

# The Effectiveness of Aid for Trade in Sub-Saharan Africa

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## Abstract

The purpose of this paper is to investigate the effectiveness of Aid for Trade in Sub-Saharan African countries. This study examines the nature of the link between Aid for Trade on both exports and imports of Sub-Saharan African countries with OECD countries over the period 2005 to 2017. From the estimation of the two respective gravity models by the Poisson Pseudo-Maximum Likelihood method, it emerges that aid for trade negatively affects the export flows and positively affects the import flows of Sub-Saharan African countries in the trade relationship with OECD countries. Aid for trade is therefore ineffective because it contributes to maintaining a trade deficit for sub-Saharan African countries. It is therefore recommended that development partners focus aid for trade on the recipient countries' import substitution strategy.

## Keywords

Aid for Trade, Trade Balance, Gravity Model, Poisson Pseudo-Maximum Likelihood, Sub-Saharan African Countries

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## 1. Introduction

Africa's level of commercial operations is among the lowest in the world; international institutions and rating agencies also note the lowest levels of economic competitiveness in this part of the world. Yet Sub-Saharan Africa (SSA) is the main beneficiary of international aid (OECD, 2006), and more specifically that directed towards commercial activities. Sub-Saharan Africa's marginal contribution to world trade can be explained by its limited market access, but also by the deterioration in its terms of trade, which is helping to slow export growth in this region (Morrissey and Mold, 2006).

The argument of insufficient savings in developing countries is also sometimes put forward to explain the limited access of poor countries to the international

market. Poor countries sometimes face a financing gap that can be filled by debt or international aid.

However, despite the benefits of international aid, sub-Saharan Africa does not seem to have fully integrated the challenges of developing its productive sector, which would make its supply of goods and services more competitive on the international market. Indeed, it is easy to see that African countries invest little in research and development, the acquisition of cutting-edge technologies and innovation, the incorporation of which into the production system would certainly enable them to offer a quality product that is competitive on the international market. Indeed, Aid for Trade is seen as a solution to the challenges of development and a key element in establishing trade relations (Melvin, 2023).

However, the constraints imposed on the entry of African products into Northern markets are also a major obstacle to the competitiveness of products from developing countries. Based on World Bank estimates, the Oxfam (2002) report notes that the barriers implemented by rich countries against exports from poor countries cost the latter 100 billion dollars a year, i.e. twice as much as they receive in ODA.

The publication of the World Bank reports “Strengthening the Effectiveness of Aid” and “Assessing Aid” in 1995 and 1998 respectively rekindled the debate on the ineffectiveness of development aid. It is the return of an old debate. We still remember the emergence of the slogan “trade, not aid”, put forward by a number of developing countries in the 1960s, which sums up one of the main principles of fair trade: trade rather than charity. The “trade, not aid” movement proposes replacing international aid, which is ineffective, with fair and equitable trade.

Indeed, the controversy over the effectiveness of official development assistance has led the World Trade Organisation (WTO) to place aid within a new paradigm: achieving development through trade. This paradigm shift took concrete form with the launch of the Aid for Trade (AFT) initiative at the Hong Kong Ministerial Conference in 2005. Under this initiative, part of international aid is devoted to a clear objective: to increase trade in developing countries, with the idea that trade can stimulate growth and reduce poverty in these countries (Dollar and Kraay, 2003, 2004; Winters et al., 2004) and that reforms aimed at liberalising trade are ineffective if they are not coupled with aid from developed countries to make them competitive. The trade balance of African countries is influenced by several factors, including the exchange rate (Keho, 2021). Despite this multitude of determinants of the trade balance, this study focuses on the effect of aid on trade in the light of current debates on the subject.

Indeed, this study takes place in a context marked both by the resurgence of debates on the effectiveness of international aid and a sustained deficit in the trade balance of sub-Saharan African countries despite the benefit of aid for trade resources, giving the impression that Africa has not been able to capitalise on the opportunity of aid to increase its gains in economic competitiveness. Gunning (2001) outlined the main arguments in favour of aid and the areas in which it can

be used to improve effectiveness: aid helps to overcome credit market failures because, despite the high potential returns on investment, developing countries have difficulty in mobilising resources on the capital markets. More than fifteen years after the launch of the “Aid for Trade” initiative.

