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Abstract

Today, there are few empirical studies assessing the effectiveness of aid for trade on trade performance. Furthermore, existing works do not test channels by which this impact is transiting. We address this question using an empirical analysis constructed in two steps. Following a model of export performance, we first test if institutions and infrastructure, our two potential channels of transmission, are indeed determinants of export performance. Secondly, we test the impact of aid for trade sectoral flows on the determinants that were highlighted in the first part. We show that the infrastructure channel appears to be highly significant in the first step whereas the institutional one turns out to have limited impact on developing countries' exports. Furthermore, in our second step, aid for infrastructure seems, once instrumented, to have a strong and positive impact on the infrastructure level. Our results indicate that a 10% increase in aid to infrastructure commitments per capita leads to an average increase of the exports over GDP ratio for a developing country of 2.34%. It is also equivalent to a 2.71% reduction of the tariff and non-tariff barriers. This highlights the very high economic impact of aid for trade throughout the channel of infrastructures.

Keywords: Export performance, trade facilitation, aid for trade, infrastructure, institution
JEL classifications: O19, O11, F10, F17, O10

L'aide au commerce influence-t-elle la performance à l'exportation ?
Une approche par le canal des infrastructures

Résumé

Aujourd'hui, il existe peu d'études empiriques évaluant l'efficacité de l'aide au commerce vis à vis de la performance au commerce. En outre, les travaux existants ne testent pas les canaux par lesquels cet effet est susceptible de transiter. Nous abordons cette question en utilisant une analyse empirique construite en deux étapes. A partir d'un modèle de performance à l'exportation, nous vérifions d'abord que les institutions et les infrastructures, nos deux potentiels canaux de transmission, sont effectivement des déterminants de la performance à l'exportation. Deuxièmement, nous testons l'impact de l'aide au commerce sur les déterminants mis en évidence lors de la première partie. Nous montrons que le canal des infrastructures semble jouer un rôle très important dans la première étape alors que la qualité des institutions liées aux commerce s'avère avoir un impact limité sur les exportations des pays en développement. En outre, dans notre deuxième étape, l'aide aux infrastructures semble, une fois correctement instrumentée, avoir un impact fort et positif sur le niveau des infrastructures. Nos résultats indiquent qu'une augmentation de 10% des engagements d'aide aux infrastructures par habitant entraîne une augmentation moyenne des exportations sur le PIB pour un pays en développement de 2,34%, ce qui est équivalent à une réduction de 2,71% des barrières tarifaires et non tarifaires. Cette étude met en lumière l'impact économique très élevé de l'aide au commerce au travers du canal des infrastructures.

Mots-clefs : Performance à l'exportation, facilitation des échanges, aide au commerce, infrastructure, institution

Classifications JEL : O19, O11, F10, F17, O10

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1. Introduction

In the empiric literature it has been demonstrated that trade can be a powerful engine to enhance economic development and poverty reduction (Winters *et al.,* 2004). Thus, outward-oriented growth has been a popular development strategy within low income countries since structural adjustments plans. However, there are few cases where these policies effectively succeed with growing revenues and reducing poverty. Furthermore, as Brun *et al.* (2005) noted, evidences are consistent with the claim that poor countries have been marginalized by the recent wave of globalization. Also, the share of the poorest developing countries in global trade has not increased despite the preferential trade schemes accorded by industrialised partners (Huchet-Bourdon *et al*, 2009).

Indeed, market access seems not enough for some countries facing internal obstacles to trade, as a lack of knowledge, excessive red tape, insufficient financing and poor infrastructure. Therefore, the international community is placing an increasing emphasis on the Aid for Trade (AfT) initiative to assist developing countries in their attempt to enhance export performance and integration into the global economy, by targeting their own domestic constraints. The AfT Task Force defines this initiative as assistance to developing countries to increase exports of goods and services, to integrate the multilateral trading system, and to benefit from liberalized trade and increased market access. Furthermore, AfT should increase economic growth and reduce poverty, as well as complement multilateral trade negotiations. Despite the ongoing debate on aid effectiveness following the "Paris Declaration" and the Doha agenda, there are little evidences on the success of previous attempt to support export development. With that in mind, it seems relevant to assess the impact of assistance to trade facilitation on trade performance.

Starting from a macroeconomic perspective, the literature on the impact of aid on growth has so far failed to provide strong and convincing results (Rajan and Subramanian, 2008; Roodman, 2007), partly because of its effects on trade via a "Dutch disease" phenomenon related to real exchange rates. Nevertheless, Adam and Bevan (2006) find that this short-run negative impact can be offset in a medium-term by potential productivity spillover created by aid-financed public expenditures. Furthermore, since growth is influenced by a variety of factors and aid for trade flows are relatively small, focusing on a particular kind of aid and its

targeted sector could be an answer to test the effectiveness without the need to consider Dutch disease problems.

Actually, there are few empirical studies assessing the effectiveness of aid for trade on trade performance, mostly because of the lack of sectoral data of sufficient quality and time length. Nevertheless, this kind of approach seems relevant to understand the various channels through which the various types of aid operate (Mavrotas and Nunnenkamp, 2007). Among the papers seeking to quantify empirically its impact on trade flows, Helble *et al.* (2009) find that assistance directed toward trade facilitation enhance the trade performance of recipient countries. They estimate, with a gravity model, that a one percent increase in assistance to trade facilitation could generate an increase in global trade of about US$ 415 million. Furthermore, the effect of aid directed to the "Trade Policy and Regulation" category seems stronger both in robustness and magnitude with a particularly high impact on aid recipient's exports. Also, this aid category exhibits the highest rate of return with US$ 697 in additional trade for every dollar invested. Nevertheless, the gravity model may not be suitable to test the effectiveness of aid for trade; there is no reason to think that a project or program financed by this assistance (*e.g.* road, telecommunications) will benefit more a direction of trade than another. Thus, an estimation using aggregate export flows across partners may be more accurate.

Cali and te Velde (2009) assess the impact of different types of aid for trade flows on the economic environment of recipient countries. In a cross-section estimation framework on 120 developing countries, they find that aid for "Trade Facilitation" reduces the export time and the cost to export (in US$). In addition, using panel data they test if aid related to infrastructure and capacity building has an impact on both sectoral and total exports. They find that aid for infrastructure has an impact on both dependent variables. Nevertheless, the effect of aid to capacity building is only revealed using sectoral exports. Indeed, this paper investigates on the various channels -namely trade and production cost- through which aid for trade enhances export performance. Nevertheless, considering the short span on aid for trade data and the persistence of aid, GMM techniques are not recommended for studies on aid effectiveness. Thus, for instance, cross-section estimations may be a better choice.

Furthermore, existing works do not test the channels of transmission of aid for trade. We might guess that some are related to internal costs to trade. Considering that the literature on trade costs and trade exhibits strong results, it seems relevant to focus on the effectiveness of aid flows on these internal constraints.

After reviewing the literature on trade cost in a second part, we present the available data on aid for trade in a third part. We address the question of the effectiveness of aid for trade in the rest of the paper using a two-step empirical analysis. Our empirical specification derives from the theoretical model of export performance from Redding and Venables (2003; 2004). Using an aggregation of gravity equations for each exporter, export supply for a country *i* depends on its size, internal costs and international market access. With that in mind, in a fourth part, we test if institutions and infrastructures, our two potential channels of transmission, are indeed determinants of export performance. Then, we test, in a fifth part, the impact of aid for trade sectoral flows on the determinants that were previously highlighted.

We show that the infrastructure channel appears to be highly significant in the first step whereas the institutional channel turns out to have limited impact on the export performance of developing countries. Furthermore, in our second step, aid for infrastructure seems to have a strong and positive impact on the infrastructure level. Moreover, we also propose a new instrument to address the endogeneity issue related with the aid for infrastructure variable.

2. Empirical literature on trade costs

As Abe and Wilson (2009) noted, trade costs can be widely defined as any costs which increase the price of traded goods during the delivery process from the exporters (or producers) in exporting countries to the final consumers. There is an extensive literature on internal trade barriers that demonstrates the opportunities for a well designed aid for trade facilitation targeted to domestic constraints (Portugal-Perez and Wilson, 2008). The concept of trade facilitation used in this study includes all customs, transit and multimodal trade procedures, including transport and infrastructure issues (UNCTAD 2006). Within this context, three approaches have been used to quantify the economic impact of trade facilitation measures: Computable General Equilibrium (CGE) models which quantify effects on income and welfare, gravity models which focus on bilateral trade effects, and country-case studies.

The CGE approach usually estimates trade facilitation measures as an improvement in the productivity of the transport sector or as a reduction in trade costs. Within this framework, the OECD (2003) finds that developing countries will benefit the most from these reforms because of their less efficient border procedures, the relative importance of their trade flows in agri-food products and their higher share of small and medium-size exporting business. Nevertheless, as Helble *et al.* (2009) point out, there is little data on the generalised

parameters used to simulate trade facilitation improvements. Furthermore, even if these studies conclude that potential gains arise from trade facilitation reforms, they do not identify which channels effectively affect transport productivity or trade costs.

