***	-0.504***
	(0.120)	(0.120)	(0.120)	(0.120)	(0.120)	(0.119)
Birth order: nine	-0.572***	-0.572***	-0.570***	-0.570***	-0.572***	-0.572***
	(0.147)	(0.147)	(0.147)	(0.147)	(0.147)	(0.147)
Birth order: ten+	-0.607***	-0.606***	-0.603***	-0.603***	-0.606***	-0.607***
	(0.188)	(0.188)	(0.188)	(0.187)	(0.188)	-0.188
Number of observations (children)	6,338	6,338	6,338	6,338	6,338	6,338
Number of mothers	2,852	2,852	2,852	2,852	2,852	2,852
Notes: Dependent variable is infant mortality (dummy variable). Standard errors clustered at the province-year level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.						
Source: Author						

In Table 2, we investigate whether the alignment and harmonisation of health aid had, in fact, positive effects on the health situation in the Cambodian provinces. The share of aid funds disbursed within the sector PBA enters negatively and significantly at the 5 percent level in column (1).<sup>44</sup> Quantitatively, an increase in the share of aid disbursed within the PBA by one standard deviation (0.12) leads to a decrease in a child's probability of dying before turning one year old by 1.6 percent (32.7 of the sample mean). This finding suggests that PBAs are an adequate means to improve development outcomes. In particular, the Cambodian government seems to be right to advocate PBAs as its preferred tool "to address many of the aid management challenges that have been documented in almost every sector and reform programme in Cambodia in recent years" (CRDB/CDC, 2010).

In column (2)-(4), we include the other indicators for aid alignment, i.e., the share of aid funds that are included in the national budget and the share of aid that uses the recipient country PFM and procurement systems, respectively. In contrast to the finding with respect to the use of a PBA, we do not find any evidence of a favourable effect of the use of in-country systems. The coefficients on the share of aid "on budget", the share of aid using in-country PFM systems and the share of aid using in-country procurement systems all turn out to be insignificant. A possible reason for the finding may lie in the fact that the quality of Cambodia's PFM and procurement systems has still been relatively poor.<sup>45</sup> Although Cambodia made some progress in this regard between 2005 and 2010, the empirical analysis comprises years where the evaluation of the systems still yielded rather modest results (OECD, 2011b).

	(1)	(2)	(3)	(4)
Log per-capita aid	0.025	-0.008	-0.005	0.009
	(0.025)	(0.028)	(0.023)	(0.024)
Programme-based approach	-0.138**			
	(0.058)			
On budget		-0.027		
		(0.076)		
PFM systems			0.057	
			(0.214)	
Procurement systems				-0.051
				(0.044)
Number of observations (children)	6,338	6,338	6,338	6,338
Number of mothers	2,852	2,852	2,852	2,852
Notes: The dependent variable is infant death (dummy variable). Mother fixed effects and mother's cohort by child birth year fixed effects are included. Control variables are not shown. Standard errors clustered at the province-year level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.				
Source: Author				

44 The effect, however, becomes insignificant when we consider the extended lag structure.

45 Although the share of aid using in-country systems has been low on average, the descriptive statistics of the three indicators show a relatively high variability over time.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log per-capita aid	0.021	0.004	-0.001	0.060	0.028	0.025	0.028
	(0.026)	(0.018)	(0.023)	(0.055)	(0.027)	(0.025)	(0.026)
Programme-based approach	-0.126**	-0.086*	-0.101	0.112	-0.137**	-0.136**	-0.141**
	(0.058)	(0.045)	(0.170)	(0.350)	(0.057)	(0.058)	(0.059)
Log per-capita aid * PBA				-0.110			
				(0.146)			
Per-capita NTL					-0.034		
					(0.056)		
Short birth interval						0.012	
						(0.012)	
Number of observations (children)	6,366	10,940	6,338	6,339	6,339	6,338	6,309
Number of mothers	2,863	7,437	2,852	2,853	2,853	2,852	2,838
Notes: The dependent variable is infant death (dummy variable). Mother and year fixed effects are included in column (1), province and year fixed effects in column (2). Columns (3)–(7) include mother fixed effects and mother’s cohort by child birth year fixed effects. In column (3), the variable programme-based approach is calculated on the basis of aid projects and not aid amounts. In column (4), an interaction term between <i>log per-capita aid</i> and <i>programme-based approach</i> is included. In column (5) and (6), <i>night-time light intensity</i> or <i>short birth interval</i> are included as additional control variables, respectively. In column (7), women just visiting the household in which the interview took place are excluded. The control variables <i>girl</i> , <i>multiple birth</i> and the dummy variables for the birth order are not shown. Standard errors clustered at the province-year level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.							
Source: Author							