In order to fully understand the low participation of sub-Saharan African countries in international trade, despite the benefits of Aid for Trade, we believe it would be useful to conduct a study to assess the relationship between Aid for Trade and international trade in sub-Saharan African countries.

Hence the research question: does Aid for Trade have a positive influence on international trade in sub-Saharan African countries?

The main objective of this research is to assess the effect of Aid for Trade on international trade in sub-Saharan African countries.

It seems appropriate to support the hypothesis that aid for trade has a negative influence on the international trade of recipient countries in Sub-Saharan Africa. Specifically, aid for trade has a negative impact on Sub-Saharan African countries' exports to OECD countries (Hypothesis 1) and a positive impact on Sub-Saharan African countries' imports from OECD countries (Hypothesis 2).

This study builds on previous research to extend the coverage and depth of Aid for Trade as it relates to international trade in Sub-Saharan African countries. The study seeks to contribute to the literature by examining how Aid for Trade disbursements influence international trade. Most existing work on the relationship between Aid for Trade and international trade is limited to the effect of Aid for Trade on recipient countries' exports. This study has the particular ambition of analysing not only the link between aid for trade and exports, but also the link between aid for trade and the imports of recipient countries in bilateral relations with OECD countries. Thus, the effectiveness of Aid for Trade would only have a real basis if it promoted more exports from sub-Saharan African countries rather than imports from OECD aid donor countries. By analysing separately, the effect of aid for trade on imports on the one hand and on exports on the other, this study fills the gaps in the empirical analysis in which trade openness or the trade balance are used to assess the effectiveness of aid for trade.

## 2. Literature Review

Theoretical foundations and a review of empirical work are presented.

### 2.1. Theoretical Foundations

The twin deficits theory describes a situation in which a country runs a trade deficit and a government deficit at the same time. Various theoretical approaches can be used to explain the link between the budget deficit and the current account deficit: most of the approaches used to illustrate the existence of a potential relationship between internal and external deficits suggest that the creation of an internal deficit also leads to an external deficit. With the exception of the overlapping generations model, which includes agents' planning horizons in the analysis

without claiming that the link is non-existent, and the Ricardo-Barro model, for which there is no link between the two deficits, all the other approaches used illustrate the presence of a link.

The arguments put forward by Ricardo and Barro to illustrate the absence of a link between the deficits are based on the hypothesis of the rationality of agents, except that this rationality is sometimes limited, for example in the presence of imperfect information. For the other models that do identify the presence of a link between the two deficits, we observe that the link is established via various mechanisms. The financing gap model can therefore explain the relationship between aid for trade and international trade. All we need to do is consider that the internal deficit is offset by aid flows, and the resulting imports following an increase in income do indeed describe international trade.

This link can also be explained by dependency theory. Dependency theory is a theory of the field of science which maintains that poverty, political instability and underdevelopment in the countries of the South are the consequence of historical processes put in place by the countries of the North, resulting in the economic dependence of the countries of the South (Yotopoulos, 1966). Authors such as R. Prebisch and C. Furtado maintain that poor economies are commercially, financially, technologically and even culturally dependent on industrialised countries. Trade dependence is based on the fact that the trade structure of poor countries is not sufficiently diversified and is based on a few primary products. The lack of savings in poor countries may explain the financial dependence of the South on the North. Financial dependence, for example through aid for trade, can lead to trade dependence. According to this theory, aid for trade would have a negative effect on trade in the countries of the South.

## 2.2. Review of Empirical Work

Several studies have analysed the link between aid for trade and exports (Cali and te Velde, 2011; Vijil and Wagner, 2012; Iwanow and Kirkpatrick, 2007, 2009; Lemi, 2017).

