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Do Donors Allocate Infrastructure Aid

in Response to Recipient Needs?

인프라 원조와 수원국 필요 간의 관계에 대한 연구

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Abstract

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This study examines whether infrastructure aid responds to needs specific to the infrastructure sector. Since both supply and demand of infrastructure are related with growth, this study identifies needs in supply and demand. These include infrastructure quantity and quality, geographical concerns, and ethnic fractionalization at the supply side; and governance and macroeconomic stability at the demand side. Controlling for donor interests, infrastructure aid, by sector and donor, is regressed on the needs using the Tobit model.

The findings of this study show that while infrastructure aid, in general, was responsive to infrastructure quantity, ethnic fractionalization, and macroeconomic stability, it was less so in infrastructure quality, geographical considerations, and governance. When divided into specific sectors, the need responsiveness becomes substantially weaker, and aid is responsive to either none or the wrong side of needs. Analyzing differences in donors, this study supports previous research on disaggregate aid allocation that multilateral aid was not any more responsive to need, but in fact less so. Good performers with respect to need include Japan, Germany, Ireland, Korea, Luxembourg, Spain, Sweden, and the U.K., while France, Netherlands, Norway, Denmark, Greece, Italy, and Switzerland performed poorly.

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I.   Introduction

The beginning of development assistance for infrastructure dates back to the history of modern aid. In the post-World War era, development assistance was allocated to the reconstruction of physical infrastructure as a foremost of the efforts to recover from the legacy of the two world wars. Such assistance was provided largely in the forms of direct financing to state-owned enterprises (SOEs) in charge of infrastructure services in developing countries. As the world entered into Cold War, it was transformed into one of the tools to ensure the economic development of each bloc and continued until the end of the war in the late 1980s.

Since the mid-1980s, infrastructure aid has taken a form that is significantly different from its earlier forms. Skepticism arose concerning the effectiveness of the SOEs in providing infrastructure services in terms of efficiency and access. Governments were questioned with respect to their capacity to provide public services on their own due to their lack of adequate resources, ineffective resource allocation, and poor management (Pessoa, 2008). Accordingly, in the 1980s, led by Ronald Reagan and Margaret Thatcher, the U.S. and U.K. undertook radical reforms of the public services sector, including infrastructure, by privatizing the SOEs. This wave of privatization subsequently disseminated to developing countries, creating a rise in public-private partnerships (PPPs) for infrastructure development. As a result of both increased private participation as well as the potential for increased participation in the sector, recent aid has been aimed at facilitating private participation in infrastructure and ensuring that social and environmental goals are not neglected (Thomsen, 2005).

Historically, aid for the infrastructure sector has played a large role. Despite fluctuations, consistent levels of aid have been allocated to infrastructure development. More recently, aid towards the infrastructure sector has been

increasing (Figure 1). Not only is it increasing in volume, it is also increasing in its proportion of total aid (Figure 2). Adding these flows to those of emerging donors, such as China and India, who have put emphasis on infrastructure, the volume of infrastructure aid is considered to be substantial when compared with other sectors.

Figure 1. Total Aid Disbursements in Infrastructure by Sector (US$ million)
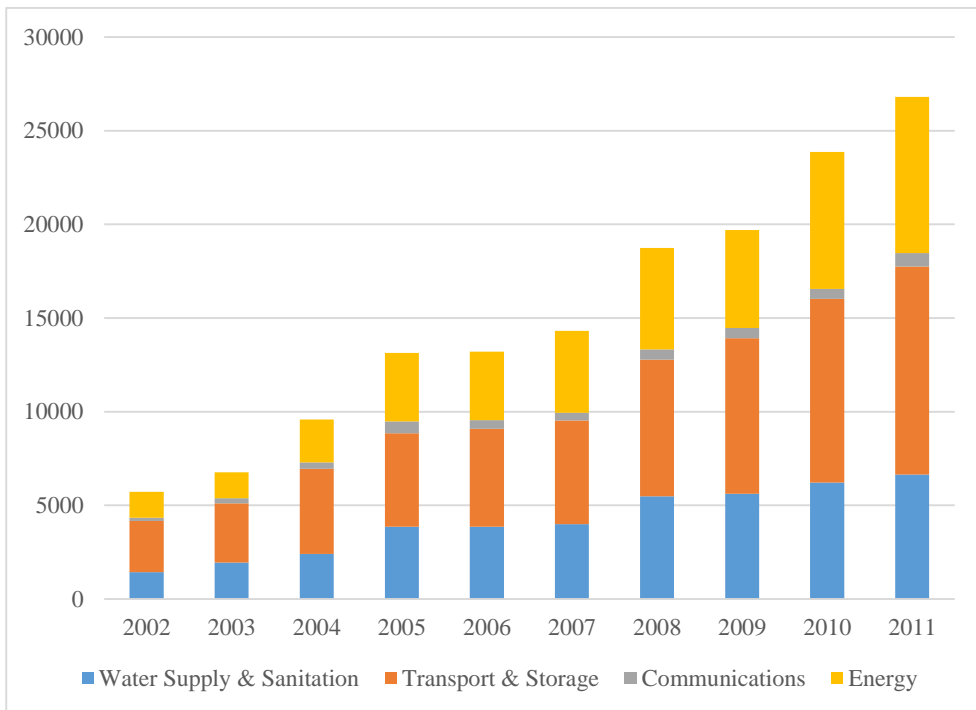
Figure 2. Proportion of Infrastructure Aid by Sector (percentage)
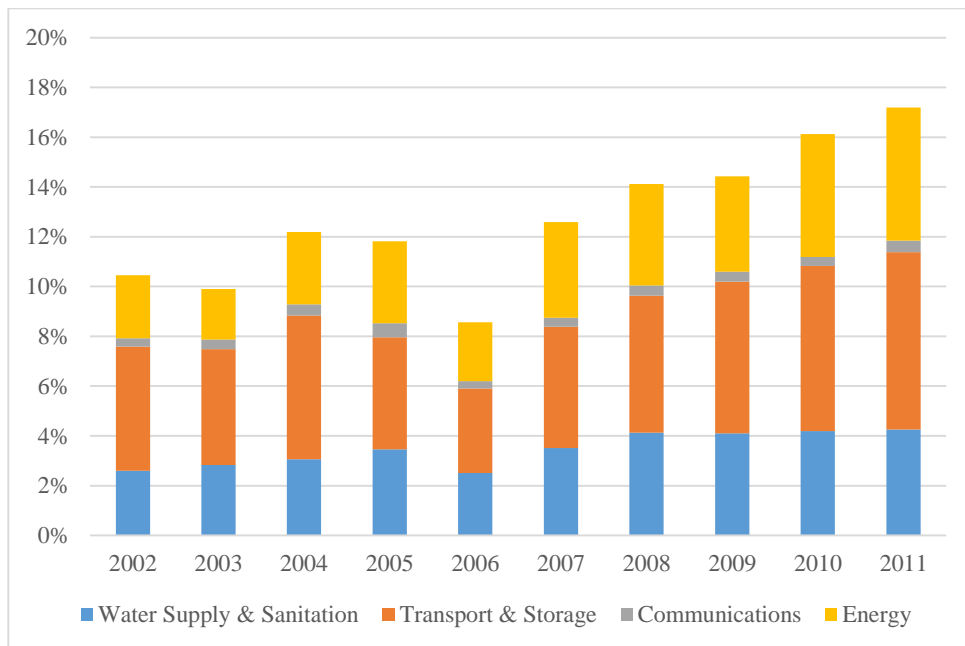
Meanwhile, across the world, private investment in infrastructure has been increasing (Figure 3). The neo-liberal wave created a burst of private investment in the 1990s. Reaching a peak in 1997, it started to decrease as a result of the Asian financial crises as the private sector lost confidence in producing investment returns in developing countries. However, it entered its second phase of proliferation since the mid-2000s, despite a slight drawback from the global financial crisis around the turn of the decade. With respect to regional distribution, Latin America and the Caribbean have traditionally been a popular destination of private capital. Investment in South Asia grew rapidly since the mid-2000s but decreased drastically in the last few years, while that in sub-Saharan Africa has recently started to grow at a rapid speed (Figure 4).

Figure 3. Trend of total private investment in infrastructure (US$ billion)
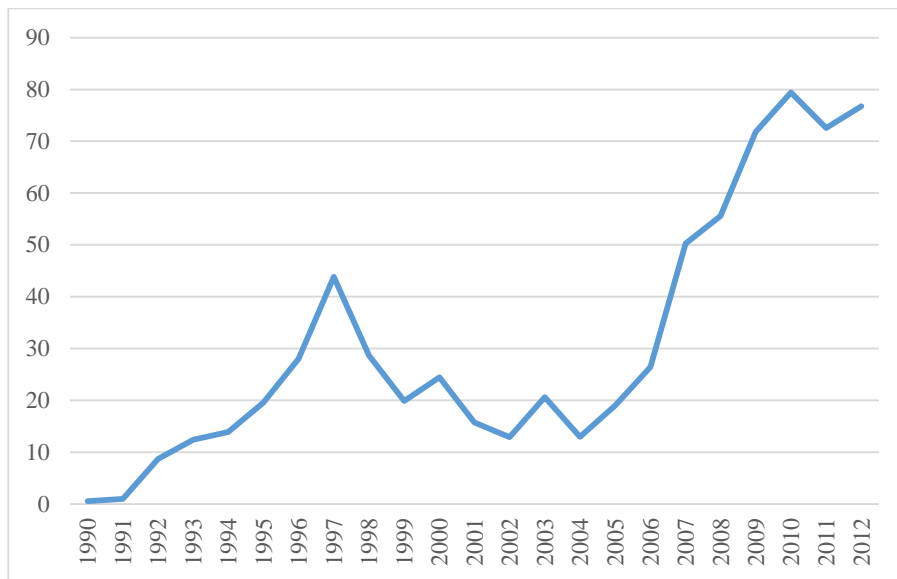
Figure 4. Private investment in infrastructure in developing countries by region (US$ billion)
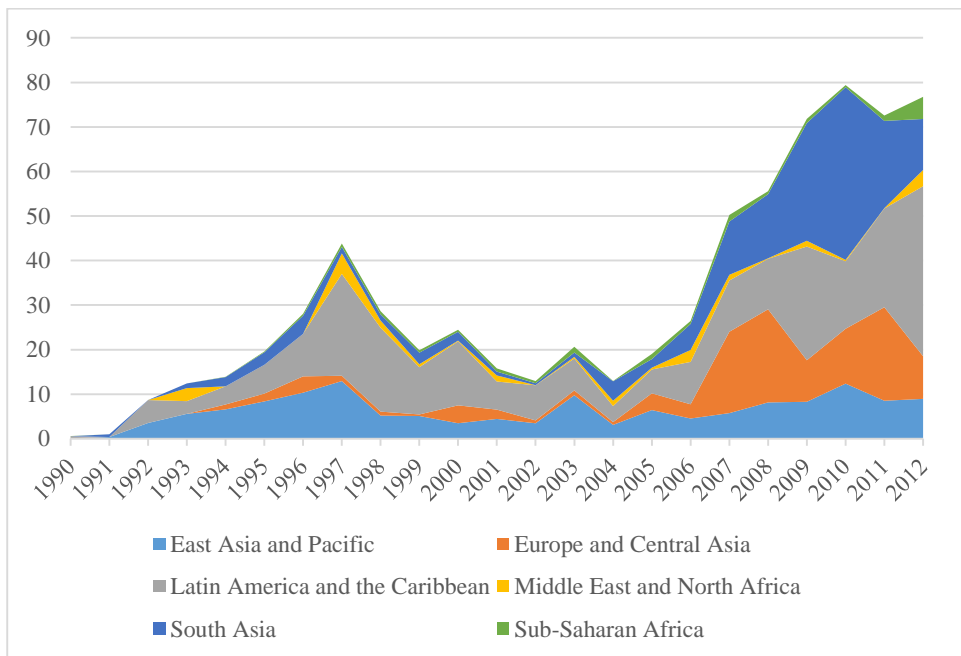
However, despite these increases in capital flow to infrastructure in developing countries, they are far from sufficient. Developing countries suffer from a huge 'infrastructure gap' – the gap between the supply and demand – which cannot be met by the current availability of finance. In this context, it is necessary to examine whether infrastructure aid is being distributed to the right places. This study aims to address the question and analyze whether infrastructure aid is being allocated according to recipient needs.