In Table 3, we perform a variety of robustness tests with respect to the significant finding on the share of aid disbursed within the sector PBA. In column (1), we include year fixed effects instead of mother’s cohort by child birth year fixed effects. The results show that the share of aid disbursed within the PBA remains significant at the 5 percent level. In contrast, the significance of the same variable drops to the 10 percent level when mother fixed effects are replaced by province fixed effects in column (2).

In column (3), we alter the definition of the share of aid disbursed within the sector PBA. The share is not based any more on aid amounts, but rather on the number of projects that are embedded in the PBA. In contrast to column (1) of Table 2, the coefficient of the share of projects embedded in the PBA fails to pass the conventional levels of significance. Clearly, the results indicate that the share of the overall volume of aid disbursed within PBAs is more important than the sheer frequency of projects embedded in PBAs. In column (4), we include an interaction term between *log per-capita aid* and *programme-based approach* in order to examine heterogeneous effects of health aid, depending on the share of aid disbursed within the PBA. The results do not reveal any significant interaction effect. It should be noted, however, that the correlation between the interaction term and per-capita aid amounts to 0.97, which is an indication of a serious multicollinearity problem.

In column (5), we control for the economic development of regions proxied by night-time light intensity.<sup>46</sup> While the variable turns out to be insignificant, the significant finding on the share of aid disbursed within the PBA remains unchanged. The same holds in column (6), where we include a dummy variable set equal to one if a child has been born within 24 months after the birth of the previous child of the same mother, and zero otherwise.<sup>47</sup> Finally, the finding on the share of aid disbursed within the PBA remains robust in column (7), where we exclude the women from the estimation who were merely visiting the households where the interviews took place.<sup>48</sup>

## 5 Conclusion

At the High Level Fora in Paris (2005) and Accra (2008), donors have committed themselves to reduce aid fragmentation and improve the harmonisation and alignment of aid. However, the evidence on the effects of donors' compliance with these principles is inconclusive. The few cross-country studies on the effects of aid fragmentation on economic growth have yielded mixed results. We employ a different approach and assess the effects of aid fragmentation and alignment on infant mortality at the regional level within Cambodia.

We find that the fragmentation of aid in the health sector did not have a negative influence on infant mortality in the Cambodian provinces. By contrast, our results show that common arrangements within a PBA led to positive effects in terms of an improved health situation in the Cambodian provinces. However, the analysis does not point to any beneficial effects of the use of recipient country systems.

Our major finding, i.e., that donor and recipient countries can improve development outcomes (in the health sector) by establishing common arrangements within PBAs, clearly deserves further empirical scrutiny. Only additional research of other sectors and recipient countries can show to what extent this result can be generalised. Arguably, the benefits of using a PBA may vary across sectors. Furthermore, a PBA may not constitute a good choice in recipient countries where the government does not have the capacity or willingness to take up the leadership role and develop a coherent development strategy.

With respect to the use of recipient country systems, our study does not find any evidence that the reliance on country systems strengthens administrative capacities and improves the performance in the health sector. Notably, the quality of Cambodia's PFM and procurement systems has still been relatively poor. Arguably, donors may do well not to use country systems of poor quality because of fiduciary risk. Again, only further research can help us better understand under which circumstances donors are advised to use recipient country systems and when they should rather bypass them when delivering aid.

