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## **The role of oil in the allocation of foreign aid: The case of the G7 donors**

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## **The role of oil in the allocation of foreign aid: The case of the G7 donors**

### **Abstract**

While it is often alleged that oil endowment might influence the destination of foreign aid, there is a lack of empirical evidence of how and why such an effect may come into play, and even less so of the channels through which it works. This paper aims to bring evidence that contributes to addressing those points. Specifically, we investigate the role of oil in aid allocation of the G7 donors. Results show that, unsurprisingly, aid allocated by these donors increases significantly with oil endowment of recipient countries. Looking more deeply, we interestingly show that their strategic interests in terms of oil security play a role in their provision of aid. More importantly, we provide evidence on the existence of competition for access to oil supplies among this group of donors.

**Keywords:** Oil endowment, Aid allocation, G7 donors, Oil competition

**JEL Classifications:** F35; Q34; Q37

## 1. Introduction

Over the last two decades, global oil consumption has increased significantly and this trend has gone hand in hand with the rise of emerging countries. Since oil is a depletable resource and it is unevenly distributed across the globe, developing secure means of accessing it is of prime importance for all countries dependent on oil imports. Therefore, we may expect oil to matter a great deal to foreign policymaking in these countries.

As foreign aid is one of the major segments of rich oil-dependent countries' foreign policies and diplomacy, we may, in turn, expect foreign aid to serve as an instrument of those countries' energy security policies. Indeed, in security studies, a burgeoning literature has provided anecdotal evidence of energy security influencing domestic and foreign policy (Delucchi and Murphy, 2008; Downs, 2004; Duffield, 2005; Gholz and Press, 2010; Klare, 2008; Leverett and Bader, 2005; Moran and Russell, 2009). On the other hand, several studies have also highlighted that oil-rich developing countries now account for a noticeable share of foreign aid (Lee, 2012; Arezki and Banerjee, 2014).

In light of this apparent link between foreign aid policymaking and countries' growing oil needs, the development of foreign aid policies from several emerging countries toward oil-producing countries in Africa has attracted attention in recent years. To give some examples, as an emerging global power and the world's second-largest economy, China has engaged in numerous efforts to sustain its energy supplies and enhance its energy security. Both the Forum on China-Africa Cooperation, which aims at promoting investment in African oil-producing countries (Klare and Volman 2006; Taylor 2006), and the recent One Belt One Road initiative have shown Beijing's insatiable thirst for oil. On the other hand, Fuchs and Vadlamannati (2013) demonstrated that India's aid allocation is also in line with the behavior of a "needy" donor. Certainly, as explained by Woods (2008), the quest for energy security is common to most of the non-traditional donors. Furthermore, the notion of "rogue aid" has been widely employed by authors like Naim (2007) to express concerns about the selfishness underlying the allocation of aid of these new donors.

While this literature seems to be expanding rapidly, the importance of oil in the allocation of foreign aid from rich western oil-dependent countries has rarely been explicitly tested. This paper aims to provide a systematic analysis of how G7 countries' energy security concerns affect their

foreign aid policy preferences. If some recent papers have introduced the discussion about the strategic role of oil in aid allocation (Dreher and Fuchs, 2011; Lee, 2012; Arezki and Banerjee, 2014), the literature lacks robust empirical evidence validating the aid-oil nexus and explicitly addressing the strategic resource motive of traditional western donors.

More specifically, to fill this gap in the aid literature, we assess empirically the importance of oil endowment of recipient countries in the foreign aid allocated by the major OECD donors (G7 donors). In addition, we consider the role played by the national interests of these donors in using foreign aid as a means to ensure their energy security. Finally, we investigate whether this energy security motive leads to competition for oil markets among the G7 donors, by analyzing their strategic interactions through the estimation of empirical spatial-lag models. By addressing all these issues, the major contribution of this paper is that we explicitly investigate, for the first time in the aid literature, the strategic role of oil on both aid allocation and competition between the G7 donors.

Our results confirm that the oil endowment of recipient countries impacts positively the aid allocation pattern of the G7 donors. They also reveal that for donors that are highly oil-dependent, energy security plays an important role in their aid allocation. Furthermore, we find that motivated by energy security concerns, G7 donors compete for oil resources. Indeed, the evidence suggests that recipient countries that increase their share in a major OECD donor's oil imports are likely to benefit from an increase from all other major OECD oil-importing donors. Finally, we find cross-country differences in the impact of oil competition on aid decisions: the more oil-dependent a donor is, the higher is the impact of oil competition on its aid decision. In particular, for large European donors that are also more vulnerable to oil supply shocks, oil competition plays a higher role in aid allocation than for other G7 donors.

The paper proceeds as follows. In Section 2, we provide some descriptive evidence and theoretical background on the aid and oil nexus from which we derive the main assumptions underlying our analysis. In Section 3, we describe our empirical framework and the data. Section 4 presents our preliminary results and highlights the importance of energy security concerns in foreign aid. Section 5 provides additional evidence on the importance of oil competition in aid allocation for all G7 donors through a spatial-lag model. Finally, Section 6 concludes.

## **2. Background and hypotheses**

### **2.1. Stylized facts of the oil – aid nexus**

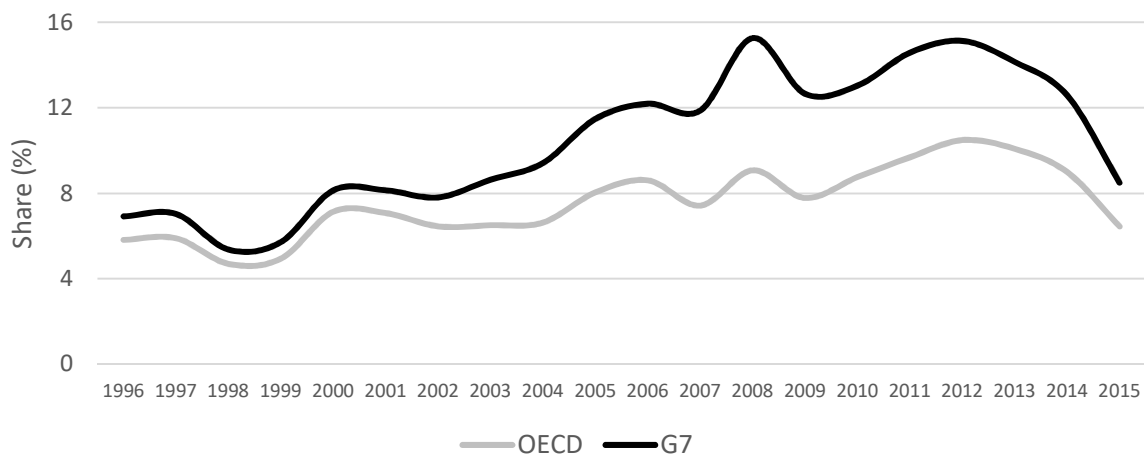
Some anecdotal evidence suggests that oil and aid may be related. Examples of oil-rich countries receiving substantial aid include countries such as Angola, which receives substantial amounts of aid from many donors while maintaining the second greatest oil exports in sub-Saharan Africa. Similarly, Nigeria continues to receive approximately \$300m. in aid from the US per annum, while holding the position of lead sub-Saharan African petroleum exporter (providing 8% of all petroleum imports to the US). However, it seems not clear whether the role of oil in aid allocation is more sensitive to recipients' needs or donors' interests.

Oil-rich countries are more attractive for the allocation of foreign aid as they have a better repayment capacity. Hence a positive correlation between aid and oil could reflect market liberalization in recipients' economies since donors' aid allocation behavior is also positively influenced by the economic environment and policy orientation (Burnside and Dollar, 2000). On the contrary, under weak institutions, the discovery of oil or other resources can also lead to an internal struggle and to interstate conflicts when oil reserves are near borders. Foreign assistance thus increases in post-conflict states as they face critical challenges stemming from the effects of the destruction of economic activity and the deterioration of both state capacity and national institutions that sustained during conflicts.

On the other hand, as the oil plays a critical role in the stability of the global economic system, the national interests of most developed nations are closely tied to oil. In particular, any prolonged shortage in oil availability can produce a global economic recession, as evidenced by the two episodes of large increases in the price of oil during the 1970s.<sup>1</sup> Even if the effects of fluctuations in the oil price have somewhat changed over time, having now lower effects on inflation and activity in developed countries (Blanchard and Galli, 2007), the oil has a central role in those economies. This holds true in particular for the G7 countries, which are still highly dependent on oil for meeting their energy requirements, as shown in Figure 1.

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<sup>1</sup> In 1974, following the Arab oil embargo and in 1979, following the Iranian revolution.

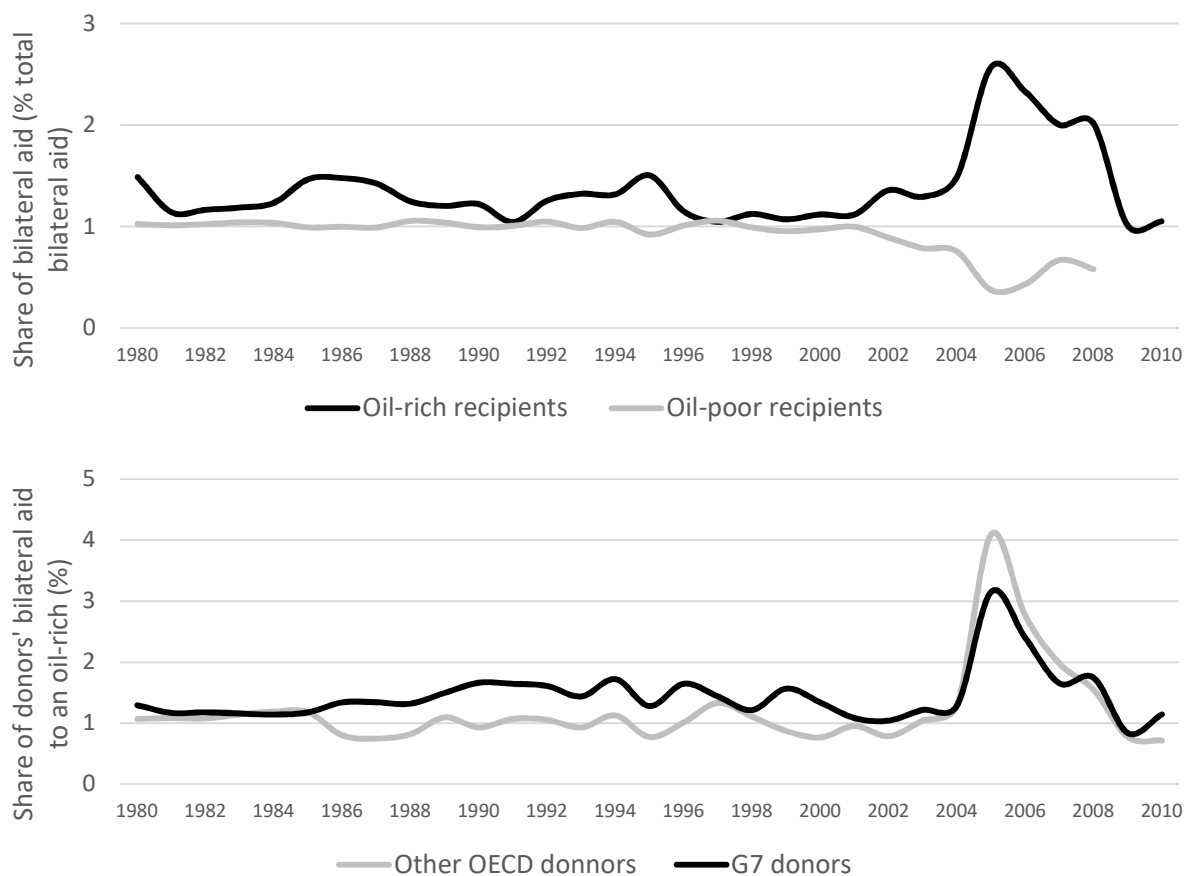


**Figure 1. Share of oil imports in total imports, OECD and G7 countries, current prices, 1996-2015**

Source: Authors' calculation based on UNComtrade.