Cali and te Velde (2011) study total merchandise trade performance for a hundred countries in the mid-2000s and conclude that the component of aid for trade allocated to economic infrastructure development was associated with an increase in recipient country exports while the component of aid for trade dedicated to improving productive capacity does not appear to influence export performance. Lemi (2017) uses the generalised least squares (GLS) method to examine the nature of the link between aid for trade and the trade performance of African countries. The author concludes that OECD Aid for Trade for “trade education and training” improves Africa’s net exports. EU AfT does not reinforce dominant forms of international dependence, at least when measured by the source of FDI it attracts (Saltnes et al., 2020).

Hoekman and Shingal (2019) analyse the effect of bilateral aid for trade on exports of goods and services from recipient countries to donor countries and find

that aid allocated to service activities, in particular economic infrastructure, has a positive effect on exports of goods from recipients to donors. Helble et al. (2012) estimate a gravity model using bilateral merchandise flows on a sample of 167 importers and 172 exporters and disaggregated aid-for-trade flows over sixteen years (1990-2005). Their results show that aid for trade leads to an increase in exports from the country receiving the aid. More specifically, this work indicates that 1 dollar of aid for trade is associated with an increase in the recipient country's exports of around 1.33 dollars.

Bearce et al. (2013) study the effects of Aid for Trade issued by the government of the United States of America to developing countries for the period from 1999 to 2008 and conclude that Aid for Trade issued by the US government has a positive effect on the export performance of the recipient country. The authors point out that an increase of 1 dollar in total US aid for trade led to an increase of around 69 dollars in recipient exports two years later. Gnangnon (2018) shows that total Aid for Trade as well as its components (AfT for services sectors and AfT for other sectors) exert a positive effect on the diversification of services exports over the whole.

The economic literature seems to pay less attention to the influence of aid for trade on imports from beneficiary countries. To the best of our knowledge, studies in this area are particularly rare. Nevertheless, it is possible to deduce from the results obtained studies illustrating the relationship between aid for trade and exports from donor countries. The relationship is reversed on the side of the recipient countries.

Hühne, Meyer and Nunnenkamp (2014) studied the impact of PTA from all DAC donor countries on imports from recipient countries. The authors find that aid for trade increases recipient countries' imports by 3%. However, the nature of the products exported was not observed. If the imported goods were strategic for the donor, then the aid could be self-serving and therefore endogenous to trade. Moreover, Biardeau and Boring (2015) show that aid seems to have a positive impact on both donor and recipient country exports.

### 3. Methodological Approach

After specifying the models, the estimation techniques for these models are presented.

#### 3.1. Model Specification

The models to be estimated are gravity models inspired by Tinbergen (1962) and adopted by Deardoff (1998). Deardoff's gravity model is written as follows:

$$T_{ij} = A \frac{Y_i \times Y_j}{D_{ij}}$$

where  $T_{ij}$ , is the value of trade (imports, exports) from country  $i$  to country  $j$ ,  $D_{ij}$  the geographical distance between country  $i$  and country  $j$ ,  $Y_i$  and  $Y_j$

being respectively the national income of country  $i$  and country  $j$ , and  $A$  a constant of proportionality.

$$\ln X_{ijt} = \ln K + \alpha_1 \ln PIB_{it} + \alpha_2 \ln PIB_{jt} + \alpha_3 \ln APC_{jit} + \alpha_4 \ln Couts_{ijt} + \varepsilon_{ijt}$$

$$\ln M_{ijt} = \ln T + \mu_1 \ln PIB_{it} + \mu_2 \ln PIB_{jt} + \mu_3 \ln APC_{jit} + \mu_4 \ln Couts_{ijt} + \rho_{ijt}$$

By positing  $\alpha_0 = \ln K$ ,  $\mu_0 = \ln T$ , certain traditional variables (dummies) of the gravity model and those capturing governance and trade freedom that would be lost with the application of log-linearisation, the equations are adjusted as follows:

The effect of aid for trade on exports from the sub-Saharan African country under consideration to the OECD country providing the aid is modelled by:

$$\ln X_{ijt} = \alpha_0 + \alpha_1 \ln PIB_{it} + \alpha_2 \ln PIB_{jt} + \alpha_3 \ln APC_{jit} + \alpha_4 \ln Couts_{ijt} + \alpha_5 \ln Lien\_col_{ij} + \alpha_6 \ln Lang\_com_{ij} + \alpha_7 \ln Gouv_{it} + \varepsilon_{ijt} \quad (\text{model 1})$$

The effect of AfT on imports from the OECD donor country to the sub-Saharan African country is modelled by:

$$\ln M_{ijt} = \alpha_0 + \alpha_1 \ln PIB_{it} + \alpha_2 \ln PIB_{jt} + \alpha_3 \ln APC_{jit} + \alpha_4 \ln Couts_{ijt} + \alpha_5 \ln Lien\_col_{ij} + \alpha_6 \ln Lang\_com_{ij} + \alpha_7 \ln Gouv_{it} + \varepsilon_{ijt} \quad (\text{model 2})$$

Models 1 and 2 are then estimated. Models 1A and 2A are the models without the quality of governance explanatory variable, whereas models 1B and 2B are the complete models that take into account the quality of governance variable previously used to justify the backwardness of developing countries. According to [Aboushady et al. \(2024\)](#), strengthening governance in countries receiving aid for trade and reducing their institutional gap with donors would increase the effect of aid for trade on their exports. However, in this study, the quality of governance is not used as a variable moderating the effect of aid for trade on exports, but rather as a control variable in the model.

The model variables are explained as follows:

$i = 1, \dots, 15$ . Indicating the sub-Saharan African country considered;

$j = 1, \dots, 5$ . Indicating the OECD partner under consideration;

$t = 2005, \dots, 2017$ ;

$PIB_{it}$  = Gross Domestic Product of country  $i$  in year  $t$ ;

$PIB_{jt}$  = Gross domestic product of country  $j$  in year  $t$ ;

$APC_{jit}$  = Flows of aid for trade from country  $j$  to country  $i$  in year  $t$ ;

$Couts_{ijt}$  = Estimated cost of bilateral trade of country  $i$  with country  $j$  at date  $t$ ;

$Lang\_com_{ij}$  = Dummy variable which captures the presence of a common language between  $i$  and  $j$ ;

$Lien\_col_{ij}$  = dummy variable that captures the presence of a colonial link between  $i$  and  $j$ ;

$Gouv_{it}$  = governance index in country  $i$  at date  $t$ ;

$\alpha_0, \mu_0, K, T$  = constants;

$\ln$  = Natural logarithm;

$\varepsilon_{ijt}, \rho_{ijt}$  = error terms assumed to be normally distributed.

### 3.2. Samples and Data Sources

The study is based on a sample of fifteen sub-Saharan African countries and five OECD countries, which are often presented as the main donors of aid to sub-Saharan Africa: Germany, Great Britain, the United States, France and Italy, the first four of which are presented by Lemi (2017) as Africa's best trading partners. The choice of sample with respect to sub-Saharan African countries is guided solely by the availability of sufficient data on the variable of interest "aid for trade" in November 2020. The sample consists of the following countries: Angola, Botswana, Cameroon, Congo, Côte d'Ivoire, Ethiopia, Gabon, Kenya, Madagascar, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania.

The dependent variables are bilateral exports and imports. The relevant data are extracted from the database of the United Nations Conference on Trade and Development (UNCTAD).

The key explanatory variable is aid for trade. Data on Aid for Trade are obtained by aggregating its components from the OECD Creditor Reporting System database (OECD, 2019), which provides disaggregated data for Aid for Trade activities. Aid for Trade measures all official development assistance devoted to trade, which comprises five main categories: technical assistance for trade policy and regulation, trade-related infrastructure, productive capacity building, trade-related adjustment and other trade-related needs. The flows used are disbursements of resources dedicated to the PCA in constant (2018) US dollars.

The other explanatory variables are control variables. These are the partners' gross domestic product (GDP), transport costs, a trade freedom indicator, a governance indicator, the common language and the colonial link.

The data on the traditional variables of the gravity model used in this study: the common language and the colonial link are taken from the database of the "Centre d'études prospectives de l'information internationale" (CEPII) (Head et al., 2010; Head and Mayer, 2013).