The gravity model allows estimating the impact of different trade facilitation reforms on bilateral trade flows. Perhaps the major examples are Wilson *et al.* (2003; 2005) who analyse these measures in terms of port efficiency, customs environment, regulatory environment and electronic business-usage for Asian Pacific Economic Cooperation members and for a broader sample of 75 countries. They find that improvements in these fields, even from unilateral efforts, significantly increase both imports and exports. Likewise, Hoekman and Nicita (2008) estimate that a fall of 10% in the domestic cost of exporting would increase exports by about 4.7%.

Finally, country-case studies allow a broader analysis of trade facilitation programs. In terms of costs of implementation, Duval (2006) presents the results of an expert survey on twelve trade facilitation measures. This study highlights the expert's opinion that long-term benefits largely exceed perceived costs of implementation.

Besides, a growing body of the empirical literature considers that costs induced by internal capacity constraints are comparable, and even higher, than applied tariffs. Using a gravity model, Anderson and van Wincoop (2004) find that transportation, information and security costs for industrialized countries are equivalent to a 30% tariff applied on trade flows, with an even higher magnitude for developing countries. Taking into account the relative preference margins of developing countries, Hoekman and Nicita (2008; 2010) suggest that an improvement in logistic performance and trade facilitation are likely to have a better payoff for developing countries than further market opening. Portugal-Perez and Wilson (2008) find the same results for African exporters. Considering that negotiations on tariff reduction in Doha are lingering, these conclusions support the focus on internal trade costs reduction as an alternative development policy to WTO market opening for developing countries (Ikenson, 2008; Hoekman and Nicita, 2010).

Internal trade costs can be classified in two main categories: "natural" barriers like institutions, infrastructures and production costs; and trade policy barriers (De Melo and Grether, 2000; Anderson and van Wincoop, 2004; Gamberoni and Newfarmer, 2009). Using a gravity model, Gamberoni and Newfarmer (2009) find that they all matter to explain both exports volumes and the probability to export for developing countries. Using the same methodology, Francois and Manchin (2007) find the same results and noted that North-South

trade is more affected by infrastructure and institutions than by tariff barriers. Furthermore, Djankov *et al.* (2006) conclude that time delays are even more an issue for developing countries' exports of perishable goods. Also, this study highlights that time burdens are explained at 75% by weak institutional features and at 25% by poor physical infrastructure.

Trade costs related to a lack of infrastructures

Indeed, theoretical and empirical evidences suggest that infrastructure quantity and quality, and investments effectively affect exports (Bougheas *et al.*, 1999; Limao and Venables, 2001; Brun *et al.*, 2005; Adam and Bevan, 2006). Introducing an average of the density of the road network, the paved road network, the rail network and the numbers of phone lines per person in a gravity model, Limao and Venables (2001) find that the level of infrastructure is one of the main determinants of transport costs and explains approximately half of the low exports value of Sub-Saharan countries. Brun *et al.* (2005) conclude that a lack of infrastructure hits harder the bilateral trade between low-income countries and their exports to the North[1].

Furthermore, soft infrastructure, in the sense of efficiency of infrastructure services and related regulation, is also essential because of the high rents that prevail in every step of an often non-competitive trade logistic chain. Indeed, a growing literature suggests that transport costs are endogenous to the characteristic of goods being traded and the market or organizational structure of the industry providing the service (Hummels *et al.*, 2009; Djankov and Sequeria, 2009). These evidences suggest that barriers to trade need to be addressed by a concerted policy action and that technical assistance to upgrade logistics and fight corruption can play a substantial role in it (Hoekman and Nicita, 2008; Portugal-Perez and Wilson, 2008; Anderson and Marcouiller, 2002).

Trade costs related to weak institutions

Findings on the effect of trade barriers due to institutional weakness on exports are less clear than for infrastructures. As an example, using indexes of the quality of institutions in a gravity

[1] There are also empirical evidences of the impact of a specific kind of infrastructure on exports. Freund and Weinhold (2004) find that a 10% increase in the number of a country's web hosts is related to an export gain of around 0.2%. Francois and Manchin (2007) find that transport infrastructure is more relevant for low income countries, but that as income per capita rises communications becomes more important.

model, Francois and Manchin (2007) find some ambiguous impacts on exports. Also, controlling for foreign market access and geography, Redding and Venables (2003)'s index of the protection of property rights and risk of expropriation does not appear as a robust determinant of export performance.

This ambiguity may be explained by the difficulty to measure institutional costs exclusively related to trade activities. Consequently, a few papers have tried to focus on more specific data. For example, Djankov and Sequeria (2009) estimate that in Southern Africa corruption into port institutions increase total shipping costs for a standard 20ft container by 14%. Anderson and Marcouiller (2002) also show that insecurity associated both with contractual enforcement problems and with transparency lowers international trade volumes significantly.

Finally, negotiations on multilateral and bilateral agreements by developing countries could also be considered as a trade cost influenced by their institutional capacity. Indeed, talks on rules of origins, for example, are very complex and with substantial consequences on export performance (Cadot *et al.*, 2008; Carrère and de Melo, 2006). Also, as we will discuss it later, to increase the participation of developing countries on international standards organisations seems relevant to straightening their institutional capacity on these non-tariff barriers (Disdier *et al.*, 2008).

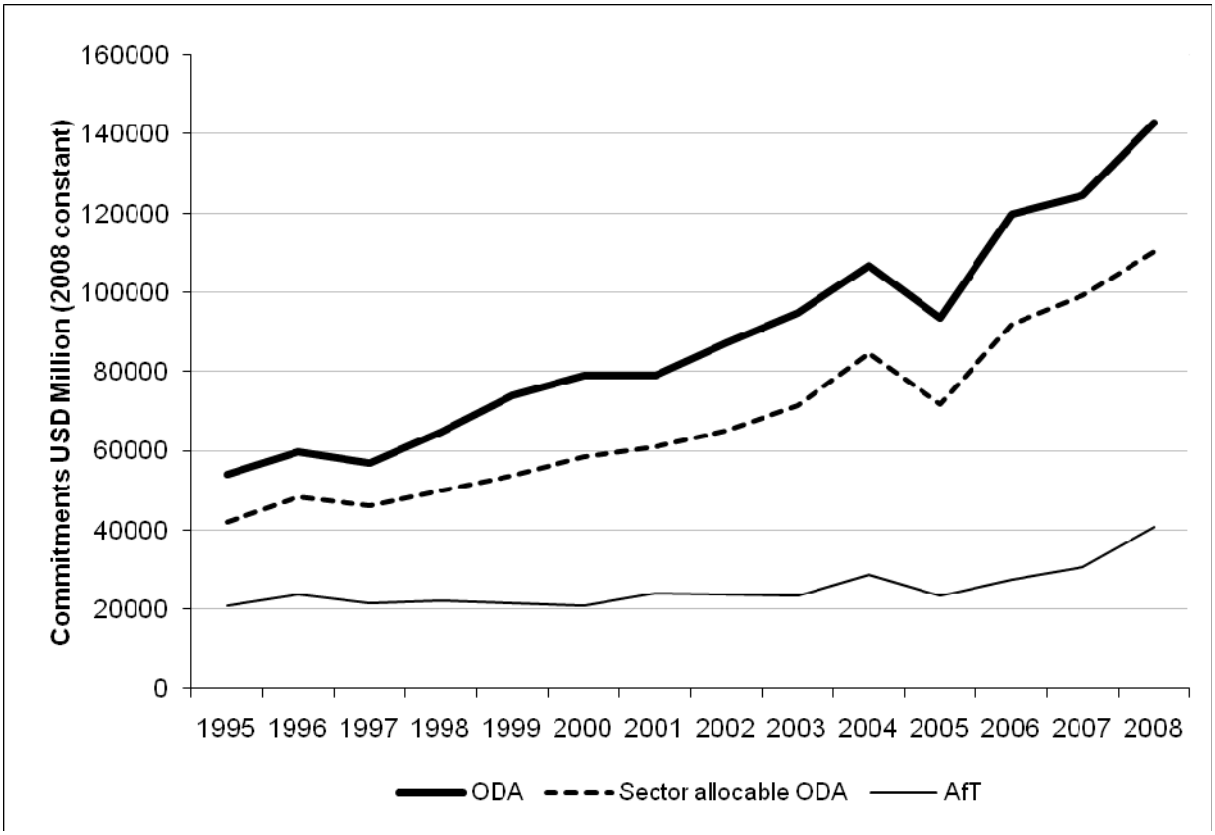
3. Aid for trade data and descriptive statistics

The supply-side constraints we saw above need to be addressed by aid for trade, as part of the overall Official Development Assistance (ODA). The Development Assistance Committee (DAC) of the OECD is the main organ in which donors seek to coordinate their bilateral cooperation activities for development. Since its creation in 1961, the DAC is also responsible for collecting statistics on the global effort of cooperation that relies primarily on declarations by DAC members and multilateral organizations. Data is collected through two reporting systems: the aggregated DAC which includes a breakdown by type of aid, donor countries and sectors, and data from the Creditor Reporting System (CRS) which contains detailed information on individual projects and aid programs. The CRS data thus allows analyzing the sectoral distribution of aid by sector, donor and recipient countries. However, it should be noticed that disbursements are only reported routinely by DAC members and the European Commission, and not by multilateral donors like the World Bank and the UN. Also, there is a

lack of quality on the aid data before 2003. Thus, to reduce measurement errors in our empirical estimations we will only consider aid commitments between 2002 and 2008.