As the reliance on imported oil exposes economies to disruption in global oil supplies and puts energy security at increased risk, oil-importing countries have an interest in ensuring reliable access to oil from foreign sources.<sup>2</sup> Therefore, energy security is also an important feature of trade and foreign policies vis-a-vis resource-abundant regions, especially in those industrialized countries that are very dependent on external sources for their energy procurement. The importance of expanding and ensuring access to energy resources has, for instance, encouraged the diversification of oil procurement and foreign investments towards oil-rich regions in Central Asia and Africa (see, for instance, Ikenberry, 1986; Li, 2005; Vivoda, 2009). It has also encouraged major donors to increase their aid assistance towards oil-rich countries, as illustrated by Figure 2. Indeed, since 1980, differences in oil endowment across recipient countries have played an increased role in aid allocation from members of the OECD's Development Assistance Committee (upper part of Figure 2), while at the same time, amongst the group of OECD donors, the G7 countries have given a higher priority to oil-rich countries in their aid allocation (lower part of Figure 2).

<sup>2</sup> Developed countries have also been encouraged to invest in energy security through the development of domestic energy resources, such as natural gas and wind power as well as strategic stockpiling (Devarajan and Weiner, 1989; Cohen et al., 2011).



**Figure 2. The importance of oil in aid allocation, G7 and OECD donors, 1980-2010**

*Note: Share of oil-rich countries in aid allocation from OECD countries and share of all OECD donors versus seven major donors in aid allocation towards oil-rich countries. Following the categorization employed by the International Monetary Fund (IMF, 2012) a country is coded as an oil-rich country if its share of oil exports in total exports exceeds at least 20 percent over the average period.*

*Source: Authors' calculation based on OECD CRS data.*

## 2.2. Hypotheses

The discussion above suggests several non-exclusive pathways through which aid allocation can be influenced by natural resources like oil. Our contribution is to provide an in-depth analysis of the relationship between oil and the aid allocation of G7 donors by investigating how their national interests affect their aid allocation across a panel of recipient countries.



First, since we are interested in capturing the role of oil in aid allocation it is important to establish a general link between the two variables. A number of studies have shown that developing countries having more oil reserves do in fact receive more aid, *ceteris paribus* (Arezki and Banerjee, 2014, Dreher and Fuchs, 2011; Lee, 2012; Carbonnier and Voicu, 2014). Thus, the first empirically testable hypothesis in this paper is:

*Hypothesis 1: Oil endowments of recipient countries increase the amount of aid allocation they receive from G7 donors.*

Additionally, as oil is a strategic asset, particularly to oil-dependent countries like the G7 donors, it seems reasonable to think that foreign aid in favor of oil-producing countries can also be considered as a way to cover energy interests of the G7 donors. Indeed, as foreign aid policy can help to secure several aspects linked to oil supply, such as foreign investment for exploration, state ownership of production companies, long-term nature of supply contracts, etc., the G7 donors can be incited to distribute aid allocation in oil-rich countries as a policy option for coping with their dependence on external energy sources. Therefore, ignoring those strategic interests could significantly distort any assessment of the foreign aid bias in favor of oil-rich developing countries. This reasoning leads us to our second hypothesis:

*Hypothesis 2: Foreign aid from oil-dependent donors is influenced by their energy security concerns.*

### **3. Empirical approach and data**

#### **3.1. Model specification and estimation strategy**

To test the above hypotheses, we extend the traditional donor interest – recipient needs framework presented by Dudley and Montmarquette (1976) and McKinlay and Little (1977), by adding several proxies that capture different incentives associated to oil. The model we estimate differs from and improves upon the existing literature on two major accounts. The first improvement is related to our description of the aid – oil nexus in the model. Some previously published works have also considered oil resources of recipient countries in order to capture the influence of oil in aid allocation of China (Dreher and Fuchs, 2011) or during the cold war (Carbonnier and Voicu, 2014). However, proxies such as oil production or oil reserves of

recipient countries capture the economic resource motive and not necessarily the energy security motive of donors. Indeed, increased aid inflows following oil discoveries in recipient countries may reflect the commercial interests of donors that wish to take advantage of recipients' potential revenue windfalls. Therefore, to better capture the motive of reliable access to oil from foreign sources in donors' aid allocation decisions, variables reflecting energy security interests are included in addition to the oil endowment and commercial interest variables in the regression. Second, we avoid biased and inefficient estimates of log-linearized models estimated using Ordinary Least Squares (OLS). Indeed, as pointed out by Santos Silva and Tenreyro (2006), in the presence of heteroskedasticity, OLS estimation may not be consistent and nonlinear estimators should be used. Another challenge described in the literature concerns the zero values. To deal with these problems, we adopt the solution proposed by Santos Silva and Tenreyro (2006) which consists of estimating the model in levels, instead of taking logarithms. In that case, OLS problems are avoided.

Our empirical analysis examining the strategic role of oil in donor aid allocation is therefore based on a nonlinear model that takes the following form:

$$Aid_{ijt} = \exp(\alpha_{ij} + \beta Aid_{ijt-1} + \gamma OilR_{jt} + \delta X_{jt} + \zeta Z_{ijt} + \theta Y_{it} + \varphi W_t + \eta_j + u_i + \lambda_t) + \varepsilon_{ijt} \quad (1)$$

where subscripts  $i$ ,  $j$  and  $t$  indicate the donor country, the recipient country and the time period, respectively. The dependent variable,  $Aid_{ijt}$ , is defined as the share of aid that donor  $i$  in a year  $t$  allocates to each recipient country  $j$ . Typically, research on aid allocation uses this variable because of its scale neutrality, as it is not affected by proportional increases in aid to all recipient countries (Barthel et al., 2014). However, as a robustness check, we will also perform additional estimations of our baseline specification in which the dependent aid variable is defined in absolute terms.<sup>3</sup>

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<sup>3</sup> We additionally include donor-specific year fixed effects in the estimations to account for the time-varying overall propensity of donors to give aid. Note that these additional fixed effects are not necessary in our main estimations where our dependent variables are formulated as aid shares and are therefore scale neutral. Including recipient-specific year fixed effect with these additional fixed effects, will make any donor- and recipient-specific (rather than dyad-specific) control variables perfectly collinear to these fixed effects and therefore automatically dropped from the estimation in these models.

$X_{jt}$  is a  $k$ -dimensional vector of variables that control for recipients' needs and merits. The variable,  $OilR_{jt}$  refers to the oil endowment of recipient countries.  $Z_{ijt}$  is a vector of variables that reflect strategic links between donor and recipient countries. The variable  $Y_{it}$  accounts for energy security motives of donors while  $W_t$  stands for a proxy reflecting instabilities in the oil market. All explanatory variables are lagged one year to avoid possible endogeneity problems. Country-fixed effects for recipient ( $\eta_j$ ) and donor ( $u_i$ ) countries and time-invariant dyad-specific effect,  $\alpha_{ij}$ , are included in order to control respectively fixed spatial characteristics and unobserved spatial heterogeneity. Specific time-fixed effects,  $\lambda_t$ , can be integrated to capture global shocks that may affect the oil-aid relationship.<sup>4</sup> Finally,  $\varepsilon_{ijt}$  is an independent and identically distributed (i.i.d.) random term.

We use a Poisson Pseudo Maximum Likelihood (PPML) estimator to estimate our nonlinear model of aid allocation. Indeed, according to Santos Silva and Tenreyro (2006), the PPML estimator is more efficient than the standard Nonlinear Least Squares (NLS). The reason is that NLS gives more weight to noisier observations, reducing henceforth the efficiency of the estimator. Besides being consistent in the presence of heteroscedasticity and providing a way of dealing with zero values of the dependent variable, the PPML estimator has a number of additional desirable properties. It is consistent in the presence of fixed effects,<sup>5</sup> which can be entered as dummy variables as in simple OLS. Furthermore, although the dependent variable for the Poisson regression is specified in levels rather than in logarithms, the coefficients of any independent variables entered in logarithms can still be interpreted as simple elasticities.<sup>6</sup> We also explore an original procedure to deal with the characteristics of our dependent variable, by using the Inverse Hyperbolic Sine (IHS) transformation of the variable,<sup>7</sup> developed by Johnson (1949) and applied to econometrics by Burbidge et al. (1988), which allows, in addition to take

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<sup>4</sup> We exclude time-fixed effects from specifications with variables that control for oil market instabilities to avoid collinearity.

<sup>5</sup> Fernández-Val and Weidner (2016) show that a Poisson model with fixed effects does not suffer from the incidental parameter problem as long as the regressors are strictly exogenous (a requirement that is also needed for the consistency of the fixed effects estimator in linear models).

<sup>6</sup> For robustness' sake, we also consider the fixed effect (FE) estimator of the log-linear version of the model. FE estimations are reported in Appendix B.

<sup>7</sup> The IHS transformation applied to a variable  $y$  is presented in the following equation:

$$\omega(y) = \frac{\ln(\theta_0 y + (\theta_0^2 y^2 + 1)^{0.5})}{\theta_0} = \sinh^{-1}(\theta_0 y) / \theta_0.$$
 It can thus be interpreted in exactly the same way as a standard logarithmic dependent variable, but unlike the logarithm, the IHS transformation is defined at zero and for negative values.

care of possible zeros and negative values in the dependent variable, for reducing the skewness of the distribution and the impact of outliers.<sup>8</sup>

If the literature on economic development often assumes that natural resource endowment is exogenous, in contrast, the resource economics literature has emphasized that the resource base is endogenous to investment in exploration and extraction. To address the potential endogeneity of *oil reserves* to foreign aid, we will also rely on an instrumental variable design.