II.   Literature Review

i.   Definition of Infrastructure

Typically, infrastructure can be broadly or narrowly defined. According to Hirschman (1988), the "widest" definition could include "all public services from law and order through education and public health to transportation, communications, power and water supply as well as such agricultural overhead capital as irrigation and drainage systems." Narrowly defined, infrastructure excludes soft or 'social' infrastructure and refers to "the physical capital investments … traditionally provided by the public sector to private households and businesses" (Fox & Smith, 1990). This study adopts the narrow definition with the coverage of four sectors – energy, telecommunications, transport, and water – that are used by the World Bank to classify infrastructure and are large capital intensive natural monopolies that make "the most sense from an economics standpoint" .

ii. Infrastructure Aid

The rationale for aid in the infrastructure sector, at its most basics, has been that there is a positive relationship between infrastructure and growth. Early aid initiatives were based on the classic two-gap and three-gap models to make up for the shortfalls in capital and foreign exchange resources to launch infrastructure investment projects (Acharya, 2003; Addison & Anand, 2012). Recently, infrastructure aid is disbursed as one of the main channels of Aid for Trade in order to promote trade and, in turn, growth. It can "foster the ability of the private sector to take advantage of new trade opportunities, improve competitiveness of domestic products, and more generally enhance the role of private activity in promoting development" (Moreira, 2010).

Then, did infrastructure aid achieve what it claimed for in theory? Aid for infrastructure has been found to have yielded positive outcomes to recipient countries. Part of the current literature on infrastructure aid studies the link between infrastructure aid and economic indicators and the conditions under which the link works. Studies have found infrastructure aid to have a positive impact on economic growth (Acharya, 2003). Clemens, Radelet, and Bhavnani (2004) showed that infrastructure aid had a short-term positive impact on economic growth over a four-year period, regardless of differences in the recipient's level of income or the quality of institutions and policies. One channel of this link between infrastructure aid and growth was trade. Another channel was through the development of institutions (Jerve & Nissanke, 2008; Kato, Diaz, & Onga, 2010). In Asia, infrastructure aid contributed to institutional reform, human capital development, and capacity building (Arakawa & Wakabayashi, 2006). Additionally, infrastructure aid has produced positive results for specific sectors. Aid aimed at the water and sanitation sector positively impacted access to safe water, yet with disappointing results for

sanitation improvement (Botting et al., 2010).

These positive results are possible under certain conditions at both the recipient and donor sides. At the recipient side, lack of ownership was cited by donors in accounting for the ineffectiveness of infrastructure aid in developing countries (Acharya, 2003). Political will and commitment, manifested in national long-term development plans, of the recipient were necessary for ensuring sustainability of infrastructure services (Jerve & Nissanke, 2008). Domestic participation or consultation is necessary for exercising ownership (Garnett, Nayyar-Stone, & Polen, 2009) and stirring a "learning-by-doing" process which results in capacity building (Acharya, 2003). There should be active involvement of local companies, and the government should ensure transparency and media exposure of major infrastructure projects (Jerve & Nissanke, 2008).

The impact of aid is dependent on economic and social conditions of recipients as well. Infrastructure aid had positive welfare effects unless the productivity of public infrastructure expenditure is very low, in circumstances where the public infrastructure investment is already very close to its optimum and the learning-by-doing externality is high (Adam & Bevan, 2006). In addition, infrastructure aid should target the export sector that uses the recipient's abundant factor in order to have a positive effect on the domestic wage rate (Choi, 2005). Moreover, the impact on growth was dependent on the level of social development, such as longer life expectancies (Clemens et al., 2004).

On the other hand, donors should implement infrastructure aid in certain ways. Since excessive fragmentation of aid at the sector level impairs aid effectiveness, division of labor among donors is necessary to reduce transaction costs (Miyamoto & Muzenda, 2012). Donors should not only be focused on funding new infrastructure projects but also integrating operations and maintenance into the development agenda (Jerve & Nissanke, 2008; Rioja, 2003). Concerning mutual accountability,

there is a danger that donors can have more leverage over countries that are highly dependent on them (Garnett et al., 2009).

The most complicated of the conditions are governance and institutions. The discussion is based on the wider debate on conditionality at the aggregate level. A well-known study by Burnside and Dollar (2000) argued that aid has a positive impact only on countries that have good policies, which are related to fiscal surplus, inflation, and trade openness. Likewise, in the infrastructure sector, many studies have found governance to be important for aid effectiveness. Clemens et al. (2004) found that the impact of infrastructure aid on growth was larger in the presence of stronger institutions. In this context, J. C. Berthélemy (2006) claimed that governance is an issue of aid efficiency, and thus aid should be given to recipients where it can have an impact.

Analyses of the effectiveness of infrastructure aid according to the Paris Declaration maintained that governance was highly important in abiding by its principles. Welle, Tucker, Evans, and Owusu (2008) concluded that the governance environment – which includes political commitment, strong financial structure, and effective institutions – was more important in its influence than the characteristics of sectors, covering water and sanitation, health, and education. Specifically, ownership required capacity, not only at the planning stage but also throughout implementation (Garnett et al., 2009). While alignment was necessary for the sustainability of infrastructure services (Jerve & Nissanke, 2008), governments required substantial capacity in country systems with respect to project management, procurement, financial management as well as environmental and social safeguards (Garnett et al., 2009; Welle et al., 2008), and donors needed long-term commitment to recipients' development plans (Jerve & Nissanke, 2008). In managing for results, governments lacked procurement, public financial management, and public administration capacities and needed to link the project- or program-level results-oriented

framework to the sectoral and national level ones (Garnett et al., 2009).

However, the relationship between institutions and aid effectiveness is like the chicken and egg problem. Scholars that studied the institutional spillover effects of infrastructure aid argued that it works the other way around. Aid strengthens the institution, and thus aid should be provided to countries that initially do not meet donor standards in terms of capacity or governance (Jerve & Nissanke, 2008; Kato et al., 2010). Provided that long-term commitments can be made, infrastructure aid contributed to economic development through strengthening or transforming institutions. In this context, Jerve and Nissanke (2008) suggested that donors "reduce the emphasis on both ex-ante and ex post policy conditionality" and "stimulate 'endogenously driven' process of development of local institutions and capacity". Furthermore, Bermeo (2008) introduced the idea that governance could be perceived as both capacity and need, depending on the types and channels of aid.

Meanwhile, due to the enormous infrastructure gap and the insufficiency of aid and public finances alone to bridge it (Addison & Anand, 2012), the focus of infrastructure aid has shifted towards facilitating other sources of financing, particularly private investment.[1] Since the 1980s, private companies, both local and multinational, have been increasing its presence in the infrastructure sector in varying degrees of participation. Around half of the current literature on infrastructure aid discuss the role of aid in attracting private investment (Addison & Anand, 2012; Basílio, 2010; Byiers & Rosengren, 2012; Feig & Finlayson, 2008; Heinrich, 2013; IFC, 2010; Kindornay, Higgins, & Olender, 2013; Mills, 2008; Miyamoto & Muzenda, 2012; OECD & WTO, 2011; Pessoa, 2008; Thomsen, 2005).

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[1] As the aid environment in general, new players are jumping into the infrastructure sector – which includes non-traditional donors, private companies, global funds, among others. There exists substantial literature discussing the rise of emerging donors, particularly China's engagement in African infrastructure (see Fletcher, 2010). Addison and Anand (2012) considers these untapped sources of infrastructure finance and proposes that aid should concentrate on leveraging the potential sources. This study only considers private investment.

Aid is provided to help fix market imperfections – the lack of developing countries' capacities to provide an adequate environment for private participation and the existence of a gap between a positive social rate of return and a negative private one (Byiers & Rosengren, 2012; Thomsen, 2005). In order to do so, aid subsidizes the private enterprises in effect (Pessoa, 2008).

Bilateral and multilateral donors been expressive in their support for private investment in the sector. Some donors, such as Austria, Belgium, Luxembourg, Italy, and Korea, explicitly acknowledge the need to mobilize private investment in Africa's infrastructure to compensate for the limited official aid flows. In case of Africa, indisputably the neediest region in the world, the two largest bilateral aid agencies, DFID and USAID, have recently turned towards encouraging private participation. The former has shown a trend not to fund new capital projects but rather PPP schemes by creating an enabling environment for the management and maintenance of existing projects, while the latter has mostly provided technical assistance with PPPs and privatization programmes. Moreover, the G20 Multi-Year Action Plan on Development emphasized the need for multilateral development banks (MDBs) to catalyze the flow of private capital to developing countries through mechanisms such as guarantees (Miyamoto & Muzenda, 2012).

