Fragmentation of sectoral development aid: The role of multilateral institutions

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1 Introduction

Large donors of bilateral foreign aid are also among the main funders of multilateral aid given through International Organizations (IOs). At the same time, these donors typically are engaged in the same countries and the same sectors as multilateral donors, raising important questions about how multilateral and bilateral aid providers interact. This paper explores the effect of World Bank programs and other multilateral aid on allocation decisions of bilateral donors across sectors. In doing so it sheds light on an important but largely ignored aspect of the aid proliferation and donor coordination debate.

Five years after the fourth 2011 High Level Forum on Aid Effectiveness in Busan identified 'Managing Diversity and Reducing Fragmentation' as one of the building blocks of its policy agenda, the proliferation of foreign aid programs shows no signs of abating. Despite policy pledges, improved donor coordination remains illusive (recent case study evidence of this comes from Nunnenkamp *et al.* 2015a,b). The ills associated with donor fragmentation include harm to economic growth (Djankov *et al.* 2009) and damage to recipient country institutions (Knack and Rahman 2007).[1]

Coordination failure between donors is a collective action problem. Existing works point to competition for economic benefits and other non-developmental objectives as main obstacles to bilateral cooperation (Fuchs *et al.* 2013). A possible response to this problem is to strengthen the role of international organizations (IOs), such as the World Bank, in providing multilateral aid. IOs have the capacity to redress some of the underlying issues, for example information asymmetries and commitment problems (Rodrik 1995). Since IOs have multiple principals or a collective principal (Lyne *et al.* 2006), their ability to act on donor preferences may not be perfect, especially if those preferences are not closely aligned (Schneider and Tobin 2013). However, despite these scope conditions, IOs should play a

[1] Though there is evidence that proliferated aid also provides some protection against sudden aid reversals and their consequences (Hudson and Mosley 2008; Gutting and Steinwand 2015).

beneficial role in reducing fragmentation and fostering donor coordination.

Treating the issue of donor coordination through the dichotomous lens of bilateral versus multilateral aid gives rise to an important puzzle. If donors use multilateral aid channels to overcome collective action problems, why do they still heavily engage in countries and sectors that have a strong presence of multilateral aid organizations? Multilateral giving clearly is not a perfect substitute for bilateral giving in these situations. The multilateral aid literature only explains how pooling aid activities can solve collective action problems *within* IO channels. But what is the relationship between multilateral aid programs and the aid that donors give bilaterally in identical countries and sectors? These questions have important implications for donor coordination. Major IOs such as the World Bank play an outsize role in individual sectors. For example, in the energy sector the World Bank is the single most important individual donor, with 10 percent of all provided aid. Efforts at increased donor coordination are bound to fall short if they concentrate only on bilateral aid but ignore the relationship between bilateral and multilateral giving.

In this project, I develop a number of competing expectations about this relationship and evaluate them empirically. Donors who pursue developmental objectives (which have public good properties) find that multilateral institutions provide technical expertise and help legitimize large aid volumes and free donors up to target sectors of their choice (Milner 2006; Annen and Knack 2015). IOs therefore promote aid proliferation across sectors.

In contrast, if aid mainly is used for promoting private goals, the relationship between multilateral IOs and bilateral donors should be more antagonistic. IO policy by necessity reflects a compromise position of the potentially diverging interests of donor countries and can also be affected by agency discretion (Schneider and Tobin 2013). Donors who seek economic and other private objectives therefore compete not only with each other, but also with the multilateral institution. A strong IO presence therefore should make it harder for bilateral donors to achieve cooperation.

In the empirical analysis, I explore to what extent World Bank programs affect how OECD donors allocate their bilateral aid across sectors and how they interact in the presence of World Bank activity. The results show that as aid volumes from the World Bank increase, donors concentrate their bilateral allocation on a smaller number of identical sectors. In addition, if the World Bank is active in a specific sector and country, donors give more aid in a complementary fashion. Both is consistent with increased competition for influence, and suggests that World Bank programs have a negative influence on donor coordination, resulting in underaided sectors. I find no comparable effects for aid from other multilateral institutions.

2 Theory

The study of aid proliferation and donor coordination has concentrated mainly on bilateral donors, with a few works exploring the role of multilateral institutions in overcoming bilateral collective action problems. To develop theoretical expectations about the interaction between multilateral IOs and bilateral donors *after* the delegation phase, we need to take a closer look at each of these literatures.

Strategic donor interactions and challenges to coordination take on a fundamentally different meaning depending on the relative balance of private versus public good properties in the aid mix (Steinwand 2015). Developmental goals have public good properties from a donor perspective, as improvements in indicators such as child mortality, literacy or malaria infection rates can be enjoyed by any donor country, whether they contributed or not (non-excludability), and those benefits don't diminish as more donors enjoy them (non-rivalry).

Many works that highlight inefficiencies resulting from aid proliferation implicitly take this aid-for-development perspective. Donor coordination is supposed to unlock efficiency gains by avoiding duplication, reducing competition for local talent, and ensuring use of

best practices. In contrast, works that give an account of the causes of coordination failure typically focus on impure public good situations and additional private motives for providing aid. An example of this is Bourguignon and Platteau (2015). The authors argue that there is a direct tradeoff between efficiency gains from coordination and private profit motives. Without a private goods component, the puzzle of coordination failure is difficult to answer. This is because reducing inefficiencies would lead to pareto-efficient outcomes, thus bilateral donors should be motivated and able to achieve coordination.

Works that address the role of multilateral institutions for coordination and that take aid to be public goods oriented follow this vein. Milner (2006) characterizes IOs as repositories of technical knowledge that help to depoliticize aid allocation decisions and therefore legitimize foreign aid in the eye of sceptical domestic audiences in donor countries. Though Milner focuses on the *perceptions* of non-developmental goals of aid policies, her argument clearly presupposes that donor governments have private information about their policy motives and cannot credibly signal to domestic audiences that they are interested in development outcomes.