The costs are estimates of the costs of bilateral trade in agricultural products and manufactured goods. The data on bilateral trade costs are extracted from the World Bank's ESCAP (Economic and Social Commission for Asia and the Pacific) database. These costs are calculated using the Inverse Gravity Framework (Novy, 2009), which estimates trade costs for each country on the basis of bilateral trade and gross national production. These costs do not take into account those related to bilateral trade in extractive products.

Common language refers to the common use of an official language between a country and its trading partner. The corresponding indicator in the CEPII database is "comlang\_off".

The colonial link reflects the existence of a historical link related to colonisation between a country and its trading partner. It corresponds to the 'colony' indicator in the CEPII database.

Gross domestic product data are taken from the World Bank's World Development Indicators database, available online in August 2020. GDP figures in dollars

are converted from national currencies using official 2010 exchange rates. GDP at purchaser prices is the sum of gross value added by all resident producers in the economy plus taxes on products and less subsidies not included in the value of products. It is calculated without deductions for depreciation of manufactured goods or depletion and degradation of natural resources.

Finally, the data on governance is taken from the World Bank's World Governance Indicators database. This is the governance indicator proposed by [Kaufmann et al. \(2010\)](#), which captures the level of perception of corruption by public authorities, taking into account both major and minor forms of corruption. The estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately  $-2.5$  to  $2.5$ . Negative scores indicate poor control of corruption, while positive scores indicate good control of corruption.

### 3.3. Estimation Techniques

After presenting the data, it is essential to explain the technique used to estimate the gravity equations with exports and imports of goods as dependent variables. In the economic literature, the Ordinary Least Squares method is the most popular for estimating the gravity model using panel data. However, this approach has its limitations. In addition to posing endogeneity problems, it does not take into account the fact that some countries do not trade with each other. Zero trade flows are eliminated because the natural logarithm of zero is not defined. Since the sample is truncated, the estimation results are biased.

A common way of dealing with this problem is to use an ad hoc correction for the presence of zero flows using the OLS estimator: a small value is added to the true value of the dependent variable so that the logarithm of this value is defined. Zero trade flows are then replaced by 1 or 0.01, for example ([Eichengreen and Irwin, 1995](#)). More concretely, these authors propose a transformation for solving the zeros problem which consists of estimating  $\ln(1+\text{Trade})$  instead of  $\ln(\text{Trade})$ , as the values of  $\ln(\text{Trade})$  and  $\ln(1+\text{Trade})$  are very close.

Another solution proposed by [Rose \(2000\)](#) consists of deleting all observations in which the dependent variable takes the value zero. However, this practice of deleting certain observations may result in a significant loss of information that could generate estimation biases insofar as it creates an artificial trade. Still in the context of OLS, another approach suggests the use of a Tobit estimator to take account of the fact that OLS is used on a truncated sample. However, these two solutions to zero OLS trade flows can generate inconsistent estimators of the parameters of interest ([Silva and Tenreyro, 2006](#)). Furthermore, log-linearisation generates inconsistent estimators in the presence of heteroskedasticity ([Silva and Tenreyro, 2006](#)).

To solve the estimation problems associated with the presence of zero trade flows [Anderson et al. \(2015\)](#), [Silva and Tenreyro \(2006\)](#) and [Cestepe et al. \(2015\)](#) propose an easy technique that consists of using a Poisson Pseudo-Maximum

Likelihood (PPML) estimator. The gravity equation is then estimated in level, which maintains observations for which trade flows are zero. Since the publication of the article by [Silva and Tenreyro \(2006\)](#), the Poisson pseudo-maximum likelihood method has become the reference in terms of estimating gravity models but is surprisingly little used in the literature studying the impact of aid for trade.

