Foreign Aid and the Environment: Still A Curse?

January 27, 2013

Abstract: Foreign aid has become a very important source of government revenue for many countries in the world. The academia and policy communities are interested in whether foreign aid has done what it is supposed to do. The aid literature has paid special attention to foreign aid's effects, if any, on poverty reduction, economic growth, human capital accumulation, to name but a few. One often overlooked area is foreign aid's environmental impacts. In order to fill this gap, we propose a theoretical model in which we posit that 1) aid is fungible and recipient governments spend foreign aid as a combination of private and public goods; 2) the distribution of aid money between private and public goods is a function of the winning coalition size (W) of aid recipient countries, with large-W systems spending more on public goods; and 3) government public goods spending generally improves environmental quality via the composition, technique, and income effects. The empirical implication from our theory, that is, foreign aid's environmental effect is conditional on the winning coalition size of the recipient government with foreign aid improving environmental quality in large-W systems, is tested in the context of air pollution. The empirical findings support our theory in the case of common types of air pollutants, especially sulphur dioxide (SO_2) and particulates (PM-10).

Introduction

The aid literature has paid special attention to foreign aid's effects on important issues such as poverty reduction, economic growth, human capital accumulation, democratization, and quality of market and political institutions.[1] One area that has often been overlooked is foreign aid's environmental impact. With an enlarging income gap between the rich and the poor countries in the world and given the fact that environmental degradation often goes hand in hand with poverty in many developing countries, it is important for us to understand whether foreign aid, though often given with non-environmental purposes (e.g., to stimulate economic development), helps, hurts, or have no impact on aid-recipient countries' environment. This paper aims to fill the gap in our understanding of the relationship between foreign aid and the environment.

There is an emerging literature on foreign aid's environmental impacts. However, it suffers from a few shortcomings, for instance, the lack of clear theory. In Lim et al. (2012), aid is assumed to be a curse for the environment given its adverse effects commonly found in other issues areas such as economic growth. It is unclear why foreign aid necessarily hurts the environment in recipient countries in the first place.[2] Chao and Yu (1999), on the other hand, posit that aid helps the environment when it is tied to environmental clean-up. This mechanism only explains environmental impacts associated with aid projects that have a strong environmental component. It says nothing about the environmental impacts of other types of foreign aid. Unfortunately, despite its recent significant increase, at the end of the 20th century, the environmental type of foreign aid leveled off just below $10 billions, only approximately 10% of total aid (Hicks, Parks, Roberts & Tierney 2008). In addition to overlooking the majority, non-environmental types of aid, this argument assumes that recipient governments indeed take aid conditionality seriously, which is questionable

[1]The aid literature is too large for us to provide a comprehensive list of references. There are a few good review articles though, see, for example, Wright and Winters (2010) on foreign aid and economic development.

[2]Lim et al. (2012) test the interactive environmental effects of foreign aid with other globalization forces (trade and foreign direct investment) and find that as a recipient country's aid dependence increases, the pro-environmental effects of trade and FDI decline and are eventually nullified.

given recent aid fungibility research which suggests that developing governments often, if not always, substitute their own resources with foreign aid or simply use aid elsewhere (Feyzioglu, Swaroop & Zhu 1998, Chatterjee, Guiliano & Kaya 2012).[3]

Arvin and Lew (2009) also argue for a beneficial effect of foreign aid on the environment. Environmental degradation in many poor countries is often related to the lack of funds for environmental clean-up and preservation, aid therefore helps as it gives government money to overcome this problem. This argument assumes an environmental friendly government that is willing to prioritize environmental protection. Given the fact that most third-world country governments, like many other governments in the world, ultimately want to survive in office, it is unclear why they would spend limited resources on environmental protection rather than on other more urgent tasks, for instance, paying their key constituencies as well as stimulating economic growth and creating jobs for the general public.

Moreover, the empirical findings from previous aid-environment studies are mixed. Kretschmer et al (2011) find that aid reduces energy intensity of domestic production, but has no effect on carbon intensity of energy use. Arvin and Lew (2009), on the other hand, find that aid helps to reduce CO_2 damage, but increases water pollution and deforestation based on data for 1990-2002. Empirical findings from Arvin et al (2006), however, show that aid increases CO_2 emissions but only in higher-income developing countries.[4] Differences in the indicators chosen to measure environmental degradation, samples of countries and time periods, and estimation techniques might account for these mixed empirical findings. But more importantly, the lack of clear understanding of the politics behind foreign aid, especially the incentives of recipient governments to use foreign aid for their own ends often makes the aforementioned analyses questionable. For instance, most of these studies simply test the correlations between foreign aid and some pollution indicators: they assume that the effect of aid is the same across different domestic political settings, therefore overlooking the potential mediating effects of domestic institutions and politics.

[3]However, there are a few fungibility studies showing that for some countries, aid is not fungible, see, for instance, Pack and Pack (1990) in the case of Indonesia and Gupta (1993) for India.

[4]They offer no theoretical explanation as to why split the sample into lower- and higher-income developing countries.

In this paper, we present a theory of foreign aid and the environment that focuses on the incentives and strategies of a recipient government for political survival. We assume that aid is fungible. The environmental effect of foreign aid is conditional on the ways by which the recipient government spends aid money which in turn is a function of government's survival strategies (Bueno de Mesquita, Smith, Siverson & Morrow 2003). To maximize the chances to stay in office, governments in polities with large winning coalitions often find it more efficient to provide public goods (Licht 2010, Bell 2011). Government public goods provisions have been shown both theoretically and empirically to benefit the environment (Lopez & Palacios 2010, Lopez, Galinato & Islam 2011, Halkos & Paizanos 2012). Aid, therefore, is more likely to be spent as public goods and benefiting the environment in countries with large winning coalitions. Informed by our theory on aid and the environment, our empirical analysis follows those who have used a range of environmental indicators and a pooled research design (e.g., Li and Reuveny (2006)). We chose to focus on measures of air pollution for which there is good quality and relatively abundant data. The empirical findings support our theory in the case of common types of air pollutants, especially sulphur dioxide (SO_2) and particulates (PM-10).

The next section of this paper reviews the foreign aid literature, focusing on key underlying causal mechanisms connecting aid to competitiveness, market and political reforms, and economic growth. The following section presents our theory on aid and the environment. The empirical sections present data and empirical findings. We conclude and discuss future research at the end.

Searching For Causal Mechanisms from the Aid Literature

Billions of dollars are given as foreign aid every year to many governments in the developing world. Aid has become one of the most important sources of government revenue. For donor countries, international organizations, and the international community in general, important questions need to be answered. First of all, does it work? That is, whether foreign aid has any effect on economic growth, market reform, government spending and taxation, democratization, and the survival of various political regimes. Second, what are the causal mechanisms that account for foreign aid's various impacts on aid-recipient countries? In other words, what happens when (often developing) countries receive aid? The second question is

especially important for us as we search the literature to fill the gap in our understanding of the relationship between foreign aid and the environment.

Foreign Aid and Dutch disease. First, aid has been connected to the phenomenon of Dutch disease. This is similar to the Dutch disease mechanism in the resource curse literature (Ross 1999). Aid, like other types of large windfalls and their associated spending, negatively affects a country's competitiveness and therefore long-term growth (Rajan & Subramanian 1992, Adam & Bevan 2003, Rajan & Subramanian 2005).[5] Aid hurts exporting sectors, often reducing their production. Less production often means less pollution. But this also depends on the nature of production: a decline in "green" sectors is actually bad for the environment as resources are more likely to move to other more polluting sectors; a shrinking "brown" sector, on the other hand, is probably good news for the environment. Moreover, less income from exports might also limit the government's financial ability to implement environmental regulations, assuming the government has the incentive to do so in the first place. Therefore, it is hard to see how foreign aid might affect the environment through the Dutch disease mechanism.