Annen and Knack (2015) also assume that donors are interested in public goods production, but they argue that donors disagree in which sectors aid should be invested. This disagreement provides self-interested recipient governments with political leverage to play off donors against each other. Delegation to an IO reduces this leverage and increases policy selectivity for everyone. Thus, even though the IO implements the policy preference of the average donor, it frees up donors to implement their own bilateral aid policies, without having to worry about aid capture from a corrupt recipient government. Though Annen and Knack locate the disagreement between donors as the choice of sector, it is unclear how sectoral preferences can diverge if aid produces pure public goods. For diverging sector preferences to make sense, donors must have at least some impure public good motives, with some private benefits attached to the choice of sector.

What implications has the public goods perspective of multilateral IOs for the relationship between bilateral and multilateral aid? According to the arguments of both Milner (2006) and Annen and Knack (2015), delegation reduces constraints that operate on donor governments, either from critical domestic audiences or from recipient governments playing donors off against each other. Importantly, IO involvement reduces the need to come to bilateral cooperative solutions, for example in pushing back recipient country leverage. As a result, we should expect that IO presence in a country frees up donors to proliferate their aid and to reduce bilateral coordination. This has two important observable implications:

Hypothesis 1: Under the public goods logic of delegation to IOs,
a) more multilateral giving is associated with greater dispersion of bilateral aid across sectors, and
b) individual donors will allocate bilateral aid differently across sectors than multilateral donors.

The reasoning behind part b) is that multilateral IOs represent the average donor, whereas bilateral aid follows heterogenous interests. It should be noted that even with heterogeneous donor interests, *aggregate* bilateral aid allocation patterns across sectors can resemble that of IO giving, if individual donors focus their programs on different, complementary sectors.

As second observable implication we can expect few or no strategic interactions between aid allocation decisions of IOs and bilateral donors. This is because aid delegation to an IO is purely functional from a donor's perspective (in that it solves legitimacy or policy selectivity problems). Accordingly, donors are not concerned with the actual policy content of multilateral aid programs. In other words, once money has been delegated to an IO it has served the donor's purpose, and the actual multilateral aid program is of little further

interest.

Hypothesis 2: Under the public goods logic of delegation to IOs, multilateral and bilateral aid allocations are not strategically interconnected.

We next turn to a scenario where donors pursue goals that are not public goods, but have private consumption value. Examples of this include the use of bilateral aid to influence recipient government decisions (Bueno de Mesquita and Smith 2009) or to benefit donors' export industries (Younas 2008). Export competition in particular has been identified as blocking efforts at donor coordination (Fuchs *et al.* 2015). Coordination in the provision of contested private goods takes the form of collusion, where individual donors agree to reduce competition between themselves to increase their sway over the recipient government. However, instances of collusion, especially in the form of a single donor acting as exclusive lead donor, are in long-term decline (Steinwand 2015).

In the aid-for-private-benefits scenario, multilateral institutions in theory can internalize the costs of competition and help to shift rents from recipient to donor governments. They should be able to do so because they have information advantages and can help monitor both recipient and donor behavior (Rodrik 1995). However, Schneider and Tobin (2013) show limits to policy delegation in the context of the European Union. EU member countries as principals can only induce the European Commission as agent to implement their preferred policies if the member countries have closely aligned preferences. Where member country preferences differ, the European Commission follows its own policy interests.

For the relationship between bilateral and multilateral aid in the post-delegation phase, the private-goods perspective suggests the existence of competitive pressures. If not all aid is channeled multilaterally, this is indicative of conflicting donor preferences that impose limits on delegation. We therefore should expect that simultaneous bilateral and multilateral

giving is characterized by competition, as bilateral and multilateral donors vie for influence and policy leadership. The competitive relationship extends from bilateral donors to the relationship between bilaterals and IOs because the latter follow a policy mixture representing a compromise of donor interests (Rodrik 1995), whereas bilateral aid is driven by undiluted donor preferences. Competition should drive bilateral aid allocations to go head-to-head with multilateral giving.

Hypothesis 3: Under the private goods logic of delegation to IOs,
a) more multilateral giving is associated with greater concentration of bilateral aid on individual sectors, and
b) individual donors will allocate bilateral aid in the same sectors as multilateral donors.

In addition, the presence of a large multilateral donor such as the World Bank should decrease the ability of bilateral donors to find collusive agreements among themselves. This should result in measurable competitive strategic behavior in aid allocation decisions between donor countries and between donors and IOs.

Hypothesis 4: Under the private goods logic of delegation to IOs, multilateral and bilateral aid allocations are driven by competition and therefore strategically interconnected.

Note that strategic interactions that result from competition result in complementarities of aid allocations. Donors who seek to influence recipient government decision making are in a bidding contest and therefore match each others aid contributions (Steinwand 2015; de Mesquita and Smith 2016).

In the following section, I discuss the operationalization of the hypotheses, data and statistical modeling choices.

3 Empirical Analysis

In the first part of the empirical analysis, I examine bilateral and multilateral aid allocation patterns across sectors (hypotheses 1 & 3). In the second part, I analyze strategic behavior in bilateral and multilateral aid allocations (hypotheses 2 & 4).

3.1 Sectoral Concentration and Multilateral Aid

3.1.1 Operationalization & Data

To study sectoral aid allocation behavior, I rely on AidData's sector aid codes, which in turn are based on the OECD's Creditor Reporting System (Tierney *et al.* 2011; AidData 2016).[2] In order to evaluate the effect of multilateral giving on bilateral sector choice I pursue the following strategy. I calculate the Herfindahl-Hirschman index (HHI) of sectoral aid concentration for each bilateral donor in a given recipient-country and year. The HHI is calculated as $HHI = \sum_j (a_j / \sum_j a_j)^2$, where a_j is the donor's allocation to sector j. The HHI sums the square of aid shares across all sectors. It is a measure of concentration and puts an emphasis on large shares in individual sectors.