### **3.2. Relevant estimation issues**

Equation (1) still confronts us with the well-known Nickell bias (Nickell, 1981).<sup>9</sup> Besides this, there might be two other econometric problems, namely incidental parameter problem and omitted variable bias. Let us briefly discuss these issues here.

#### *Incidental parameter problem:*

In our model, each observation may be affected by more than one fixed effect, and some fixed effects can be overlapped. This can generate a problem of consistency of our FE-PPML model with various different fixed effects specifications, known as the “incidental parameter problem”. PPML with fixed effects may suffer from an incidental parameter problem under various scenarios:

First, if the estimated fixed effects in the model suffer from a bias that does not disappear asymptotically with the size of the panel, estimates of any non-fixed effect parameters will be contaminated by this bias as well and will, therefore, be inconsistent. Second, the presence of fixed effects can also induce small sample bias in estimators that are asymptotically consistent.

As shown in Fernández-Val and Weidner (2016) with “two-way” panels, a Poisson model with fixed effects does not suffer from the incidental parameter problem as long as the regressors are strictly exogenous. Hence in current applied work, it is often assumed that:

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<sup>8</sup> We apply this procedure to our dependent variable, but also on independent variables with potential outliers like population, oil production and reserves or inflation rate. Compared with the results of our core specifications, the overall picture remains unchanged. Results are available upon request.

<sup>9</sup> As Nickell (1981) shows, in a panel data framework with fixed effects and in the presence of the lagged dependent variable as a right-hand side variable, the estimates might be biased and inconsistent due to the correlation between the lagged dependent variable and the error term. However, as the magnitude of this bias is given by  $1/T$  and the time dimension of the sample ( $T$ ) is quite large in our study, the bias in our estimates can be considered as negligible.

If the set of non-fixed effect regressors is exogenous to  $\varepsilon_{ijt}$  after conditioning on the fixed effects  $\mu_{it}$ ,  $\eta_{jt}$ , and  $\alpha_{ij}$ , FE-PPML estimates from the three-way gravity model<sup>10</sup> are consistent for  $N \rightarrow \infty$ .

The results by Fernández-Val and Weidner (2016) with a two-way FE-PPML create the impression in current practice that Poisson models are immune to incidental parameter problems, regardless of how many fixed effects are included or which dimensions of the panel grow with the sample (Correia et al., 2019a, b).<sup>11</sup>

Because the three-way FE-PPML model inherits the consistency properties of the two-way estimator, one might expect that it also inherits its *unbiasedness* properties as well. There is a current lack of clarity regarding the asymptotic properties of a nonlinear estimator with multiple high-dimensional fixed effects, especially in the case where the number of years is small relative to the number of donor-recipient pairs. To address this issue, following the recent study of Larch et al. (2019), we apply an iterative PPML estimation procedure that facilitates the inclusion of additional fixed effects for large data sets and also allows for correlated errors across countries and time. In this paper, our estimates are realized with *ppmlhdfe*, a new Stata command for estimation of (pseudo) Poisson regression models with multiple high-dimensional fixed effects.

#### *Omitted variable bias:*

Donor motivations are complex, and no single motivation can explain aid flows in any period. Discussions started in the 1970s (Dudley and Montmarquette, 1976; McKinlay and Little, 1977) on the opposition between strategic behavior, linking aid to the self-interest of the donors, and altruistic behavior, relating it to recipient needs and merits (Berthélemy, 2006). The consensus now is that, whenever these variables are relevant for the explanation of aid allocation, one needs to introduce them all together to avoid any omitted variable bias. However, by defining the dependent variable as described above and restraining our focus on a relatively homogeneous

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<sup>10</sup> Applying three-way PPML to large data sets has only recently become possible thanks to methods described in Larch et al. (2019).

<sup>11</sup> This result follows because we can re-write the three-way FE-PPML estimator as a two-way estimator, such that the earlier consistency result from Fernández-Val and Weidner (2016) for two-way estimators can again be applied. In other words, the three-way FE-PPML model is consistent as  $N \rightarrow \infty$  for the same reason two-way FE-PPML and other two-way nonlinear gravity estimators are generally consistent.

group of donors, we neutralize the impact of some (unobserved) donor characteristics that would affect the budget for aid.

As discussed in Bermeo (2017), there is no consensus in the empirical literature concerning the variables to include when studying aid allocation. “This lack of a generally accepted starting point complicates comparisons with existing work and generates a list of variables, which are too numerous to include in one study, often collinear with each other, and at times significantly lacking in country coverage” (Bermeo, 2017, p. 743). To keep the analysis manageable, we include in this study a sufficient number of variables to distinguish patterns across potential explanations, variables that are widely used in this field as well as a few key ones to test our aforementioned hypotheses.

In consequence, our model specification allows us to control for a range of observable factors that might influence donor aid allocation decisions. To address the problem of spatial clustering and unobserved spatial heterogeneity, we estimate all models with dyad fixed effects. As Barthel et al. (2014) mention, this removes all variations between dyads, and the estimation is solely based on the within variation of each dyad. While this controls for any time-invariant dyad-specific effect (e.g. bilateral relations, cultural or geographic proximity), neither bias from time-varying omitted variables nor reverse causality can be excluded. As concerns the former, depending on the hypothesis we are testing, our gravity-type model necessarily omits some variables because of the type of fixed effects included or excluded to estimate a specific marginal effect.

To address further the omitted variable bias, we measure the relative importance of selection on the unobservable bias by investigating how the coefficient of *oil reserves* changes with the inclusion of the additional explanatory variables<sup>12</sup>. If including controls substantially attenuates the estimated coefficient, then it is possible that the inclusion of more controls would reduce the estimated effect even further. If, on the other hand, the inclusion of controls has no effect on the estimated magnitude of the coefficient, then we can be more confident in suggesting a causal interpretation for the estimated relationship. Following Altonji et al. (2005), we formalize this intuition and derive the ratio of the “influence” of unobservable variables relative to the

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<sup>12</sup> These additional explanatory variables are of two types: recipient related and other fixed effects (recipient, recipient-time, time).

observable that would be needed to explain (away) the entire macroeconomic impact. A large ratio would imply that the result could not be plausibly explained by the unobservables.<sup>13</sup>

### 3.3. Data description

We use for aid commitments Official Development Assistance (ODA) data taken from the OECD's Creditor Reporting System (CRS) dataset. This dataset provides, among other things, time-series data on the official statistics on aid flows to developing countries, provided and validated by the members of the OECD's Development Assistance Committee (DAC).<sup>14</sup> We consider observations on aid flows from the G7 countries (Canada, Germany, France, Italy, Japan, the United Kingdom, and the United States) to 82 recipient countries.<sup>15</sup>

We restrict our attention to the G7 donors for two main reasons. G7 countries are the major donors among all DAC donor countries and are usually criticized for weak targeting of aid, selfish aid motives and insufficient coordination (Berthélemy, 2006). Moreover, there are insufficient observations for other DAC donors and new donors<sup>16</sup> to carry out meaningful data analysis.

Our main variable of interest, *Oil\_R*, refers to oil reserves held by recipient countries. The hypothesis is that oil-rich recipient countries are more inclined to receive aid from the G7 countries that are oil-importing donors. Compared to proxies of oil dependence, which are usually used in the literature, such as oil exports or oil production, proxies of oil wealth, such as oil reserves, capture the oil abundance and are less likely to fall within reverse causality concerns. Oil reserves are drawn from the dataset compiled by Cotet and Tsui (2013).<sup>17</sup> The set of other control variables for recipient-related features, represented by the vector  $X_{jt}$  in Equation (1),

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<sup>13</sup> Details of this method are provided in the Appendix C.

<sup>14</sup> Validated CRS data are made public by the OECD DAC Secretariat and are freely available on the OECD website: [www.oecd.org/dac/stats/idsonline](http://www.oecd.org/dac/stats/idsonline).

<sup>15</sup> For the list of countries included in our sample, see Appendix A.

<sup>16</sup> A major concern here is the lack of data since the OECD-CRS data on emerging donors' aid flows are incomplete. Indeed, some important non-DAC donors (China, India, Brazil, and the Russian Federation) do not report their aid activities to OECD DAC or do not publish detailed data on their foreign aid activities). China and India, in particular, frame their financial, economic and technical support to other emerging and developing countries as South-South cooperation rather than aid assistance.

<sup>17</sup> This dataset uses oil exploration and discovery data from the Association for the Study of Peak Oil (ASPO). Oil reserves for each country at any particular year are calculated by subtracting cumulative production from cumulative discovery.

follows the literature on aid allocation. It encompasses first indicators of beneficiary needs: the level of income measured as per capita Gross Domestic Product (GDP), multilateral aid per capita, a human development index, the Human Assets Index (HAI), combining indicators of health, nutrition and education, and taken from the database developed by the United Nations Department of Economic and Social Affairs (UN-DESA).<sup>18</sup> The conditions imposed on aid are also examined by including proxies of institutional quality that capture merits criteria for aid distribution. Following the aid allocation literature, we include the inflation rate (*Inflation*) and the quality of governance of recipient countries. The governance variable is measured by the democracy indicator (*Democracy*), taken from the Democracy and Development Revisited dataset compiled by Cheibub et al. (2010). As numerous empirical studies found that donors tend to be biased toward countries with small populations (Isenman, 1976; Dowling and Hiemenz, 1985), we include population (*Pop*) to control for the recipient country size.

Considering that foreign aid allocation is also motivated by donors' interests, political, economic and energy security motives of donors are included. The possibility of a political bias (Alesina and Dollar, 2000) is examined by using a dummy variable (UNSC) for United Nations Security Council membership of recipient countries, which is, according to Dreher et al. (2009), a credibly exogenous regressor, compared to other geopolitical variables such as voting patterns in the United Nations General Assembly. The idea is that donors are more willing to give aid to recipient countries that are potential political allies. We also control for bilateral trade (Trade) between donor and recipient countries to account for their commercial linkages. Indeed, donors may be more motivated in giving aid to recipient countries that account for a significant part of their exports. All data are annual series for the period 1980-2010 given the availability of our main variables of interest. The sources and the definitions of all our variables are described in greater detail in Table A.1 (Appendix A). Summary statistics are presented in Table 1. Let us briefly discuss some of them here. The first observation from Table 1 is that *Aid share* variable is widely dispersed, indicating that aid allocations vary significantly across either or both countries and years. As expected, world oil reserves are unevenly distributed, demonstrating, once again, why energy security concerns stem from reliance on oil. Over the period considered, the average

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<sup>18</sup> The HAI is a composite index based on the following indicators: (i) nutrition (percentage of the population that is undernourished); (ii) health (child mortality ratio); (iii) school enrolment (gross secondary school enrolment ratio) and (iv) literacy (adult literacy ratio).