We can see in Figure 1 that commitments of total ODA and sector allocable ODA have more than doubled in volume over the period 1995-2008, with a particularly strong growth since 2000 and the Paris Declaration on Aid Effectiveness[2]. Aid for trade volume also doubled since then, while its share in total sector allocable ODA has been declining from 49% in 1995 to 37% in 2008. Thus, the increase in volumes is additional and not at the expense of a diversion of resources from other social or economic sectors.

Figure 1: Medium term trends in ODA and AfT



Source: Authors' calculations

2 The Paris Declaration endorsed on March 2, 2005, is an international agreement to which over one hundred ministers, heads of agencies and other senior officials adhered and committed their countries and organisations to continue to increase efforts in harmonisation, alignment and managing aid for results with a set of monitorable actions and indicators.

Following the Task Force on Aid for Trade definition, aid for trade can be divided in five categories: (i) technical assistance for trade policy and regulations; (ii) trade-related infrastructures; (iii) productive capacity building; (iv) trade-related adjustment; and (v) other trade-related needs. Nevertheless, there is no consensus whether the productive capacity building category needs to be included on the agenda, *i.e.* whether aid for trade should be confined to reducing trade costs or, in addition, include support to increase the productive and competitive capacity of the private sector. There is even less agreement on the need to include trade related adjustments costs and other trade-related needs (OECD, 2006). Considering that the aim of this paper is to test the channels by which aid for trade can affect trade performance, we will only focus on aid for trade policy and regulations and aid to trade-related infrastructures, because other pathways can be more difficult to measure.

Thus, the two categories covered in our study are:

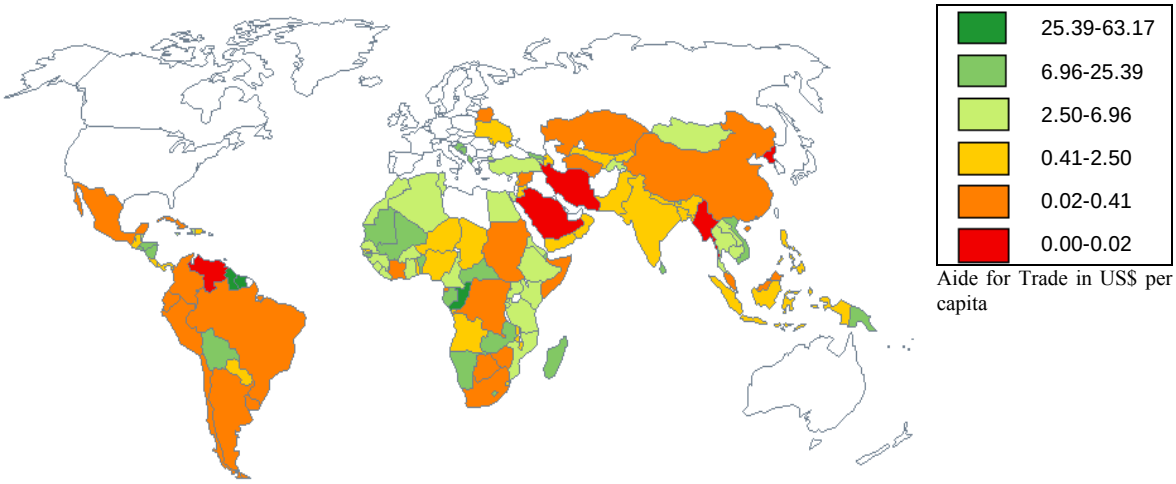
1) Trade policy and regulations, which is almost exclusively delivered by technical assistance and can be considered as aid to institutions related to trade. In average between 2006 and 2008, this category accounts for US$ 1,155 million commitments (constant 2008). It includes five sub-categories: projects and programs oriented to trade policy and administrative management, trade facilitation, regional trade agreements, multilateral trade negotiations and trade education/training. As an example, flows from this category aim at helping countries to develop trade strategies, negotiate trade agreements and implement their outcomes.

2) Economic Infrastructure, proxy for **trade-related infrastructure**, has the main objective to connect local markets to the global economy. In average between 2006 and 2008, this category received US$17,758 million commitments (constant 2008). This category includes three sub-categories: aid for communications, energy and transport and storage. Projects or programs range from technical cooperation to policy planning for ministries to heavy constructions of roads, power plants or airports.

We observe from Figure 2 and from Figure 3 and 4 in Annex 1 that Aid for Trade is not always allocated toward countries that need it most. Indeed, some countries are bad performers in terms of time delays to export and infrastructure quantity and quality, but still receive relatively less aid for trade per capita (Figure 5 and 6, Annex 1). Nevertheless, before advocating for an increase in aid for trade flows, it is its effectiveness and channels of transmission on trade outcomes that need to be at first investigated. We turn to this feature using an empirical analysis constructed in two steps. First, we test if institutions and infrastructure, our two potential channels of transmission, are indeed determinants of export

performance. Secondly, we test the impact of aid for trade sectoral flows on the determinants that were highlighted in the first step.

Figure 2: **Aide for Trade in US$ per capita (2002-2007, Trade Policy and Regulations and Economic Infrastructure)**



Source: Authors' calculations

4. On the search for aid for trade effectiveness channels

In order to reveal internal determinants of export performance that can be influenced by aid for trade, we use a theoretical model developed by Redding and Venables (2003; 2004), which is based on an aggregation of gravity equations between partners and allows us to explain the total volume of exports for a country by demand conditions and internal supply-side characteristics.

4.1. Theoretical background

The world is composed by $i = 1, ..., R$ countries whose tradable good sectors produce a range of symmetric differentiated products. The model is based on a demand structure using symmetric constant elasticity of substitution (CES), implying an utility function of the form:

$$U_j = \left[\sum_i^R n_i x_{ij}^{\frac{(\sigma-1)}{\sigma}}\right]^{\frac{\sigma}{(\sigma-1)}}, \sigma > 1 \qquad (1)$$

with:

σ = elasticity of substitution between any pair of products;

n_i = the set of varieties produced in country *i;*

x_{ij} = country j's consumption of a variety from n_i; all such varieties are symmetric.

It should be noticed that at the beginning the range of products produced in each country and their prices are fixed as exogenous. This hypothesis will be relaxed later in order to include general equilibrium relationships.

G_j is a price index in each country, which is constructed from the prices of all the varieties produced in *i* and sold in *j*, p_{ij}:

$$G_j = \left[\sum_i^R n_i p_{ij}^{1-\sigma}\right]^{\frac{1}{(1-\sigma)}} \quad (2)$$

E_j is the total expenditure of country *j* in differentiated products. The Shephard's lemma on the price index allows to set the demand of country *j* for each variety,

$$x_{ij} = p_{ij}^{-\sigma} E_j \, G_j^{(\sigma-1)} \quad (3)$$

where σ is the *j*'s price elasticity of demand and $E_j \, G_j^{(\sigma-1)}$ gives the position of the demand curve in market *j*.

The authors fixed the same producer price, p_i, for all the varieties coming from *i*. Three trade costs are added to this price:

$$p_{ij} = p_i t_i T_{ij} t_j$$

where T_{ij} is the transport cost between countries. Furthermore, t_i and t_j are internal costs related to the delivery of the product to and from the exporter and partner customs. It should be noticed that these can depend on trade-related infrastructure, like the road or rail network, and on internal geography.

Thus, unlike Redding and Venables (2003; 2004) for whom these variables capture the internal geography, we will use them as a measure of infrastructure. Indeed, as we saw it earlier in the literature review, many studies underline the importance of transport costs on the explanation of developing countries' trade (Limao and Venables, 2001; Brun *et al.*, 2005). Moreover, the internal geography is exogenous and cannot be influenced by aid for trade.

Thus, on the formulation of the value of exports from *i* to *j* we find a basis for the estimation of a gravity trade model:

$$n_i p_i x_{ij} = n_i p_i^{1-\sigma} (t_i T_{ij} t_j)^{1-\sigma} E_j G_j^{\sigma-1} \quad (4)$$

where we recognise exporter and importer country characteristics, that determine the supply capacity $n_i(p_i t_i)^{1-\sigma}$ and the market capacity $E_j\left(G_j/t_j\right)^{\sigma-1}$ respectively.

As in Redding and Venables (2003; 2004), in the rest of the model these terms will be defined as:

$$\mathrm{m_i} \equiv \mathrm{E_i}\left(\mathrm{G_i}/\mathrm{t_i}\right)^{\sigma-1} \text{ and } s_i \equiv n_i(p_i t_i)^{1-\sigma}. \quad (5)$$

Considering so, equation (4) can we re-writhed on the form:

$$n_i p_i x_{ij} = s_i (T_{ij})^{1-\sigma} m_j \quad (6)$$

Also, aggregating this equation between all importers for each *i* allows us to obtain each country's overall export value, V_i, which depends on supply capacity and foreign market access:

$$V_i = n_i p_i \Sigma_{i \neq j} x_{ij} = s_i \Sigma_{j \neq i} (T_{ij})^{1-\sigma} m_j = s_i M_i \quad (7)$$

where M_i is the access to external markets for each exporter, and corresponds to the sum of market capacities of all partners, weighted by bilateral trade costs related to external geography:

$$M_i \equiv \Sigma_{j \neq i} (T_{ij})^{1-\sigma} m_j \quad (8)$$

Thus, the total quantity demanded for each exporter, $n_i x_i$, can be written on the form:

$$n_i x_i = n_i \sum_{j \neq i} x_{ij} = \frac{s_i M_i}{p_i} = n_i (p_i)^{-\sigma} (t_i)^{1-\sigma} M_i \quad (9)$$

(using equations (4), (5) and (8))

In order to endogenise supply capacity, the authors specify a supply function for exports Ω:

$$n_i x_i = a_i \Omega \left(\frac{p_i}{a_i}\right), \text{ with } \Omega' > 0 \quad (10)$$

where Ω is the same for all countries, but parameters c_i and a_i are country specific; c_i measures the relative costs of producing in the export sector of country *i* and a_i measure the size of the economy.