I operationalize a test of hypotheses 1 and 3 that proceeds in two steps. First, I use recipient-donor years as unit of analysis and the HHI of sectoral bilateral aid as dependent variable. To measure whether multilateral giving increases proliferation of bilateral aid across sectors (public goods scenario) or instead leads to greater concentration (private goods scenario), I calculate the share of multilateral aid as percentage of total aid provided across all sectors in a given country and year. Here, I distinguish between the World Bank and all other IOs that provide multilateral aid. I single out the World Bank because in many countries it plays an important leading role, both in terms of aid engagement, but more importantly as a highly visible policy leader.[3]

[2] I coarsen the code to the highest level of aggregation, e.g. 'Education', 'Health', etc.

[3] In the years 2000-2013, World Bank giving on average amounted to 12 percent of total annual aid

Second, I include a HHI measure of sectoral concentration for the total aid flows that a country receives in a given year, including total multilateral and bilateral aid. The predictions of hypotheses 1a and 1b are consistent with two different aid allocation patterns. First, the liberty to disperse aid across sectors as they see fit can lead donors to proliferate their aid across a large number of sectors, resulting in low sector concentration scores for individual donors. Accordingly we should observe low HHI values for individual sectoral allocations in the presence of greater IO engagement. As a second possibility, individual donors are also free to concentrate their aid in a low number of sectors. However, to be consistent with the prediction of hypothesis 1b, these preferred sectors must not be the same for all donors. That would contradict the premise of Annen and Knack (2015)'s theory of aid delegation that donors have diverging sectoral interests. Looking at sectoral concentration of total aid flows allows us to distinguish these two scenarios. If donors concentrate their aid in a small number of sectors but these sectors do not overlap, we should find a positive effect of multilateral giving on the dependent variable, but a negative relationship between the sectoral concentration of total aid flows and the dependent variable.

Table 1: Expected empirical patterns

Hypothesis	Donor HHI	Total HHI
1a & 1b	−	+
or	+	−
3a & 3b	+	+

Looking at the sectoral concentration of total aid flows also helps us distinguish hypotheses 1a & 1b from hypotheses 3a & 3b. Under hypotheses 3a & 3b all donors concentrate their aid in the *same* sectors in an effort to compete with the IO and other donors. This behavior

allocations, or roughly 1/4 of all multilateral aid. The variable includes aid given through the International Bank for Recovery, International Development Association, Carbon Finance Unit, and International Finance Corporation. It excludes money provide through the Managed Trust Funds and the Debt Reduction Facility.

should results in a positive relationship between the sectoral concentration of total aid flows and individual sectoral concentration. The predictions for the two independent variables are summarized in table 1.

3.1.2 Results

I begin the empirical analysis with descriptive statistics. Table 2 summarizes all variables used. The data cover the years 2000 to 2012.[4] There are 175 recipient countries in the sample and 44 bilateral donors.[5] The first two rows show that individual donors on average are much more selective and concentrate more aid in individual sectors than is the case with total aid flows. The average sectoral HHI for individual donors is 0.550, whereas it is 0.208 for total aid allocations. The average World Bank share of all aid committed per recipient country and year is 14.0 percent, with 33.9 percent for other multilateral donors, and the remainder (52.1 percent) bilateral commitments. Donors commit on average $78.9 million per recipient country and year, though the distribution is heavily right-skewed, with the median commitment only amounting to $4.25 million. Each country on average is promised $1.68 billion per year from all donors (bilateral and multilateral), a very high number. Again this is driven by hefty right-skew of the distribution, with median commitments only at $734 million per year. As possible confounding variables I consider recipient country GDP per capita and population size. Poorer countries have finance needs across a wide variety of sectors, whereas aid to better off countries potentially can be more concentrated. The countries in the analysis have a mean GDP per capita of $3,620 dollar with a median of $2,162. Similarly to GDP per capita, recipient countries with larger populations have greater needs and can absorb

[4] I lag all independent variables by 1 year and accordingly lose the year 2013.

[5] AidData also lists infrastructure projects in rich industrialized countries that received multilateral or even outside bilateral financing. For example, water projects in the US boarder region with Mexico received support from the North American Development Bank. There are no principled reasons to remove these observations from the analysis. However, the number of cases affected is minuscule and dropping instances of main OECD donors receiving aid does not alter the results of the analysis (for example, excluding the US, Canada, UK, France, Germany, Japan and Australia reduces n from 32,142 to 32,127.

more aid projects. Aid should therefore be less concentrated as population size increases. The mean of the variable is 51.8 million people, and the median 11.0 million.

Table 2: Summary Statistics

	Mean	Median	Minimum	Maximum
Donor HHI sectoral	0.550	0.492	0.0815	1.00
Total HHI sectoral	0.208	0.163	0.0616	1.00
World Bank Share	0.140	0.0960	0.00	1.00
Other Multilateral Share	0.339	0.303	0.00	1.00
Donor total commitment, $ mil	78.9	4.25	4.6×10^{-5}	57,000
Country total commitment, $ mil	1,680	734	1.510	63,200
GDP p.c., $	3,620	2,161	194	67,400
Population, mil	51.8	11.0	0.00941	1,350

Table 3 shows bivariate relationships between the main variables in the analysis. There are weak negative correlations between the World Bank share of total aid commitments and sectoral concentration of both bilateral as well as total aid allocations. This pattern is in line with hypotheses 1a & 1b, which predicts increased sector diversity in the presence of higher World Bank activity. Also in line with this is that sectoral concentrations of bilateral allocations and total aid allocations are moderately positively correlated. Of course, bivariate correlations do not account for the temporal and cross-sectional structure of the data. We have to turn the multivariate analysis to correct for this and to control for possible spurious correlations.

Also of interest are the moderate negative correlation between World Bank giving and sectoral concentration of total aid as well as the correlation between World Bank giving and other multilateral aid allocations. It appears that World Bank engagement leads to greater concentration of total aid on a few sectors. Also, the World Bank and other IOs tend to target different countries, providing aid in complementary fashion. Again, these are only

bivariate patterns which need to be subjected to more systematic statistical scrutiny.