See <https://www.un.org/development/desa/dpad/least-developed-country-category/hai-indicators.html>



level of per capita income across the countries is less than one thousand dollars. Another variable that shows large fluctuations is the inflation rate (with a high average consumer price index (CPI) of 29). Concerning the rivalries in the MENA region, which we will discuss more below, we see that conflicts and political instability in this region are quite frequent. On average, there have been more than 16 rivalries every year with a maximum number of 32 (which occurred during 1984). Finally, note that according to UN-DESA, a country is included in the least developed countries category if its HAI is 62 or below. Table 1 suggests that on average, the HAIs of the countries in our sample have been below that threshold level during the period considered.

**Table 1. Summary statistics**

	Obs.	Mean	Std. Dev.	Min	Max
Year	17,794	1995	8.945	1980	2010
Aid share (allocated by donor)	15,459	0.0112	0.0281	5.83e-07	0.561
Oil reserves (barrels)	15,400	216,238	2.865e+06	0	5.750e+07
Import crude oil (thousand barrels per day)	13,940	2,896	2,758	354.9	11,564
UNSC	17,010	0.0424	0.201	0	1
Multilateral aid per capita (log)	16,261	1.797	1.339	-2.394	7.170
Human Asset Index (HAI)	16,100	50.25	22.79	1.098	95.77
GDP per capita (2005 prices, US\$)	15,575	978.9	1,055	50.04	14,901
Inflation (CPI)	13,524	29.05	314.3	-17.64	11,750
Population	16,261	3.227e+07	1.114e+08	144,416	1.225e+09
Bilateral trade (log)	14,715	10.07	2.418	0.465	17.01
Rivalries in MENA	17,794	16.65	11.96	0	32
Net oil imports ratio on consumption	13,940	0.684	0.215	0.234	1.129
Democracy	16,100	0.322	0.467	0	1

## 4. Empirical evidence

### 4.1. Baseline results

Table 2 provides the results obtained by using the PPML estimator. The first column reports the results for the most parsimonious specification with the variable of interest, oil endowment, but without the additional controls. Column (2) shows the results when adding the set of usual control variables.

**Table 2. Oil and aid allocation, G7 countries, 1980-2010**

VARIABLES	(1) Aid share	(2) Aid share	(3) Aid total
<i>Oil reserves</i>	0.0459*** (0.0106)	0.0498*** (0.0106)	0.0232* (0.0130)
Lagged Dep	4.048*** (0.386)	3.093*** (0.369)	0.00041 *** (3.68e-05)
Multilateral aid		0.101*** (0.0264)	0.148*** (0.0483)
Trade		0.138*** (0.0431)	0.499*** (0.0679)
Inflation		-0.0328* (0.0179)	0.0119 (0.0241)
HAI		-0.0144** (0.00558)	-0.00117 (0.00325)
GDP pc		-0.374 (0.229)	-0.258*** (0.0939)
Population <sup>a</sup>		1.388*** (0.410)	0.139** (0.0584)
UNSC member		-0.00322 (0.0455)	-0.0994 (0.0993)
Democracy		-0.146** (0.0675)	-0.340*** (0.114)
Observations	9,896	7,479	7,706
Dyadic FE	Yes	Yes	Yes
Donor_time FE	Yes	Yes	Yes
R-squared	0.155	0.65	0.55

*Note: This table presents the Pseudo Poisson Maximum Likelihood estimates of the gravity model of bilateral aid allocation. In column 3, the results for the specification with aid in absolute terms are presented. Robust standard errors are in parentheses. Independent variables are lagged to reflect aid allocation process and avoid simultaneity bias. \*\*\*, \*\*, and \* indicate 1%, 5%, and 10% significance levels. UNSC: United Nations Security Council.*

In all of the PPML specifications of Table 2, the coefficient associated with the variable *oil reserves* is positive and statistically significant, consistent with an oil effect on the aid allocation. A 1 percent increase in oil reserves results in an approximately 0.05 percent increase in the share of a recipient country in the total aid commitments allocated by the G7 donors. The coefficient is also significant and positive with aid in absolute terms: a 1 percent increase in oil reserves

produces a 0.02 percent increase in foreign aid. These initial findings suggest that oil motive is an important factor in aid allocation provided by the G7 donors.<sup>19</sup>

Turning to the other control variables specified in Equation (1), the coefficient of the lagged dependent variable is positive and robustly significant at the one percent level. This result confirms the administrative inertia in aid allocation. Consistent to expectations from the aid allocation literature that poorer countries would receive more aid, the coefficient of GDP per capita is negative and significant, suggesting that recipient needs are a significant factor in the allocation decision of the G7 donors. It also appears that western countries provide more aid to recipient countries that receive higher shares of multilateral aid.

As expected, bilateral trade is also positively associated with aid allocation, meaning that the G7 donors tend to provide more aid to countries with which they trade. The positive and statistically significant coefficient of the population variable suggests that the G7 donors prefer to give aid to recipients with larger populations.

Contrary to expectations from the aid allocation literature that more democratic countries would receive more aid, the coefficient of the democracy variable is negative and statistically significant, suggesting that a lower level of democracy in the recipient countries results in receiving more aid from the G7 donors. A major reason provided to explain the bias towards less democratic recipients can be related to strategic considerations. The G7 donors may be more inclined to provide foreign aid to less democratic countries as they consider these recipient countries more prone to provide policy concessions in exchange for aid (Alesina and Weder, 2002; Bueno de Mesquita and Smith, 2009). Finally, the level of inflation, which captures economic performances of the recipient countries, as well as the human development index are not significant in the determination of the G7 donors' aid allocation.<sup>20</sup>

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<sup>19</sup> We also checked that our findings are not driven by a potential omitted variable bias. We employed Altonji et al. (2005) procedure to deal with the selection on unobservables and confirmed that our results are robust on this matter. Results are available upon request.

<sup>20</sup> Note that our estimations rely on the dyadic model rather than a recipient, one-sided model. The dyadic analysis allows a closer examination of the role played by individual donor-recipient ties in determining aid flows. Hence this framework offers the most appropriate way to deal with unobserved characteristics that would affect the relationship between aid and oil, either through propensity of donors to give aid or the recipients to receive aid (e.g. Tanzania receives more aid than other similar countries).

## 4.2. IV estimates

As specified in Section 3.1, to purge our estimates of endogeneity, we have used lagged values of our explanatory variables. In order to ensure that our results are robust, we undertake additional checks, investigating the possible endogeneity of oil endowments. The results corresponding to the tests performed in this section are reported in Table D.1 in Appendix D.

Following Hunziker and Cederman (2017), we employ geospatial data on the location of sedimentary basins as a new instrument for oil endowment. To test if this instrumental variable is valid, first, we perform under-identification and weak-identification tests to check if our instrumental variable is relevant (i.e. sufficiently correlated with oil endowments), then, deal with the orthogonality condition to test the exogeneity of our instrumental variable.

For under-identification, we use the Kleibergen-Paap rk Lagrange multiplier, which is valid under heteroscedasticity (Kleibergen and Paap, 2006). The results strongly reject the null hypothesis of under-identification. For detecting weak instruments, we use the Cragg-Donald statistic (Cragg and Donald, 1993), which is a generalization of the F statistic. Since the Cragg-Donald-based weak instruments test assumes homoscedastic errors, we also report Kleibergen-Paap Wald rk F statistic which is valid under non-i.i.d. errors. Our results show that both Cragg-Donald statistics and Kleibergen-Paap Wald rk F statistics are above the 10% value. Overall, we reject the weakness of instruments. Next, the test statistics we use for instrument exogeneity are the Anderson-Rubin Wald test (based on Anderson and Rubin, 1949) and the Stock-Wright S test (Stock and Wright, 2000). The null hypothesis that the instruments are valid cannot be rejected at the 5% level of significance. Finally, the results of the first-stage relationship between sedimentary basins and oil endowment show that current sedimentary basins are significantly related to oil endowments.

We also consider an alternative measure of oil abundance by accounting for the role played by national oil companies (NOCs). While the majority of NOCs were established through nationalizations in the 1970s, new trends of nationalization have occurred in the 1990s, making NOCs the largest holders of oil reserves in the world. Several scholars see this new oil global environment driven by resource nationalism as a threat to the future sustainability of energy markets (Leverett and Noel, 2006; Umbach, 2010). We then use this phenomenon to confirm that

the G7 donors are more likely to allocate their aid to recipient countries with NOCs in order to secure their access to oil resources. Nationalization is measured as the establishment of a NOC in a given year. Following Mahdavi (2014) and Cheon et al. (2015) we measure nationalization as a binary variable according to whether or not a state establishes a majority state-owned NOC. All years prior to NOC establishment are coded zero; from the year of nationalization onwards they are coded one.

The results of using alternative measures of oil endowments are presented in Table 3 and confirm our previous findings. First, our IV-PPML estimates show that the aid-oil nexus is not a spurious correlation. A 1 percent increase in sediment volume yields a 0.2 and 0.6 percent increase in the share of a recipient country in the total aid commitments and the total amount of aid it receives, respectively. Moreover, in columns 2 and 4, our estimation shows that countries with NOCs receive more bilateral aid than other recipients: on average, they have 0.2 percent greater share of the total aid commitment and receive 0.3 percent higher amount of foreign aid. This finding shows that the aid-oil nexus cannot be explained by donors rewarding market liberalization and a good policy environment. In fact, donors increase aid to those countries, as market forces matter less than political and diplomatic factors once the government begins to control oil reserves. Further, as shown by Hartley and Medlock (2008), NOCs are more focused on current output and cash flow in order to subsidize domestic consumers. Thus, production is shifted from the future to the present. Our results show that these objectives of NOCs are in line with the self-interests of the donors who increase bilateral aid to oil-rich recipients to benefit from their oil resources.

Regarding the control variables, similar to the results obtained above (see Table 2), per capita GDP and trade have robust effects on aid allocation. Furthermore, the variables, multilateral aid, HAI, and Democracy affect significantly aid allocation when the sedimentary basins are used as an instrument for oil endowment.

As depicted in Fig. 1, the share of oil imports in total imports of G7 countries increased significantly after 2004. A question worth investigating here is whether similar results would be obtained if the period from 2005 to 2010 were excluded from the analysis. Table E.1 in Appendix E shows that our results are robust to this exclusion.