In order to attract private investors, infrastructure aid should be aimed at creating the 'enabling environment'. This is composed of certain legal, regulatory, political, and economic conditions that encourage private investment in infrastructure. The enabling legal and regulatory environment is composed of predictable judicial systems, clearly defined land tenure and property rights, and clear regulatory requirements and procedures. The political environment necessitates political commitment and consensus at all levels (local, national, and regional), political stability, and ability to make decisions free from undue political interference, crime and corruption. Lastly, the enabling economic and commercial environment

consists of the economy's prospects for growth, general business practices, presence of local infrastructure developers, and development of local capital markets at the national level; and global industry changes and global financial crises at the international level. Furthermore, private investment requires capacities for project identification and development, comprehensive plans for implementation, adequate procurement policies, contract design, financial systems, and monitoring (Byiers & Rosengren, 2012; Feig & Finlayson, 2008; Mills, 2008).

Unlike traditional infrastructure projects, commercial viability needs to be ensured in infrastructure projects invested by the private sector. One of the major causes of a project failure was the selection of projects that had limited bankability or commercial viability (Byiers & Rosengren, 2012; Mills, 2008). It is necessary to allocate risks, ensure rate of return, and impose viable tariff levels (Feig & Finlayson, 2008; Mills, 2008). In the case of NEPAD, lower tariffs charged on services under political pressure discouraged private participation (Mills, 2008). Limited buy-in by local authorities also reduced commercial viability of the project (Feig & Finlayson, 2008).

Institutions are emphasized for this different focus of aid as well. Acharya (2003) proposes that aid can make a visible impact by capacity building of not only the public sector but also the private sector. Furthermore, supporting the enabling environment is challenged by governance issues such as political instability, weak public administration, unreliable legal frameworks, and corruption (Miyamoto & Muzenda, 2012).

In the meantime, large-scale infrastructure projects, as opposed to small-scale projects, demand significantly more partner country capacity (Garnett et al., 2009). Urban areas require larger infrastructure projects, and thus they require particular attention with regard to alignment (Welle et al., 2008). Moreover, large infrastructure projects are more visible and exposed to political interferences, raising the risk of

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regulatory changes that could influence the operations and revenues of the project (Miyamoto & Muzenda, 2012). Based on the experiences of the Asian Development Bank with PPP assistance as well, in larger recipient countries with significant PPP potential, extensive support for establishing adequate legal, regulatory, and institutional frameworks is required (Feig & Finlayson, 2008).

Previous literature referred to differences between sectors. Different sectors produce different cost recovery characteristics, and this strongly influences the levels of interest from foreign lenders as well as private investors. Sectors, such as road and bridge, that promise low returns are likely to be heavily funded through gift aid because it discourages poor country governments from taking standard repayable loans, and the fungibility of aid is limited by the technical demands of infrastructure projects (Fletcher, 2010). For attracting private participation, some sectors, such as power and telecommunications, were more conducive than others, such as transport and water, due to the capital-intensive nature, higher commercial viability, and better institutions of the sectors (Byiers & Rosengren, 2012; Feig & Finlayson, 2008; Mills, 2008; Pessoa, 2008). This is reflected in the fact that about 95 percent of foreign investment, by dollar value, across the world has been devoted to the first two sectors. Taking the urban-rural divide into account, urban ICT networks and storage, in contrast with projects in non-tolled roads, water and sanitation, or rural electrification are more popular for private investors (Miyamoto & Muzenda, 2012).

The water and sanitation sector found it the most difficult in attracting private investment (Miyamoto & Muzenda, 2012). Water was more sensitive to lack of political will or opposition to private participation. This could be due to the hybrid nature of the sector, with characteristics of both social and economic infrastructure (Welle et al., 2008). During the Asian financial crisis, private investment in the power, ports, and telecommunications sectors were more heavily influenced (Feig & Finlayson, 2008; Thomsen, 2005). However, others dismissed these sectoral

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differences as minor to those in governance (Acharya, 2003; Botting et al., 2010).

To summarize, infrastructure aid contributes to growth and facilitates private participation under certain conditions and good governance. Its impact on growth through trade and institutional development increases as recipients exercise ownership, political will, participation, low public infrastructure investment, and high level of social development; and donors abide by the division of labor and consider maintenance. On the other hand, recent aid, both bilateral and multilateral, has shifted its focus towards facilitating private investment. In order to effectively do so, infrastructure aid should support the enabling environment, ensure the commercial viability of projects, and be conditioned on governance. While transport and water sectors are more likely to be heavily funded by grant aid, the power and telecommunications sectors are more conducive to private investment. In conclusion, substantial research has been made to figure out the right way to implement infrastructure aid; however, no study has yet to give a detailed analysis of the allocation of infrastructure aid. For aid as a whole, nevertheless, this analysis has been made in great volume and detail.

iii. Aid Allocation

There is abundant, mostly quantitative, literature on the allocation of aggregate aid. Earlier studies adopted the dichotomy of determinants between recipient need and donor interest, which was first outlined by McKinlay and Little (1977). Further studies added governance and human rights to the discussion. Recipient need is originally based on the traditional two-gap or three-gap model of foreign aid, where aid is provided as a compensation for shortfalls in domestic resources (Maizels & Nissanke, 1984). The most straightforward indicator of beneficiary needs is income

per capita (J.-C. Berthélemy & Tichit, 2004). In some studies, it was considered sufficient to be the only indicator to account for recipient needs (Neumayer, 2003b). It has had a generally negative relationship with aid allocation, i.e., more aid is distributed to countries with lower income per capita (Bandyopadhyay & Wall, 2007; J.-C. Berthélemy & Tichit, 2004; Wall, 1995).

On the contrary, aid based on donor interests has prioritized political and strategic considerations and economic interests. Concerning strategic political interests, colonial history, political alliances, and geographical differences have been found to be significant. The political component in this category relates to "maintaining, or expanding, a sphere of interest" (Maizels & Nissanke, 1984). There was general agreement over the significance of colonial history – aid "favors former colonies partly due to political interest in maintaining their influence on those countries" (Alesina & Dollar, 2000; Neumayer, 2003c). UN voting patterns, which reflect political alliances, mattered for friends of Japan, but not those of the U.S. (Alesina & Dollar, 2000). Geographical differences showed a negative relationship with aid for donors that wanted to promote a regional sphere of influence (Neumayer, 2003b). Furthermore, donors pursue their economic interests by favoring their trading partners. All the big donors sought to promote their exports through aid (Neumayer, 2003b). J.-C. Berthélemy and Tichit (2004) also found trade linkages to grow in impact over time.

Governance includes the political environment as well as economic and social policies. Concerning the political environment, government institutions, corruption, conflict, and democracy have been found to be relevant. Government institutions or government effectiveness have been found to attract aid (Alesina & Dollar, 2000; Bandyopadhyay & Wall, 2007; J.-C. Berthélemy & Tichit, 2004; Dollar & Levin, 2006). According to (Neumayer, 2003c), levels of perceived corruption did not play any role in aid allocation. However, Alesina and Weder (1999) found that while there

was no evidence that less corrupt governments received more foreign aid, more corrupt governments did receive more foreign aid. Internal conflict increased aid, while interstate conflict reduced aid (J. C. Berthélemy, 2006). In case of socio-political instability, aid allocation depended on the type of instability, characteristics of recipient countries, and whether the aid was bilateral or multilateral (Chauvet, 2003). Many authors found democracy to be crucial in determining aid. J.-C. Berthélemy and Tichit (2004) stated that "the best way to attract bilateral assistance is to go democratic", particularly in the case of American and Australian assistance.

Good economic and social policies were found to be positive determinants of aid. Larger FDI flows were found to attract bilateral aid in one study (J.-C. Berthélemy & Tichit, 2004), while another found no mutual dependence between private flows and bilateral aid (Alesina & Dollar, 2000). Trade openness showed a moderate association with aid, but no strong tendency (Alesina & Dollar, 2000). Social policies, reflected in indicators such as primary school enrollment and infant mortality rates, have been found to be considered in the allocation of aid. J.-C. Berthélemy and Tichit (2004) found gross primary school enrollment to be positively related with aid. While infant mortality rates showed a negative relationship with aid (J.-C. Berthélemy & Tichit, 2004), changes in infant mortality were found to be both positively (Bandyopadhyay & Wall, 2007) and negatively (Trumbull & Wall, 1994) related.

The literature on the importance of human rights is mixed. Neumayer, in three consecutive studies (Neumayer, 2003a, 2003b, 2003c) analyzed the relationship between human rights and aid. The respect for civil and political rights and personal integrity rights differed among donors, particularly between multilateral and bilateral donors. On the other hand, Bandyopadhyay and Wall (2007) found that political rights had a positive relationship with aid.

Discussion on the allocation of disaggregated aid is scarce and of comparatively

recent descent. Clemens et al. (2004) pointed out the significance of analyzing disaggregated aid by finding a positive relationship between "short-impact" aid and economic growth. Several studies have emerged since to analyze the allocation of disaggregate aid. All of these studies analyze aid toward each of a number of sectors against certain indicators of need and other determinants (Akramov, 2006; Bermeo, 2008; Hidefumi, 2008; Nielsen, 2010; Thiele, Nunnenkamp, & Dreher, 2007).

Analyses of disaggregated aid improved insight into the determinants of aid. Nielsen (2010) proposed a new relationship between recipient needs and donor interests – one in which they are not "mutually exclusive". The study showed that donors are most responsive to needs in the countries that are the most important to them. In addition, governance could be perceived as both a capacity and a need. If the role of the recipient government in providing aid in a sector is higher, its importance as a capacity, relative to that as a need, increases. In the case of the infrastructure sector, since the role of the government is high, governance is considered as a capacity and positively related with infrastructure aid (Bermeo, 2008).