Table 3: Correlations of Main Variables

	Donor HHI	Total HHI	World Bank Share	Other Multi-lateral Share
Total HHI	0.199	1.00		
World Bank share	-0.0880	-0.107	1.00	
Other Multi–lateral share	0.0610	0.143	-0.238	1.00

Turning to the multivariate analysis, I treat the sectoral HHI of bilateral aid allocations as continuous variable.[6] All independent variables enter the analysis with a one-year time lag, to ensure a correct temporal ordering. I also include a lagged version of the dependent variable on the right-hand side of the equation. The resulting model has the form

$$y_{i,j,t} = \varphi + \gamma y_{i,j,t-1} + \mathbf{x_{t-1}}\boldsymbol{\beta} + \varepsilon_{i,j,t}, \tag{1}$$

where i indexes recipients, j donors, and t years. The model includes a common intercept φ, $\mathbf{x}\boldsymbol{\beta}$ are vectors of covariates and coefficients, and $\varepsilon_{i,j,t}$ is a well-behaved error term.

Table 4 presents results of the analysis. I begin with a simple specification that includes only the share of World Bank giving, the lacked dependent variable, and recipient-donor fixed effects (model 1). The model reveals a highly statistically significant positive relation between increased World Bank giving and greater concentration of bilateral aid on individual sectors. This is a reversal from the bivariate correlation reported in table 3. The fixed-effects specification only makes use of inter-temporal variation, assigning each donor-recipient pair a separate constant. Not surprisingly, if we re-estimate model 1 with random effects the sign of

[6]The main drawback of this approach is that it can incorrectly produce fitted values that fall outside the $[0, 1]$ interval. One possibility to account for the bounded nature of the dependent variable is a one and zero inflated beta regression. However, there are no good theoretical reasons to differentiate between the data generating process that drives values in the (0,1) interval and the endpoints, as required by this approach.

the World Bank share switches ($\hat{\beta} = -0.0188$, $p \leq 0.018$). However, a Hausman specification test resoundingly rejects the random effects specification ($\chi^2_2 = 9233,\ p \leq 0.0000$). Thus the evidence supports a positive relationship between World Bank engagement and a greater sectoral concentration of donors' aid allocations. This in in line with both hypotheses 1 and 3.

The substantive effect is quite small though. For a 10 percentage points increase in the World Bank's aid share the average sectoral HHI increases by 0.23 percentage points. Varying the World Bank share across its entire range from 0 to 1 increases the HHI by 0.023, or about 8 percent of the dependent variable's standard deviation.

Next I add the share of other multilateral aid to the fixed effects specification (model 2). I also include the logged total of donor commitments per recipient country and year. Naturally, a greater allocation allows for a wider distribution of aid across sectors. Since bilateral aid allocations are potentially correlated with World Bank engagement, this is a possible confounding variable. The results show that other multilateral aid has no effect on sectoral aid concentration. Total donor commitments have the expected negative effect on sectoral concentration, i.e. greater allocations are associated with wider sectoral distribution. The effect of World Bank engagement on sectoral concentration remains positive, but effect size and statistical certainty decrease.

In a final step, I include the sectoral HHI for total aid allocations, which will allow us to differentiate between hypotheses 1 and 3, as well as the total aid committed to a country in a given year (model 3). I also include the log of GDP per capita and logged population as measures of recipient needs. Controlling for absolute aid commitments is important because the aggregate size of the aid pie is a function of complementarities in aid allocation choices and thus a likely confounder the relationship between World Bank engagement and sectoral choice.

Including the new variables does not change the effect of World Bank share. Substan-

Table 4: Estimation Results, Sectoral HHI of Individual Donors

	1	2	3	4
Donor HHI	0.119***	0.112***	0.102***	0.461***
sectoral	(0.00586)	(0.00588)	(0.00603)	(0.00509)
World bank share	0.0226**	0.0164*	0.0209**	0.0226***
	(0.00902)	(0.00997)	(0.0103)	(0.00858)
Other multilateral		-0.00630	0.00504	−0.0109*
share		(0.00769)	(0.00824)	(0.00610)
Donor total		−0.0113***	−0.00944***	−0.0247***
commitment (log)		(0.000957)	(0.00101)	(0.000527)
Country total			−0.00853***	−0.00557***
commitment (log)			(0.00226)	(0.00138)
Total HHI			0.0378***	0.0678***
sectoral			(0.0125)	(0.0103)
GDP p.c. (log)			0.0398***	0.00797***
			(0.00947)	(0.00127)
Population (log)			−0.170***	−0.00398***
			(0.0201)	(0.00108)
Constant	0.479***	0.656***	3.24***	0.769***
	(0.0125)	(0.0157)	(0.286)	(0.0233)
n	32,142	32,142	30,847	30,847
	fixed effects	fixed effects	fixed effects	random effects

* $p \leq 0.1$, ** $p \leq 0.05$, *** $p \leq 0.01$

tively, the effect size decreases minimally and is estimated with similar statistical precision (a 10 percentage point increase in the World Bank share is associated with a 0.21 percentage point increase in donor sectoral HHI). Importantly, the sectoral HHI of total aid commitments is positively related to the sectoral HHI of donor aid choices. That is, greater sectoral concentration of total aid flows corresponds with greater concentration of individual donors' aid choices. This pattern is not consistent with complementary sectoral aid choices of individual donors, as stipulated by hypothesis 1a. Instead, donors appear to focus on the same sectors when concentrating their aid activity. Thus we have evidence for hypotheses 3a & 3b, which predict that World Bank engagement leads to greater sectoral concentration and competitiveness of bilateral aid allocations. Substantively, a 10-percentage point increase in sectoral HHI of total aid allocations is associated with a 0.38 percentage point increase of individual sectoral HHI.

Model 3 is our preferred specification. A likelihood ratio test establishes that the additional variables significantly improve fit over model 2 ($\chi^2_5 = 258,\ p \leq 0.0000$). The recovered point estimates do not substantively change using the random effects estimator (model 4), and recovered standard errors are robust to jackknifing and bootstrapping (not shown).