**Table 3. IV-PPML results - Oil and aid allocation, G7 countries, 1980-2010**

VARIABLES	(1) Aid share	(2) Aid share	(3) Aid total	(4) Aid total
<i>IV-Oil reserves</i>	0.218*** (0.0724)		0.616*** (0.109)	
<i>NOC</i>		0.258** (0.124)		0.326** (0.159)
Lagged Dep	5.754*** (0.635)	6.833*** (0.408)	0.00020*** (3.85e-05)	0.00042*** (3.19e-05)
Multilateral aid	0.136** (0.0587)	0.0337 (0.0264)	0.403*** (0.0630)	0.132** (0.0534)
Trade	0.218*** (0.0480)	0.258*** (0.0335)	0.243*** (0.0819)	0.524*** (0.0655)
Inflation	-0.000105 (0.0200)	-0.0108 (0.0197)	0.0196 (0.0233)	0.0107 (0.0249)
HAI	-0.0129** (0.00604)	0.00360 (0.00258)	-0.0420*** (0.00894)	0.00141 (0.00345)
GDP pc	-0.874*** (0.226)	-0.236*** (0.0830)	-2.082*** (0.344)	-0.304*** (0.106)
Population <sup>a</sup>		0.113*** (0.0429)	-0.0438 (0.0654)	0.0971 (0.0612)
UNSC member	-0.0494 (0.0553)	-0.00322 (0.0528)	-0.211** (0.0948)	-0.134 (0.101)
Democracy	-0.144** (0.0707)	-0.158* (0.0908)	-0.187** (0.0873)	-0.175 (0.124)
<i>NOCxDemocracy</i>		-0.0760 (0.119)		-0.181 (0.157)
Observations	7,098	7,555	7,313	7,772
Dyadic FE	Yes	Yes	Yes	Yes
Donor_time FE	Yes	Yes	Yes	Yes
R-squared	0.327	0.542	0.66	0.64

*Note: This table presents IV-PPML estimates of our bilateral aid allocation model. In columns 3 and 4 the results for the specification with aid in absolute terms are presented. Oil reserves variable is instrumented by the location of sedimentary basins. <sup>(a)</sup>: The sediment volume variable is the natural logarithm of total sediment volume beneath each group's populated territory, thus collinear with our variable "population". Robust standard errors are in parentheses. Independent variables are lagged to reflect aid allocation process and avoid simultaneity bias. \*\*\*, \*\*, and \* indicate 1%, 5%, and 10% significance levels.*

*UNSC: United Nations Security Council.*

### 4.3. Energy security and foreign aid

In this section, we explicitly test our Hypothesis 2: Donors energy security concerns affect their aid allocation, by discussing the individual donor's strategy to deal with energy security concerns over our period of analysis.

As indicated by Tables 4.a and 4.b, G7 countries differ in their exposure to energy security risks and their energy diversification strategies. Facing a hostile security environment, they respond to increases in oil supply's insecurity by investing in energy R&D, diversifying energy supply, or stockpiling.

**Table 4.a. Energy supply security strategies**

	Average Energy R&D (% GDP)	Average Energy R&D Since 2000	Oil Stock-Pile (Kilotons)	Nuclear-Hydro Energy (% Total Energy Elect.)
Canada	10.99	7.93	8403.5	71
France	9.54	8.61	14341.6	88
Germany	6.2	3.04	18686.5	30
Italy	10	4.25	13483.7	14
Japan	11	9.98	12184.5	34
UK	4.34	1.44	6863.5	21
US	5.58	4	68892.1	26

Source: IEA data. Author's calculation over the period 1980-2010.

Table 4.b shows some key indicators of oil exposure risks in the G7 economies as well as the OECD average values. The first indicator measures the exposure of the economies to supplies of oil. The second indicator relates to the magnitude of energy costs to national economies. Finally, the third indicator measures energy use in relation to economic output. All figures are obtained from the U.S. Chamber of Commerce's Institute (Institute for 21st Century Energy, 2016) and are calculated over the period 1980-2010.

Oil exposure risks are clearly very different across the G7 countries. Japan and the three largest European economies (France, Germany, and Italy) rely on imports for much of their energy supply. The US, as the former world's largest energy importer, used to enhance its security of supply through the diversity of supply according to the source. Therefore, the US purchased crude oil from more than 60 different countries. Import risks are therefore a big factor influencing energy security risk scores of those countries, compared to the UK and Canada, which are large energy producers (see Table A.2 in Appendix A).

**Table 4.b. Indicators of energy security risk: G7 countries and OECD average**

	<b>Oil Import Exposure<sup>(a)</sup></b>	<b>Fossil Fuel Import Expenditure per GDP<sup>(b)</sup></b>	<b>Petroleum Intensity<sup>(c)</sup></b>
Canada	3	4	948
France	1253	716	494
Germany	1282	751	518
Italy	1239	796	535
Japan	1300	874	595
UK	14	58	463
US	572	575	854
OECD	799	640	708

Notes: Average values over the period 1980-2010. <sup>(a)</sup> Net oil imports as percentage of total national oil supply; <sup>(b)</sup> Net fossil fuel import costs as a share of GDP; <sup>(c)</sup> Million Btu of petroleum consumed per 1,000 US dollars of real GDP. All metrics are first normalized by calibrating their 1980 values in reference to the common OECD 1980 baseline. Then, they are normalized so that the value for 1980 equals 1000. For subsequent years, the indexed value for each metric is adjusted proportionally higher or lower relative to this 1980 value.

Source: Authors' calculation over the period 1980-2010 based on the U.S. Chamber of Commerce's Institute data.

To capture the role played by oil security concerns in aid allocation we include two different variables related to oil interests of donors and instabilities in the oil market. The net oil imports on oil consumption ratio of donors,  $OilM_{it}$ , is included with the idea that donors that are highly dependent on oil imports are more inclined to provide aid to oil-rich recipients in order to secure their access to mineral resources. We also account for political risks in the Middle East and North African (MENA) countries, by using the variable *Rivalries in MENA* as an exogenous measure of instabilities in our model. In recent history, the MENA has been home to some of the most important oil producers in the international system. The Middle East also boasts two of the most important world oil transit chokepoints, the Strait of Hormuz and the Suez Canal. Therefore, we expect energy security concerns to emerge among donors when the MENA region is unstable, either because they rely on oil imports or because they have important private companies investing in the region.<sup>21</sup> The results are presented in Table 5.

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<sup>21</sup> The variable *Rivalries in MENA* includes the total number of militarized interstate disputes, as well as the total number of episodes of political violence, engaged in the MENA zone. Political risks in MENA countries are measured on the basis of the major rivalries in the region. In identifying rivalries, we rely on Klein et al. (2006) and Marshall (2016), who consider not only enduring rivalries but also shorter-term rivalries.



**Table 5. Energy Security and Aid allocation, G7 countries, 1980-2010**

VARIABLES	(1) Aid share	(2) Aid share	(3) Aid share
<i>Rivalries in MENA</i>	<b>0.00744**</b> (0.00290)	<b>0.0126***</b> (0.00233)	<b>0.0152***</b> (0.00245)
<i>Oil Import ratio (donor)</i>		<b>-0.284</b> (0.227)	<b>0.984***</b> (0.278)
Oil reserves	0.0343*** (0.0117)	0.0195** (0.00923)	0.0177** (0.009)
Lagged Dep. Var	2.855*** (0.469)	6.637*** (0.442)	6.706*** (0.379)
Multilateral aid	0.0208 (0.0268)	0.0822** (0.0335)	0.117*** (0.036)
Trade	0.0706 (0.0453)	0.250*** (0.0343)	0.377*** (0.0472)
Inflation	-0.0479*** (0.0141)	-0.0256 (0.0197)	-0.0426** (0.0198)
HAI	-0.000552 (0.00581)	0.000905 (0.00281)	0.00214 (0.00315)
GDP pc	-0.477** (0.204)	-0.216*** (0.0814)	-0.1695** (0.0847)
Population	-0.208 (0.246)	0.172*** (0.0404)	0.0965* (0.0452)
UNSC member	0.0201 (0.0469)	-0.0133 (0.0586)	-0.0645 (0.0779)
Democracy	-0.163** (0.0714)	-0.232*** (0.0719)	-0.256*** (0.0823)
Observations	7,479	6,968	5,021
Dyadic FE	Yes	Yes	Yes
Excluded			UK CAN
R2	0.34	0.32	0.35

Note: This table presents the Pseudo Poisson Maximum Likelihood estimates of the gravity model of bilateral aid allocation. All estimations include dyad fixed effects. Robust standard errors are in parentheses. \*\*\*, \*\*, and \* indicate 1%, 5%, and 10% significance levels. UNSC: United Nations Security Council.

Regarding oil security motives, the coefficient associated with conflicts and political instability in the MENA region is significant at the one percent level. This suggests that the G7 donors are likely to provide more aid when the instability in oil markets increases. As such instabilities put energy security at increased risk, western donors are indeed more inclined to pledge more aid in order to secure their access to oil resources. The significance of energy security motive in aid allocation decision of the G7 donors is also highlighted by the positive and statistically significant coefficient of the oil dependence variable, except donors that are net oil-exporters as the UK and Canada (Table 5 - column 3). Indeed, the oil dependence of the G7 donors, measured

by the ratio of net oil imports to oil consumption, becomes significant when excluding, among these donors, net oil exporters. It appears therefore that energy security concerns encourage the G7 donors to provide more aid, especially those that are more oil-dependent.

We estimate the same models using three-year averages of all variables to reflect the lag in the relationships being tested and smooth out short-term fluctuations. The results are given in Table F.1 in Appendix F. Furthermore, to investigate the conditional effects of rivalries in MENA we include an interaction term between the variables Oil Import Ratio and Rivalries in MENA. The results are depicted in Table F.2 in Appendix F. We find that our results are robust to these alternative specifications and that the interaction term is significant and positive, implying that the higher the donor's dependence on oil imports, the greater is the effect of instabilities in the MENA region on its aid allocation.

To summarize, there is strong and robust evidence that oil-dependent G7 donors tend to increase their aid to oil-rich recipients for energy security reasons. This empirical result brings us to examine another dimension of donors' behavior. Since foreign aid seems to be considered as a means to ensure energy security, the G7 donors may have competing interests in recipient countries from which they import oil. In particular, their decisions are likely to depend on the decisions of other donors competing for access to oil markets of recipient countries. Therefore, one interesting question is whether oil can be regarded as a potential source of competition between G7 donors.

## **5. Oil competition among the G7 donors**

Although analyses of contagion and strategic dependency patterns in aid allocation decisions are not new, spatial analyses are still scarce and are usually based on trade considerations (Neumayer and Plümper, 2010a; Barthel et al., 2014; Steinwand, 2015). Oil, besides being an important element of aid allocation decisions, may also generate competitive relationships among donors for several reasons. First, if foreign aid is used to pursue oil security interests, we can expect that a donor also has to observe aid allocation decisions by other donors and make changes in their aid giving into account when allocating its own aid. Second, aid provided by other donors to oil-rich countries may serve as a signal for a good investment in this sector and reduce the uncertainty on the effectiveness of aid projects. Finally, as outlined by Gupta (2008), oil production in non-

OPEC regions (such as the North Sea) has declined, which has caused oil importers to become more dependent on a few oil-exporting countries. Such an increasing dependence on oil may yield a fierce geopolitical competition among the G7 donors in order to secure their oil needs. For these various reasons, the G7 donors may then spatially depend on each other in their aid provision, especially when they allocate their aid in order to satisfy their strategic and economic interests in terms of energy security.