Foreign Aid and Economic Reform. Second and more recently, foreign aid has been connected to the possibilities of economic reforms which in turn affect the prospect for economic growth (Collier 1997, Morrissey 2004). Foreign aid might be entirely spent by recipient government on useless government consumption and yet it could still be effective for growth if such consumption helps the government to adopt economic reforms. In other words, foreign aid acts as a bribe, first, given by donor countries to the recipient government. Recipient government, once decided to adopt economic reform, uses foreign aid to pay off those hurt by the proposed reform. Bearce (2010) advances this aid-reform-growth model by incorporating domestic institutions as they condition the effects of aid on reform. Political regimes affect

[5]With a flexible exchange regime, aid flows increase the nominal exchange rate, making export sectors uncompetitive if wages in those sectors do not adjust downwards. With a fixed exchange rate system, aid money spent on domestic goods will push up the price of these resources given limited domestic supply, rendering industries facing foreign competition uncompetitive. However, see Ross (1999)'s discussion on why Dutch Disease might not work as expected; though his discussion is in context of natural resources rather than foreign aid.

the costs for economic reform with authoritarian rulers often facing less pressures from the "reform losers" compared to their democratic counterparts. Therefore, given the same level of foreign aid, authoritarian governments are more likely to pursue economic reform which is likely to spur economic growth.[6]

Economic reforms, particular the neo-liberal types, are often associated with Western aid and include policy changes directed at creating and opening markets, such as reduced trade barriers, decreased government intervention in the economy, and secured private property rights.[7] If aid really affects the chances of economic reform, the environmental implications from the aid-reform channel depends on how neo-liberal economic reforms affect the environment. Unfortunately, the empirical findings on the relationship between such reforms and the environment are rather mixed (Abaza 1996, Munasinghe & Cruz 1995, Young & Bishop 1995, Reed 1996, Shandra, Shircliff & London 2011). Economic reforms affect the environment through many potential causal mechanisms. On the one hand, such reforms remove perverse subsidies that encourage inefficient use of energy; they are also argued to increase economic and price stability which promote sound resource management. On the other hand, more negative environmental impacts associated with neo-liberal economic reforms have been pointed out by the literature. First, price changes and deflationary policies increase short-term unemployment and poverty that encourage over-exploitation of natural resources. Second, trade liberalization often boosts investments in brown sectors (e.g., extractive, industrial, and transport sectors) in developing countries. Finally, the removal of subsidies on basic commodities for the poor causes increased dependency on natural resources (Kessler & Dorp 1998).

Therefore, aid might affect the chances of economic reform, but the empirical connection between reform and the environment is unclear. Reviewing the reform-environment literature, Kessler and Van Dorp (1998) conclude that the net results from available studies

[6]Furthermore, Bearce and Tirone (2010) point out that the lack of strategic goals of the donor government also conditions the link between aid and reform: only when strategic benefits associated with providing aid are small for the donor government can the conditionalities with aid be effective.

[7]Western aid still is the majority of foreign aid even though countries like China are increasing their aid to other developing countries.

suggest that such reforms' negative environmental impacts often exceed positive ones. If reform hurts the environment, to the extent that aid helps economic reform in recipient countries, we should expect, all else equal, a negative relationship between aid and environmental quality. In other words, aid is more likely to increase pollution via neo-liberal economic reform. Moreover, if the aid-reform connection is more salient in countries with low reform costs (i.e., authoritarian states according to Bearce (2010)), the aid-increase-pollution effect should be more pronounced in non-democratic countries. Our empirical analysis in following sections, however, does not support these empirical implications: aid is often found to reduce pollution in general and this relationship is more salient in democratic countries.

Foreign Aid and Government Spending. Finally, there is an aid-spending connection. Indeed, when discussing the impacts of foreign aid (mostly on growth), most scholars assume that aid should have its causal effect, if any, via the government spending channel. Wright and Winters (2010) review the aid-growth literature by highlighting important steps along the aid-spending-growth causal chain. Our theoretical story, discussed in detail in the following section, focuses on an aid-government spending-environment causal chain: how aid recipient government spends aid money is the key for us to understand the aid-environment connection.

According to Wright and Winters (2010), for aid to affect economic growth via the public spending channel, it has to make it to the government budget, which might not happen at all, because corrupted leaders often pocket aid for themselves.[8] The ruler simply keeps the aid money, for himself and/or to distribute among close allies. Aid can also be stolen by other government officials at various stages of aid programs — note this is often tolerated by the ruler as a way to pay off those in the distributional coalition. In sum, aid simply could become rents divided among those governing the country before it even reaches government budget.

For aid that reaches the government budget, it could also be distributed as subsidies to certain sectors. Subsidies, especially the sectoral type (compared to the horizontal type),

[8]Once aid makes it to be budget, how the government spends it matters for economic growth: here the difference is between consumption and investment with the latter largely assumed to be pro-growth (Wright & Winters 2010).

are essentially rents distributed selectively by the government to buy off support.[9] For example, Knack (2001) argues that aid is often commonly used for patronage purposes by subsidizing employment in the public sector or in state-operated enterprises, because aid can provide funds for government to undertake investments that would otherwise be made by private sectors. Note, direct theft of foreign aid by government officials (as long as it is implicitly tolerated by the ruler) as well as subsidies financed by fungible foreign aid through government budget can both be considered private goods doled out by the ruler to buy off support among key supporters. They are private goods because they are meant to benefit certain individuals and interest groups but not the public.

Finally and hopefully, part of foreign aid will be spent as public goods, for example, government consumption and investment in education, public health, poverty reduction, and environmental protection. In our theoretical model discussed in the following section, we argue that government public spending generally helps the environment because, for instance, it increases human capital which replaces certain proportion of pollution as inputs of domestic production (Lopez, Galinato & Islam 2011). The "conversion rate" from foreign aid to government public goods provision is the key factor that affects the extent to which aid helps the environment in recipient countries. Indeed, we argue that governments spend foreign aid as a combination of private and public goods, with public goods provisions benefiting the environment. But is there a connection between government private goods provisions and the environment? The rest of this section will focus on the environmental impacts of private goods, for instance, corruption and rent-seeking activities. We leave the detailed discussion on public goods provisions and the environment to the next section of the paper.

Many believe that aid increases the incentives of rent-seeking behavior because there is more rent to divide (Krueger 1974, Murphy, Shleifer & Vishny 1993, Torvik 2002, Svensson 2000, Hodler 2007). However, there is also empirical research pointing out the fact that

[9]Sectoral aid is the sum of all state aid granted to specific sectors (agriculture, fisheries, manufacturing, coal, transport except railways and other services) and state aid given on an ad-hoc basis to individual companies, for example, for rescue and restructuring. Horizontal aid, on the other hand, is much less distortive. Horizontal aid addresses well-defined common interests such as growth, employment, and the environment; it includes state aid that is not granted to specific sectors, which is usually considered as being targeted to market failures.

foreign aid helps to reduce corruption in recipient countries (Tavares 2003), especially those already with lower levels of corruption (Okada & Samreth 2012). Here, corruption and rent-seeking activities are among the types of private goods doled out by recipient governments. While the connection between aid and corruption is still disputed, the second step in the aid-corruption-environment causal chain, that is, whether there is a connection between rent-seeking/corruption and environment quality, is an interesting question that has intrigued students of environmental studies.

Following the theoretical model in Lopez and Mitra (2000), Leitao (2010) shows that the turning point (in per capita income) of the inverted-U-shaped Environmental Kuznets Curve — where things are getting better — is higher in more corrupted countries, implying a negative effect of corruption on the environment. Moreover, corruption has been shown to reduce environmental and energy policy stringency (Damania, Fredriksson & List 2003, Fredriksson, Vollebergh & Dijkgraaf 2004). However, corruption in these studies is treated as exogenous to external factors such as foreign aid. More specifically, it is conceptualized as some innate weight that the government places on taking bribes from *domestic* interest groups relative to other objectives such as maximizing social welfare (Lopez & Mitra 2000).[10] In fact, corruptibility is a more accurate term here since it captures the extent to which government weighs bribes against general social welfare. Bribes are assumed to come from domestic interest groups only (e.g., business and labor in energy-intensive sectors): they are used to sway policies away from social optimum levels to benefit certain interest groups.

It is important to theoretically distinguish between rent-seeking and corruption *activities*, which are observable, and government's *corruptibility*, which is often a latent characteristic.[11] Whether foreign aid will increase the corruptibility of a recipient country is still an open question. In other words, would aid make the government more subject to the influence of domestic interest groups? Indeed, it might be logical to think that the aid might reduce the corruptibility of the government because aid, as "bribes" from foreign countries, might reduce government's need to take bribes from domestic interest groups. We think

[10]Either as an end in itself (Fredriksson, Vollebergh & Dijkgraaf 2004) or a way to win the next election.

[11]Also note that rent-seeking and corruption activities is a product of available resources and corruptibility.

the aid-corruption (corruptibility)-environment connection is unclear from both theoretical models and empirical findings in the existing literature.[12] The other way that the government spends aid money, that is, on public goods, is the key for us to connect foreign aid to the environment. We discuss this in the next section.