The identified empirical patterns are consistent with the private goods logic of delegation to IOs. Instead of freeing up bilateral donors to allocate aid as they wish, it appears that donors concentrate their activities in similar sectors, instead of spreading their efforts out more evenly. This suggests that World Bank programs are associated with an increase in competitive behavior between donors and the World Bank itself. An important caveat of this finding is that the recovered substantive effect sizes are small. In the second part of the empirical analysis, I directly assess the strategic interactions between bilateral donors in sectors with and without World Bank presence.

3.2 Strategic Interactions in Sectoral Aid Allocations

3.2.1 Operationalization

To tap into strategic interdependencies I rely on a Spatial Autoregressive (SAR) setup that models sectoral aid allocation decisions of donors. The SAR model and other spatial lag models have found wide application in capturing interdependencies across politically and economically connected units, including collusion between foreign aid donors (Steinwand 2015), tax competition (Franzese and Hays 2008), and diffusion of policy reforms (Hennessy and Steinwand 2014).

Hypotheses 2 and 4 stipulate that strategic relationships between bilateral donors change if the World Bank is engaged in a given sector and country. To directly test this claim, I adjust the standard SAR setup to allow for covariates in the spatial parameter ρ, re-parameterizing ρ using a logit link. The resulting model has the form

$$y_{i,j,t} = \rho \sum_{r} w_{i,r} y_{i,j,t} + \mathbf{x}\boldsymbol{\beta} + \varepsilon_{i,j,t}, \tag{2}$$

where

$$\rho = 2 \left\{ \frac{\exp(\gamma_0 + \gamma_1 I_{i,t}^{World\ Bank})}{\exp(\gamma_0 + \gamma_1 I_{i,t}^{World\ Bank}) + 1} - .5 \right\}. \tag{3}$$

As before, i indexes a recipient country, j a donor, and t the time period. Other donors that provide aid to the same recipient country in the same time period are called r. Period-specific strategic connectivity weights between a pair of donors j and r are denoted $w_{j,r,t}$. As usual, $w_{j,j,t} = 0$. Note that the model will be estimated separately sector-by-sector. Hence i will be specific to a recipient country sector. In the logit transformation of parameter ρ in (3), γ_0 is a shared intercept and $I_{i,t}^{World\ Bank}$ is an indicator variables that is 1 if the World

Bank is engaged in a given sector in country i at time t, and 0 otherwise. The transformation is scaled to ensure that ρ maps into the $(-1, 1)$ interval.

In order to avoid potentially complex spatiotemporal dynamics and issues of endogenous interdependence that arise from non-orthogonal temporal and spatial effects (Hays *et al.* 2010), I average aid allocations across 4 year time periods.[7] The first of four resulting periods includes the years 1998 to 2002, the last 2010 to 2013. In addition, connectivity weights are motivated substantively as discussed below and vary across time periods.

Defining connectivity weights is an important substantive decision that requires theoretical guidance (Beck *et al.* 2006; Steinwand 2011). Since I am interested in free-riding behavior and competitive pressures in sectoral aid allocations, I base connectivity weights on the observed importance that a donor assigns to a sector in its overall aid portfolio. To measure this, I begin with the share of aid dedicated by donor j in period t to sector s across all recipient countries relative to j's total aid allocations in this time period, $S_{j,s,t} = y_{j,s,t} / \sum_s y_{j,s,t}$. Since strategic interactions are dyadic in nature, I need to determine how monadic sectoral importance $S_{j,s,t}$ feeds into dyadic connectivity weights. For the private goods scenario, donors are concerned about competition and therefore should put more strategic emphasis on interactions with those donors that are engaged in similar sectors. Likewise for the public good scenario, free-riding incentives are more salient when facing donors that have similar sectoral aid portfolios. In order to capture this, I calculate dyadic connectivity weights $w_{s,j,r,t}$ as complements of the sectoral importance that donors j and r jointly assign to sector s, according to

$$w_{s,j,r,t} = \sqrt{S_{j,s,t}}\sqrt{S_{r,s,t}}. \tag{4}$$

[7] This is approach is frequently used in GDP growth regressions.

Taking the square roots of the raw sectoral importance measures linearizes the mapping from sectoral importance to the [0,1] interval, which otherwise would be convex.

In future iterations of this project I will utilize additional weight specifications and model discrimination methods as robustness checks and to sort through the wealth of possible weight specifications (Zhukov and Stewart 2013, for example featuring monadic sectoral importance weights only, and dyadic importance weights with weight on World Bank giving set to zero).

3.2.2 Results

I estimate equation 2 separately for each sector. To code sectors, I use the OECD's Creditor Reporting System, coarsening top level codes to the highest 2 digits. This results in a total of 26 sectors. Reporting regression results for this many specifications is impractical, the full results can be found in tables 5–11 in the appendix.

Instead, figure 1 shows the key quantity of interest across all sectors. This is the effect of the World Bank dummy $\gamma_1 I_{i,t}^{World\ Bank}$ on the connectivity parameter ρ. Hypothesis 2 predicts that for aid with public good properties World Bank activity in a given sector should have no effect on strategic interactions between donors. Accordingly, $\gamma_1 I_{i,t}^{World\ Bank}$ should have no effect on ρ. In contrast, hypothesis 4 states that when donors care about private goods, World Bank engagement in a given sector should hamper coordination and therefore increase competition. This will result in complementarities (positive spill-ins) in aid provision. The World Bank dummy $\gamma_1 I_{i,t}^{World\ Bank}$ therefore should contribute to an increase in the value of connectivity parameter ρ.

Figure 1 shows that for most sectors, World Bank engagement is in fact associated with a positive effect on ρ.[8] For 21 out of 26 sectors, World Bank engagement is associated with increased complementarities in aid allocation. However, this effect is only recovered

[8]The effect of $\gamma_1 I_{i,t}^{World\ Bank}$ is obtained by parametric re-sampling of parameters and varying the value of $I_{i,t}^{World\ Bank}$ from 0 to 1 to simulate ρ according to equation 3. Whiskers represent 95 percent confidence bands.

at standard levels of statistical significance for 6 sectors. In declining order of effect size, these sectors are General Environmental Protection, Other Social Infrastructures and Services, Transport and Storage, Energy Generation and Supply, Water and Sanitation, and Education.