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46 See Henderson, Storeygard, & Weil (2012) for the motivation to use night-time light intensity as a proxy for economic development and Elvidge, Hsu, Baugh, & Ghosh (2013) for computational details.

47 The dummy variable is also set equal to zero for the first child of each mother. In the literature, a shorter birth interval is found to be associated with higher infant mortality (e.g., Hobcraft, McDonald, & Rutstein, 1985; Kadamatsu, 2012).

48 In this way, we account for the possibility that these women live in another province than the one where they were interviewed.

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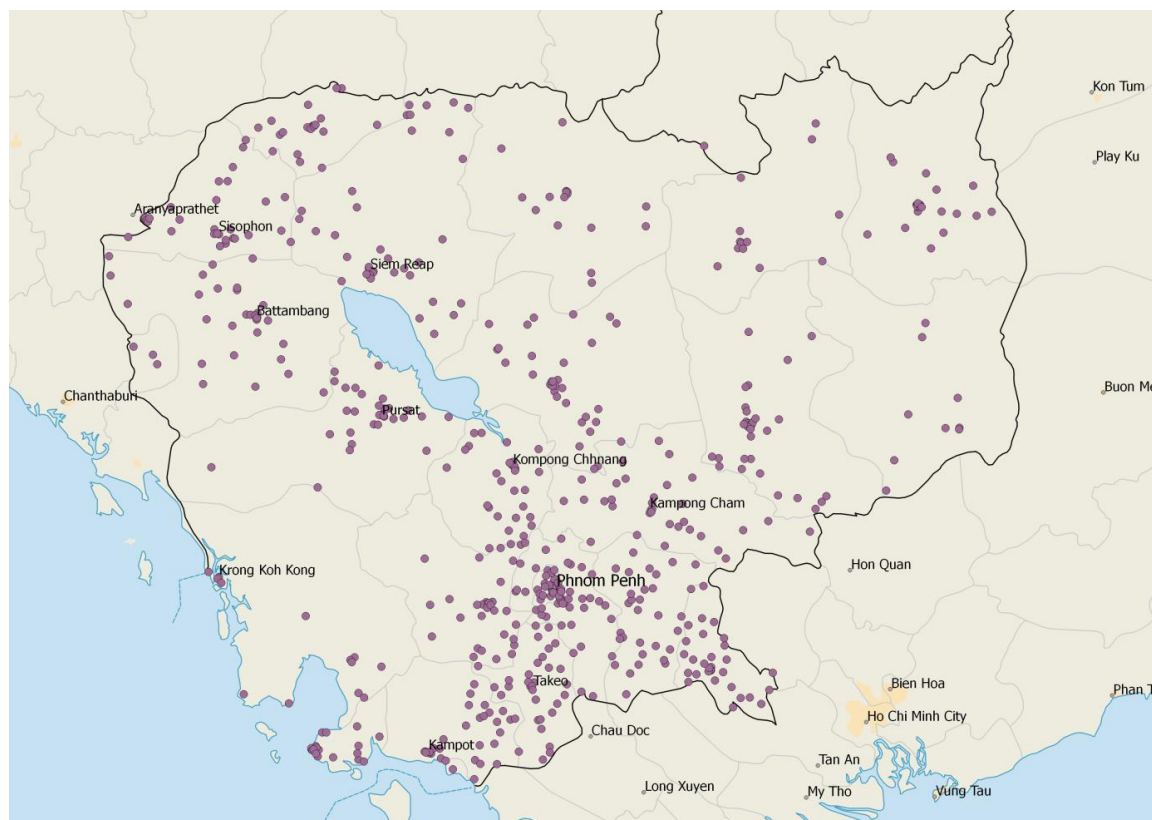
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## **Appendix**