A log-linearization of equations (9) and (10) gives us:

$$\hat{x} = -\sigma \hat{p} + (1-\sigma)\hat{t} + \hat{M} \quad (11)$$

and

$$\hat{n} + \hat{x} = \hat{a} + \omega(\hat{p} - \hat{c})$$

These two equations allow us to eliminate the price term:

$$\hat{x}(\omega + \sigma) + \sigma \hat{n} = \sigma \hat{a} + \omega\left[\hat{M} - \sigma \hat{c} + (1-\sigma)\hat{t}\right] \quad (12)$$

where ω captures the price elasticity of export supply, and ^ indicates a proportional deviation from a reference point.

We chose a log specification because it allows us to take into account the cross country variation, and to interpret the coefficients that will be estimated empirically as elasticities.

Thus, following equation (11), the total value of exports $V_i = n_i p_i x_i = s_i M_i$ can be re-written as:

$$\hat{V} = \hat{n} + \hat{p} + \hat{x} = \hat{a} - \omega \hat{c} + \left[\hat{M} + (1-\sigma)\hat{t} - \hat{x}\right]\frac{(1+\omega)}{\sigma} \quad (13)$$

And finally, to obtain the equations that justify the empirical estimation that will be used in our paper, a further condition is needed, which is the way how export volumes vary, between the number of varieties, n, and the output per variety, x.

Indeed, in a standard monopolistic competition model the output per commodity is a constant, $\hat{x} = 0$, implying that (13) becomes:

$$\hat{V} = \hat{\alpha} - \hat{c}\omega + \left[\hat{M} + (1-\sigma)\hat{t}\right]\frac{(1+\omega)}{\sigma} \qquad (14)$$

Nevertheless, if the number of varieties that can be produced by a country is fixed, $\hat{n} = 0$, equations (12) and (13) give us:

$$\hat{V} = \left\{\frac{(\sigma-1)(\hat{\alpha}-\hat{c}\omega)+[\hat{M}+(1-\sigma)\hat{t}](1+\omega)}{(\sigma+\omega)}\right\}.$$

Thus, for each country *i*, exports depend on the relative costs of producing in the export sector c_i, on infrastructures t_i, on the size of the economy a_i , and on foreign market access M_i.

4.2. Empirical analysis

The empirical estimation that follows is derived from the last two final equations. The model can be translated in the following log-linear specification:

$$\text{(I)}\ \ln(V_i) = \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(Pop_i) + \beta_3 \ln(M_i) + B_4 \ln(t_i) + \beta_5 \ln(c_i) + \varepsilon_i$$

Where β are parameters to be estimated. All variables are in logarithm in order to interpret the coefficients as elasticities. For the estimation, we use average values for the period 2002-2008. We deliberately choose to discard panel estimation techniques as we believe it would have prevented us from using variables of higher quality and precision. Indeed, the most interesting and precise data for some variables (*e.g.* trade-related institutions, trade restrictiveness index) is only available for, at best, the most recent years (2005-2008) if not only for one year. Considering the trade-off between data quantity versus quality, we believe that, in our case, simpler cross-section estimations might be more insightful. Furthermore, talks on trade oriented toward developing countries' concerns started with the Doha Round in

2001. Thus, we can expect a change on donors and developing countries' governments' behaviour starting from this date.

The dependent variable implied by the theoretical model is total exports by country in constant US dollars V_i. Nevertheless, as we focus on a set of highly heterogeneous developing countries, we choose to also normalize the export volumes by considering alternatively exports over GDP, $\frac{Exports_i}{GDP_i}$, following Guillaumont et Guillaumont (1988) and de Melo and Grether (2000)[3]. Furthermore, we subtracted from those two variables exports of oil and mineral resources. We believe that these two extractive sectors follow different economic mechanisms than those we want to reveal. Data were obtained from the World Trade Indicators (WTI) database constructed by The World Bank.

Two variables can be considered as potential channels of transmission for the aid for trade impact: t_i and c_i, which capture the comparative costs of exporting in each country due to internal constraints.

The first variable, t_i, is related to the infrastructure quantity. More than geographical characteristics as in Redding and Venables (2003; 2004), we think it is the supply of infrastructure that undermines the export performance of a country. Following Limao and Venables (2001), Brun *et al.* (2005) and Francois and Manchin (2007), we construct an index of infrastructure which includes kilometres of road and paved road (on total area, in km²), and the number of subscribers to mobile and fixed lines (per 100 people) from the World Development Indicators (WDI) database. As in Brun *et al.* (2005) the two first variables are normalised by surface. The infrastructure index used in the rest of the paper is the first principal component obtained from our infrastructures variables by Principal Component Analysis (PCA) (Francois and Manchin, 2007; Calderon and Servén, 2004)[4]. This first component, associated with an eigenvalue of 2.33, accounts for 77% of the variability of our sample and respectively applies the following weights to our three variables: 0.62, 0.62 and 0.45. We expect a positive effect of this variable on exports.

3 Indeed, Guillaumont et Guillaumont (1988) explain that an export over GDP measure is better than exports per capita, because the former increases mechanically with the revenue per capita for a specific export rate.

4 PCA allows us to identify clusters of points in the data, and to identify linear combinations of variables that reduce the size of the index without losing much information.

Another comparative costs of exporting due to internal constraints is the quality of institutions, c_i, in particular for developing countries (Redding and Venables, 2003; Redding and Venables, 2004; Djankov *et al.*, 2006; Francois and Manchin, 2007). We follow Djankov *et al.* (2006) and Gamberoni and Newfarmer (2009) using the number of days needed to export from the Doing Business database. This variable measures the time required to move a standard cargo from the gate factory in the economic capital to the ship in the most easily accessible port. Indeed, three-quarters of the delays seem to be due to administrative constraints, such as multiple procedures, taxes, licensing and inspection of containers (Djankov *et al.*, 2006). Thus, an increase in days indicates deterioration in the quality of institutions related to trade. Therefore, we expect this variable to play a negative impact on exports.

Another variable justified by the theoretical model is country's size. At first, we will capture it by population, Pop_i, and GDP in 2000 constant US dollars, GDP_i, from the WDI database. When moving to $\frac{Exports_i}{GDP_i}$ as the dependent variable, we will then consider GDP per capita in 2000 constant US dollars, $\frac{GDP_i}{Pop_i}$. These two variables are measures of economic size, and their relations with exports are ambiguous. In the one hand, we expect richer countries to have a larger capacity to export. In the other hand, an increase in revenue indicates that local production can serve a larger domestic market. We also expect population to be negatively related to the dependent variable, as larger countries face relatively lower cost to trade domestically than smaller ones and benefit from increasing returns. This variable can also be a proxy for relative factor endowments (Brun *et al.*, 2005).

International market access for exports from *i*, M_i, is captured by the market access due to tariff and non-tariff barriers (*MA-OTRI*) borrowed from Kee *et al.* (2009). This variable captures the distortions that the rest of the world's tariffs and non-tariffs barriers[5] have on exports from country *i*. We expect it to be negatively related to the dependent variable.

In order to address endogeneity problems due to reverse causality or any remaining unobserved heterogeneity that may lead to omitted-variable bias, we instrument infrastructure and institutions. Indeed, there is a potential reverse causality between the export over GDP

5 The non-tariffs barriers included in this measure are: price control measures, quantity restrictions, monopolistic measures, technical regulations and agricultural domestic support (Kee *et al.*, 2009).

ratio and our two interest variables, because countries with better export performance can be more interested in reducing trade costs related to these variables.

To control for this potential problem, infrastructures are instrumented by a variable reflecting internal geography, taken from Gallup *et al.* (1999): the proportion of land area within 100km of the coast or a navigable river in 1995. We expect that countries with better geography conditions will tend to supply more infrastructure related to trade. Indeed, Canning (1998) explains that infrastructure has network effects, and the internal geography, such as the location of rivers and mountains, determine their supply. Also, these variables can be considered as exogenous to the error term[6]. Concerning institutions, we decided to follow Djankov *et al.* (2006) and use the number of documents needed to export from the Doing Business database as an instrument for the time measure. The idea is that the extra paperwork due to more documents extends the number of days for exports processing, but are unlikely to be affected by export volumes. Indeed, more trade may extend the waiting time for a document, but certainly not the number of documents needed.