Two of these sectors, Transport and Storage, and Energy Generation and Supply, constitute the number 1 and 3 sectors to which the World Bank provides money. These sectors are also important for some of the largest bilateral OECD donors. In terms of overall aid allocations, the Transport and Storage sector is ranked 4 for the US, 3 for France and 1 for Japan. Likewise, the Energy Generation and Supply sector ranks 5th in US aid, 3rd in German allocations, and 2nd in Japanese aid. While Water and Sanitation only reaches rank 8 for the World Bank, for Germany and Japan it is ranked 4th, and 5th for France. Education plays an important role in the budgets of Britain (rank 4), France and Germany (both rank 2).

We therefore find a competitive relationship in 4 sectors that make up a big part of the core competencies of the five largest bilateral OECD donors. Other sectors in which the top OECD donors are active, but where we *do not* observe World Bank induced competition are Action Relating to Debt, Government and Civil Society, General Budget Support, Emergency Response, Other Multisector, and Population Policies/Programmes and Reproductive Health. Importantly, all of these sectors are arguably less dependent on donor expertise (and donor contractors) and therefore provide fewer opportunities to generate private benefits to donors. Thus, we have evidence that the World Bank activity increases bilateral competition between OECD donors in key sectors that are also most likely to generate private benefits to them, and no such effect in other important sectors that are less prone to private goods generation. This is fully in line with hypothesis 4. It also matches the finding from the previous section that World Bank activity is associated with greater concentration of bilateral aid in similar sectors.

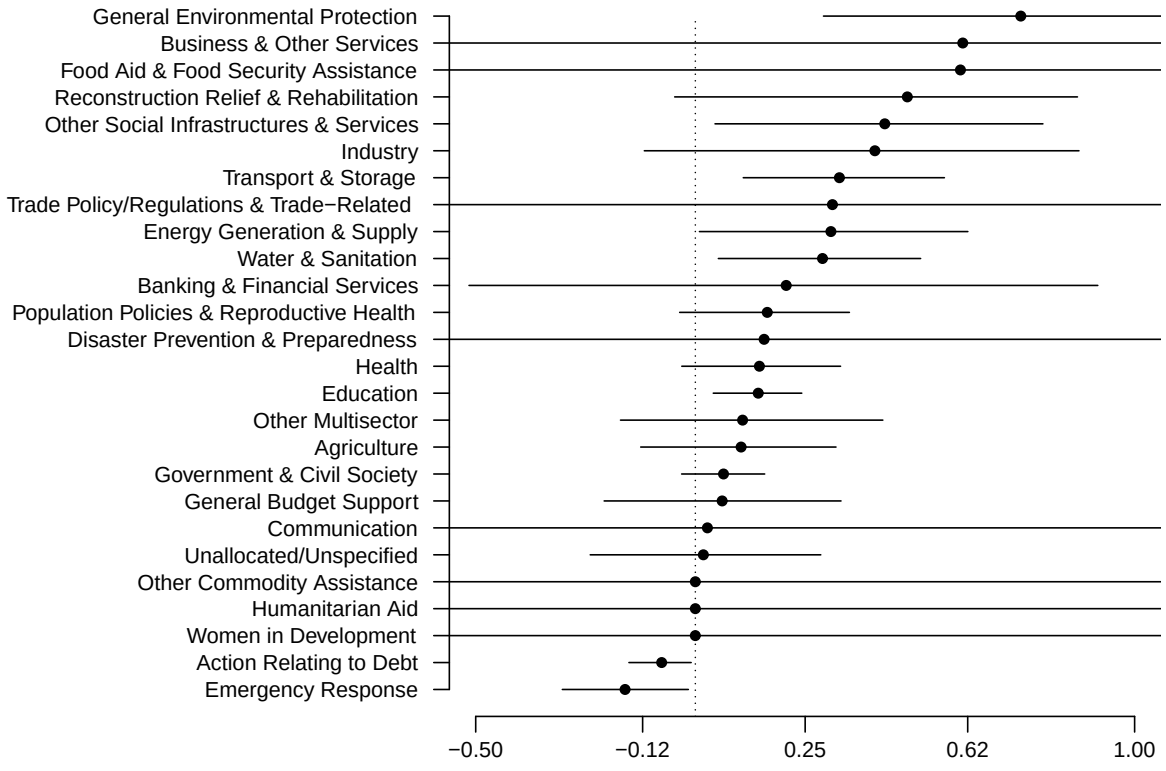
Returning to figure 1, in two sectors World Bank activity is associated with substitution behavior (negative spill-ins). For the Actions Relating to Debt sector and Emergency Response, having a World Bank presence appears to induce other donors to reduce the amount of bilateral aid as other donors give more. As we have just seen, these are important sectors in which the largest OECD donors engage. The finding is neither in line with hypothesis 2, which connects aid with public good properties to an absence of strategic interactions among donors. Nor does it fit with hypothesis 4, which predicts competition in the presence of World Bank activity. Emergency response and to a lesser degree debt relief are actions that are unlikely to generate private benefits for donors. Emergency response in particular has classic public good properties. The observed negative spill-ins are therefore consistent with free-riding behavior.

While outside the scope of my theoretical ex-ante considerations, it appears that World Bank engagement in these sectors induces free-riding among bilateral donors. A more benevolent interpretation could be that bilateral donors prefer to give the World Bank a leading policy role when it comes to emergency response and debt relief negotiations, and therefore substitute bilateral aid with contributions to World Bank funds that are earmarked for use in these sectors. My measure of World Bank giving excludes the Managed Trust Fund category, which would be the primary vehicle for such a financing arrangement. The politics of trust funds or 'earmarked aid' is a research topic that only recently has become tractable due to systematic data gathering efforts by Eichenauer and Reinsberg (2016), and we will be able to answer questions about earmarking in these sectors soon.