Theory

Our theory on foreign aid's environmental impact is based on a few assumptions. First, we assume aid is fungible.[13] Recipient governments can and often take foreign aid and use it for purposes other than those required by donor countries. As we discussed in the previous section, the government can pocket the money and distribute it directly to its allies. It might also implicitly tolerate theft of foreign aid by various government officials. The government can also channel the money to government budget and use it to subsidize key constituencies. All of these can be considered private goods doled out by the government. Government can

[12]Corruption and corruptibility, for many countries in our sample, are slow-moving, if not time-invariant, variables. We use country-fixed effects in our empirical analysis that are capable to control for country-specific effects. Another reason why we chose not to include corruption variables is that existing corruption measures cover much shorter time series than those used in our empirical analysis: Corruption Perception Index from the Transparency International only covers 1995-2010, the World Bank indicator for corruption estimate covers 1996-2009, and the Freedom from Corruption indicator from the Heritage Foundation 1994-2006. Note our empirical analysis include SO_2 and CO_2 regressions for year 1961-2003 and PM-10 from 1991 to 2005. Including these variables would significantly reduces the number of observations (e.g., in the best scenario, it reduces more than 600 observations for PM-10 regressions, that is, over one third of the observations).

[13]There are a few studies showing the lack of aid fungibility based on single country data: most notably, Indonesia according to Pack and Pack (1990) and India for Gupta (1993). However, more recent studies based on cross-country data suggest that aid is fungible (e.g., Chatterjee et al (2012)). McGillivray and Morrissey, in a review essay on the studies of aid fungibility, conclude that aid indeed is used in a fungible manner, although one can not make any general comment regarding the extent of fungibility (McGillivray & Morrissey 2004).

also spend aid money as public spending targeting the whole population — these become public goods provisions.[14]

Second, we assume that certain forms of government social and public goods spending reduce pollution. This assumption deserves a closer look. Government spends money often as a combination of private and public goods. The examples of private goods include direct payment to close allies and key constituencies.[15] Public goods, on the other hand, often include government spending in education, health, social welfare, transport, communications, public order and safety, research and development, environment, recreation and culture and social housing. The way by which government spends money affects the environment. According to Lopez et al (2011), public good spending affects production pollution by the scale, composition, technique, and income effects. With regard to the scale effect, government spending in the form of public goods often cause economic growth which might increase environmental pressures.[16] However, public goods spending helps the environment via the composition, technique, and income effects. Regarding the composition effect, government spending may favor human-capital intensive activities at the expense of physical-intensive industries which are often among the most polluting industries. Moreover, government public good provisions increase human capital which in turn increases labor efficiency. In many ways, human capital and pollution-generating dirty inputs are substitutes in production. Therefore, more human capital reduces dirty inputs of production, which reduces pollution-output ratio. More specific government spending in R&Ds has a more direct causal effect for the technique effect because this often helps private actors in the market to adopt better and often cleaner technologies. Finally, the income effect stipulates that with more income,

[14]Note that other sources of non-tax revenues are also often fungible, for example, income from natural resources. However, the extraction of natural resources itself often generate severe pollution, e.g., oil and natural gas.

[15]More related to the environment, they might include subsidies to fossil fuel production, input subsidies, subsidies to energy consumption, farm programs, credit subsidies, grants to corporations, and other forms of subsidies that target specific industries or firms.

[16]In the empirical analysis, we control for this economic growth effect.

people might have a higher environmental demand, that is, they are more willing to sacrifice their personal income in exchange for better environmental quality (Inglehart 1995).[17]

Our theory on foreign aid and the environment is ultimately about how an aid-recipient country spends aid money: aid comes in as fungible income and the government decides on how to spend it as a combination of private and public goods. Discussion from the previous section suggests that both the theoretical and empirical connections between private goods (rent-seeking and corruption; on and off-budget) and environmental quality are unclear. Recent research, on the other hand, reveals government public goods provision often improves the environment (Lopez & Palacios 2010, Lopez, Galinato & Islam 2011, Halkos & Paizanos 2012). Therefore, the "conversion rate," by a recipient government, from foreign aid to government public goods provision is the key determinant of foreign aid's environmental impact. We posit that this rate is a function of a recipient government's regime type.

We assume that governments want to survive in office. Whether through direct diversion or budgetary substitution, survival-driven governments aim to convert some portion of aid to reinforce their supporters' loyalty. Following the selectorate theory, government with large winning coalition size therefore is more likely to spend the money as public goods: as the size of the coalition that rulers have to build to stay in power increases, they provide more public goods, because the relative price of doing so falls compared to buying support with private good transfers. This size argument follows because in principle everyone in the society can benefit from the provision of any unit of a pure public good without diminishing

[17]In terms of the empirical findings concerning the environmental impacts of government public spending, Halkos and Paizanos (2012) show that for both sulfur dioxide and carbon dioxide, government spending is estimated to have a negative direct impact on per capita emissions. Lopez and Palacios (2010) report total government expenditure as a negative and significant determinant of air pollution, even when controlling for the composition of public expenditure, for 21 European countries for the period 1995-2006. Lopez et al (2011) show that an increase in the share of government spending on public goods in total government spending decreases pollution significantly for a sample of both developed and developing countries.

the enjoyment that others derive from the same unit (Bueno de Mesquita et al. 2003).[18] Licht (2010) makes a similar argument that governments differ in their use of foreign aid, conditional on their winning coalition sizes.[19] Bell (2011) also shows that the use of public and private goods for regime survival depends on the type of political regimes: public goods are more efficient for inclusive (large-W) regimes while private goods work better for exclusive (small-W) systems.[20]

Therefore, the effect of foreign aid on the environment is conditional on the winning coalition size of the recipient country, with those with large winning coalition more likely to spend a larger share of aid money as public goods which improve environmental quality. As Licht (2010) suggests, in large-winning-coalition systems, any newly arriving resources must be turned toward the overarching goal of shoring up support in the interest of tenure, and this means providing further public benefits. Foreign aid, as an additional source of government revenue, serves to reinforce the existing patterns of government spending with large-winning-coalition governments more likely to spend it as public goods. However, we are not making an argument that for regimes with large winning coalitions, aid is always disproportionably spent as public goods. We argue that a larger proportion of aid flows is spent as public goods in large-W systems than in small-W systems. Indeed, when we look

[18]There are different types of public goods and their environmental impacts might vary. For example, building roads, dams, and factories often generates pollution, even though they help to stimulate economic growth. We suspect that these are more likely to be short-term effects because investments in transportation and other infrastructure eventually increase productivity and efficiency and are likely to reduce pollution and energy intensity of domestic production. In the empirical analysis, we control for a battery of economic variables such as the percentage of industrial production in GDP and GDP growth rate. We think these variables can partially capture some of the potential short-term negative effects associated with some types of infrastructure building. Moreover, human capital and environmental public goods often benefit the environment. The Selectorate theory itself does not provide answers for the relative salience of different types of public goods given different winning coalition sizes though.

[19]Though her concern is on regime survival.

[20]His model also adds in the dimension of regime consolidation.

at the substantive effect of aid on pollution in the empirical analysis, the negative effect is statistically significant but not as large as one would hope. We log both pollution and aid variables so the coefficients can be interpreted as elasticities. For the case of SO_2, 1% increase in per capita aid can reduce pollution by only about 0.02%. The case of PM-10 is even less promising and the mean effect is about 0.005%.[21]

Alternative Theoretical Accounts

One key assumption for our theory is that aid is fungible: this does not mean complete direct diversion or budgetary substitution, rather an important part of foreign aid is misused.[22] Moreover, we implicitly assume that the level of aid fungibility is not a function of winning coalition size. This is an important assumption without which the conditional effect of winning coalition size found in the empirical section could be explained by an alterative theory: If foreign aid is less fungible in large-W countries (often democracies), that is, democratic governments are more likely to use aid properly (for instance, because of more checks and balances); and if most of the aid programs are about providing public goods, we should also expect that aid in democracies help the environment, but not because of the different ways that governments spend fungible aid as our theory argues; rather, it is because aid is less fungible in democracies — more aid in democracies is spent the way it is supposed to be spent, that is, to aid programs, the majority of which are likely to be related to public goods provisions; and public goods provisions benefit the environment (Lopez, Galinato & Islam 2011).

In order to rule out this alternative explanation, that is, the conditional effect of winning coalition size is about aid fungibility as a function of the winning coalition size or political regime type,[23] we need empirical evidence on the relationship between aid fungibility and recipient country winning coalition size and regime types. Studies on country-specific

[21]These are short-term effects though.

[22]The estimates of the fungibility factor varies by different studies. Some studies indicate a higher level of fungibility, for example, Chatterjee et al (2012) show that investment aid crows out 80-90 % of domestic government spending.