Thus, the export equations to be estimated by Two Step Least Squares (2SLS) are the following:

(IIa) $$\ln(V_i) = \beta_0 + B_1 \ln(Infrastructures_i) + \beta_2 \ln(Time_i) + \beta_3 \ln(GDP_i) + \beta_4 \ln(Pop_i) + \beta_5 \ln(MA - OTRI_i) + \varepsilon_i$$

(IIb) $$\ln\left(\frac{Exports_i}{GDP_i}\right) = \beta_0 + B_1 \ln(Infrastructures_i) + \beta_2 \ln(Time_i) + \beta_3 \ln(\frac{GDP_i}{Pop_i}) + \beta_4 \ln(Pop_i) + \beta_5 \ln(MA - OTRI_i) + \varepsilon_i$$

As a robustness check, following Lederman *et al.* (2010), we choose to introduce sequentially two additional control variables outside of the model. We control for the trade restrictiveness imposed by country *i* on its imports from the rest of the world[7] (OTRI) from Kee *et al.* (2009). As Brun *et al.* (2005) noted, a tariff applied on imports is equivalent to an export tax. Thus, we expect a negative relationship between this variable and exports over GDP. Finally, we also introduce the volatility of the exchange rate in country *i* as a proxy for business climate (Lederman *et al.*, 2010); this variable is measured by the coefficient of variation of the

6 The correlation between exports over GDP ratio and the infrastructure instrument is very low (18%) and not significant.

7 This variable captures the relative price distortion created by the trade policy imposed by *i* on its own imports.

dollar to the local currency exchange rate and data come from the International Financial Statistics database of the International Monetary Fund (IMF). We expect this variable to be related negatively to export performance.

4.3. Results

The results for equation (IIa) using OLS and 2SLS are shown in Table 1. In this table, we present the result of the equation reflecting directly the outcome of the formulation of Redding and Venables (2003; 2004).

Table 1: Trade costs and exports in constant US$

	(1) OLS	(2) OLS	(3) 2SLS
Infrastructures	1.211	0.465	2.390
	(0.247)***	(0.204)**	(0.549)***
Time	-0.387	-0.130	0.107
	(0.133)***	(0.171)	(0.462)
GDP	0.607		0.421
	(0.078)***		(0.135)***
Pop	0.213	-0.135	0.419
	(0.077)***	(0.042)***	(0.142)***
Ma-Otri	-0.698	-0.164	-0.942
	(0.256)***	(0.287)	(0.346)***
Constant	3.532	0.502	2.034
	(1.104)***	(1.099)	(2.299)
Observations	88	88	84
R-squared	0.93		0.92
First stage F-stat for Infrastructures			51.38
First stage F-stat for Time			10.04

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables are in logarithm.

In the first column, using OLS estimator, all of our variables turn out significant with the expected sign (but population which appears with a positive sign). Nevertheless, from the theoretical model, we have to check if those results hold when imposing the constraint of a coefficient relative to GDP set to unity (when using the ratio of exports over GDP as the dependent variable)[8]. As displayed in column 2, in that case, only *Infrastructures* seem to have an impact on exports.

This is also the case in column (3): once our infrastructure and institutions variables are instrumented, only the level of infrastructure seems to be correlated with exports. The

8 For further details, see Redding and Venables (2003; 2004)

coefficient is positive as expected. The geographic variable used to explain infrastructure has a fairly strong explaining power as the first stage F-statistic is above the rule of thumb of 10, which is the standard threshold for weak instrumentation. The number of documents needed to export seems to be also a good instrument even if, in that case, the F-stat is lower (see Annex 2 for 2SLS first stage results). It should be noted that results are robust to the use of the Limited Information Maximum Likelihood estimator that helps to deal with the relative weakness of our institutional instrument (results under request). Moreover, considering that our model is not over-identified as there is only one instrument for each of our endogenous variables, we are naturally not able to provide the result of the Hansen J test. Nevertheless both theoretically and empirically, our instruments seem to be valid.

The results for equation (IIb) using OLS and 2SLS[9] are shown in Table 2. As earlier, we can see in column (2), that once our infrastructure and institutions variables are instrumented, only the level of infrastructure seems to be correlated with the export ratio[10]. As a robustness check, we then introduce sequentially additional control variables in column (3) and (4). The results related to the infrastructure and institutions channels remain the same both in magnitude and in significance. As one can see in column (4), adding the Own Market Access variable $OTRI_i$, reduces dramatically our sample[11] without modifying our results. Our preferred specification is shown in column (5) where we dropped two outliers[12] identified using the method of Hadi (1994).

9 Using alternatively the Limited Information Maximum Likelihood (LIML) estimator leads to the same results in term of significance levels.

10 As a matter of fact, we try to disentangle our broad infrastructure effect by considering each of our three infrastructure variables (road, paved road and phone subscribers) instead of the infrastructure index in equation (IIb). Using alternative instruments as surface area in km², density of population or the share of urban population, we find that it is actually the density of the paved road network that seems to matter the most (results upon request).

11 The anti-trade bias of the import regime $OTRI$ is not statistically significant, suggesting that general equilibrium effects are not a strong determinant of exports.

12 Guinea and Zimbabwe appear as outliers.

Table 2: Trade costs and exports over GDP ratio

	All developing countries					Aid for Trade recipients
Exports (without oil and minerals)/GDP	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	2SLS	2SLS	2SLS	2SlS
Infrastructures	0.641	1.812	2.077	1.981	2.069	2.114
	(0.262)**	(0.455)***	(0.569)***	(0.604)***	(0.579)***	(0.568)***
Time	-0.312	0.112	0.299	-0.113	0.275	0.154
	(0.124)**	(0.455)	(0.534)	(0.544)	(0.545)	(0.441)
GDP/Pop	-0.195	-0.384	-0.378	-0.496	-0.386	-0.473
	(0.079)**	(0.122)***	(0.136)***	(0.130)***	(0.135)***	(0.147)***
Pop	-0.172	-0.174	-0.140	-0.176	-0.147	-0.178
	(0.035)***	(0.038)***	(0.042)***	(0.049)***	(0.046)***	(0.049)***
Ma-Otri	-0.541	-0.799	-0.860	-0.918	-0.866	-1.032
	(0.244)**	(0.298)***	(0.362)**	(0.446)**	(0.363)**	(0.366)***
Volat			0.364	0.307	0.081	-0.305
			(0.131)***	(1.425)	(1.322)	(0.911)
Otri				0.065		
				(0.180)		
Constant	6.978	6.001	4.532	7.062	4.796	5.911
	(0.889)***	(2.471)**	(2.954)	(3.186)**	(2.993)	(2.485)**
Observations	96	91	81	62	79	67
R-squared	0.41	0.28	0.14	0.28	0.13	0.20
First stage F-stat for Infrastructures		47.27	38.83	29.43	38.99	29.58
First stage F-stat for Time		9.47	8.81	6.25	8.92	10.23
Outliers (HADI) (p=0.05)					Guinea Zimbabwe	

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Instruments used are: documents needed to export for the institutional variable and the proportion of land area within 100km of the coast or a navigable river in 1995 for the infrastructure variable. All variables are in logarithm.

The estimation results indicate that infrastructure is a potential channel of transmission by which aid for trade might affect export performance. Indeed, an increase of 10% of the quality and quantity of infrastructure leads to an average increase in exports over GDP of 20.6%. This is a high economic effect that follows the extensive literature on infrastructure and trade (Limao and Venables, 2001; Brun *et al.*, 2005; Francois and Manchin, 2007; Gamberoni and Newfarmer, 2009). On the other hand, institutions *Time* do not seem to be a determinant of export performance. The statistical significance of the time to export of the OLS estimation disappears once we control for endogeneity. This result is similar to the one of Lederman *et al.* (2010).

In the final column of Table 2, we dropped from the sample all the countries that are not receiving aid for trade. Clearly, one can argue that those countries are richer and then might influence our results and their interpretations. It is apparently not the case. Indeed, even with this reduced sample, the coefficient for infrastructure remains broadly the same, suggesting that the relation we investigate on is robust and relatively stable among income groups. Likewise, the coefficient for our institution variable remains insignificant.

Finally, it should be noticed that results are robust to the inclusion of a landlocked dummy and regional dummies (results upon request).

Regarding the other explanatory variables, *GDP/Pop* has a negative and statistically significant sign, suggesting that richer countries exhibit an export to GDP ratio relatively lower than poor ones. The negative and significant sign for *Pop* also indicates that countries with larger markets export relatively less. The restrictiveness faced by exporters in the rest of the world, $MA-OTRI$, has a negative impact on exports. The business climate, *Volat*, does not seem to be a significant determinant of export performance once we control for outliers.

In order to further assess the robustness of our results, we use alternative measures of our institutional variable (Annex 3). As the reverse causality might still be an issue and as using the number of documents needed to export might seem less appropriate for alternative institutional variables, we had to find alternative instruments. We choose to rely on the work of La Porta *et al.* (1999) by using as instruments binary variables for French, English, German and Scandinavian legal origins.

The time to export measure was replaced by the efficiency of the clearance process by border control agencies, including customs (*Customs_Lpi*), from the Logistic Performance Index (LPI). The LPI has been widely used by recent studies on trade facilitation (Portugal-Perez

and Wilson, 2008; Gamberoni and Newfarmer, 2009; Hoeckman and Nicita, 2010). We do not find any significant impact on exports. Following Anderson and Marcouiller (2002) and Sequeira and Djankov (2009) we also use two variables of control for corruption; the first one from the Polity IV database (*Pol4_corrupt*) and the other (*Icrg_corrupt*) from the International Country Risk Guide (ICRG) but without finding any significant impact. Nevertheless, it should be noticed that across all estimations the infrastructure proxy is positive and highly significant.