The relationship between infrastructure aid and governance was mixed. Hidefumi (2008) found that low governance, measured by the quality of public service and bureaucracy, and corruption impede efficient inter-sectoral allocation in recipient countries. Governance, measured by law and order and economic openness, was positively related with both bilateral aid (law and order) and multilateral aid (law and order and openness) towards economic infrastructure, which is a different cluster excluding water and sanitation and including business and financial sectors. However, when donor interests were controlled for, the relationship became insignificant, and donors responded to governance differently across sectors (Bermeo, 2008). Moreover, in another study focused on governance, there was no significant difference in per capita aid to economic infrastructure between countries

grouped according to levels of governance (Akramov, 2006).

Another contribution of disaggregation is showing that, while the literature on aggregate aid allocation accounted for recipient needs primarily and solely by income, adopting a different measurement of needs brings a different interpretation concerning need responsiveness. Nielsen (2010) points out that the income level, represented by the GDP, is not a good measure of recipient need because: (1) it can capture variation in all kinds of things; (2) it does not fully capture variation in recipient need; and (3) developing countries with similar levels of GDP may also have very different development needs. Needs when assessed by the indicators of the Millennium Development Goals (MDGs) were met by aid in the corresponding sectors (Nielsen, 2010; Thiele et al., 2007). However, when need was measured according to national development priorities, Hidefumi (2008) found no evidence that inter-sectoral allocation reflects need and figured it could explain why it is difficult to find the positive effect of aid on growth. Meanwhile, Bermeo (2008) found that donor interests were not important determinants of aid, except for military assistance and immigration in the case of bilateral aid and colonial history and immigration in the case of multilateral aid.

Different sectors showed different responsiveness to needs. While the energy sector responded to needs in energy, the communications sector was found to be more responsive to military alliances (Nielsen, 2010). Access to improved sanitation was positively related to aid in the water supply and sanitation sector, while access to improved water was positively related to aid in the basic drinking water sector (Thiele et al., 2007). In the meantime, lack of coordination caused misallocation across sectors (Hidefumi, 2008).

Donors differ in their motivations for aid; however, the results of aggregate and disaggregate aid allocation were incongruent as to how the differences occurred. Many studies of aggregate aid allocation emphasize the difference between the

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multilateral and bilateral donors. Maizels and Nissanke (1984) concluded that multilateral aid responded more to recipient interests, while bilateral aid was motivated by donor interests. In his study of the role of human rights in aid allocation, (Neumayer (2003a), 2003b), 2003c)) found that while multilateral agencies awarded human rights with higher aid receipts, bilateral donors showed less or no respect for human rights. Moreover, political instability discouraged bilateral aid, but not multilateral aid (Chauvet, 2003). However, disaggregating aid, multilateral donors were found to be no more need oriented than bilateral donors, except in the road sector (Nielsen, 2010). In 2010, while multilateral donors and EU institutions disbursed significantly more than the bilateral countries, the difference was mostly in energy and transport. In fact, the bilateral donors collectively disbursed more for water & sanitation than the multilaterals (Miyamoto & Muzenda, 2012).

Among bilateral donors, there are variances, which again differed between aggregate and disaggregate studies. Regarding donor interest, large donors, expect for Japan, were not interested allocating more assistance to trading partners, while smaller donors, such as Australia, Austria, New Zealand, and with less significance, Belgium, Denmark, Finland, and Italy, target trading partners with geographical specialization (J.-C. Berthélemy & Tichit, 2004). In his later study, J. C. Berthélemy (2006) classified donors into three categories based on the trade intensity parameter: (1) the "altruistic" cluster, including Austria, Denmark, Ireland, Netherlands, New Zealand, Norway, and Switzerland; (2) the "moderately egoistic" cluster, including Belgium, Canada, Finland, Germany, Japan, United Kingdom, and U.S.; and (3) the "egoistic" cluster, which includes Australia, France, and Italy. However, after disaggregation, France, Norway, and the U.K. were found to allocate aid based more on need than Japan, Denmark, Sweden, the U.S. and IDA (Thiele et al., 2007). Nielsen (2010) reaffirmed these results by concluding that Scandinavian donors were no better than other bilateral donors. In the energy sector, Japan was responsive to

need. Overall, donors that were designated as 'self-interested' were as responsive to recipient need as donors that were thought to be 'humanitarians'.

The analysis of economic policy variables, FDI and lagged growth, showed mixed results, particularly with the U.S. showing negative correlation, suggesting that American assistance has been allocated based on political or democratic rather than economic performances (J.-C. Berthélemy & Tichit, 2004). In an aggregate study, although most donors supported democracy in their aid allocation, some donors, such as the U.S. and Australia, valued democracy more than others, while others, such as France and Belgium responded negatively or without significance (J.-C. Berthélemy & Tichit, 2004). A disaggregate study overturned these results. U.K. and Denmark were found to favor democracy, while France, Sweden, the U.S. and the International Development Association (IDA) of the World Bank did not (Thiele et al., 2007).

In summary, while aggregate aid is allocated according to recipient needs, donor interests, governance, and human rights, the newly added literature on disaggregated aid allocation augments understanding of the relationship and concepts of these determinants as well as need measurement. There are differences between bilateral and multilateral donors as well as among donors; however, they vary in analyses of aggregate and disaggregate aid. As reviewed, in the current literature, no attempt has been made to give a sector-specific analysis of aid allocation. In particular, no in-depth analysis of aid allocation in the infrastructure sector has been made. Therefore, this study gives a sector-specific analysis of the allocation of infrastructure aid by means of adopting a more precise measure of infrastructure need and taking the geographical characteristics and private participation into consideration.

III. Theoretical Background

While an analysis of disaggregate aid allows for a more detailed indicator of recipient needs, a sector-specific analysis of the infrastructure sector should take into account the unique characteristics of the sector. To assess the responsiveness of infrastructure aid to needs, previous studies adopted only the level of infrastructure stock as an indicator of recipient need. However, infrastructure stock by itself is insufficient in addressing recipient needs when considering the relationship between infrastructure and growth. In explaining the relationship, Jerve and Nissanke (2008) refers to both the demand and the supply of infrastructure:

> "Indeed, there has long been a universal agreement that infrastructure stock per capita is closely correlated with GDP per capita (Mundial, 1994). Hence, as a country's economy grows the amount of infrastructure increases. This is, however, a two-way process in that growth itself creates demands for infrastructure and, the other way round, investments in infrastructure are viewed as essential to foster growth – i.e. to remove bottlenecks."

In other words, tackling either the supply or demand of infrastructure increases infrastructure, which accompanies increased growth. A supply based thinking finances the state in its infrastructure investment. On the other hand, raising infrastructure demands increases infrastructure investment based on market supply mechanisms. Mundial (1994) "identifies the need for changing the incentives in the provision of infrastructure services by strengthening the demand side".

A concentration solely on either supply or demand has had drawbacks. Infrastructure aid since the end of the World War II until the 1980s was largely supply

driven. It decreased in volume in the 1980s mostly due to the ineffective and inefficient state management of infrastructure: "inefficient operations, inadequate maintenance, fiscal drain, unresponsiveness to user demands, neglect of the poor, and neglect of the environment". In the 1980s, the donor community shifted to a demand driven approach encouraging private participation in infrastructure. However, it was soon followed by a disillusionment with private involvement as it could not overcome the gap between private and social returns in utility services for the poor. Private investment fell sharply in the aftermath of the Asian financial crises in 1997 until the mid-2000s.

Therefore, in order for infrastructure aid to be responsive to the recipient needs in the sector, it should address the needs in both the supply and demand of infrastructure. Since infrastructure should be supported at both sides to promote growth, a measurement of needs should also include both dimensions. Recipient needs can be defined as shortfalls in domestic resources (Maizels & Nissanke, 1984). In this sense, the level of infrastructure stock used in former studies offers only a partial view into the need for infrastructure supply. In order to account for supply needs, infrastructure quality, geographical considerations, and ethnic fractionalization are included. For demand needs, governance, investment climate, and macroeconomic stability are considered. Infrastructure aid is then further divided into sector-level and donor-level to find differences among sectors and relative similarities among donors. Each section summarizes with the relevant hypotheses assuming that infrastructure aid responds to the needs.

i. Needs for Infrastructure Supply

In order to account for needs in infrastructure supply, not only infrastructure quantity but also infrastructure quality should be considered. The inclusion of the latter is a common tendency of the literature on infrastructure in providing an accurate measurement of infrastructure Calderón and Chong (2004) .The quality of infrastructure is one of the most pervasive binding constraints to export growth, productivity increases, and increases in national incomes (OECD & WTO, 2011). Moreover, infrastructure quality reflects how well infrastructure is being maintained and managed. Maintenance was cited by many as important (Acharya, 2003; Jerve & Nissanke, 2008) in creating a positive impact for infrastructure aid. Rioja (2003) found that donors' funding of new infrastructure projects decreases maintenance and reduces the quality of existing infrastructure.

Even if countries have the same infrastructure stock and quality, their needs for investment may differ due to the geographical nature of infrastructure. Transport costs depends on the countries' levels of infrastructure as well as their geography (Venables & Limao, 1999). Geographical disadvantages limit the level and scope of production and trade and inhibit economies of scale, productivity, and efficiency (Jerve & Nissanke, 2008). Lower population density hampers cost recovery and discourages supplying services to poorer and more remote communities. Furthermore, land-locked countries have higher needs of infrastructure services than coastal countries (Estache, 2006). In order to respond to need, more infrastructure aid can be provided to countries that have low population density and are land-locked.

Moreover, ethnically divided countries have a larger need for infrastructure or public goods and services. This is because of the necessity to respond to different individual preferences, which prevent the pooling of resources for common public projects (Alesina, Baqir, & Easterly, 1999; Hammami, Ruhashyankiko, & Yehoue,

2006). To sum up, in order to respond to supply needs, infrastructure aid should consider infrastructure quantity and quality, land-lockedness, population density, and ethnic fractionalization.

H1: Infrastructure aid is negatively related with infrastructure quantity and quality.

H2: Infrastructure aid is negatively related with population density and positively related with land-lockedness.