[23]The winning coalition size variable is correlated with the polity variable at 0.83 level in our data.

estimates of aid fungibility beyond single country context are indeed few in the literature. Moreover, early studies often focus on one single country (Pack & Pack 1990, Gupta 1993). However, evidence from recent studies suggest that aid fungibility is unlikely to be a function of the regime type of aid recipient countries. For instance, breaking down components of government spending into pro-poor expenditures and other expenditures, Petterson (2007) estimates fungibility for 57 aid recipient countries. He finds that the correlation between country-specific fungibility estimates and the democracy index (Polity score) is virtually zero.[24]

Finally, our theory follows the selectorate theory (Bueno de Mesquita et al. 2003). But there are other theories on the ways that different political regimes affect public goods provisions. One relevant tradition in political economy is the conceptualization of regime type as an institution for redistribution (Acemoglu & Robinson 2003). Here, the conflict in both democracies and autocracies is the one between citizens and elites: elites are wealthy but smaller in number compared to citizens; the redistribution of wealth is assumed to go from the elites to the public. Citizens prefer higher redistribution than the elites; the elites prefer no redistribution at all if possible. Therefore, in democracies, the threat is from the elites who are unhappy with the redistribution and coup is a potential outcome. Aid, similar to other types of non-tax revenue, can help the government to tax less (on the elites) and therefore reduce the chances of coup (Morrison 2009). Aid, however, does not affect government spending. Therefore, in democracies, aid should have no effect on the

[24]However, it is worth noting that fungibility studies such as Petterson (2007) and Pack and Pack (1990) are subject to a number of limitations. For instance, these studies assume that public goods purchased from non-fungible part of the aid do not affect government spending decisions; in other words, the budget substitution effect of aid is not incorporated in these studies (McGillivray & Morrissey 2004). Moreover, there are data limitations such as measurement errors, the mismatch between government spending categories and those used by aid agencies, and missing data (especially for government spending data). Finally, because of data limitations, studies such as Petterson (2007) often look at aggregate spending categories while there are possibilities that aid might be diverted within each category, for example, from health to education (even though both of them belong to the category of pro-poor expenditures).

environment, at least not through the channel of government public goods provisions (Lopez, Galinato & Islam 2011).

In non-democracies, the threat is from the public who demand more redistribution which might result in revolution. Aid can help the government to distribute un-earned money to welfare policies to appease the public without taxing the elites (Morrison 2009). The environmental implication is that in authoritarian states the increased public goods provisions help the environment by the composition, technique and income effects. Note this is a different prediction compared to that from our theory even though both go through "the public goods provisions" mechanism. The prediction of foreign aid's environmental impacts from the redistributive politics model also points to the conditional effect of regime type: aid is expected to have positive effect on the environment only in non-democratic regimes, because aid increases government redistribution only in authoritarian states (Morrison 2009). Our empirical analysis from the following sections, however, does not support this prediction.

Data

Pollution Indicators. Our empirical analysis uses a range of environmental indicators and a pooled research design. We chose to focus on three measures of air pollution for which there is good quality and relatively abundant data: sulphur dioxide (SO_2), particulates (PM-10), and carbon-dioxide (CO_2). Sulphur dioxide is a serious air pollutant. It is associated with ground-level smog and haze as well as acid deposition, causing damage to human health and reducing agricultural productivity (Hill 2004). Two-thirds of emissions result from fossil fuel-burning electricity generation, particularly from burning of high-sulphur content coal. Many developed countries have managed to reduce emissions due to changes to less sulphurous fossil fuels, deindustrialization, domestic legislation, and pollution control technologies encouraged by regional as well as international arrangements. However emissions are still increasing in rapidly growing developing countries like China and India. We use Stern's data on SO_2 emissions, in logged kilograms per-capita, per year (Stern 2005).

Particulates may comprise mixtures of a number of substances including sulphates, nitrates, metals, dust, and biological matter. Major sources are dust from farms, mines, and roads. Burning fossil fuels contributes most to smaller, more damaging particulates (Hill 2004). Particulates often cause ground-level smog and haze, especially in urban areas.

They damage human health, especially from the smallest particles lodging in lungs and even reaching the bloodstream. They are also associated with exacerbation of heart-disease and with lung cancer. We focus on the density of suspended particulates less than 10 microns in diameter, in logged micrograms per cubic meter (PM-10). We use data taken from World Bank Development Indicators for 1990-2005.

Carbon dioxide (CO_2) is implicated in climate change as the most significant anthropogenic forcing factor. It is also implicated in an enormous range of problems, including potential food scarcity, health, development, security, and loss of bio-diversity. It has been under intense discussion since the late 1980s, primarily under the umbrella of the 1992 Framework Convention on Climate Change. Despite the entering into force of the 1997 Kyoto Protocol in 2005, regional action such as the EU Emissions Trading Scheme, and action at state and local scales, policy has had little impact to date. We use CO_2 emissions, in logged metric tonnes per capita, from the World Bank's Development Indicators.

Foreign Aid and Winning Coalition Size. Winning coalition size (W) data are from Bueno de Mesquita et al (2003). The variable is bounded between 0 and 1 with higher values representing larger coalition sizes. Bueno de Mesquita et al (2003) data on W only extend to 1999. Author and colleague (2012) extend it to 2005 using Cheibub, Gandhi, and Vreeland (2010) coding of regime types and Polity IV data (Marshall, Gurr & Jaggers 2010).[25]

There are different ways to measure foreign aid in the literature: aid per capita and aid per GDP are the two most commonly used indicators (Remmer 2004). We chose to use aid per capita as the primary measure in this paper because total population is a much more stable denominator than GDP. GDP can simply fluctuate as a function of many exogenous

[25]Bueno de Mesquita et al (2003) assign the lowest score to military regimes on the assumption that military regimes have particularly small W. The value of W goes up by a fixed amount if the executive is not chosen by heredity or in rigged or in unopposed elections. An additional increment is added if the executive is not recruited from a group based on heredity. If there are relatively stable groups that regularly compete for political influence, W is also increased. We recalculated W using Cheibub, Gandhi, and Vreeland's coding throughout, for consistency. Over the cases where the two measures of W are available the correlation between them is as high as 0.94.

factors such as changes in exported commodity prices and in exchange rates, especially for developing countries that are likely to be aid recipient countries. We used aid per GDP mainly to check the robustness of our findings: the results from regressions with the aid per GDP measure actually better support our theory (Figure 1). Data are from World Development Indicators.[26] There is a wide variation in terms of the empirical distribution for the variable of aid per capita (in 2000 constant dollars): countries such as Palau (in 2003, 2005) and Seychelles (in 1971) received over $1000 per capita of foreign aid while many countries received less than $10 per capita per year (about %27 observations in our data). We therefore log the aid per capita variable. Since the dependent variables are also logged, the coefficient of the aid per capita variable can be interpreted as elasticities, that is, the percentage change in pollution caused by a percent change in aid per capita.

Control Variables. While aid per capita, winning coalition size, and their interaction are the key variables, our model controls for several other factors which can bear upon environmental quality of aid-recipient countries. We controlled for trade openness (sum of imports and exports as a percentage of GDP): trade openness is conceptually important as it reflects the actual and perceived economic conditions and levels of insecurities associated with the vagaries of the global market which might affect the chances to unleash changes in domestic environmental policies. We include both GDP per capita (in constant 2000 US dollars, logged) and its squared term in the model to capture the potential curvilinear relationship between wealth and environmental protection: the Environmental Kuznets Curve argument posits that there is a U shape relationship between income/economic development and environmental protection.

We also control for GDP growth rate. While higher growth rates often require more intensive use of resources and lead to higher levels of pollution, they may also encourage technological advancement and human capital accumulation that might eventually improve environmental quality. Our model includes the share of industrial production in GDP because the industrial production is often associated with higher levels of pollution, especially in relation to the service sector. We also include two demographic variables, population density

[26]This measure captures both loans and grants from all bilateral and multilateral donors; military aid is excluded.

(population divided by land area) and urban population (as a share of total population) to control for demographic influences on pollution levels. Countries with high population density might prioritize development at the expense of environmental protection. Large urban population might also increase environmental burden of the country; but urban population is also likely to be associated with environmental activism and protection.

Empirical Findings

We estimate the model with OLS regressions with lagged dependent variable as well as fixed country and year effects. It is of great importance that common external shocks (for example, oil crisis) are controlled. We therefore include year dummy variables to control for potential common shocks. Including fixed country effects often leads to lower efficiency, but it is a conservative strategy when there is a possibility of estimation bias due to uncontrolled factors correlated with independent variables. Including both lagged dependent variable and country fixed effects might create a simultaneity problem: the lagged dependent variable is correlated with the error term by its correlation with the time-invariant component of the error term; when country fixed effects are included, the lagged dependent variable will still be correlated with the error term, and this leads to the so-called Nickell bias. However, recent literature suggests that the Nickell bias is really negligible and all remedies (such as Anderson-Hsiao or Arellano-Bond) are worse than the original Nickell bias (Kiviet 1995, Adolph, Butler & Wilson 2005). As the number of years gets larger, this bias becomes less of a problem.