In this section, we examine empirically the potential competition for oil between the G7 donors with spatial lag models. The spatial-lag model can allow us to capture the reciprocal influences that donors exert on one another in their aid allocation decision, by including as endogenous right-hand side component a *contagion effect*. Specifically, this effect measures the extent to which the aid flow between a donor  $i$  and a recipient  $j$  depends on the aid flows of other donors  $k$  to the same recipient country  $j$ .<sup>22</sup> With this type of model, it is, therefore, possible to quantify the existence, nature, and strength of these strategic interactions between donors.

### 5.1. Panel data estimates

We perform the analysis by estimating a parsimonious spatial lag model (Equation 2) and a spatial lag augmented model (Equation 3), which in addition allows for dependence on several control variables previously used and specified in Equation (1):

$$Aid_{ijt} = \alpha_{ij} + \rho \sum_{k \neq i} W_{ikt} Aid_{kjt} + \eta_j + u_i + \lambda_t + \epsilon_{ijt} \quad (2)$$

$$Aid_{ijt} = \alpha_{ij} + \rho \sum_{k \neq i} W_{ikt} Aid_{kjt} + \beta Aid_{ijt-1} + \gamma OilR_{jt} + \delta X_{jt} + \zeta Trade_{ijt} + \eta_j + u_i + \lambda_t + \epsilon_{ijt} \quad (3)$$

where  $W_{ik}$  is a  $N$  by  $N$  by  $T$  spatial weights matrix that captures the connectivity between dyads that form the spatial dependence (i.e. a measure of the extent to which donors  $k$  influence  $i$ 's aid decision when giving aid to  $j$ ).  $\rho$  is the spatial autoregressive coefficient that measures mutual influence between donors in aid provision. If there is oil supply competition in aid provision, then  $\rho$  is expected to be positive: the G7 donors will increase their own allocations in reaction to

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<sup>22</sup> For other forms of spatial contagion, such as aggregate source or aggregate target contagion, and specific target contagion, see Neumayer and Plümper (2010b).

increases by others.  $\eta_j$  and  $u_i$  are country-fixed effects,  $\alpha_{ij}$ , time-invariant dyad-specific effect and  $\lambda_t$ , time-fixed effects.  $\varepsilon_{ijt}$  is an i.i.d. error term.

A crucial decision when specifying spatial effects concerns the choice of weights in the matrix  $W_{ik}$  (Neumayer and Plümper, 2010b). Our intuition is that aid decision making among the G7 donors that compete for the same sources of oil procurement are interdependent. In order to capture this oil competition in aid provision, we create spatial weights that capture the degree to which donors compete in the same recipient country, according to their share of oil imports in a recipient's total oil exports. In other words, we assume that the influence of donor  $k$  over donor  $i$  regarding aid to recipient  $j$  depends on the share of the donor  $k$  in the oil exports of recipient  $j$  on the one hand and the share of donor  $i$  in the oil exports of recipient  $j$  on the other hand:

$$W_{ikt} = \frac{\text{oil imports}_{ijt}}{\text{oil exports}_{jt}} \times \frac{\text{oil imports}_{kjt}}{\text{oil exports}_{jt}} \quad (4)$$

Therefore, the weights compare the oil trade flows between the G7 donors and the recipient country: the more important recipient  $j$  is for oil imports from both donor  $i$  and donor  $k$ , the stronger donor  $i$  will be influenced by donor  $k$  in its allocation to recipient  $j$ .

Given that oil dependence of donors is already included in spatial weights through the share of their oil imports in total oil exports of recipient countries, the control variables considered in the augmented spatial lag model refer to recipients' oil endowment ( $OilR_{jt}$ ), recipients' needs and merits ( $X_{jt}$ ) as well as bilateral commercial trade between donor and recipient countries ( $Trade_{ijt}$ ). As countries influence each other's aid policies reciprocally, the spatially lagged aid variable,  $\rho \sum_{k \neq i} W_{ikt} Aid_{kjt}$ , in Equations (2) and (3) is likely to be endogenous. Then estimating the spatial lag model by OLS (spatial OLS, S-OLS) will lead to biased results. Barthel et al. (2014) suggest that ignoring this endogeneity does not produce strongly biased results as long as the degree of interdependence,  $\rho$ , is small and exogenous factors are well specified. Arguing that this bias should be less pronounced in aid shares than in aid levels, the authors lag by one year the spatial lag to further mitigate this endogeneity problem<sup>23</sup> and estimate their empirical model

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<sup>23</sup> Franzese and Hays (2007) suggest that the omitted-variable biases of the current default practice of non-spatial OLS are generally large, whereas the simultaneity biases of S-OLS are typically smaller, especially as the strength of

by spatial OLS. An alternative solution suggested by Anselin (2001) and Franzese and Hays (2007) is to estimate the spatial lag model by Maximum Likelihood (spatial Maximum Likelihood, S-ML). While S-ML is computationally intense, especially when both cross-section and time dimensions increase, it produces parameter estimates consistent and asymptotically efficient (Ord, 1975).

Table 6 displays the results derived from the estimation of the two spatial lag models, using S-OLS and S-ML estimators. Looking at the estimation results, we find that the spatial coefficient is positive and statistically significant for both models, corroborating our intuition: if other donors provide aid to a specific recipient country from which they import oil, then this makes more likely that an oil-importing donor will also provide aid to this specific recipient country. The results from OLS estimations indicate a low level of oil competition between the G7 donors, but as aforementioned these results may be subject to bias. Indeed, the S-ML estimator leads to a higher spatial coefficient, revealing a downward bias in OLS estimations and the presence of a rather strong oil competition between the G7 donors. Specifically, recipient countries that increase their share in donor's oil imports by 10% are likely to benefit from an increase of 2.3% in aid from all oil-importing donors.

Regarding the other control variables, the coefficients associated with recipients' oil endowment and needs are statistically significant and have the expected signs, suggesting that bilateral aid is still positively related to oil endowment and needs of recipient countries. Concerning bilateral trade, there is evidence of a decreased significant role in commercial linkages as a determinant of aid allocation. On the contrary, the coefficient on the dummy variable (UNSC) for United Nations Security Council membership of recipient countries becomes slightly significant while we do not find any more robust average effect of the variables democracy and multilateral aid per capita.

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interdependence remains quite modest, and when domestic and exogenous external factors are well specified as well as powerful explanatory variables.

**Table 6. G7 donors' competition for oil, 1980-2010**

Model	Spatial lag	Spatial lag augmented	Spatial lag	Spatial lag augmented
	S-ML	S-ML	S-OLS	S-OLS
<i>W: oil competition</i>	6.322*** (1.377)	2.069* (1.172)	0.116*** (0.0301)	0.0683*** (0.0247)
<i>Oil<sub>R</sub></i>		0.135*** (0.0391)		0.0682* (0.0363)
<i>Aid<sub>-1</sub></i>		5.947*** (0.565)		0.326*** (0.0771)
<i>Multilateral aid<sup>(a)</sup></i>		0.170 (0.116)		0.251* (0.149)
<i>Trade</i>		0.169** (0.0859)		0.228 (0.201)
<i>Inf</i>		-0.165*** (0.0525)		0.00233 (0.0403)
<i>HAI</i>		-0.0132* (0.00708)		-0.00987 (0.0310)
<i>GDP<sup>(a)</sup></i>		-0.473 (0.288)		-1.317* (0.739)
<i>Pop</i>		0.0876 (0.145)		-1.844 (1.758)
<i>UNSC</i>		0.217* (0.114)		-0.0639 (0.176)
<i>Democracy</i>		-0.104 (0.211)		0.774*** (0.185)
Constant	-2.697*** (0.392)	-5.468 (4.052)	-4.025*** (0.516)	35.93 (34.69)
Observations	1,097	668	1,068	612
R-squared	0.085	0.485	0.080	0.324
Number of dyads	137	91	135	92
Time dummy	YES	YES	YES	YES
Dyadic FE	YES	YES	YES	YES

Notes: This table presents estimates of the two spatial lag models using OLS and maximum likelihood estimators. (a) Variables per capita. The dependent variable is the share each recipient country *j* receives from a donor *i*. *W* is the spatial component, which captures donors' competition for oil. Robust standard errors are in parentheses. Independent variables are lagged to reflect the aid allocation process and avoid simultaneity bias. \*\*\*, \*\*, and \* indicate 1%, 5%, and 10% significance levels. UNSC: United Nations Security Council.

## 5.2. Cross-country differences

The findings obtained above relate to aggregate donors. As discussed in Section 4, there is a substantial difference between donors. Thus, the weights given to oil interests as well as competitive incentives for oil markets in aid allocation decisions are likely to be different too. Table 7 reports the results from the spatial lag augmented model estimated separately for each G7 country. The regression results largely substantiate the findings for aggregate bilateral aid. Indeed, we find evidence for oil competition-driven spatial dependence in the allocation of aid for

most countries, except Japan and the UK. For countries for which estimates of the coefficient of the spatial dependence are significant, the range of variation of estimates of the parameter varies from about 6.62 for Canada to 49.1 for Italy and seems consistent with the range of variation in terms of energy security risk scores. In particular, European countries which are a large consumer of oil have a high dependence on oil imports and seem to react more to oil competition. However, this finding does not hold for Japan who seems to pursue rather a needs-based aid allocation strategy. Indeed, for this latter donor, the spatial lag coefficient is not significant, while the (negative) coefficients on GDP per capita and on the human asset index prove to be significant. In support of this finding, Gupta (2008) find evidence of low market risk for Japan, which has significantly lessened its overall oil vulnerability as compared to other countries. The particularity of Japan is also found by Kilian (2008) who shows that in all G7 countries – but Japan – an exogenous oil supply disruption causes a decline in real growth.

Another interesting finding is that other individual donor countries also seem to care about needs in recipient countries, except the US and the UK for which trade concerns appear to be stronger. Finally, there is still evidence in Table 7 that oil endowment increases the amount of aid allocation received by recipient countries, while the (positive) coefficient on oil reserves proves to be insignificant at conventional levels with regard to donors that are producers of oil like the UK and the US.