5. Aid for trade and infrastructure

5.1. Empirical analysis

Since only infrastructures appear as a determinant of export performance, we now turn to test the effectiveness of aid for trade. First, we want to check that the level of infrastructure is indeed the channel through which aid for trade impacts exports. In order to do so, we include the logarithm of aid for trade per capita *AfT_pc* in equation (IIb) and sequentially add our infrastructure and institution variables.

As it can be seen, in the first column of Table 3, aid for trade seems to have a positive and significant impact on the exports over GDP ratio when we do not control for either the infrastructure or the institutions channel. Nevertheless, aid for trade remains significant only in column (3) when we only introduce our trade related institutions variable. In column (2) and (4), as soon as we control for the level of infrastructure, the significance on the aid for trade variable disappears.

Those results seem to confirm that it is only through its impact on infrastructure that aid for trade influences export performance. Thus, aid for trade and more particularly aid to economic infrastructure enhance the export over GDP ratio. It seems then pertinent to test the impact of aid to infrastructure on our infrastructure index. Indeed, a lack of trade-related infrastructure can discourage investment oriented toward the tradable sector.

Table 3: Aid for trade, infrastructure and institutions

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS
GDP/Pop	0.156	-0.294	-0.014	-0.298
	(0.069)**	(0.126)**	(0.155)	(0.122)**
Pop	-0.087	-0.112	-0.093	-0.118
	(0.043)**	(0.048)**	(0.044)**	(0.077)
Ma-Otri	-0.338	-0.772	-0.316	-0.702
	(0.228)	(0.295)***	(0.215)	(0.572)
AfT_pc	0.113	0.002	0.100	0.001
	(0.052)**	(0.058)	(0.057)*	(0.060)
Infrastructures		2.058		1.910
		(0.544)***		(1.142)*
Time			-0.648	-0.167
			(0.529)	(1.189)
Constant	2.623	4.807	6.118	5.704
	(1.039)**	(1.279)***	(3.219)*	(6.686)
Observations	96	60	95	60
R-squared	0.22	0.08	0.29	0.12
First stage F-stat for Infrastructures		36.24		42.81
First stage F-stat for Time			8.36	2.76

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Instruments used are: documents needed to export for the institutional variable and the proportion of land area within 100km of the coast or a navigable river in 1995 for the infrastructure variable. All variables are in logarithm.

In order to further investigate on this issue, we follow Canning (1998) and the literature on economic geography, urban economics and the determinants of public investment in infrastructure. The equation to be tested is the following:

$$\text{(III)}\quad \begin{aligned}\ln(Infrastructures_i) &= \gamma_0 + \gamma_1 \ln(Infrastructure\_aid\_pc_i) + \gamma_2 \ln(ODA\_pc_i) + \gamma_3 \ln(Pop_i) + \\ &\gamma_4 \ln\left(\frac{GDP_i}{Pop_i}\right) + \gamma_5 \ln(area_i) + \gamma_6 (pop100km_i) + \gamma_7 (land100km_i) + \gamma_8 \ln(pop\_density) + \\ &\gamma_9 \ln(urbanization_i) + \gamma_{10} \ln(rule\_of\_law_i) + \eta_i\end{aligned}$$

where γ are the parameters to be estimated.

We use averaged data over the period 2002-2007. The dependant variable is the same infrastructure index $Infrastructures_i$ used in the previous analysis. $Infrastructure\_aid\_pc_i$ is aid commitments for trade-related infrastructure per capita in constant US dollars of 2000, in average for the period 2002-2007. We use aid commitments in our analysis as the disbursements are not systematically reported by IFIs in the CRS. This variable contains assistance for transport infrastructure, storage and communications (but not aid for the energy

sector) in order to remain consistent with our infrastructure index. Finally, to test for the existence of a different effect of sectoral aid over total aid, we also include total ODA commitments per capita in constant US dollars of 2000, ODA_pc_i. Data come from the CRS database collected by the OECD.

Following Canning (1998), Randolph *et al.* (1996), Fay and Yepes (2003) and Esfahani and Ramirez (2003), we introduce the population Pop_i and GDP per capita $\frac{GDP_i}{Pop_i}$ in order to control for demand effects and the cost of supply. Data come from the World Bank's WDI. We expect a positive influence of these two variables on our infrastructure index. Geography will be captured by two groups of variables related to the shape of a country and to urban economics (Straub, 2008). Firstly, we control for networks effect related to the shape of a country using the proportion of land area $land100km_i$ and population $pop100km_i$ within 100km of the coast or a navigable river in 1995, and surface in squared kilometres $area_i$. Secondly, we try to capture economies of scale induced by networks using the average population density (population per square kilometre) $pop\_density_i$ and the degree of urbanization (the share of population in urban areas) $urbanization_i$; indeed, costs of providing infrastructure in cities are lower. Also, Canning (1998) noted that the degree of urbanization is also a good proxy for the sectoral structure of production, since high values for this variable are associated with more manufacturing and less agricultural activities. Considering that the manufacture sector highly relies on infrastructures, we expect this relationship to be positive. Last but not least, we control for the quality of institutions as Esfahani and Ramirez (2003) explain that production in infrastructure is highly capital intensive and potential investors are concerned about the possibilities of ex-post expropriation of their quasi-rents trough nationalizations or government investments. The institutional quality is approximated by the rule of law variable $rule\_of\_law_i$ from the Polity IV database.

In order to address the endogeneity problem due to reverse causality, measurement error in the data or any remaining unobserved heterogeneity that may lead to omitted-variable bias, we choose to propose a new instrument for aid for infrastructure: the number of privatization transactions in the infrastructure sector between 2000 and 2007. Indeed, we can expect a reverse causality problem because aid for infrastructure is almost certainly allocated toward countries that lag behind (Figure 5, Annex 1). The data was retrieved from the World Bank's

Privatisation Database[13]. This database contains data on the number and sale price of privatization transactions of over $1 million, carried out in developing countries between 2000 and 2007. It only includes transactions which generated proceeds or monetary receipts to the government resulting from partial and full divestitures, concessions, management contracts, and leases. Transactions in infrastructure include those in transportation, telecommunications, water and sewerage, natural gas transmission and distribution, and electricity generation, transmission, and distribution. To be coherent with our infrastructure index, we only rely on the number of transactions within the first two sectors. The dataset covers 99 developing countries.

For the last 25 years, the importance of private investment in infrastructure has been extensively debated in both academic and political circles alike. If it was historically accepted that the supply of water, electricity, roads or telecom was solely a public sector responsibility, this vision has largely evolved over the past two decades. Indeed, during the nineties, supported by the very large number of colossal failures from the states to deliver what were seen as public services, an increased involvement of the private sector appeared as the only answer, leaving only a residual role to the governments. Sadly, as it appears today, this sequence of fast deregulations and restructurations failed to provide the expected results. The most dramatic and well-known examples come from the Latin American experience in the nineties. Today, the developing countries are struggling to compensate this lack of investment in large scale network expansions or in major maintenance of the existing networks that took place in the 90's.

Nowadays, the public sector is once again seen as the major player in financing many of these expansion needs. Getting rid of the dichotomous choice between public and private involvement, the public sector is now expected to retain an important financing role while the private sector might bring a better efficiency in the supply and management. Furthermore, because of the high costs and limited capacity to pay of many of the users, the donor community is expected to be a central actor in the scaling-up of the public investment efforts, at least in the poorer countries (Eustache and Fay, 2007). Hence, privatization transactions are often followed hand by hand with assistance directed toward sectors that were reformed.

Thus, we expect that the number of privatization transactions explains the aid for infrastructure received without directly affecting our infrastructure indicator at the macro level. Indeed, today, most of the privatizations are limited in amounts and firm sizes. The very

13 http://rru.worldbank.org/Privatization/

important investments needed and the high levels of risk or insufficient returns often discourage large private promoters. Then, in many countries, small providers are taking the lead in serving low-income households and dispersed populations in rural and peri-urban areas where large scale providers are unwilling to go. Furthermore, if some of the ventures exhibit strong success in terms of coverage extension or efficiency, a lot of privatization attempts have also failed mostly where institutional environment covering prices and the broader investment climate were not of sufficient quality (Kenny, 2007). Thus, as demonstrated in Andres *et al.* (2008) for Latin America[14], we don't expect to witness any impact of the number of privatizations at the aggregate level on the output and coverage of infrastructure.

5.2. Results

The results from the estimation of equation (III) are shown in Table 4 using OLS and 2SLS. Across all specifications, once instrumented, the aid for infrastructure per capita variable $Infrastructure\_aid\_pc_i$ appears to have a positive and statistically significant effect on infrastructures.

As before, we choose to introduce additional controls sequentially. For column (2) to (5), our coefficient of interest remains remarkably stable both in magnitude and in significance. Indeed, column (5) suggests that an increase of 10% in aid for infrastructure per capita leads to an increase of the quantity of infrastructures of 1%. Results are highly significant at 1% and robust to outliers (column 5)[15]. Furthermore, our instrument seems to perform relatively well. As it can be seen in Annex 2 Table 6, the number of privatization transactions has a positive and very significant impact on the logarithm of aid for infrastructure. The first stage F-stats are also in most cases very close to 10. Even if we cannot provide the statistic of the over-identification test, as we only have one instrument, those evidences tend clearly to confirm our theoretical predictions.