H3: Infrastructure aid is positively related with ethnic fractionalization.

ii.   Needs for Infrastructure Demand

Demand for infrastructure is supported so that it induces supply, often of other sources of financing, of which the private sector is the focus of this study, according to market rules. Demand for infrastructure rises under certain governance and economic conditions. In case of governance, private investment in infrastructure requires the right legal and regulatory frameworks (Abdel Aziz, 2007; Alfen et al., 2009; Farquharson, de Mästle, & Yescombe, 2011; Garvin & Bosso, 2008; Hammami et al., 2006; Kwak, Chih, & Ibbs, 2009; Vanoyan, 2011; Zhang, 2005a). Due to the long-term nature of projects, extensive support for establishing adequate legal and regulatory frameworks is required (Feig & Finlayson, 2008). Moreover, since PPP is a legally binding contract, there is a need for legal and regulatory frameworks to make it enforceable and defend the public and private parties' interests (Byiers & Rosengren, 2012; De Vito, 2008; Pessoa, 2008). These frameworks include: well defined land tenure and property rights, clear regulatory requirements and procedures, and systems to establish legal relations between

governments and the private sector, all of which are at times realized through the drafting of 'PPP laws' (Byiers & Rosengren, 2012).

However, developing countries lack these frameworks since regulators in developing countries lack resources, make regulatory decisions that are repeatedly interfered by politics, experience difficulty in attracting and retaining competent staff, and have short or no history of performing regulatory functions. These phenomena are particularly apparent in countries that are afflicted by conflict or have a political environment that makes it difficult to set up any kind of independent institution (Thomsen, 2005). In this context, Jerve and Nissanke (2008) argued that infrastructure aid should not only mobilize financial resources but also transfer "intangible assets" for "policy and organizational capacity for operating and maintaining services."

While it is true that robust legal and regulatory frameworks are necessary to successfully manage infrastructure projects and attract private investment, due to the central role of the government in the infrastructure sector, it should be perceived more as a capacity rather than a need (Bermeo, 2008). From planning to implementation and managing for results, infrastructure projects require a high level of capacity at the recipient government. The large size and long duration of the projects themselves as well as private participation demand substantial capacity in country systems. In the planning stage of PPPs, governments should identify and develop viable projects, negotiate contracts, and conduct feasibility studies (Byiers & Rosengren, 2012; Feig & Finlayson, 2008; Kwak et al., 2009; Zhang, 2005a).

Effective procurement systems are emphasized both for aid effectiveness and selection of an appropriate private concessionaire (Alfen et al., 2009; Feig & Finlayson, 2008; Garnett et al., 2009; Kwak et al., 2009; Zhang, 2005b). Moreover, the size and duration require administrative and institutional capacity in country systems with respect to project management and implementation and overall public

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financial management (Feig & Finlayson, 2008; Garnett et al., 2009; Thomsen, 2005). Managing environmental and social impacts also pose challenges to government systems with regard to aid effectiveness and PPPs (Feig & Finlayson, 2008; Garnett et al., 2009). Experience with PPP assistance by the Asian Development Bank showed that lack of capacity hindered the successful repeat transactions of successful pilots (Feig & Finlayson, 2008). All in all, if governance is not perceived as a capacity, aid would respond to need but have little impact.

On the other hand, infrastructure demand is determined by levels of economic activity (Mills, 2008). Demand risk imposed one of the biggest challenges to private participation in infrastructure. The private sector's in infrastructure is dependent on prospects for economic growth, the investment climate, and the development of local capital markets (Feig & Finlayson, 2008; Miyamoto & Muzenda, 2012). Similarly, one of the success factors of a PPP was creating a favorable investment environment (Farquharson et al., 2011; Kwak et al., 2009; Zhang, 2005a). Therefore, infrastructure aid should be given to countries with less demand in terms of economic activity.

In addition, macroeconomic stability affects private investment in infrastructure. One of the greatest risks to any foreign investor is rapid currency depreciation. Risks of large depreciation of the local currency given the long-term nature of the infrastructure contracts are combined with those of sudden currency swings in many developing countries (Thomsen, 2005). For example, the Asian financial crises raised cautiousness among foreign investors and decreased private investment in infrastructure (Feig & Finlayson, 2008; Thomsen, 2005). To summarize, in order for infrastructure aid to respond to needs in demand, it should be allocated to countries with good governance, unfavorable market conditions, and macroeconomic instability.

H4: Infrastructure aid is positively related with the quality of governance

H5: Infrastructure aid is more likely to be allocated to countries with unattractive market conditions.

H6: Infrastructure aid is negatively related with macroeconomic stability.

iii. Sector and Donor Differences

Due to different cost recovery characteristics, sectors have differing needs in the supply and demand of infrastructure. With regard to supply, sectors, such as transport and water, with low returns are more likely to be heavily funded by grant aid, and thus might have less needs in supply. However, this is the other way around when it comes to demand. Water and sanitation and transport, in order, opposed to energy and communications, find it more difficult to attract foreign lenders and private investors. Infrastructure aid should respond to the demand needs in the water and transport sectors.

Furthermore, donors might not show much differences in their levels of need responsiveness. Following the findings of disaggregate aid allocation literature, it is expected that multilateral donors are not more need oriented than bilateral donors, except in the transport sector. Likewise, donors that were considered 'egoistic' would be as responsive to needs as donors that were thought to be 'humanitarian'.

H7: Infrastructure aid is more likely to account for supply needs in transport and water sectors and demand needs in energy and communications sectors.

H8: Donors are similar in their levels of need responsiveness.

IV. Data and Method

Statistical analysis of aid allocation must take the truncated nature of the aid variable into account. Aid tends to be selectively allocated, particularly in the case of smaller donors such as Denmark or Norway that focus their aid on a few recipients. Since there are many values that are equal to zero, a nonlinear method of estimation is more appropriate than OLS estimation, which in this case will produce biased estimates. To deal with this issue, the aid allocation literature has used three different approaches: two-part Probit and OLS estimation, Heckman sample selection model, and the Tobit model. Using the first two models poses the risk of incurring a selection bias and multicollinearity, respectively. Therefore, this study adopts the Tobit model in accordance with J.-C. Berthélemy and Tichit (2004).

Therefore, the equation to be estimated is as follows:

$$y_{it} = \max(\boldsymbol{B}\boldsymbol{X}_{it} + u_{it}, 0)$$

where i stands for the recipient, t for the time, y for infrastructure aid, $\boldsymbol{X}$ is a vector of explanatory variables and $\boldsymbol{B}$ the vector of corresponding parameters, and u is a normally distributed error term.

For the dependent variable, aid commitments to developing countries, as defined by the OECD, were used. Aid commitments rather than disbursements are used, because the former can provide a purer reflection of the motivations of donors, in accordance with established practice (J.-C. Berthélemy & Tichit, 2004). The data on aid in the infrastructure sector from 2006-2011 in current US$ was retrieved from the Creditor Reporting System (CRS) of the OECD DAC. The data covers the four sectors – transport and storage, communications, energy, and water and sanitation – including assistance in administration, sub-sectors, and research.

Independent variable data cover the period 2004-2009, applying a two-year lag in consideration of the unlikeliness of decision makers having more recent data available at the time they allocate aid flows in accordance with Neumayer (2003a), Cingranelli and Pasquarello (1985), and Poe and Sirirangsi (1994). The independent variables, the data used, and the expected relationship are summarized in Table 1.

First of all, income and population are added to account for needs in both supply and demand – general needs and market conditions. GDP per capita and population are widely used in aid allocation literature to capture recipient needs. In general, bigger and poorer countries require more aid, regardless of sectors. Furthermore, they can also represent market conditions, with population accounting for market size and income accounting for purchasing power. The data are retrieved from the World Bank.

At the supply side, for infrastructure quantity and quality, infrastructure data from the World Development Indicators by the World Bank is used. The infrastructure data are not measured yearly, creating missing data problems. These are solved through taking a 3-year average, in accordance with Thiele et al. (2007). Given that the correlation among individual measures of infrastructure is high, composite indexes are made to account for quantity and quality. Three aggregate methods are used to calculate composite measures of infrastructure stock and infrastructure quality: principal components method, unobserved components method, and quartile aggregation index Calderón and Servén (2004). This study uses the principal components analysis as is common practice in literature that uses indicators for infrastructure.

The indicator for infrastructure quantity integrates road network per kilometer, telephone lines per 100 people, and electric power consumption per capita. Infrastructure quality includes paved roads as percentage of total roads, electric power transmission and distribution losses as percentage of output, and percentage

of population with access to improved water source. In case of sector level analysis, the corresponding indicators of infrastructure quantity and quality are used.

To capture geographical conditions, population density and land-lockedness are included. The data for population density is retrieved from the World Bank. A dummy for land-lockedness from the CEPII GeoDist Database is included. Furthermore, for ethnic fractionalization, a dummy from Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg (2003) that has a zero value in case of fractionalization is included.

At the demand side, a composite index using principal components is included to account for governance. Data is retrieved from the Worldwide Governance Indicators, which boasts comprehensive coverage with a small number of missing values. The indicators included in the index are control of corruption, government effectiveness, rule of law, and regulatory capacity, with higher values indicating better governance. To account for macroeconomic stability, inflation, money supply, and international reserves are included. All of these data are extracted from the World Bank.

Variables to account for donor interests are included in order to obtain a more precise assessment of the effect of recipient needs. It has been noted that a failure to include donor interests may underestimate the true impact of need on aid allocation (McGillivray, 2003). Therefore, colonial history, military alliances, natural resources, and trade volume are included to account for political and economic donor interests. In case of infrastructure aid of all donors, dummies are created for French, Dutch, Portugese, Spanish, and British colonization. For donor-level analysis, one dummy is included to address whether the recipient country had been colonized by the particular donor. Military alliances account for whether a dyad of two countries has ever been in an alliance since 1900. As the colonial history variable, the dummy in all-donor analysis refers to alliance with all DAC donors, while, in donor-level

analysis, it refers to the particular donor. Similarly for trade, the total analysis indicates the volume of trade with all donors, as opposed to trade with the particular donor in the donor-level analysis.