Table 1 reports the empirical findings. Two model specifications are included for each type of air pollution: one without and one with the interactive effect between foreign aid and winning coalition size. For both SO_2 and PM-10, the effect of per capita foreign aid is negative and statistically significant in models without the interaction term. For the case of CO_2, the effect is negative but not significant judging by normal significance levels ($p < 0.5$ or $p < 0.10$). These are marginal effects of per capita aid regardless of the level of winning coalition size. In terms of the substantive effect, per capita aid's negative impact on pollution is not that important. Because both the dependent variables and the per capita aid variable is logged, coefficients can be interpreted as elasticities. In case of SO_2, one percent increase in per capita aid, all else equal, is expected to reduce SO_2 emissions by about 0.016 percent. In the case of PM-10, the effect is even smaller; one percent increase in per capita aid is

expected to reduce PM-10 emissions by about 0.007 percent. However, these are short-term effects because the model includes the lagged dependent variable. In a model with a lagged dependent variable, for example, $Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \beta_0 X_t + \varepsilon_t$, the mean long-term effects, also sometimes called long-run multiplier (LRM), for an independent variable is determined by $\frac{\beta_0}{1-\alpha_1}$.

It is difficult to calculate long-run multipliers for variables in interaction terms given that the marginal effects and the associated standard errors vary with the value of the other lower-order variable in the interaction term. But for model specifications in Table 1 in which no interaction term is included, we can follow the formula and calculate the "unconditional" long-term effects. The mean long-term effect for per capita aid in the case of SO_2 emissions, calculated by $\frac{\beta_0}{1-\alpha_1}$, is almost six times larger (0.09): one percent increase in per capita aid is expected to reduce SO_2 emissions by about 0.09 percent in the long run. For PM-10, the long-term effect is 0.025, also much larger than the short-term effect. The less straightforward part is to estimate the standard errors for the LRM. But the long term effect is ultimately the ratio of two coefficients, the approximation of the variance of a ratio of coefficients, for example, a and b, with known variances can be used (De Boef & Keele 2008): $Var(\frac{a}{b}) = \frac{1}{b^2}Var(a) + \frac{a^2}{b^4}Var(b) - 2\frac{a}{b^3}Cov(a,b)$. We calculate the variance and use it to calculate the 95% confidence interval associated with the long-term effect: for the case of SO_2, the interval is $\{-0.180, -0.005\}$; for the case of PM-10, it is $\{-0.047, -0.001\}$. Judging by the 95% confidence interval, $\{-0.033, 0.009\}$, the long term effect of per capita aid on CO_2 emissions is also not statistically significant.

Table 1 also includes one model with an interactive effect of per capita aid and winning coalition size for each type of air pollution. In the model specifications that we have reported, the interactive effect is actually not statistically significant. However, there are reasons to still include this. The most important justification for this is that a model with an interaction term yields coefficients that provide a more detailed description of the relationship between a dependent variable and a set of independent variables than a model without an interaction term (Friedrich 1982). Rather than assuming that the relationship between variables are the same everywhere, an interactive model assesses the possibility that relationships between variables change with changes in other variables. Moreover, in models with interaction terms, it is well known that not only the marginal effect but also the associated standard errors

vary with the value of the other lower-order variable (Friedrich 1982, Braumoeller 2004). In other words, it is hard to get a sense of the conditional effects by looking at coefficients and standard errors in the table only. The left-column sub-figures in Figure 1 show the conditional effects of winning coalition size on the per capita foreign aid variable across pollution types. In all three sub-figures, the long-dashed lines are the upper and lower bounds of the 95% confidence intervals of the estimated effect (short-term); the dark line in between the dashed lines represents the mean coefficient estimated.

Our theoretical expectation on the conditional effect of winning coalition size is that with increasing winning coalition size, the recipient government is more likely to spend foreign aid as public goods which we assume to be beneficial for the environment. In other words, foreign aid is more likely to help the environment, for instance, to reduce pollution levels, in countries with larger sizes of winning coalitions. Figure 1(a) and (c) show that such conditional effects are supported by the empirical data for SO_2 and PM-10. With small winning coalition sizes (approximately ≤ 0.5), the effect of per capita foreign aid on pollution is negative but not statistically significant as indicated by the corresponding 95% confidence intervals. Moving to higher values of W, the negative effect of foreign aid on pollution becomes more important substantively as indicated by the downward slopes of the mean estimated effects for both SO_2 and PM-10. Moreover, the upper bounds of 95% confidence intervals reach below zero when W is around 0.5. These all suggest that for countries with relatively large winning coalition sizes, per capita aid helps to reduce pollution for both SO_2 and PM-10.

However, for the case of CO_2, even though a similar pattern is observed — the mean estimated effects, across different levels of winning coalition size, of per capita aid is always negative and the mean negative effect becomes larger with increasing W — the 95% confidence intervals always include zero, rendering these negative effects never statistically significant. Therefore, we find empirical support for our theory in the case of SO_2 and PM-10 emissions, but for CO_2, the evidence is much weaker. We have mentioned that we use the aid per GDP variable to check the robustness of our findings. The right-column sub-figures in Figure 1 show the conditional effects of winning coalition size on the per GDP foreign aid variable across three pollution types. The results here actually better support our theory. Even in the case of CO_2 emissions, we observe a clear conditional effect of winning coalition

size for foreign aid's environmental impacts (Figure 1(f)). In the case of SO_2 and PM-10, the conditional effects are very similar to the cases when we use aid per capita variable. Regression tables for model specifications using the aid per GDP variable are presented in Table 2 of the paper: since we mainly use regressions with the aid per GDP variable to check the robustness of our findings, the following discussion on control variables' effects is based on regressions using aid per capita variable, that is, those in Table 1; however, the coefficient estimates are similar between the two tables.

In terms of the effects of control variables on three types of air pollution, we use GDP per capita and its squared term to test the Environmental Kuznets Curve (EKC) argument, that is, whether there is an inverted-U shape relationship between income/economic development and pollution. We find evidence for this in the case of SO_2 emissions. Both coefficients for GDP per capita and its squared term are statistically significant and signs suggest that with GDP per capita in the rise, pollution will go up first and then drop down after it reaches a turning point. Based on the mean coefficient estimates, the turning point is around $83,561.1$ constant 2000 US dollars. This threshold is very high but is consistent with what has been found in the Environmental Kuznets Curve literature. For instance, Stern (2001) finds that the EKC is effectively monotonic for the global sample because the implied turning point, \$101,166 (constant 1990 dollars in PPP), is very high by the standards of the existing literature. Note that the estimates of turning points of the EKC vary by studies and those empirical analyses that are based on the OECD samples often give much lower thresholds, often lower than 8-9 thousand dollars (Markandya, Golub & Pedroso-Galinato 2006). There is no evidence of EKC for PM-10. And for CO_2, the signs of coefficients for GDP per capita and its squared term actually suggest an inverse EKC. This is indeed consistent with some more recent empirical research on EKC in CO_2 (Aslanidis & Iranzo 2009, Arvin & Lew 2011).

Moreover, the share of industrial production in GDP is found to increase SO_2 emissions only. GDP growth rate has opposite effect on PM-10 and CO_2: faster economic growth reduces PM-10 pollution but increases CO_2 emissions. The two demographic variables only affect CO_2 emissions: while high population density increases per capita CO_2 emission, urbanization tends to reduce it. Finally, the globalization variable, trade openness, are positively associated with both PM-10 and CO_2 emissions.

Conclusion and Discussion

Billions of dollars are spent as foreign aid by the international community every year to help countries in the developing world. However, evidence suggests that foreign aid is often ineffective and sometimes even a curse for economic development and social welfare of aid-recipient countries (Collier 1997, Morrissey 2004, Wright & Winters 2010). The literature has extensively studied foreign aid's effects on poverty reduction, economic growth, human capital accumulation, democratization, and political institutions, to name but a few. Foreign aid's environmental impacts have often been overlooked by students of political science. This is an important gap in our understanding of foreign aid's impacts. Many developing countries suffer from severe environmental degradation which threatens their long-term prosperity. Moreover, environmental degradation often causes poverty in the poorest countries in the world. Understanding foreign aid's environmental impacts, therefore, has implications for aid-recipient countries' long-term sustainable development.