For 18 sectors, the effect of World Bank activity on strategic interactions between bilateral donors cannot be estimated with sufficient accuracy. Hypothesis 2 predicts a null-effect of World Bank engagement if aid has mainly public good properties. The standard hypothesis testing framework does not allow us to distinguish between the absence of an effect and an existing effect that is either estimated with too much uncertainty or which is too small to be

reliably distinguished from zero. In figure 1 for example, the Business and Other Services sector and the Food Aid sector shift ρ by a large amount, but we cannot be certain that this is not due to chance. Since point estimates still contain some information, it is instructive to see for which sectors World Bank activity is estimated to have very little or no impact on ρ. This is the case for three sectors, which are Humanitarian Aid, Women in Development, and other Commodity Assistance. In contrast to the sectors for which we have evidence of competition, these three sectors arguably generate few opportunities for donors to benefit privately and are more public goods oriented in nature.

Figure 1: Change in ρ, World Bank Activity



Looking at the overall revealed empirical patterns, we see that World Bank activity is associated with competition in core sectors of top OECD donors (in line with hypothesis 4), whereas effects closest to zero are estimated for sectors that are more public goods oriented in nature (in line with hypothesis 2). Not captured in my theoretical setup, but in line with this overall pattern, is the evidence for free-riding in aid allocations to the Emergency Response and Debt Relief sectors. Together, these observations suggest that the World Bank has the potential to act as a spoiler for coordination efforts in sectors that form the core of OECD donors' aid portfolios. Combining this insight with the finding that World Bank activity is associated with increased concentration of bilateral aid into specific sectors, we have a solid evidence that in fact the presence of the World Bank reduces coordination among bilateral donors. Given the focus on sectors where donor expertise allows for private benefits, the reduction in coordinated behavior is likely due to increased competitive pressures.

In future iterations of this project I will explore in more detail how important these pressures are in substantive terms (i.e. how much aid allocations increase because of World Bank induced competitive pressures). As mentioned above, I will also test additional connectivity structures. Of special interest is the question whether competitive complementarities in aid allocations mainly result from competition *with* the World Bank or *between* bilateral donors, with World Bank activity only serving as a catalyst.

4 Conclusion

This projects aims to fill a gap in the literature on donor coordination. Existing works have mainly focused on collective action problems that hinder cooperation between bilateral donors and on the role of multilateral donors in overcoming these collective actions problems. However, bilateral donors are heavily engaged in the same countries and sectors as multilateral institutions. This raises the question how bilateral donors interact with multilateral

IOs, and whether the presence of both types of aid hinder or promote donor coordination.

This paper looks at this question from the perspective of aid as impure public good. Where the public good content of aid dominates, donors delegate aid to IOs to reduce constraints on their bilaterals activities. This suggests that multilateral giving allows donors to proliferate aid more widely and that there is no competition or other strategic relationship between bilateral and multilateral giving. In contrast, where private goals dominate, delegation results in IO activities that represent an average of donor preferences, or, to the extent that delegation fails, agency preferences. This renders bilateral and IO activities potentially at odds, and we would expect competitive strategic interactions between bilateral and multilateral donors.

The paper reports empirical results from an analysis that focuses on the relationship between World Bank activity and the sectoral concentration of bilateral aid flows, as well as directly measuring strategic interactions in aid allocations between donors in the presence of World Bank activity. The empirical analysis shows that donors increasingly concentrate their aid on similar sectors in the presence of World Bank programs, and their aid allocation decisions become increasingly competitive in character in these situations. This is in line with the private goods logic of aid delegation. These conclusions can be further strengthened in the future by performing robust checks and testing alternative weight matrix specifications in the empirical analysis.

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Appendix

Table 5: SAR Results, Committed Aid, Million US Dollars, part 1

	Education		Water & Sanitation		Government & Civil Society		Other Social Infrastructures & Services	
s^2	**15.2**	(0.103)	**25**	(0.209)	**33.5**	(0.227)	**26.5**	(0.187)
ρ Intercept	-0.107	(0.101)	-0.13	(0.249)	0.0377	(0.0976)	-0.109	(0.363)
ρ World Bank	**0.285**	(0.102)	**0.597**	(0.253)	0.127	(0.099)	**0.886**	(0.37)
Intercept	**-62.3**	(2.42)	**-111**	(5.24)	**-104**	(5.26)	**-77.7**	(4.57)
Committed Aid – Donor to Country (log)	**1.84**	(0.0734)	**3.12**	(0.155)	**3.18**	(0.156)	**2.24**	(0.137)
Committed Aid – Country Total (log)	**0.282**	(0.0525)	**0.568**	(0.142)	**0.735**	(0.123)	**0.444**	(0.1)
GDP per capita (log)	-0.0243	(0.102)	**0.615**	(0.204)	0.355	(0.225)	**0.908**	(0.186)
Population (log)	**1.27**	(0.0918)	**1.88**	(0.204)	**1.39**	(0.199)	**0.954**	(0.164)

Table 6: SAR Results, Committed Aid, Million US Dollars, part 2

	Communication		Energy Generation & Supply		Agriculture		Industry	
s^2	**9.71**	(0.0915)	**47.8**	(0.442)	**16.5**	(0.127)	**27.6**	(0.236)
ρ Intercept	-2.87	(5.87)	0.00448	(0.315)	-0.0229	(0.226)	-0.0402	(0.518)
ρ World Bank	12.6	(64.4)	**0.645**	(0.32)	0.212	(0.232)	0.833	(0.533)
Intercept	**-28.3**	(2.27)	**-201**	(11.1)	**-60.6**	(2.95)	**-87.2**	(6.01)
Committed Aid – Donor to Country (log)	**0.677**	(0.0699)	**5.45**	(0.32)	**1.64**	(0.0845)	**2.27**	(0.173)
Committed Aid – Country Total (log)	**0.211**	(0.0585)	**1.11**	(0.282)	**0.402**	(0.0897)	**0.686**	(0.146)
GDP per capita (log)	**0.575**	(0.0882)	**1.64**	(0.437)	0.0138	(0.124)	**1.62**	(0.24)
Population (log)	**0.335**	(0.0841)	**3.16**	(0.416)	**1.23**	(0.122)	**0.821**	(0.223)