Table 1. Summary of Independent Variables, Data, and Expected Relationship

Variable		Data Description	Expected Relationship
General needs	Population	Total population, World Bank	Positive
	Income	GDP per capita, PPP (constant 2005 international dollars), World Bank	Negative
Needs in infrastructure supply	Infrastructure quantity	Composite index (principal components) of: • Road network (per kilometer) • Telephone lines (per 100 people) • Electric power consumption (KWh per capita) World Development Indicators, World Bank	Negative
	Infrastructure quality	Composite index (principal components) of: • Paved roads (% of total roads) • Electric power transmission and distribution losses (% of output) • Improved water source (% of population with access) World Development Indicators, World Bank	Negative
	Population density	Population density (people per km^2 of land area), World Bank	Negative
	Land-lockedness	CEPII GeoDist Database (1 if landlocked) (Mayer & Zignago, 2011)	Positive
	Ethnic fractionalization	Fractionalization data (0 if fractionalized) Alesina et al. (2003)	Negative
Needs in infrastructure demand	Governance	Composite index (principal components) of: • Control of corruption • Government effectiveness • Rule of law • Regulatory capacity Worldwide Governance Indicators, World Bank	Positive
	Inflation	Consumer prices (annual %), World Bank	Positive

	Money supply	Money and quasi money (M2, % of GDP), World Bank	Negative
	International reserves	Total reserves (includes gold, current US$)	Negative
Donor interests	Colonial history	ICOW Colonial History database (1 if colonial experience)	Positive
	Military alliances	Correlates of War Formal Alliance dataset, version 4.1 (1 if alliance experience since 1900) (Gibler, 2009)	Positive
	Natural resources	Total natural resources rents (% of GDP), World Bank	Positive
	Trade	Gross exports plus gross imports with DAC members, OECD Trade in Value Added database	Positive

V.   Analysis

i.   Total Infrastructure Aid

Infrastructure aid as a whole was aimed at bigger and poorer countries. The coefficients of population and income per capita are highly significant in all three models, except for income in the random effects model where it lost significance. At the supply side, infrastructure quantity showed a significant negative relationship, which was robust in all three models, in accordance with the results of previous studies, while infrastructure quality was not significant. This confirms the prematurity of the conclusion made by the literature on disaggregate aid allocation that infrastructure aid responded to needs solely based on the measures of infrastructure stock. Furthermore, none of the geographical considerations, reflected in population density and land-lockedness, mattered for total infrastructure aid. Nonetheless, infrastructure aid in general responded to ethnical diversity and the increased need for supply due to divergent individual preferences.

At the demand side, governance was surprisingly not significant. This may be due to donors' perception of governance as both a capacity and need, as suggested by Bermeo (2008), and thus infrastructure aid taken as a whole showed mixed results. Concerning macroeconomic stability, inflation is positively related, but the coefficient of money supply is positive as well. Looking at the coefficients, the impact of inflation is greater, and robust to all three models, than that of money supply. This is even more so considering the units of the data – the mean of inflation is around 10 percent, and that of inflation is 55 percent. Therefore, in total, it can be said infrastructure aid generally responded to demand needs created by macroeconomic instability.

With regard to donor interests, donors showed limited egoism in the allocation of infrastructure aid. They allocated more infrastructure aid to only former French and Dutch colonies, an effect which dissipates in other models. The only variable highly significant among donor interests is natural resources. This is probably because natural resources are highly linked with infrastructure. On the contrary, trade was significantly negatively related with infrastructure aid. This shows that trade was less of an interest to donors than a goal. It seems that as part of the Aid for Trade, infrastructure aid has been targeted at countries with lower trade volumes.

Table 2. Regression Results for Total Infrastructure Aid
(Tobit, OLS, Random Effects)

	Tobit	OLS	Random effects
Population	0.00***	0.00***	0.00***
	(11.47)	(9.86)	(4.63)
GDP per capita	-0.03***	-0.03***	-0.03
	(-2.82)	(-3.00)	(-1.62)
Infrastructure quantity	-121.54**	-92.58***	-121.24*
	(-2.46)	(-2.63)	(-1.70)
Infrastructure quality	26.68	12.12	32.40
	(0.80)	(0.40)	(0.62)
Population density	0.08	0.34**	0.27
	(0.40)	(2.27)	(1.07)
Land-lockedness	-98.71	-105.11**	-107.75
	(-1.39)	(-2.06)	(-0.76)
Ethnic fractionalization (0 = fractionalized)	-362.23**	-328.94**	-465.23*
	(-2.37)	(-2.45)	(-1.81)
Governance	44.72	40.08	3.28
	(1.30)	(1.52)	(0.07)

Inflation	20.51*** (4.69)	20.14*** (3.03)	7.21** (1.98)
Money supply (M2)	2.50* (1.82)	2.52** (2.01)	2.37 (1.25)
International reserves	-0.00 (-1.45)	-0.00* (-1.75)	-0.00 (-1.40)
French colony	216.83*** (2.63)	228.18*** (2.60)	120.53 (0.83)
Dutch colony	306.45* (1.79)	339.14* (1.94)	401.45 (1.10)
Portugese colony	49.74 (0.39)	62.87 (0.87)	96.40 (0.37)
Spanish colony	-26.42 (-0.23)	8.36 (0.14)	-69.89 (-0.30)
British colony	54.89 (0.68)	76.69 (1.06)	279.32** (2.02)
Military alliances	66.60 (1.08)	44.17 (0.73)	89.96 (0.82)
Natural resources	5.73*** (2.92)	5.76** (2.43)	7.86*** (2.96)
Trade (with OECD countries)	-0.14*** (-3.79)	-0.14*** (-4.60)	-0.08** (-2.05)
Year trend	24.28* (1.67)	23.32 (1.62)	25.44** (2.45)
Constant	-48608.98* (-1.66)	-46716.45 (-1.62)	-50874.47** (-2.45)
Observations	264	264	264
Adjusted R^2		0.588	

*** Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

ii.   Infrastructure Aid by Sector

Sector-level analyses show scant response to sector-specific needs. Aid towards all sectors except communications are aimed at both larger and poorer countries. However, no sector reacted to infrastructure quantity. In case of infrastructure quality, only aid in the energy sector was responsive. Concerning the geography, aid in the communications sector acted counter to need. The coefficient on land-lockedness was negative for energy and communications. The only sector that accounted for ethnic fractionalization was energy. .

At the demand side, aid in the water and sanitation sector was the most responsive. It allocated more aid to countries with good governance and macroeconomic instability. The communications sector also considered governance. On the other hand, aid was allocated to macroeconomically stable countries in the energy sector.

Turning to donor interests, aid in the transport sector was allocated more to former French colonies, the energy sector to Dutch colonies, and the water sector to Spanish colonies. Apart from the transport sector, none other was motivated by military alliances. However, natural resources were positively related with aid in all sectors except communications. Trade was negatively related in all sectors excluding communications, which suggests that aid was aimed at promoting trade as part of the Aid for Trade agenda.

To summarize, infrastructure aid has generally failed to respond to need in the specific sectors. In order to respond to needs, aid towards the transport and water sectors should account for supply needs, and that towards the energy and communications sectors should consider demand needs. However, aid in the transport and storage sector responded to no need specific to the sector. The energy sector was only focused on the supply side, while the communications and water

sectors were concentrated only on the demand side. The transport sector was motivated the most by donor interests; whereas the communications sector was unrelated with any variable of donor interest. Table 4 summarizes the need responsiveness of the sectors.

Table 3. Summary of Need Responsiveness by Sector

	General	Supply				Demand	
		Infra QT	Infra QL	Geo-graphy	Ethnic diversity	Gover-nance	Macro stability
Transport & Storage	O						
Energy	O		O	X	O		X
Communi-cations	O			X		O	
Water & Sanitation	O					O	O

O : Responded to needs
X : Did not respond to needs
O/X : Mixed results
Empty : Not significant

Table 4. Regression Results for Infrastructure Aid by Sector (Tobit)

	Transport & Storage	Energy	Communi- cations	Water & Sanitation
Population	0.00*** (6.87)	0.00*** (6.45)	0.00 (0.84)	0.00*** (13.60)
GDP per capita	-0.02** (-2.37)	-0.02*** (-3.90)	-0.00*** (-3.26)	-0.01*** (-3.72)
Infrastructure quantity	-102.99 (-1.27)	0.02 (1.44)	-0.14 (-1.43)	27212645.41 (1.64)
Infrastructure quality	-0.97 (-1.02)	-2.63* (-1.96)	0.00 (0.03)	-0.32 (-0.51)
Population density	0.29 (1.44)	0.06 (0.82)	0.01*** (2.62)	0.06 (0.94)
Land- lockedness	-46.25 (-0.64)	-72.28* (-1.87)	-4.44** (-2.28)	-23.53 (-1.12)
Ethnic fractionalization	-104.52 (-0.91)	-109.19* (-1.81)	2.04 (0.68)	-8.61 (-0.26)
Governance	32.88 (1.23)	-2.33 (-0.21)	1.06* (1.67)	17.92** (2.44)
Inflation	0.83 (0.14)	1.01 (0.60)	0.01 (0.09)	1.19 (1.01)
Money supply (M2)	0.32 (0.24)	1.30** (2.36)	-0.02 (-0.69)	0.51 (1.17)
International reserves	-0.00 (-1.28)	-0.00 (-0.14)	-0.00 (-0.48)	-0.00*** (-2.81)
French colony	161.16** (2.29)	-1.28 (-0.04)	-2.65 (-1.39)	34.45 (1.59)
Dutch colony	51.79 (0.45)	181.43** (2.50)	2.90 (0.77)	5.56 (0.12)

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Portugese colony	-81.70 (-0.65)	82.04 (1.23)	1.86 (0.39)	61.27 (1.04)
Spanish colony	-102.09 (-0.78)	11.57 (0.19)	2.76 (0.75)	73.55[*] (1.85)
British colony	33.79 (0.51)	43.11 (1.37)	-1.70 (-1.05)	-13.80 (-0.71)
Military alliances	112.94[*] (1.87)	-23.27 (-0.93)	-2.37 (-1.49)	-5.71 (-0.35)
Natural resources	4.48[**] (2.55)	1.50[*] (1.79)	0.06 (1.29)	1.27[**] (2.35)
Trade (with OECD countries)	-0.00[***] (-2.63)	-0.00[***] (-4.26)	0.00 (0.23)	-0.00[***] (-4.40)
Year trend	22.37[*] (1.75)	20.68[***] (3.56)	-0.36 (-1.00)	3.75 (0.85)
Constant	-44801.97[*] (-1.75)	-41341.42[***] (-3.55)	725.28 (1.02)	-7478.76 (-0.85)
Observations	213	283	389	223

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

iii. Infrastructure Aid by Donor

A comparison between bilateral and multilateral donors show that while bilateral donors are indeed more self-interested, multilateral donors are less responsive to need. Concerning general needs, while bilateral aid responded to both population and income with high significance, multilateral aid did not respond to a larger population and responded to income with a lower significance. However,

when it came to infrastructure quantity and quality, bilateral donors did not respond to either, although quantity was significant in other models and close to significance in the Tobit model. In contrast, multilateral donors allocated to donors with worse quality infrastructure and, unexpectedly, more infrastructure stock. All other need variables at the supply side were not significant for multilateral aid. In comparison, land-lockedness was significant but with a negative coefficient. This is probably due to the common belief that land-locked countries have had faster rates of improvement in infrastructure than coastal countries since the land-locked characteristic increases the demand for infrastructure services (Estache, 2005). Therefore, bilateral donors might have attempted to respond to actual needs in practice.