[14] Andres *et al.* (2008) review the performance of 181 privatized firms in 3 sectors (telecommunications, electricity distribution, water and sewerage) across 15 Latin American countries. Controlling for existing pre-privatization and transition-period trends, they conclude that overall there are no significant impacts on output and coverage. Their main conclusion is clearly that regulation is a multi-dimensional issue, with complex effects on the array of outcomes they analyze.

[15] Outliers are Jamaica, Burundi, Philippines, Sri Lanka, Rwanda, India, Mauritius and Bangladesh

Table 4: Aid for infrastructures and infrastructures

Infrastructures	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	2SLS	2SLS	2SLS	2SLS
Infrastructure_aid_pc	0.015	0.107	0.110	0.114	0.102	0.102
	(0.018)	(0.047)**	(0.040)***	(0.042)**	(0.031)**	(0.036)***
ODA_pc	-0.057	-0.197	-0.190	-0.193	-0.180	-0.157
	(0.033)*	(0.069)***	(0.058)***	(0.061)**	(0.050)**	(0.046)***
Pop	0.058	0.043	0.382	0.339	0.150	0.366
	(0.023)**	(0.029)	(0.342)	(0.341)	(0.308)	(0.300)
GDP/Pop	0.181	0.214	0.171	0.184	0.153	0.206
	(0.024)***	(0.026)***	(0.030)***	(0.033)**	(0.033)**	(0.049)***
Lnd100km	0.055	-0.126	0.541	0.516	0.386	0.656
	(0.094)	(0.134)	(0.220)**	(0.226)**	(0.207)*	(0.227)***
Area	-0.116	-0.132	-0.460	-0.418	-0.225	-0.443
	(0.021)***	(0.025)***	(0.353)	(0.351)	(0.319)	(0.309)
Pop100km			-0.653	-0.632	-0.593	-0.766
			(0.208)***	(0.206)**	(0.190)**	(0.197)***
Pop_density			-0.319	-0.276	-0.097	-0.280
			(0.346)	(0.345)	(0.313)	(0.306)
Urbanpop			0.136	0.126	0.212	0.098
			(0.101)	(0.099)	(0.089)**	(0.100)
Rule_of_law				-0.052	-0.049	-0.006
				(0.095)	(0.088)	(0.077)
Constant	-0.375	0.364	-0.028	-0.029	-0.207	-0.304
	(0.417)	(0.691)	(0.590)	(0.602)	(0.621)	(0.554)
Observations	68	68	68	68	60	68
R-squared	0.77	0.61	0.65	0.64	0.65	0.64
First stage F-stat for Infrastructure_aid_pc		9.22	8.97	8.59	15.40	10.79

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
In column (5) eight outliers were dropped using the HADI procedure (Jamaica, Burundi, Philippines, Sri Lanka, Rwanda, India, Mauritius, Bangladesh)
Aid to infrastructure per capita is instrumented by the number of privatizations in the infrastructure sector between 2000 and 2007.
All variables are in logarithm except *Lnd100km* and *Pop100km*.

Regarding the other explanatory variables, GDP per capita $\frac{GDP_i}{Pop_i}$ appears with a positive and statistically significant sign, suggesting that infrastructure supply increase with revenue. As Canning (1998) noted, geographical variables have the biggest strong explanatory impact. The surface in squared kilometres $area_i$ and the proportion of population within 100km of the coast or a navigable river in 1995 $pop100km_i$ are highly significant. The degree of urbanization $urbanization_i$, proxy for the cost of supply of infrastructure and for the manufacture sector, is also positive. Institutions $rule\_of\_law_i$ do not appear as a determinant of infrastructure.

Finally, we observe that assistance to infrastructure has a clearly different effect than total ODA per capita ODA_pc_i on our dependent variable. In every specification total ODA seems to have a fairly robust negative influence on the level of infrastructure. Nevertheless, this result might most certainly be due to the well-known reverse causality problem extensively documented and debated in the literature over the last decade. As a robustness check, we try to instrument total ODA by the voice and accountability variable from the Polity IV database (results upon request). In that special case, it turns out that the coefficient related to total ODA per capita loose its significance whereas the results for the other variables remain the same.

As an additional robustness check, we run the same regression (III) by using aid disbursements instead of commitments (column 6, Table 4). These results need to be considered with caution because, as explained earlier, IFIs do not report their disbursements to the CRS. Nevertheless, the aid for infrastructure variable still appears positive and highly significant.

6. Concluding remarks

The actual slow down of multilateral talks has highlighted the relevance of trade facilitation measures as a complementary economic policy for developing countries. Indeed, recent empirical studies confirm that benefits from a reduction in internal trade costs can be as large as a tariff reduction within the Doha Round (Ikenson, 2008; Hoekman and Nicita, 2008; Hoekman and Nicita, 2010).

Nevertheless, despite the attractiveness of the Aid for Trade initiative for policy makers, there is only scarce evidence on the effectiveness of such assistance. We fill this gap by proposing a two step analysis that allows us to disentangle the channel by witch aid for trade enhance export performance. Our results indicate that a 10% increase in aid to infrastructure commitments leads to an average increase of the exports over GDP ratio of an aid recipient of 2.34%[16]. Accordingly, considering the coefficient of the MA-OTRI variable in Table (2) for our preferred specification, it is also equivalent to a 2.71% reduction of the tariff and non-tariff barriers. This highlights the very high economic impact throughout the channel of infrastructures. Thus, our analysis seems to support the view that aid for trade might be a powerful instrument to assist developing countries in their attempt to enhance export performance and integration into the global economy while the multilateral talks within the Doha round are lingering on.

16 We saw in Table 2, column (5) that an increase of 10% of the infrastructure index leads to an average increase of 10.7% in export performance. Furthermore, an increase of 10% in aid to infrastructure commitments leads to an average increase of the infrastructure index of 1.14% (Table 4, column 5).

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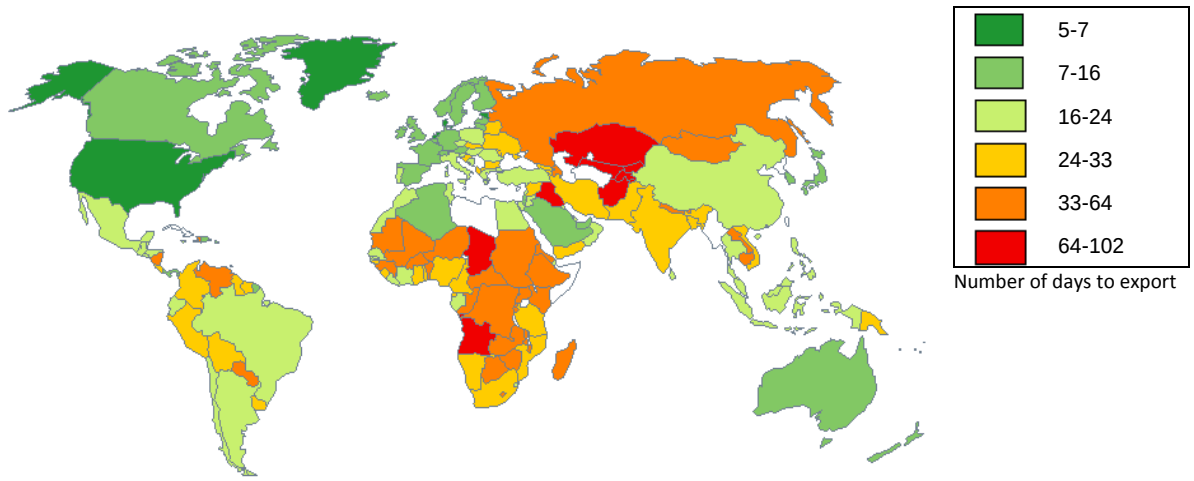
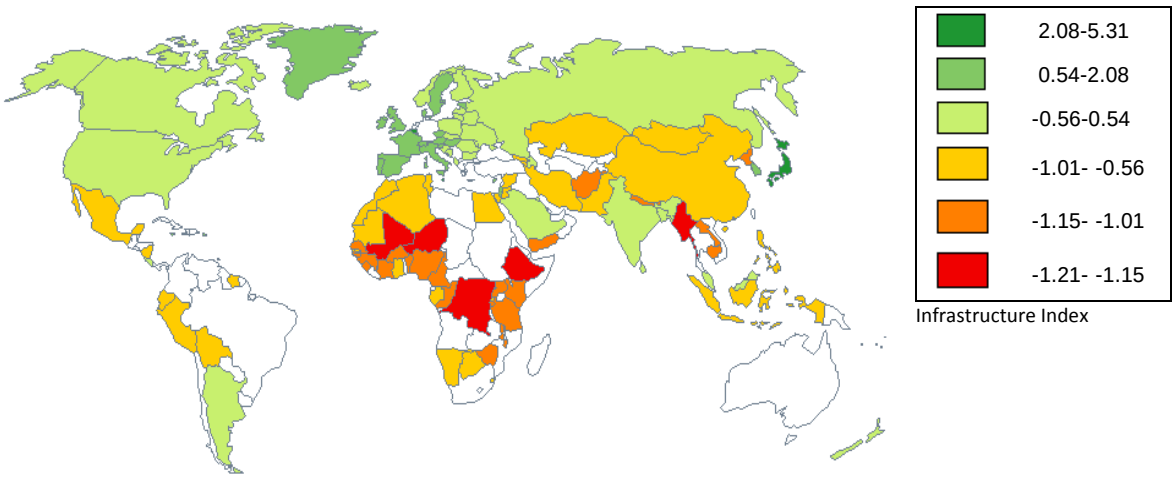
Annex 1:

Figure 3: Number of days to export (2005-2007)



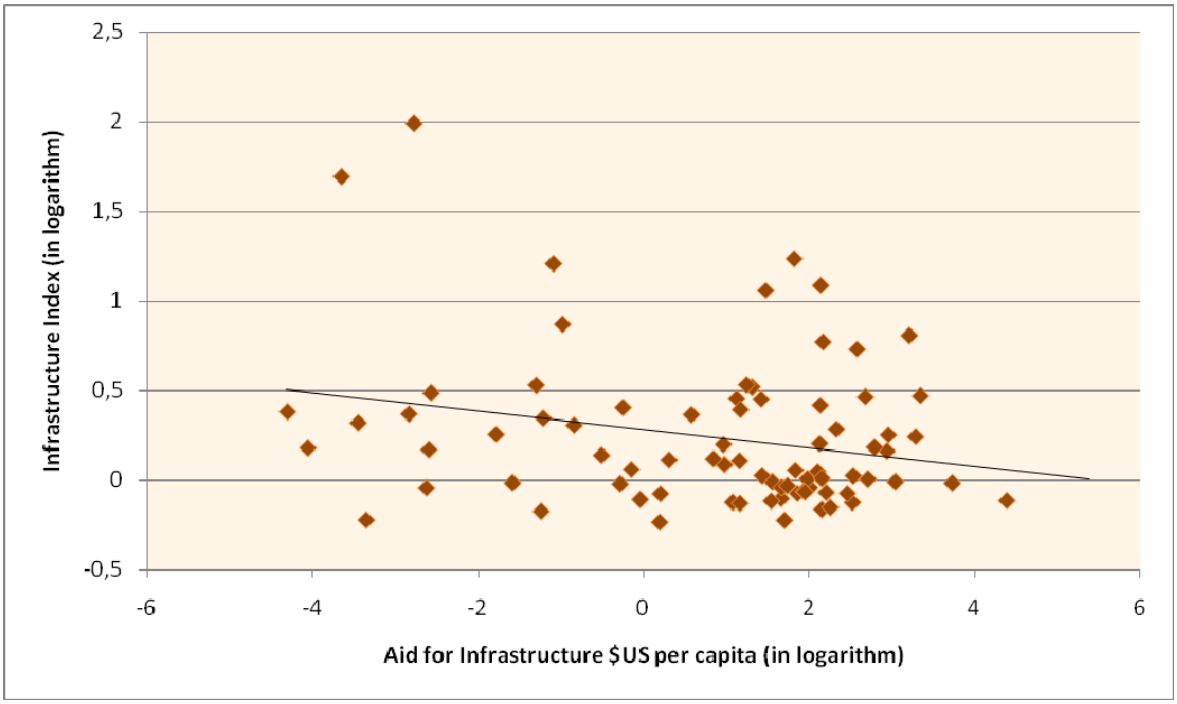
Source: Authors' calculations

Figure 4: Infrastructure Index (2002-2007)



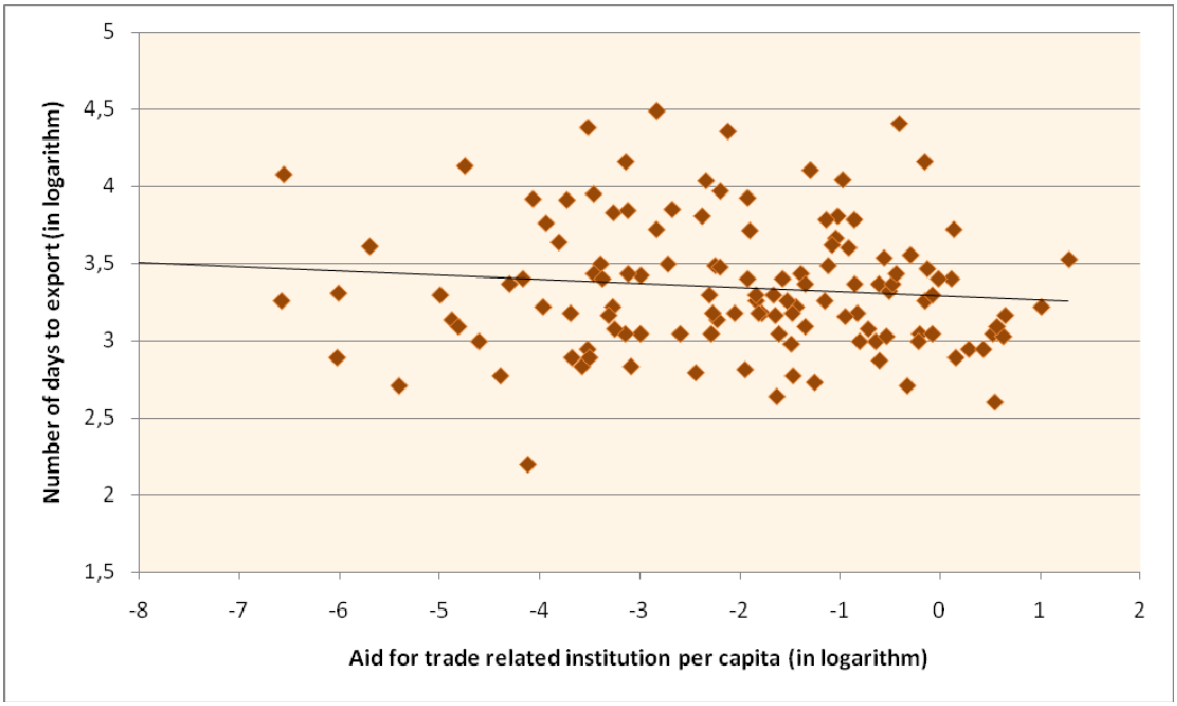
Source: Authors' calculations

Figure 5: Correlation between Infrastructure and Aid to Infrastructure (2002-2007).



Source: Authors' calculations

Figure 6: Correlation between Number of days to export and Aid to Trade-related Institutions (2002-2007).



Source: Authors' calculations

Annex 2:

Table 5: Instrumentation of equation (IIb)

	(1) Infrastructures	(2) Time
GDP/Pop	0.199	-0.187
	(0.021)***	(0.037)***
Pop	0.013	-0.013
	(0.015)	(0.022)
Ma-Otri	0.109	0.103
	(0.088)	(0.121)
Lnd100km	0.004	-0.001
	(0.001)***	(0.001)
Documents	-0.133	0.698
	(0.099)	(0.227)***
Constant	-0.972	3.697
	(0.389)**	(0.845)***
Observations	91	91
R-squared	0.84	0.76

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables except *Lnd100km* are in logarithm.

Table 6: Instrumentation of equation (III)

	Infrastructure_aid_pc
ODA_pc	1.436
	(0.261)***
Pop	-0.862
	(2.671)
GDP/Pop	-0.308
	(0.247)
Lnd100km	1.214
	(1.508)
Area	1.072
	(2.752)
Pop100km	0.773
	(1.464)
Pop_density	0.787
	(2.672)
Urbanpop	-0.841
	(0.580)
Rule_of_law	1.070
	(0.689)
Privatizations_00_07	0.019
	(0.006)***
Constant	-3.301
	(4.290)
Observations	68
R-squared	0.71

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables except instruments are in logarithm except *Privatizations_00_07*.

Annex 3:

Table 7: Robustness on Exports to GDP ratio

	(1) 2SLS	(2) 2SLS	(3) 2SLS
Infrastructures	1.884 (0.372)***	1.332 (0.279)***	1.627 (0.336)***
Customs_Lpi	-0.640 (1.003)		
Icrg_corrupt		-0.183 (0.345)	
Pol4_corrupt			-0.748 (0.734)
GDP/Pop	-0.363 (0.145)**	-0.269 (0.113)**	-0.224 (0.183)
Pop	-0.132 (0.061)**	-0.168 (0.041)***	-0.173 (0.045)***
Ma-otri	-0.845 (0.291)***	-0.642 (0.296)**	-0.765 (0.301)**
Volat	-0.166 (1.454)	0.050 (0.574)	0.247 (0.151)
Constant	5.972 (1.194)***	6.144 (0.842)***	5.903 (0.871)***
Observations	71	69	76
R-squared	0.10	0.28	0.13
First stage F-stat for Infra	36.31	45.75	43.72
First stage F-stat for Institutions	9.73	4.52	4.94
Outliers (HADI)	Guinea Zimbabwe	Guinea Zimbabwe	Guinea Zimbabwe

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Instruments for institutions variables in columns (1) (2) and (3) are 4 dummy variables for French, English, German and Scandinavian legal origins as in Laporta *et al*. (1999).

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