Table 7: SAR Results, Committed Aid, Million US Dollars, part 3

	General Environmental Protection		Other Multisector		Transport & Storage		Population Policies & Reproductive Health	
s^2	**-14.1**	(0.113)	**23.6**	(0.172)	**70.8**	(0.671)	**18.1**	(0.163)
ρ Intercept	-0.177	(0.448)	-0.0274	(0.317)	-0.0357	(0.233)	**0.393**	(0.174)
ρ World Bank	**1.75**	(0.495)	0.231	(0.321)	**0.665**	(0.236)	*0.363*	(0.208)
Intercept	**-37.2**	(2.71)	**-101**	(4.19)	**-327**	(17.1)	**-48.6**	(4.04)
Committed Aid – Donor to Country (log)	**0.946**	(0.079)	**2.86**	(0.124)	**9.95**	(0.523)	**1.59**	(0.115)
Committed Aid – Country Total (log)	**0.166**	(0.0682)	**0.642**	(0.101)	**1.52**	(0.426)	**0.301**	(0.148)
GDP per capita (log)	**0.28**	(0.111)	**0.483**	(0.17)	**1.69**	(0.652)	**-0.483**	(0.159)
Population (log)	**0.765**	(0.101)	**1.6**	(0.157)	**4.36**	(0.61)	**0.834**	(0.168)

Table 8: SAR Results, Committed Aid, Million US Dollars, part 4

	Banking & Financial Services		Business & Other Services		General Budget Support		Emergency Response	
s^2	**116**	(1.07)	**19.5**	(0.18)	**386**	(4.02)	**14.7**	(0.111)
ρ Intercept	-0.0793	(0.883)	-1.41	(2)	-0.0819	(0.284)	**0.55**	(0.0289)
ρ World Bank	0.465	(0.892)	1.52	(2.02)	0.129	(0.292)	**-0.328**	(0.151)
Intercept	**-241**	(28)	**-73.7**	(4.72)	**-1140**	(123)	**-34.1**	(2.62)
Committed Aid – Donor to Country (log)	**5.83**	(0.866)	**1.83**	(0.142)	**24**	(3.34)	**1.28**	(0.077)
Committed Aid – Country Total (log)	**2.15**	(0.742)	**0.584**	(0.116)	**19.9**	(4.25)	**0.213**	(0.0767)
GDP per capita (log)	**4.49**	(1.06)	**1.47**	(0.186)	**23.4**	(4.04)	**-0.368**	(0.11)
Population (log)	**2.37**	(1.02)	**0.741**	(0.162)	3.15	(4.05)	**0.42**	(0.103)

Table 9: SAR Results, Committed Aid, Million US Dollars, part 5

	Reconstruction Relief & Rehabilitation		Disaster Prevention & Preparedness		Unallocated/Unspecified		Health	
s^2	**-18.8**	(0.197)	**5.85**	(0.0665)	**-8.18**	(0.0617)	**13.3**	(0.0997)
ρ Intercept	*0.619*	(0.354)	-1.09	(5.75)	0.216	(0.201)	-0.114	(0.194)
ρ World Bank	*1.5*	(0.853)	1.01	(5.88)	0.0292	(0.289)	0.296	(0.197)
Intercept	**-49.5**	(5.36)	**-14**	(1.77)	**-21.1**	(1.57)	**-54.6**	(2.34)
Committed Aid – Donor to Country (log)	**1.43**	(0.151)	**0.31**	(0.0508)	**0.606**	(0.0497)	**1.57**	(0.0682)
Committed Aid – Country Total (log)	**0.642**	(0.208)	**0.255**	(0.073)	**0.114**	(0.0361)	**0.36**	(0.0684)
GDP per capita (log)	-0.0463	(0.191)	0.0977	(0.0654)	0.073	(0.0599)	**-0.232**	(0.0987)
Population (log)	**0.434**	(0.204)	0.103	(0.0657)	**0.375**	(0.057)	**1.1**	(0.0962)

Table 10: SAR Results, Committed Aid, Million US Dollars, part 6

	Trade Policy/Regulations & Trade-Related		Women in Development		Developmental Food Aid & Food Security Assistance		Other Commodity Assistance	
s^2	**11.1**	(0.109)	**-1.45**	(0.019)	**-10.2**	(0.121)	**-7.95**	(0.183)
ρ Intercept	-0.768	(1.83)	0.717	(7.34)	0.0582	(0.404)	5.63	(342)
ρ World Bank	11.1	(98.7)	-1.93	(61.3)	13.2	(113)	3.54	(357)
Intercept	**-26.4**	(2.69)	**-2.31**	(0.551)	**-36.9**	(3.4)	**-18.5**	(4.71)
Committed Aid – Donor to Country (log)	**0.728**	(0.0834)	**0.0563**	(0.0154)	**1.17**	(0.0983)	**0.396**	(0.15)
Committed Aid – Country Total (log)	**0.182**	(0.0653)	0.0364	(0.0252)	**0.28**	(0.13)	*0.278*	(0.145)
GDP per capita (log)	**0.3**	(0.106)	-0.0112	(0.0179)	-0.15	(0.12)	**0.343**	(0.167)
Population (log)	**0.316**	(0.0953)	0.0307	(0.0227)	**0.493**	(0.14)	0.158	(0.174)

Table 11: SAR Results, Committed Aid, Million US Dollars, part 7

	Action Relating to Debt		Humanitarian Aid	
s^2	**69**	(0.906)	**12.1**	(0.266)
ρ Intercept	**0.461**	(0.0189)	-7.07	(232)
ρ World Bank	**-0.162**	(0.0765)	-4.88	(919)
Intercept	**-242**	(30.2)	**-36.8**	(8.06)
Committed Aid – Donor to Country (log)	**5.93**	(0.916)	**0.72**	(0.23)
Committed Aid – Country Total (log)	**6.34**	(1.69)	**0.888**	(0.315)
GDP per capita (log)	0.583	(0.933)	**0.596**	(0.265)
Population (log)	-0.987	(1.32)	-0.0819	(0.308)