Furthermore, bilateral donors are more responsive to needs in demand as well. They allocated more to countries with good governance and macroeconomic stability. Concerning the latter, inflation and international reserves were significant, while money supply was not. In case of multilateral institutions, they responded to high inflation, albeit to much lower degree (the coefficients for bilateral aid is 14.37 and multilateral aid is 3.25, respectively), but also to bigger money supply. Therefore, since the responsiveness to inflationary pressures is reduced by the opposite effect with regard to money supply, the overall responsiveness to macroeconomic stability for multilateral aid seems obscure.

Donor interests are also stronger in effect for bilateral infrastructure aid decisions. French and Dutch colonies were allocated more aid, in accordance with the results of total infrastructure aid. In case of multilateral aid, French and British colonies received significantly more aid, and Spanish colonies less aid. Military alliances and natural resources rents were highly significant for bilateral aid, while they were not for multilateral aid. The opposite direction that these two groups of donors takes explains the limited egoism that was spotted in the previous section on

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the allocation of total infrastructure aid. In case of trade, bilateral aid perceived trade significantly as a need rather than interest, while multilateral donors did not take it into account.

Table 5. Regression Results for Bilateral and Multilateral Infrastructure Aid (Tobit)

	Bilateral	Multilateral
Population	0.00*** (14.43)	0.00 (1.38)
GDP per capita	-0.03*** (-3.48)	-0.02*** (-5.77)
Infrastructure quantity	-78.15 (-1.47)	48.78** (2.43)
Infrastructure quality	5.50 (0.22)	-75.70*** (-5.88)
Population density	-0.06 (-0.38)	-0.03 (-0.56)
Land-lockedness	-100.92* (-1.83)	25.29 (0.88)
Ethnic fractionalization (0 = fractionalized)	-409.51*** (-3.81)	-17.31 (-0.31)
Governance	68.44** (2.46)	-0.44 (-0.03)
Inflation	14.37*** (4.19)	3.25* (1.82)
Money supply (M2)	0.95 (1.21)	0.74* (1.81)
International reserves	-0.00* (-1.68)	-0.00 (-0.48)

French colony	179.95*** (2.86)	98.80*** (2.96)
Dutch colony	426.69*** (3.39)	-72.33 (-1.11)
Portugese colony	-0.40 (-0.00)	-85.91 (-1.62)
Spanish colony	3.97 (0.04)	-109.57** (-2.24)
British colony	19.68 (0.31)	93.18*** (2.87)
Military alliances	122.31*** (2.68)	19.50 (0.84)
Natural resources	6.24*** (4.19)	0.54 (0.68)
Trade (with OECD countries)	-0.00*** (-4.55)	-0.00 (-1.16)
Year trend	15.15 (1.36)	26.64*** (4.59)
Constant	-30254.73 (-1.36)	-53364.57*** (-4.58)
Observations	279	294

*** Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

Bilateral donors differed in their responsiveness to need. While the effect of population is significant only for some donors, such as Germany, Japan, U.K., Ireland, and Luxembourg, and with Denmark preferring smaller countries, income is accounted for by most donors, except for the U.K., Luxembourg, New Zealand, and Spain. Only Japan, Korea, New Zealand, and Spain responded to infrastructure

quantity, and Finland, Ireland, and Luxembourg to infrastructure quality. Once again, some donors' allocation decisions are positively related with infrastructure quantity and quality. It is more common in the quality, with three of the major donors – Germany, Japan, and the U.S. – giving more infrastructure aid to countries with better quality infrastructure. Considering the fact that infrastructure quality is related with the maintenance and management of infrastructure services, it may be a reflection of the capacity of countries to manage and administer them. In this regard, it can be said that these three donors allocate to countries with better capacities for infrastructure management. Donors might be motivated to do so in order to raise the effectiveness of infrastructure aid, which makes sense considering that these donors disburse the largest amounts of aid.

Responsiveness differed among donors with regard to geographical considerations and ethnic fractionalization. Only Germany and Spain responded to population density, and Norway and Korea reacted in the opposite direction. Land-lockedness was taken into account by the U.K., Norway, and Switzerland. However, Japan, U.S., Korea, and Spain responded with less aid for land-locked countries, with a much larger impact than those that responded with more aid. In case of ethnic fractionalization, donor-specific analyses show less promising results, with only Japan, Denmark, Greece, Italy, Korea, and Spain taking it into consideration. The U.S. and Ireland, to a much lesser degree, failed to respond to needs in this area.

Turning to the demand side, Japan, U.S. and Sweden performed particularly well. Governance is positively related with aid for Japan, U.S., Sweden, Luxembourg, and Netherlands and not significant for others. The influence is greatest for the major donors, Japan and the U.S. In case of macroeconomic stability, donors that responded to needs were France, Japan, U.S. Sweden, Korea, New Zealand, and Spain, and with mixed results for Finland and Greece, while Italy failed to do so.

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Concerning colonial history, the Netherlands and Spain considered it significant. On the contrary, at a closer look, France did not allocate more infrastructure aid to its former colonies. Military alliances were regarded as the most influential by France, followed by the U.S., and, to a much smaller degree, Ireland. Natural resources mattered for Japan, U.S., Korea, and Netherlands, and were avoided by Ireland and Spain. With regard to trade, donors vary in whether they perceive it as an interest or a need. Those that allocated aid according to trade interests include France, Germany, Denmark, Norway, Greece, Korea, New Zealand, and Spain. Only Japan considered it as a need. It seems that the effect of Japan is so large compared to other donors considering it as an interest that the relationship between infrastructure aid and trade in the total aid and bilateral aid is negative.

Overall, need responsiveness varied across donors. Surprisingly, contrary to previous literature, Japan was the most responsive to needs in the infrastructure sector. Other good performers include Germany, Ireland, Korea, Luxembourg, Spain, Sweden, and the U.K. Distinguishing between supply and demand, Germany, Japan, Korea, and Spain were sensitive to needs in supply, while Germany, Japan, Sweden, and the U.S. were alert to those in demand. In fact, Sweden and the U.S. only responded to needs in demand and not supply. On the other hand, France, Netherlands, Norway, Denmark, Greece, Italy, and Switzerland were weak in their responsiveness, of which the first three donors were focused only on supply and the other four addressed only the demand side. Among the Scandinavian countries, only Sweden was particularly need based, in accordance with findings in studies of allocation of disaggregate aid. Table 6 summarizes the need responsiveness of donors.

Table 6. Summary of Need Responsiveness by Donor

	General	Supply				Demand	
		Infra QT	Infra QL	Geo-graphy	Ethnic diversity	Gover-nance	Macro stability
Denmark	O				O		
Finland	O		O				O/X
France	O						O
Germany	O		X	O	O	O	O
Greece	X				O		O/X
Ireland	O		O		X	O	
Italy	O				O		X
Japan	O	O	X	X	O	O	O
Korea	O	O		X	O		O
Luxembourg	O		O			O	X
Netherlands	O					O	
New Zealand		O	X				O
Norway	O			X	O		
Spain		O		O/X	O		O
Sweden	O	X				O	O
Switzerland	O			O			
U.K.	O			O			O
U.S.	O		X	X	X	O	O

O : Responded to needs

X : Did not respond to needs

O/X : Mixed results

Empty : Not significant

Table 7. Regression Results for Infrastructure Aid by Donor (Major and Scandinavian Donors)

	France	Germany	Japan	U.K.	U.S.	Denmark	Finland	Norway	Sweden
Population	-0.00	0.00***	0.00***	0.00***	-0.00	-0.00*	0.00	0.00	-0.00
	(-0.77)	(6.17)	(16.89)	(3.96)	(-0.27)	(-1.81)	(0.20)	(0.63)	(-0.07)
GDP per capita	-0.01**	-0.00**	-0.02***	-0.00	-0.01***	-0.01***	-0.00***	-0.00***	-0.00***
	(-2.19)	(-2.19)	(-2.79)	(-0.79)	(-3.85)	(-3.43)	(-3.00)	(-3.20)	(-3.97)
Infrastructure quantity	-12.65	-12.95	-126.65***	-0.33	-20.78	4.01	-0.83	-0.60	11.02***
	(-0.68)	(-1.19)	(-3.25)	(-0.07)	(-1.38)	(0.54)	(-0.43)	(-0.24)	(2.73)
Infrastructure quality	9.28	9.90**	52.74***	-3.38	32.78***	-2.74	-2.34**	-0.04	-1.38
	(1.12)	(2.02)	(2.66)	(-1.50)	(4.43)	(-0.87)	(-2.52)	(-0.03)	(-0.76)
Population density	-0.05	-0.07*	0.08	0.00	-0.02	0.01	0.00	0.01*	-0.01
	(-0.75)	(-1.68)	(1.29)	(0.88)	(-0.46)	(0.53)	(1.62)	(1.70)	(-0.92)
Land-lockedness	-10.86	0.53	-99.72**	16.31***	-30.89**	-7.96	4.12**	6.95***	-1.81
	(-0.60)	(0.06)	(-2.43)	(3.74)	(-2.20)	(-1.13)	(2.16)	(3.09)	(-0.47)
Ethnic fractionalization	-22.03	-31.88	-196.94**	12.90	71.30**	-25.36*	-2.74	2.12	2.03
	(-0.57)	(-1.56)	(-2.25)	(1.24)	(2.33)	(-1.82)	(-0.66)	(0.42)	(0.24)
Governance	1.85	3.61	45.22**	-1.66	27.34***	5.66	0.71	1.00	4.63**
	(0.20)	(0.74)	(2.01)	(-0.61)	(3.55)	(1.58)	(0.67)	(0.79)	(2.39)