Unlike previous studies that mainly engage in empirical tests of aid-pollution correlations, we develop a political economy theory that focuses on the incentives and strategies of a recipient government for political survival. Our theory on aid and environment is ultimately about how an aid-recipient country spend aid money. Foreign aid comes in as fungible income and the government decides on how to spend it as a combination of private and public goods, with the latter often benefiting the environment (Lopez & Palacios 2010, Lopez, Galinato & Islam 2011, Halkos & Paizanos 2012). Therefore, the "conversion rate" from foreign aid to government public goods provisions is the key determinant of foreign aid's environmental impact. We argue that this rate is a function of a recipient government's winning coalition size as those with large winning coalitions are more likely to spend aid as public goods (Bueno de Mesquita et al. 2003, Licht 2010, Bell 2011). The theoretical prediction is that aid is likely to help the environment in countries with large winning coalitions. The empirical analysis tests the theory in three common types of air pollution and we find support in SO_2 and PM-10 emissions. This suggests that despite not having any effect or sometimes even resulting in adverse effects for economic development, foreign aid might finally have some beneficial side-effect in the case of the environment. But such beneficial environmental effect is only likely to happen for countries with large winning coalitions. Moreover, the magnitude

of foreign aid's environmental impact, even when considering the long-term effect, is much smaller than one would hope. We find the best scenario in the case of SO_2: one percent increase in per capita aid is at best associated with less than 0.1 percent reduction in pollution in the long term; short-term effect is actually smaller than 0.02 percent.

The empirical findings from this paper, however, need to be interpreted with caution and future research is needed to further confirm or reject what we have proposed in this research. One area for future research is to disaggregate total aid. Our theory on aid and environment is about aid and government spending. Foreign aid might affect the environment through other channels though. Indeed, a more direct channel is through aid projects that are specifically designed to address environmental issues, that is, green aid. However, disaggregating aid brings in many empirical challenges. For example, many aid projects have multiple purposes. Focusing solely on green aid also brings in the endogeneity issue: countries that receive many green aid projects might be exactly those experiencing the worst environmental degradation. How to come up with reasonable instruments to account for such selection bias is a challenging question for future research.[27]

Moreover, more empirical tests are needed to support our theoretical assumptions. For instance, we assume that countries with large winning coalition size are more likely to spend aid as public goods.[28] To illustrate that this is indeed the causal mechanism that accounts for our empirical findings requires us to test the relationship between foreign aid and government public goods provisions. Note how foreign aid affects government fiscal behaviors in itself is an interesting research question in the aid literature (Remmer 2004, McGillivray & Morrissey 2004). However, empirically differentiating private from public goods is difficult, if not impossible, especially for developing countries. Available data such as IMF's Government Financial Statistics categorize government spending into different components. However, the use of such data can raise certain questions, for example, is government spending in infrastructure 100% public goods provisions? Corrupted leaders can simply give contracts to close allies and use public spending as private payoffs. Detailed comparative case studies

[27]Using total aid is much less likely to suffer such endogeneity problem because it is unlikely that most of the aid is given based on environmental conditions of the recipient countries. Green aid still accounts for less than 10% of total aid (Hicks et al. 2008).

[28]We are not the first to make such assumption though (Licht 2010, Bell 2011).

might be needed to help to illustrate the causal mechanism. Finally, we hope this paper can bring the aid-environment connection to the attention of students of international and domestic politics and encourage more research in this direction.

References

Abaza, Hussein. 1996. "Integration of Sustainability Objectives in Structural Adjustment Programmes Using Strategic Environmental Assessment." *Project Appraisal* 11(4):217–228.

Acemoglu, Daron & James A. Robinson. 2003. *Economic Origins of Dictatorship and Democracy*. New York: Cambridge University Press.

Adam, C.S. & D.L. Bevan. 2003. "Aid, Public Expenditure, and Dutch Disease." *CSAE Working Paper 2003-02: Oxford: Center for the Study of African Economies* .

Adolph, Christopher, Daniel M. Butler & Sven E. Wilson. 2005. "Like shoes and shirt, one size does not fit all: Evidence on time series cross-section estimators and specifications from Monte Carlo experiments." *Working paper* .

Arvin, B. M. & B. Lew. 2009. "Foreign aid and ecological outcomes in poorer countries: an empirical analysis." *Applied economics letters* 16(3):295–299.

Arvin, B. Mak & Byron Lew. 2011. "Does democracy affect environmental quality in developing countries?" *Applied Economics* 43:1151–1160.

Arvin, B. Mak, Parviz Dabir-Alai & Byron Lew. 2006. "Does Foreign Aid Affect the Environment in Developing Economies?" *Journal of economic development* 31(1):63.

Aslanidis, Nektarios & Susana Iranzo. 2009. "Environment and development: is there a Kuznets curve for CO2 emissions?" *Applied Economics* 41(6):803–810.

Bearce, David H. 2010. "Why Foreign Aid May be Less Effective at Promoting Economic Growth in More Democratic Countries?" *Unpublished manuscript, University of Colorado, Boulder* .

Bearce, David H. & Daniel C. Tirone. 2010. "Foreign Aid Effectiveness and the Strategic Goals of Donor Governments." *The Journal of Politics* 72(03):837–851.

Bell, Curtis. 2011. "Buying Support and Buying Time: The Effect of Regime Consolidation on Public Goods Provision1." *International Studies Quarterly* 55(3):625–646.

Braumoeller, Bear F. 2004. "Hypothesis Testing and Multiplicative Interaction Terms." *International Organization* 58(4):807–820.

Bueno de Mesquita, Bruce, Alastair Smith, Randolph M. Siverson & James D. Morrow. 2003. *The Logic of Political Survival*. Cambridge: Cambridge University Press.

Chao, Chi-Chur & Eden S.H. Yu. 1999. "Foreign aid, the environment, and welfare." *Journal of development economics* 59(2):553–64.

Chatterjee, Santanu, Paola Guiliano & Ilker Kaya. 2012. "Where Has All the Money Gone? Foreign Aid and the Composition of Government Spending." *Working paper* .

Cheibub, Jose, Jennifer Gandhi & James Vreeland. 2010. "Democracy and dictatorship revisited." *Public Choice* 143:67–101.

Collier, Paul. 1997. The Failure of Conditionality. In *Perspectives on Aid and Development*, ed. Catherine Gwin & Joan M. Nelson. Washington, DC: pp. 51–7.

Damania, Richard, Per G. Fredriksson & John A. List. 2003. "Trade liberalization, corruption, and environmental policy formation: theory and evidence." *Journal of Environmental Economics and Management* 46(3):490 – 512.

De Boef, Suzanna & Luke Keele. 2008. "Taking Time Seriously." *American Journal of Political Science* 52(1):184–200.

Feyzioglu, Tarhan, Vinaya Swaroop & Min Zhu. 1998. "A Panel Data Analysis of the Fungibility of Foreign Aid." *The World Bank Economic Review* 12(1):29–58.

Fredriksson, Per G., Herman R.J. Vollebergh & Elbert Dijkgraaf. 2004. "Corruption and energy efficiency in OECD countries: theory and evidence." *Journal of Environmental Economics and Management* 47(2):207 – 231.

Friedrich, Robert J. 1982. "In Defense of Multiplicative Terms in Multiple Regression Equations." *American Journal of Political Science* 26(4):797–835.

Gupta, Kanhaya. 1993. Sectoral Fungibility of Foreign Aid in India. mimeo Edmonton, University of Alberta.

Halkos, George & Epameinondas . Paizanos. 2012. "The impact of government expenditure on the environment: An empirical investigation." *MPRA Paper No. 39957* .

Hicks, R.L., B.C. Parks, J.T. Roberts & M.J. Tierney. 2008. *Greening Aid?Understanding the Environmental Impact of Development Assistance: Understanding the Environmental Impact of Development Assistance*. OUP Oxford.

Hill, Marquita K. 2004. *Understanding Environmental Pollution: A Primer*. Cambridge University Press.

Hodler, Roland. 2007. "Rent seeking and aid effectiveness." *INTERNATIONAL TAX AND PUBLIC FINANCE* 14(5):525–541.

Inglehart, Ronald. 1995. "Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 Societies." *PS: Political Science and Politics* 28(1):57–72.

Kessler, J.J & M Van Dorp. 1998. "Structural Adjustment and the Environment: the Need for An Analytical Methodology." *Ecological Economics* 27(3):267 – 281.

Kiviet, Jan F. 1995. "On bias, inconsistency, and efficiency of various estimators in dynamic panel data models." *Journal of Econometrics* 68:53–78.

Knack, Stephen. 2001. "Aid Dependence and the Quality of Governance: Cross-Country Empirical Tests." *Southern Economic Journal* 68(2):310–329.

Kretschmer, Bettina, Michael H?ler & Peter Nunnenkamp. 2011. "Does Foreign Aid Reduce Energy and Carbon Intensities of Developing Economies?" *Journal of International Development* .