**Table 7. The importance of oil competition: cross-country differences, 1980-2010**

	Canada	France	Germany	Italy	Japan	UK	US
<i>W: oil competition</i>	6.62*** (1.174)	10.29*** (3.633)	28.24*** (3.017)	49.1*** (10.4)	-9.782 (7.457)	1.908 (9.498)	11.39*** (2.480)
<i>OilR</i>	0.268*** (0.0758)	0.230** (0.113)	0.268** (0.111)	0.662*** (0.171)	1.203*** (0.332)	0.396 (0.559)	0.0463 (0.0339)
<i>Aid<sub>-1</sub></i>	-3.302 (2.999)	6.300** (2.573)	5.042*** (1.865)	5.582*** (1.658)	2.300 (2.163)	-2.259 (5.146)	7.374*** (1.532)
<i>Multilateral aid<sup>(a)</sup></i>	0.640*** (0.206)	0.607*** (0.169)	0.569* (0.328)	0.617*** (0.184)	0.412 (0.295)	0.833 (0.745)	0.815*** (0.143)
<i>Trade</i>	0.143 (0.193)	1.013*** (0.391)	-0.751*** (0.277)	1.541** (0.627)	0.791 (0.525)	0.936*** (0.282)	0.420* (0.215)
<i>Inf</i>	0.173*** (0.063)	-0.130** (0.058)	-0.256*** (0.062)	-0.167* (0.094)	-0.049 (0.07)	-0.740 (0.872)	0.105 (0.088)
<i>HAI</i>	-0.0343* (0.0182)	-0.0250** (0.0113)	-0.0631*** (0.0173)	0.0162 (0.0188)	-0.0706*** (0.0124)	0.00161 (0.0395)	-0.0200* (0.0103)
<i>GDP<sup>(a)</sup></i>	0.265 (0.621)	-2.134*** (0.512)	-0.895* (0.543)	-3.145*** (0.993)	-0.767** (0.384)	-1.910 (2.606)	-0.453 (0.443)
<i>Pop</i>	0.807** (0.365)	-0.872*** (0.231)	0.708 (0.436)	-2.042** (0.821)	-1.204 (0.861)	-0.193 (0.557)	0.356* (0.215)
<i>UNSC</i>	-0.593 (0.429)	-0.217 (0.326)	0.823 (0.608)	0.111 (0.528)	0.0568 (0.278)	-0.755 (0.809)	-0.112 (0.216)
<i>Democracy</i>	0.527 (0.342)	-0.275 (0.411)	-1.661** (0.667)	-0.941* (0.543)	-0.0170 (0.236)	0.875 (0.737)	-0.452 (0.352)
Constant	-22.99** (11.65)	9.117 (6.391)	1.243 (7.172)	29.40** (12.25)	-4.633 (7.364)	-0.603 (26.40)	-12.87** (5.948)
Observations	134	204	185	161	100	108	218
R-squared	0.50	0.647	0.80	0.79	0.98	0.37	0.73

*Notes: This table presents the coefficients estimates of W, the spatial component that captures donors' competition for oil in our individual spatial lag model using maximum likelihood estimators. <sup>(a)</sup> Variables per capita. The dependent variable is the share each recipient country j receives from a donor i. Robust standard errors are in parentheses. Independent variables are lagged to reflect the aid allocation process and avoid simultaneity bias. \*\*\*, \*\*, and \* indicate 1%, 5%, and 10% significance levels. UNSC: United Nations Security Council.*



## **6. Conclusion**

In this paper, we investigated the influence of oil on the aid policy of the seven major OECD donors. Our empirical analysis covers 82 recipient countries over the 1980-2010 period. Several important insights emerge from this analysis. Our results show that oil endowment of recipient countries increases the amount of aid commitments received from the G7 donors, after controlling for other important determinants of aid and endogeneity issues. Our second contribution relates to the importance of energy security motives for aid allocation. Major OECD donors that are highly dependent on oil commit more bilateral aid. We also find that aid provision increases with instability in the oil market, including political instability in major oil exporters, especially those in the Middle East. We attribute those findings to the importance of foreign aid as a way to ensure the security of oil supply. Finally, we demonstrated the existence of competition for oil among the G7 donors, by estimating the degree to which donors compete within the same recipient country, according to their share of oil imports in the recipient country's total oil exports. By using the cross-country dimension, we find that the role and share of oil in the economies of the G7 donors are important for understanding aid allocation driven by oil competition, the magnitude of this effect being more important for donors that are more exposed to oil security risks. These key results are robust to several checks, including additional tests run with another aid database and with other estimators.

All in all, our paper contributes to the literature on the role of the self-interest of the donors, by adding an energy security dimension to the conventional geopolitical or commercial motives. The paper also makes a significant contribution to the literature by linking energy security policy in the G7 donors with the formation of their foreign aid policies. We evidence that among the different energy policies implemented by industrialized countries to address energy security concerns, aid allocation can be considered as a way to expand and ensure access to energy resources. Furthermore, as aid is, at least partly, given for these strategic reasons, there is some evidence of competition in aid allocation across industrialized countries, which is motivated by the quest for energy security.

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## APPENDIX A

### Data source and description

Our samples of countries included in our analysis are as follows:

1. **Donor countries:** Canada, Germany, France, Italy, Japan, the United Kingdom, and the United States.
2. **Recipient countries:** Afghanistan, Angola, Bangladesh, Belize, Benin, Bhutan, Bolivia, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Rep., Chad, Comoros, Congo Rep., Côte d'Ivoire, Djibouti, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gambia, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iraq, Kenya, Kiribati, Korea, Dem. Rep., Kosovo, Laos, Lesotho, Liberia, Madagascar, Malawi, Mali, Marshall Islands, Mauritania, Moldova, Mongolia, Morocco, Mozambique, Myanmar (Burma), Nepal, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Paraguay, Philippines, Rwanda, Samoa, Sao Tome & Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, Sri Lanka, Sudan, Swaziland, Syria, Tanzania, Togo, Tonga, Tuvalu, Uganda, Ukraine, Vanuatu, Vietnam, Yemen, Zambia, and Zimbabwe.

**Table A.1. Data description**

Variable	Definition	Source
<i>Aid</i>	Bilateral ODA commitments from donors in year t in constant 2010 US\$.	OECD-CRS
<i>Project Aid</i>	Project level aid commitments from donors year t in constant 2010 US\$	AidData
<i>Multilateral aid</i>	Multilateral aid received by recipient j in year t in constant 2010 US\$.	OECD-CRS
<i>HAI</i>	100-Human asset index	United Nations
Democracy	Dummy variable coded 1 if the regime qualifies as democratic following the definition used in Cheibub et al. (2010).	Cheibub et al. (2010)
<i>GDP per capita</i>	Gross Domestic Product per capita, in constant 2005 US\$.	World Bank, WDI
<i>Pop</i>	Recipients' total population.	World Bank, WDI
<i>Trade</i>	Bilateral trade between a donor and a recipient country (current prices).	World Bank
<i>OilR</i>	Recipients' oil reserves (in thousands million barrels).	Cotet and Tsui (2013)
<i>OilM</i>	Donors' net oil imports, expressed relative to oil consumption.	IEA database
<i>Rivalries in MENA</i>	Number of rivalries in MENA. Based on Major Episodes of Political Violence (MEPV) database and Klein et al. (2006) International rivalries dataset	Author's calculation
<i>MEPV</i>	Major Episodes of Political Violence, coded on a scale of one to ten according to an assessment of the full impact of their violence on the societies that directly experience their effect	Center for Systemic Peace
<i>UNSC</i>	Dummy variable coded 1 if a country is temporarily serving on the United Nations Security Council, and 0 otherwise.	United Nations

Note: WDI : World Development Indicators. IEA : International Energy Agency

**Table A.2. Oil self-sufficiency of G7 countries**

	1975	1985	1995	2005	2015
Canada	1	1.24	1.47	1.5	2.4
Germany	0.02	0.04	0.04	0.02	0.01
France	0.04	0.05	0.03	0.04	0.03
Italy	0.01	0.03	0.06	0.08	0.11
Japan	0	0	0	0	0
UK	0.02	1.75	1.76	1.21	0.79
US	0.63	0.71	0.51	0.35	0.73
G7	0.39	0.55	0.44	0.35	0.64

Note: Oil self-sufficiency is given by oil production as a percentage of total oil primary energy supply. Data source: IEA (2017)



## APPENDIX B

**Table B.1. OLS estimates-Oil and aid allocation, G7 countries, 1980-2010**

VARIABLES	(1)	(2)	(3)	(4)	(5)
<i>OilR</i>	0.0195*** (0.00606)	0.0197*** (0.00674)	0.0197*** (0.00674)	0.0199*** (0.00700)	0.0200** (0.00910)
<i>Rivalries in MENA</i>			0.0639*** (0.0132)	0.0558*** (0.0138)	0.0335** (0.0159)
<i>OilM</i>				0.149 (0.372)	1.372** (0.535)
<i>Aid<sub>-1</sub></i>	0.452*** (0.0244)	0.364*** (0.0278)	0.364*** (0.0278)	0.341*** (0.0289)	0.317*** (0.0346)
<i>Multilateral aid<sup>(b)</sup></i>		0.0837*** (0.0215)	0.0837*** (0.0215)	0.0728*** (0.0230)	0.0807*** (0.0278)
<i>Trade</i>		0.155*** (0.0268)	0.155*** (0.0268)	0.149*** (0.0280)	0.191*** (0.0380)
<i>Inf</i>		0.00403 (0.00976)	0.00403 (0.00976)	0.00879 (0.0108)	0.00449 (0.0130)
<i>HAI</i>		-0.00787 (0.00483)	-0.00787 (0.00483)	-0.00402 (0.00540)	0.00262 (0.00659)
<i>GDP<sup>(b)</sup></i>		-0.283** (0.140)	-0.283** (0.140)	-0.235 (0.158)	-0.219 (0.192)
<i>Pop</i>		-0.0486 (0.341)	-0.0486 (0.341)	-0.227 (0.370)	-0.366 (0.432)
<i>UNSC</i>		-0.0135 (0.0433)	-0.0135 (0.0433)	-0.0104 (0.0482)	-0.0102 (0.0620)
<i>Democracy</i>		0.0609 (0.0497)	0.0609 (0.0497)	0.0786 (0.0556)	0.0957 (0.0721)
Constant	-3.183*** (0.142)	-2.634 (6.298)	-2.634 (6.298)	-0.223 (6.765)	2.215 (7.988)
Observations	9,793	7,287	7,287	6,610	4,751
R-squared	0.259	0.222	0.222	0.201	0.207
Number of rec_don	516	458	458	458	329
Time dummy	YES	YES	YES	YES	YES
Dyadic FE	YES	YES	YES	YES	YES
UK&CAN excluded					YES

*Note: This table presents the Fixed Effects estimates of the log-linearized model of bilateral aid allocation. <sup>(b)</sup> Variables per capita. Robust standard errors are in parentheses. Independent variables are lagged to reflect aid allocation process and avoid simultaneity bias. \*\*\*, \*\*, and \* indicate 1%, 5%, and 10% significance levels. UNSC: United Nations Security Council.*

## APPENDIX C

### Assessing the importance of omitted variable bias

Let us consider the following model

$$Y = \alpha T + X'\gamma + \varepsilon$$

where  $X$  is a vector of control variables and  $T$  the treatment variable.

The OLS estimation of the effect of  $T$  on  $Y$  has a standard omitted variables bias (Wooldridge, 2002):

$$Plim\hat{\alpha}_{ols,R} = \alpha_0 + \gamma \frac{cov(T, X'\gamma)}{var(T)}$$

Now, suppose additional individual controls, unobservable for researcher during the identification process, but that could potentially influence outcome  $Y$  and the treatment  $T$  such that:  $X = x + \tilde{X}$  ( $x$  are observed). The new OLS estimate of  $\alpha$  will have the following bias:

$$Plim\hat{\alpha}_{ols,extend} = \alpha_0 + \gamma \frac{cov(T, \tilde{X})}{var(T)}$$

where “extend” denotes the new model.