<b>Appendix A: Infant mortality rate per province</b>		
<b>Province</b>	<b>Infant mortality rate</b>	<b>Per-capita aid (average 2005–2012)</b>
Preah Vihear	95	9.7
Stung Treng	95	8.2
Mondul Kiri	82	12.9
Ratanak Kiri	82	9.0
Kampong Chhnang	78	8.5
Svay Rieng	78	7.7
Kracheh	76	8.2
Takeo	68	8.5
Kampong Speu	65	8.8
Prey Veng	64	8.2
Banteay Meanchey	61	9.4
Kandal	61	7.6
Kampot	60	8.6
Krong Kep	60	7.5
Kampong Thom	57	9.8
Kampong Cham	54	10.0
Pursat	53	9.2
Koh Kong	50	7.7
Krong Preah Sihanouk	50	7.6
Siem Reap	50	11.3
Battambang	45	8.6
Krong Pailin	45	8.2
Otdar Meanchey	42	10.4
Phnom Penh	13	9.5

Sources: 2010 CDHS and CRDB/CDC ODA database. Note that some provinces are merged in the CDHS. In these cases, we take the combined figures for the respective provinces.

**Appendix B: Survey clusters from the 2014 Cambodia Demographic and Health Survey**



Source: Own construction based on the 2014 CDHS.

<b>Appendix C: Definition of variables</b>	
<b>Variable</b>	<b>Definition</b>
Infant death	Dummy variable indicating whether a child died before turning one year old; 2006–2013
Log per-capita aid	Log of health aid in per-capita terms per province and year, 2005–2012
Number of donors	Number of active donors in the health sector in a given province and year
Number of insignificant donors	Number of active donors in the health sector in a given province and year which are not part of the largest donors who together contribute at least 90 percent of overall health aid in a given province and year
Herfindahl index	Herfindahl index per province and year (health aid)
Share of largest donor	Aid share of the largest donor in the health sector in a given province and year
Largest – second-largest donor	Difference in the aid shares of the largest donor and the second-largest donor in the health sector in a given province and year
Programme-based approach	Share of health aid (projects) embedded in a programme-based approach in a given province and year
On budget	Share of health aid included in the national budget in a given province and year
PFM systems	Share of health aid that uses the recipient country PFM systems
Procurement systems	Share of health aid that uses the recipient country procurement systems
Girl	Dummy variable equal to one if the child is female
Multiple birth	Dummy variable equal to one if the child is a twin, triplet etc.
Birth order: one – birth order: ten+	Dummy variables indicating the birth order of the child (one up to 10 or higher)
Night-time light intensity	Sum of (inter-calibrated) night-time light in per-capita terms per province and year
Short birth interval	Dummy variable equal to one if a child is born within 24 months after the birth of the previous child from the same mother (the dummy is set equal to zero for the first birth of each mother)
Source: Author	

<b>Appendix D: Descriptive statistics</b>					
<b>Variable</b>	<b>Observations</b>	<b>Mean</b>	<b>Std. dev.</b>	<b>Min</b>	<b>Max</b>
<b>Infant death</b>	6,338	0.05	0.22	0	1
<b>Per-capita aid</b>	6,338	9.2	1.9	5.0	15.8
<b>Number of donors</b>	6,338	17.6	2.2	13	21
<b>Number of insignificant donors</b>	6,338	7.9	1.5	6	11
<b>Herfindahl index</b>	6,338	0.13	0.02	0.10	0.22
<b>Share of largest donor</b>	6,338	0.24	0.05	0.17	0.40
<b>Largest donor – second-largest donor</b>	6,338	0.08	0.05	0.00	0.21
<b>Programme-based approach (amounts)</b>	6,338	0.39	0.12	0.12	0.64
<b>Programme-based approach (projects)</b>	6,338	0.45	0.14	0.15	0.64
<b>On budget</b>	6,338	0.86	0.09	0.38	0.98
<b>PFM systems</b>	6,338	0.04	0.05	0	0.26
<b>Procurement systems</b>	6,338	0.07	0.08	0	0.40
<b>Girl</b>	6,338	0.49	0.50	0	1
<b>Multiple birth</b>	6,338	0.03	0.16	0	1
<b>Birth order</b>	6,338	2.62	1.74	1	13
<b>Night-time light intensity</b>	6,338	0.003	0.006	0	0.062
<b>Short birth interval</b>	6,338	0.19	0.39	0	1
Source: Author					

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