Krueger, Anne O. 1974. "Political Economy of Rent-seeking Society." *American Economoc Review* 64(3):291–303.

Leitao, Alexandra. 2010. "Corruption and the environmental Kuznets Curve: Empirical evidence for sulfur." *Ecological Economics* 69(11):2191 – 2201.

Li, Quan & Rafael Reuveny. 2006. "Democracy and Environmental Degradation." *International Studies Quarterly* 50(4):935–956.

Licht, Amanda A. 2010. "Coming into Money: The Impact of Foreign Aid on Leader Survival." *Journal of Conflict Resolution* 54(1):58–87.

Lim, Sijeong, Victor A. Menaldo & Aseem Prakash. 2012. "Economic Globalization, Foreign Aid, and Pollution." *SSRN Electronic Journal* .

Lopez, Ramon & Amparo Palacios. 2010. "Have Government Spending and Energy Tax Policies Contributed to make Europe Enviornmentally Cleaner?" *University of Maryland Working Papers 94795* .

Lopez, Ramon, Gregmar I. Galinato & Asif Islam. 2011. "Fiscal spending and the environment: Theory and empirics." *Journal of Environmental Economics and Management* 62(2):180 – 198.

Lopez, Ramon & Siddhartha Mitra. 2000. "Corruption, Pollution, and the Kuznets Environment Curve." *Journal of Environmental Economics and Management* 40(2):137 – 150.

Markandya, Anil, Alexander Golub & Suzette Pedroso-Galinato. 2006. "Empirical Analysis of National Income and SO2 Emissions in Selected European Countries." *Environmental and Resource Economics* 35:221–257.

Marshall, Monty G., Ted R. Gurr & Keith Jaggers. 2010. "Polity IV Project Dataset Users' Manual." *Severn, MD: Center for Systemic Peace* .

McGillivray, Mark & Oliver Morrissey. 2004. Fiscal Effects of Aid. In *Fiscal Policy for Development: Poverty, Reconstruction and Growth*, ed. Tont Addison & Alan Roe. Basingstoke, Hampshire, United Kingdom: pp. 72–96.

Morrison, Kevin M. 2009. "Oil, Nontax Revenue, and the Redistributional Foundations of Regime Stability." *International Organization* 63(1):107–138.

Morrissey, Oliver. 2004. "Conditionality and Aid Effectiveness Re-Evaluated." *World Economy* 27(2):153–171.

Munasinghe, M. & W. Cruz. 1995. "Economywide policies and the environment." *World Bank Environment Paper 10. The World Bank, Washington* .

Murphy, Kevin M., Andrei Shleifer & Robert W. Vishny. 1993. "Why is Rent-seeking so Costly to Growth." *American Economoc Review* 83(2):409–414.

Okada, Keisuke & Sovannroeun Samreth. 2012. "The effect of foreign aid on corruption: A quantile regression approach." *Economics Letters* 115(2):240 – 243.

Pack, Howard & Janet R. Pack. 1990. "Is Foreign Aid Fungible? The Case of Indonesia." *Economic Journal* 100:188–194.

Pettersson, Jan. 2007. "Foreign sectoral aid fungibility, growth and poverty reduction." *Journal of International Development* 19(8):1074–1098.

Rajan, R.G. & A. Subramanian. 1992. "Aid and the Dutch Disease: Macroeconomic Management When Everybody Loves You." *World Development* 20(11):1587–97.

Rajan, R.G. & A. Subramanian. 2005. "What Undermines Aid's Impact on Growth?" *IMF Working Paper 05/126* pp. 153–171.

Reed, David. 1996. *Structural Adjustment, the Environment and Sustainable Development*. London: Earthscan.

Remmer, Karen L. 2004. "Does Foreign Aid Promote the Expansion of Government?" *American Journal of Political Science* 48(1):77–92.

Ross, Michael L. 1999. "The Political Economy of the Resource Curse." *World Politics* 51(02):297–322.

Shandra, John M., Eric Shircliff & Bruce London. 2011. "The International Monetary Fund, World Bank, and structural adjustment: A cross-national analysis of forest loss." *Social Science Research* 40(1):210 – 225.

Stern, David I. 2005. "Global Sulfur Emissions from 1850 to 2000." *Chemosphere* 58:163–175.

Stern, David I. & Michael S. Common. 2001. "Is There an Environmental Kuznets Curve for Sulfur?" *Journal of Environmental Economics and Management* 41(2):162 – 178.

Svensson, Jakob. 2000. "Foreign aid and rent-seeking." *Journal of International Economics* 51(2):437 – 461.

Tavares, Jose. 2003. "Does foreign aid corrupt?" *Economics Letters* 79(1):99 – 106.

Torvik, Ragnar. 2002. "Natural resources, rent seeking and welfare." *Journal of Development Economics* 67(2):455 – 470.

Wright, Joseph & Matthew Winters. 2010. "The Politics of Effective Foreign Aid." *Annual Review of Political Science* 13(1):61–80.

Young, Carlos E.F. & Joshua Bishop. 1995. "Adjustment policies and the environment: a critical review of the literature." *CREED Working Paper Series No.1, IIED, London* .

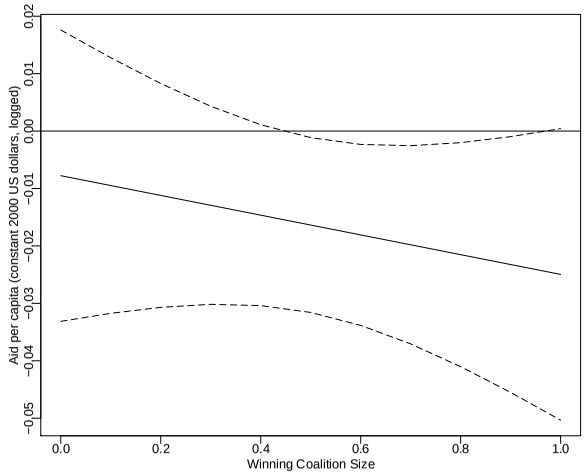
TABLE 1. Modeling foreign aid (aid per capita)'s environmental impacts: country and year fixed effects are estimated but not reported because of space limit.

	SO_2				PM-10				CO_2			
	Coef.	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)
Intercept	-1.157	0.589 (0.05)	-1.173	0.589 (0.05)	0.748	0.356 (0.04)	0.721	0.359 (0.04)	-0.186	0.135 (0.17)	-0.190	0.135 (0.16)
Lagged DV	0.824	0.009 (0.00)	0.824	0.009 (0.00)	0.723	0.016 (0.00)	0.723	0.016 (0.00)	0.827	0.009 (0.00)	0.827	0.009 (0.00)
GDP per cap	0.408	0.142 (0.00)	0.411	0.142 (0.00)	-0.106	0.092 (0.25)	-0.099	0.093 (0.29)	-0.083	0.033 (0.01)	-0.082	0.033 (0.01)
GDP per cap^2	-0.018	0.010 (0.08)	-0.018	0.010 (0.07)	0.009	0.007 (0.21)	0.008	0.007 (0.25)	0.013	0.002 (0.00)	0.013	0.002 (0.00)
Industry (% of GDP)	0.003	0.001 (0.01)	0.003	0.001 (0.01)	0.001	0.000 (0.26)	0.001	0.000 (0.26)	-0.000	0.000 (0.49)	-0.000	0.000 (0.52)
GDP growth	0.001	0.001 (0.46)	0.001	0.001 (0.44)	-0.001	0.000 (0.00)	-0.001	0.000 (0.00)	0.001	0.000 (0.00)	0.001	0.000 (0.00)
Population density	-0.106	0.082 (0.20)	-0.105	0.082 (0.20)	0.018	0.044 (0.69)	0.017	0.044 (0.69)	0.038	0.018 (0.04)	0.038	0.018 (0.04)
Urban pop. (% of total)	0.000	0.002 (0.97)	0.000	0.002 (0.97)	-0.002	0.001 (0.14)	-0.002	0.001 (0.13)	-0.001	0.000 (0.02)	-0.001	0.000 (0.02)
Trade openness	-0.030	0.025 (0.23)	-0.031	0.025 (0.21)	0.065	0.010 (0.00)	0.065	0.010 (0.00)	0.009	0.006 (0.10)	0.009	0.006 (0.11)
Aid per capita	-0.016	0.008 (0.04)	-0.008	0.014 (0.57)	-0.007	0.003 (0.04)	-0.003	0.007 (0.64)	-0.002	0.002 (0.28)	-0.000	0.003 (0.94)
W: winning coalition size	0.037	0.032 (0.24)	0.086	0.069 (0.21)	-0.003	0.015 (0.83)	0.014	0.034 (0.68)	0.019	0.007 (0.01)	0.029	0.016 (0.07)
Aid per capita × W			-0.017	0.022 (0.43)			-0.005	0.010 (0.57)			-0.004	0.005 (0.49)
Adjusted R^2		0.95		0.95		0.98		0.98		0.99		0.99
N. of obs./Countries		3018/127		3018/127		1772/132		1772/132		3671/141		3671/141
Time period		1961-2003		1961-2003		1991-2005		1991-2005		1961-2003		1961-2003