Hence, the ratio between the estimates in restricted and extended models is given by:

$$\frac{\hat{\alpha}_{ols,extend}}{\hat{\alpha}_{ols,R} - \hat{\alpha}_{ols,extend}} = \frac{cov(T, \tilde{X})}{cov(T, X'\gamma)}$$

This ratio measures how much stronger the selection on unobservables needs to be, relative to observables, to explain the entire effect. This methodology first implemented by Altonji et al. (2005), and discussed by Bellows and Miguel (2009) and Nunn and Wantchekon (2011), provides a measure the likely bias arising from unobservables.

Following the discussion in Nunn and Watchekon (2011), the intuition behind the formula is straightforward. The smaller the difference between  $\hat{\alpha}_{ols,R}$  and  $\hat{\alpha}_{ols,extend}$ , the less the estimate is affected by selection on observables, and the stronger the selection on unobservables needs to be (relative to observables) to explain away the entire effect. Therefore, in our case, the ratio will show how strong the influence of unobserved donor and

recipient characteristics must be to explain the entire aid-oil nexus. On the other hand, a large ratio suggests that it is not plausible that potential omitted variable bias explains away the entire estimated effect of oil on donors' aid allocation. Thus, we will compare estimates from conservative specification (columns 1 and 2 in Table 2) with estimates from extended specifications with additional explanatory variables: recipient related (conflict<sup>24</sup>, migration<sup>25</sup> or exposure to external shocks like a disaster, exports shocks, etc.) and augmented fixed effects (recipient, recipient-time, time).

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<sup>24</sup> Chauvet (2002) finds with other data that aid allocation depends positively on violent political instability.

<sup>25</sup> Bermeo and Leblang (2015) examine the relationship between migration and aid allocation in the post-Cold War period and conclude that donors seek to decrease migration by using aid to promote development in previous migrant-sending states.

## APPENDIX D

**Table D.1. First stage IV test**

VARIABLES	(1)
	Oil reserves
Sediment basins	0.640 *** (0.233)
Bilateral aid (lag)	0.078 (0.139)
Multilateral aid	0.233 (0.1937)
Trade	0.680*** (0.208)
Inflation	-0.023 (0.094)
HAI	-0.059* (0.0325)
GDP pc	2.82* (1.46)
UNSC member	0.0451 (0.340)
Democracy	- 0.397 (0.495)
Number of recipients	82
Under-identification tests	Kleibergen-Paap rk LM statistic
	91.856 (0.000)
Weak identification test	Cragg-Donald Wald statistic
	96,46 ††
	Kleibegen-Paap Wald rk F statistic
	94,08 ††
Weak-instrument-robust inference	Anderson-Rubin Wald test: F statistic
	36.00 (0.000)
	Anderson-Rubin Wald test: Chi-square statistic
	36.00 (0.000)
	Stock-Wright LM S statistic
	37.80 (0.0000)

*Note: P-values of LM, Sargan J, and Sargan C statistics are in parenthesis. 10% maximal IV size as the Stock-Yogo weak ID test critical values is 16.38 (Stock and Yogo, 2005). †† denotes significance at 10%.*

## APPENDIX E

### Excluding the period 2005-2010

**Table E.1. IV-PPML results - Oil and aid allocation, G7 countries, 1980-2004**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Aid share	Aid share	Aid share	Aid share	Aid total	Aid total	Aid total
Oil reserves	0.0569*** (0.0142)	0.0522*** (0.0141)			0.0151 (0.0127)		
NOC				0.197 (0.123)			0.339** (0.133)
IV-Oil reserves			0.180** (0.0746)			0.526*** (0.120)	
Lagged Dep. var	4.315*** (0.675)	2.975*** (0.568)	6.154*** (0.924)	7.200*** (0.804)	0.0004*** (6.39e-05)	0.0002*** (5.30e-05)	0.0004*** (6.32e-05)
Multilateral aid		0.155*** (0.0389)	0.147** (0.0674)	0.161*** (0.0388)	0.239*** (0.0672)	0.446*** (0.0802)	0.226*** (0.0696)
Trade		0.170*** (0.0480)	0.252*** (0.0481)	0.274*** (0.0354)	0.580*** (0.0660)	0.341*** (0.0806)	0.592*** (0.0606)
Inflation		-0.0163 (0.0128)	0.0343* (0.0202)	0.0234 (0.0200)	0.0849** (0.0354)	0.0882** (0.0359)	0.0778** (0.0353)
HAI		-0.017*** (0.00620)	-0.00988 (0.00651)	0.00302 (0.00265)	-0.00247 (0.00384)	-0.0380*** (0.0102)	-0.00174 (0.00380)
GDP pc		-0.470* (0.259)	-0.75*** (0.243)	-0.159* (0.0905)	-0.290*** (0.103)	-1.831*** (0.388)	-0.351*** (0.115)
Population <sup>a</sup>		1.116* (0.589)		0.174*** (0.0447)	0.141** (0.0663)		0.0991 (0.0687)
UNSC member		0.0105 (0.0452)	-0.0283 (0.0583)	-0.00139 (0.0572)	-0.00864 (0.110)	-0.124 (0.107)	-0.0362 (0.114)
Democracy		0.0925 (0.0628)	-0.0629 (0.0736)	-0.0931 (0.0891)	-0.310** (0.121)	-0.135 (0.0921)	-0.0569 (0.110)
NOCxDemocracy				-0.00487 (0.128)			-0.284* (0.146)
Observations	8,550	6,275	5,971	6,340	6,463	6,133	6,508
Dyadic FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Donor time FE	Yes	Yes			Yes	Yes	Yes
R-squared	0.15	0.37	0.35	0.34	0.66	0.68	0.66

*Note: This table presents IV-PPML estimates of our bilateral aid allocation model. In columns 5 to 7 the results for the specification with aid in absolute terms are presented. Oil reserves variable is instrumented by the location of sedimentary basins. <sup>(a)</sup>: The sediment volume variable is the natural logarithm of total sediment volume beneath each group's populated territory, thus collinear with our variable "population". Robust standard errors are in parentheses. Independent variables are lagged to reflect aid allocation process and avoid simultaneity bias. \*\*\*, \*\*, and \* indicate 1%, 5%, and 10% significance levels.*

*UNSC: United Nations Security Council. NOCs: National Oil Companies*

## APPENDIX F

### Estimations using three-year averages of the variables

**Table F.1. Energy security and aid allocation, three-year averages, G7 countries, 1980-2010**

VARIABLES	(1) Aid share	(2) Aid share	(3) Aid share	(4) Aid share
Oil reserves	0.0196*** (0.00594)	0.0178** (0.00881)	0.0180** (0.00875)	0.0109 (0.00801)
<i>Rivalries in MENA</i>		0.0128*** (0.00304)	0.0122*** (0.00292)	0.0146*** (0.00297)
<i>Oil Import ratio (donor)</i>			0.0277 (0.190)	1.271*** (0.214)
Lagged Dep. var	12.58*** (0.768)	10.61*** (1.161)	10.81*** (1.091)	10.81*** (0.897)
Multilateral aid	0.250*** (0.0324)	0.156*** (0.0349)	0.154*** (0.0365)	0.114*** (0.0376)
Trade	0.376*** (0.0315)	0.197*** (0.0328)	0.192*** (0.0326)	0.364*** (0.0380)
Inflation	0.0326* (0.0180)	0.00879 (0.0244)	0.00601 (0.0268)	0.00225 (0.0278)
HAI	0.00364* (0.00206)	0.00409 (0.00282)	0.00460 (0.00285)	0.00781*** (0.00283)
GDP pc	-0.296*** (0.0567)	-0.168** (0.0772)	-0.170** (0.0775)	-0.178** (0.0728)
Population	0.111*** (0.0402)	0.232*** (0.0415)	0.236*** (0.0418)	0.0714 (0.0471)
UNSC member	-0.302*** (0.0931)	-0.139 (0.0900)	-0.0538 (0.119)	-0.202 (0.148)
Democracy	-0.0642 (0.0524)	-0.0872 (0.0617)	-0.0689 (0.0641)	-0.0400 (0.0697)
Observations	2,976	2,976	2,742	1,974
Dyadic FE	Yes	Yes	Yes	Yes
Excluded R2	0.54	0.525	0.50	UK & CAN 0.58

*Note: This table presents the Pseudo Poisson Maximum Likelihood estimates of the gravity model of bilateral aid allocation with three-year averages of the variables. All estimations include dyad fixed effects. Robust standard errors are in parentheses. \*\*\*, \*\*, and \* indicate 1%, 5%, and 10% significance levels. UNSC: United Nations Security Council.*

**Table F.2. Conditional effect of donors oil dependence – Instability in MENA, three-year averages, G7 countries, 1980-2010**

VARIABLES	(1) Aid share	(2) Aid share	(3) Aid share	(4) Aid share
Oil reserves	0.0402*** (0.0100)	0.0394*** (0.0100)	0.0269*** (0.00986)	0.0175** (0.00844)
<i>Rivalries in MENA</i>	-0.00340 (0.00831)	-0.00317 (0.0106)	-0.00665 (0.00705)	-0.00892 (0.00780)
<i>Oil Import ratio (donor)</i>	-0.273 (0.324)	0.320 (0.468)	0.352 (0.216)	0.952*** (0.211)
<i>Oil_M × Rivalries</i>	0.0295*** (0.0108)	0.0304** (0.0131)	0.0206** (0.00895)	0.0307*** (0.00941)
Lagged Dep. var	13.37*** (1.033)	13.46*** (0.865)	11.03*** (1.027)	11.33*** (0.741)
Multilateral aid			-0.00764 (0.0341)	0.106*** (0.0344)
Trade			0.260*** (0.0280)	0.399*** (0.0300)
Inflation			0.0282 (0.0303)	0.0223 (0.0311)
HAI			0.00492* (0.00272)	0.00656** (0.00264)
GDP pc			-0.370*** (0.0718)	-0.285*** (0.0675)
Population			0.3154*** (0.045)	0.158*** (0.053)
UNSC member			0.0459 (0.125)	-0.147 (0.168)
Democracy			-0.0520 (0.0689)	-0.0427 (0.0705)
Observations	2,868	2,075	2,527	1,830
Dyadic FE	Yes	Yes	Yes	Yes
Excluded R2		UK & CAN		UK & CAN
	0.39	0.45	0.51	0.61

*Note: This table presents the Pseudo Poisson Maximum Likelihood estimates of the gravity model of bilateral aid allocation with three-year averages of the variables. All estimations include dyad fixed effects. Robust standard errors are in parentheses. \*\*\*, \*\*, and \* indicate 1%, 5%, and 10% significance levels. UNSC: United Nations Security Council.*