Inflation	0.77	0.05	7.49***	0.78***	4.68***	0.15	0.33***	0.13	0.28
	(0.70)	(0.09)	(2.79)	(2.73)	(5.37)	(0.38)	(2.80)	(0.91)	(1.25)
Money supply (M2)	-0.06	-0.08	0.38	0.06	-0.58**	0.13	0.08***	-0.07	-0.16**
	(-0.22)	(-0.56)	(0.58)	(0.67)	(-2.20)	(1.22)	(2.60)	(-1.57)	(-2.16)
International reserves	-0.00***	-0.00	-0.00***	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(-2.84)	(-1.63)	(-2.70)	(-0.16)	(-0.43)	(-1.32)	(-1.26)	(-1.31)	(-0.84)
Colonial history	29.83	-	-	-2.17	39.93	-	-	-	-
	(1.43)			(-0.40)	(0.50)				
Military alliances	108.85***	-11.66	-	2.53	26.58*	-	-	-	-
	(5.08)	(-0.46)		(0.32)	(1.69)				
Natural resources	-0.83	-0.26	5.32***	-0.03	1.73***	0.22	0.00	-0.07	0.01
	(-1.49)	(-0.88)	(4.24)	(-0.23)	(4.04)	(1.02)	(0.00)	(-1.00)	(0.09)
Trade	0.00***	0.00**	-0.00***	-0.00	0.00	0.00*	0.00	0.00*	0.00
	(3.19)	(2.55)	(-4.41)	(-0.52)	(1.18)	(1.84)	(1.51)	(1.66)	(1.02)
Year trend	7.60*	6.45***	11.83	0.96	3.38	1.39	0.97**	0.32	0.77
	(1.91)	(3.02)	(1.24)	(0.89)	(1.04)	(0.91)	(2.07)	(0.59)	(0.91)
Constant	-15240.94*	-12916.75***	-23682.11	-1967.18	-6793.86	-2794.77	-1964.30**	-646.82	-1532.04
	(-1.91)	(-3.01)	(-1.23)	(-0.90)	(-1.04)	(-0.91)	(-2.08)	(-0.59)	(-0.90)
Observations	279	279	279	279	279	279	278	277	279

*** Significant at the 1% level   ** Significant at the 5% level   * Significant at the 10% level

Table 8. Regression Results for Infrastructure Aid by Donor (Other Donors)

	Greece	Ireland	Italy	Korea	Luxembourg	Netherlands	New Zealand	Spain	Switzerland
Population	-0.00	0.00***	-0.00	-0.00	0.00*	-0.00	0.00	0.00	0.00
	(-0.33)	(2.78)	(-0.20)	(-1.52)	(1.69)	(-0.62)	(0.46)	(1.25)	(1.16)
GDP per capita	-0.00***	-0.00**	-0.00***	-0.00***	-0.00	-0.01***	-0.00	-0.00	-0.00***
	(-3.20)	(-2.29)	(-3.24)	(-3.86)	(-1.43)	(-4.49)	(-1.21)	(-0.97)	(-2.74)
Infrastructure quantity	0.58	0.37	-1.18	-13.93**	-1.18	-5.42	-4.59*	-25.41***	2.23
	(1.36)	(1.34)	(-0.43)	(-2.22)	(-1.16)	(-0.76)	(-1.82)	(-3.27)	(1.06)
Infrastructure quality	0.30	-0.55***	-1.28	2.89	-0.81**	1.74	1.78*	-0.24	0.11
	(1.60)	(-4.54)	(-1.06)	(0.97)	(-2.15)	(0.60)	(1.95)	(-0.08)	(0.11)
Population density	-0.00	0.00	-0.01	0.02*	-0.00	0.01	0.00	-0.11***	-0.00
	(-1.25)	(0.69)	(-1.40)	(1.94)	(-1.06)	(0.54)	(0.19)	(-2.64)	(-0.31)
Land-lockedness	-0.02	0.12	-2.06	-12.56**	-0.01	-4.90	-1.84	-30.64***	3.94**
	(-0.05)	(0.50)	(-0.79)	(-2.00)	(-0.02)	(-0.93)	(-1.23)	(-3.98)	(2.13)
Ethnic fractionalization	-2.06***	1.59**	-9.88*	-36.11***	-1.54	7.20	-3.45	-67.93***	-0.66
	(-2.72)	(2.34)	(-1.82)	(-2.85)	(-1.06)	(0.58)	(-1.47)	(-4.83)	(-0.16)
Governance	0.04	0.30**	0.01	2.02	0.69*	9.28***	-0.60	0.33	-0.01
	(0.19)	(2.18)	(0.01)	(0.63)	(1.87)	(3.15)	(-0.98)	(0.10)	(-0.01)

Inflation	-0.07**	0.00	-0.07	0.41	-0.16***	0.33	-0.00	0.09	-0.00
	(-2.15)	(0.32)	(-0.46)	(1.05)	(-2.62)	(1.06)	(-0.07)	(0.22)	(-0.01)
Money supply (M2)	0.00	-0.00	0.08**	0.13	0.01	-0.03	-0.02	0.07	0.00
	(0.96)	(-0.56)	(2.22)	(1.34)	(0.55)	(-0.35)	(-1.20)	(0.71)	(0.13)
International reserves	-0.00**	-0.00	-0.00	-0.00***	-0.00	-0.00	-0.00*	-0.00***	0.00
	(-2.20)	(-0.31)	(-0.89)	(-2.69)	(-0.59)	(-1.05)	(-1.68)	(-2.75)	(1.45)
Colonial history	-	-0.07	-	-	-	34.41***	-	25.43**	-
		(-0.31)				(3.46)		(2.48)	
Military alliances	0.96	0.79**	3.65	-	-	-	-	-	-
	(1.09)	(2.55)	(0.61)						
Natural resources	0.01	-0.02**	0.00	0.45**	-0.04	0.33*	-0.05	-0.42**	-0.08
	(0.65)	(-2.54)	(0.06)	(2.45)	(-1.39)	(1.95)	(-0.89)	(-2.02)	(-1.17)
Trade	0.00**	0.00	0.00	0.00***	-0.00	0.00	0.00***	0.00***	-0.00
	(2.44)	(0.16)	(0.50)	(2.76)	(-0.00)	(1.46)	(2.93)	(2.61)	(-1.48)
Year trend	-0.09	-0.03	0.37	3.47**	0.13	-3.15**	0.31	-0.40	0.43
	(-1.06)	(-0.69)	(0.69)	(2.45)	(0.96)	(-2.57)	(1.37)	(-0.28)	(1.00)
Constant	179.91	63.26	-730.27	-6947.48**	-254.11	6329.81**	-619.14	832.48	-869.82
	(1.07)	(0.68)	(-0.68)	(-2.44)	(-0.96)	(2.58)	(-1.37)	(0.29)	(-0.99)
Observations	278	279	279	279	256	279	275	279	279

*** Significant at the 1% level   ** Significant at the 5% level   * Significant at the 10% level

VI. Conclusion

Rising infrastructure aid as well as private participation in infrastructure necessitates research on allocation of infrastructure aid and whether it is responding to recipient needs. Yet, no such attempt has been made so far. This study identifies the needs particular to the infrastructure sector in the supply and demand of infrastructure and tests whether the current allocation of infrastructure need is responsive to the needs.

The findings of this study show that while infrastructure aid, in general, was responsive to infrastructure quantity, ethnic fractionalization, and macroeconomic stability, it was less so in infrastructure quality, geographical considerations, and governance. When divided into specific sectors, the need responsiveness becomes substantially weaker, and aid is responsive to either none or the wrong side of needs. The transport sector is allocated regardless of needs, the energy sector is focused on supply needs, and the communications and water sectors are responsive to needs in demand.

Distinguishing between bilateral and multilateral donors, this study supports previous research on disaggregate aid allocation that multilateral aid was not any more responsive to need, but in fact less so. A deeper look into individual donors again reaffirm the studies on disaggregate aid that the conventional classification of 'egoistic' and 'humanitarian' donors is incorrect. Good performers with respect to need include Japan, Germany, Ireland, Korea, Luxembourg, Spain, Sweden, and the U.K., while France, Netherlands, Norway, Denmark, Greece, Italy, and Switzerland performed badly.

This study is the first in analyzing the allocation of aid in one specific sector. As the infrastructure sector has its own characteristics in maintenance, geographical nature, sensitivity to individual preferences, demand of capacity, and involvement of

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the private sector, every sector has its unique attributes that brings about different needs. As a result, a whole new bunch of research on the sector-specific needs and what it means for the aid allocation process could be initiated. In particular, considering the fact that the participation of an increasingly diverse array of actors in the aid processes is not unique to the infrastructure sector but rather pervasive throughout aid, needs in demand could be shared across different sectors.

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국문초록

인프라 원조와 수원국 필요 간의 관계에 대한 연구

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　　본 연구는 인프라 원조의 인프라 분야 특성에 따른 수원국 필요 충족여부를 검증했다. 인프라 수요 및 공급이 경제성장과 관련이 있기 때문에, 인프라 수요와 공급에 따른 필요를 추출했다. 이는 공급 측면에서의 인프라 양과 질, 지리적 조건 및 민족적 분할, 그리고 수요 측면에서의 거버넌스와 거시경제적 안정을 포함한다. 인프라 원조가 인프라 양, 민족적 분할 및 거시경제적 안정에 따른 필요를 충족시키는 반면, 인프라의 질, 지리적 조건 및 거버넌스에 의해 일어나는 필요에 대한 대응은 부족했다. 세부 분야에 대한 원조를 보면, 각 분야에 대한

필요 충족도가 현저히 떨어지며, 원조는 필요를 충족시키지 않거나 수요, 공급 중 잘못된, 필요가 적은 쪽에 배분되었다. 수원기관별로 살펴 보면, 다자원조가 양자원조보다 필요충족도가 더 높거나 오히려 더 적다는 점에서 이전 문헌과 일치한다. 또한, 필요충족도가 높은 나라로서 일본, 독일, 아일랜드, 한국, 룩셈부르크, 스페인, 스웨덴, 영국이 있는 반면, 프랑스, 네덜란드, 노르웨이, 덴마크, 그리스, 이탈리아, 스위스는 필요충족도가 낮았다.