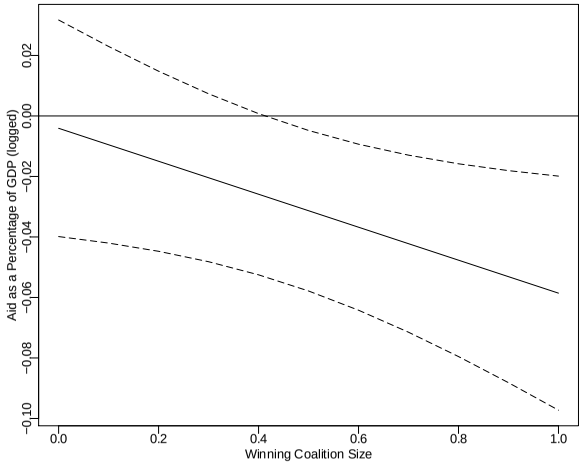
TABLE 2. Modeling foreign aid (aid per GDP)'s environmental impacts: country and year fixed effects are estimated but not reported because of space limit.

	SO_2				PM-10				CO_2			
	Coef.	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)	*Coef.*	$\hat{\sigma}$ ($p>\|t\|$)
Intercept	-0.951	0.601 (0.11)	-1.058	0.603 (0.08)	0.835	0.367 (0.02)	0.759	0.371 (0.04)	-0.152	0.138 (0.27)	-0.190	0.138 (0.17)
Lagged DV	0.824	0.009 (0.00)	0.823	0.009 (0.00)	0.723	0.016 (0.00)	0.722	0.016 (0.00)	0.826	0.009 (0.00)	0.825	0.009 (0.00)
GDP per cap	0.356	0.141 (0.01)	0.374	0.141 (0.01)	-0.140	0.092 (0.13)	-0.123	0.093 (0.19)	-0.091	0.033 (0.01)	-0.086	0.033 (0.01)
GDP per cap^2	-0.015	0.010 (0.12)	-0.017	0.010 (0.09)	0.011	0.007 (0.12)	0.009	0.007 (0.17)	0.013	0.002 (0.00)	0.012	0.002 (0.00)
Industry (% of GDP)	0.003	0.001 (0.02)	0.003	0.001 (0.01)	0.001	0.000 (0.24)	0.001	0.000 (0.23)	-0.000	0.000 (0.46)	-0.000	0.000 (0.63)
GDP growth	0.001	0.001 (0.42)	0.001	0.001 (0.38)	-0.001	0.000 (0.00)	-0.001	0.000 (0.00)	0.001	0.000 (0.00)	0.001	0.000 (0.00)
Population density	-0.111	0.082 (0.18)	-0.102	0.082 (0.22)	0.020	0.044 (0.65)	0.024	0.044 (0.59)	0.037	0.018 (0.04)	0.041	0.018 (0.03)
Urban pop. (% of total)	0.000	0.002 (0.97)	0.000	0.002 (0.95)	-0.002	0.001 (0.17)	-0.002	0.001 (0.12)	-0.001	0.000 (0.02)	-0.001	0.000 (0.02)
Trade openness	-0.025	0.025 (0.31)	-0.028	0.025 (0.26)	0.066	0.010 (0.00)	0.066	0.010 (0.00)	0.010	0.006 (0.07)	0.010	0.006 (0.09)
Aid per GDP	-0.029	0.014 (0.04)	-0.004	0.019 (0.83)	-0.009	0.006 (0.11)	-0.002	0.008 (0.82)	-0.005	0.003 (0.14)	0.004	0.004 (0.38)
W: winning coalition size	0.036	0.032 (0.25)	0.117	0.052 (0.02)	-0.002	0.015 (0.87)	0.028	0.028 (0.32)	0.019	0.007 (0.01)	0.048	0.012 (0.00)
Aid per GDP × W			-0.054	0.028 (0.05)			-0.015	0.012 (0.21)			-0.018	0.006 (0.00)
Adjusted R^2		0.96		0.96		0.99		0.99		0.99		0.99
N. of obs./Countries		3018/127		3018/127		1772/132		1772/132		3671/141		3671/141
Time period		1961-2003		1961-2003		1991-2005		1991-2005		1961-2003		1961-2003

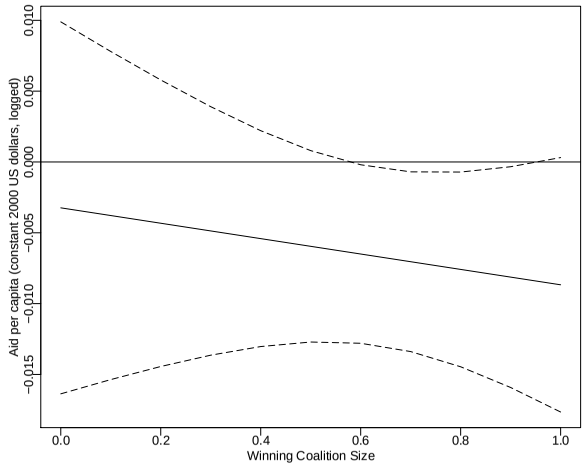
FIGURE 1. Conditional effects of winning coalition size on foreign aid's environmental impacts.



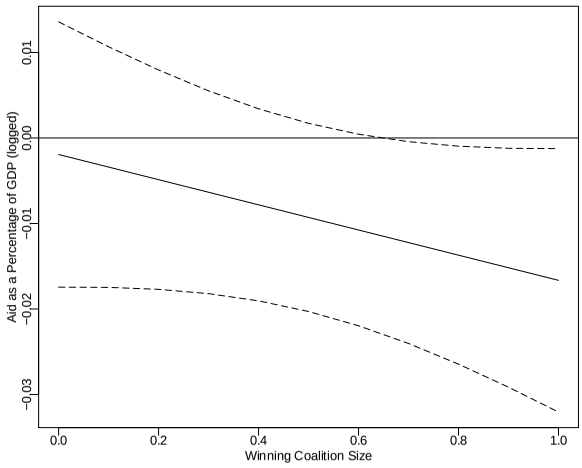
(a) SO_2: aid per capita.



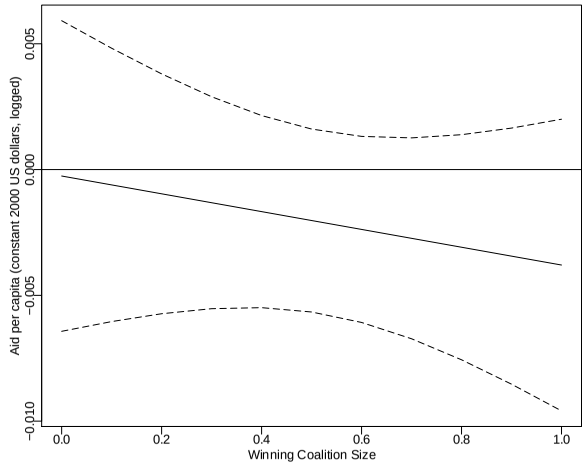
(b) SO_2: aid per GDP.



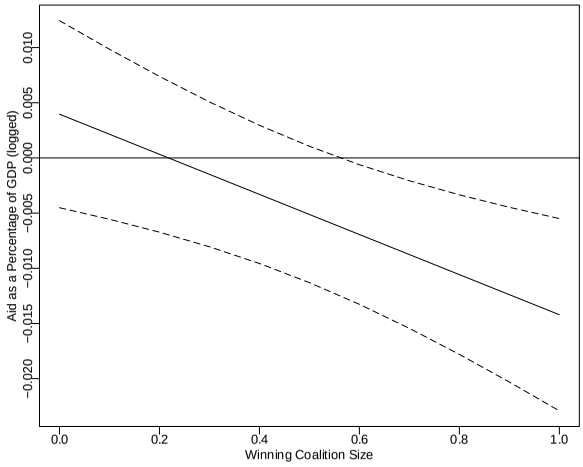
(c) PM-10: aid per capita.



(d) PM-10: aid per GDP.



(e) CO_2: aid per capita.



(f) CO_2: aid per GDP.