Our dependent variables take the value zero if there is no trade between a Sub-Saharan African country and its OECD partner. Consequently, we have zero observations whose elimination generates a selection bias. Consequently, we propose an estimation method that makes it possible to deal with the presence of zero flows. This is the pseudo-maximum likelihood estimator within the framework of a Poisson model suggested by Silva and Tenreyro (*op. cit.*), which has the advantage of including zero observations in the regression and guarantees an unbiased estimate of the values of the coefficients even in the presence of heteroskedasticity. Moreover, in order to take account of the progress made in estimation methods in the field of international trade, and particularly the gravity model, the PPML method is particularly suitable for consolidating the validity of our results. This method is undoubtedly the gold standard in gravity model estimation. Indeed, it is more effective in mitigating both heteroskedasticity and endogeneity concerns ([Lemi, 2017](#)).

In summary, our two gravity equations will be estimated using the PPML estimator to address the issues of endogeneity and null values. However, to verify the robustness of our results, we use the Generalised Least Squares (GLS) method to estimate the equation modelling imports, as the variable is not truncated; in other words, no import flows are null. This method is suggested by Lemi A. (*op. cit.*) to correct heteroskedasticity, given the diversity of African countries. Furthermore, as some export flows are null, the use of OLS would not be appropriate. Thus, we propose the Heckman estimation method to consolidate our results concerning the equation modelling exports.

Before proceeding to the actual estimation, it is necessary to verify the stationarity of certain explanatory variables in our model, specifically those that vary over time, as the data form a static panel.

#### **4. Results and Discussions**

Before presenting the results of our estimations, it is important to recall that the analysis is based on unbalanced panel data, with the individual dimension comprising fifteen countries and the temporal dimension spanning thirteen years (2005-2017).

Our data were compiled and processed using Excel 2007. Furthermore, STATA software, version 2014, was employed for the econometric analysis of our data.

We will also revisit the gravity equations to be estimated and the study's hypotheses.

#### 4.1. Results and Discussions on the Estimation of the Model Explaining the Effect of Trade Aid on Exports

The results are summarised in **Table 1** below:

**Table 1.** Estimation results using the PPML and heckman methods for the model explaining the effect of trade aid on exports.

Estimation Techniques	Estimation using the PPML method		Estimation using the Heckman method	
Models	Model 1A	Model 1B	Model 1A	Model 1B
Dependent variables	Exportations	Exportations	Exportations	Exportations
Independent variables	$\ln X_{ij}$	$\ln X_{ij}$	$\ln X_{ij}$	$\ln X_{ij}$
GDP of the African country $i$ ( $\ln PIB_i$ )	<b>0.0448***</b> (0.00257)	<b>0.0409***</b> (0.00263)	<b>0.864***</b> (0.0437)	<b>0.796***</b> (0.0474)
GDP of the OECD country $j$ ( $\ln PIB_j$ )	<b>0.0392***</b> (0.00389)	<b>0.0384***</b> (0.00384)	<b>0.736***</b> (0.0674)	<b>0.724***</b> (0.0670)
Aid for Trade received by country $i$ from $j$ ( $\ln APC_{ji}$ )	<b>-0.00340***</b> (0.00107)	<b>0.00353***</b> (0.00107)	<b>-0.0695***</b> (0.0533)	<b>-0.0722***</b>
Colonial link between countries $i$ and $j$ ( $Lien_{colij}$ )	<b>-0.00150</b> (0.00868)	<b>-0.00173</b> (0.00902)	<b>0.0255</b> (0.156)	<b>0.0249</b> (0.155)
Common language between countries $i$ and $j$ ( $Lang_{comij}$ )	<b>-0.00372</b> (0.00552)	<b>0.000196</b> (0.00565)	<b>-0.0542</b> (0.126)	<b>0.0116</b> (0.127)
Transport costs between countries $i$ and $j$ ( $\ln Couts_{ij}$ )	<b>-0.207***</b> (0.0144)	<b>-0.197***</b> (0.0150)	<b>-3.738***</b> (0.171)	<b>-3.556***</b> (0.177)
Governance level of country $i$ ( $Gouv_{it}$ )		<b>-0.0181**</b> (0.00725)		<b>-0.305***</b> (0.0867)
Constant	<b>1.831***</b> (0.141)	<b>1.880***</b> (0.138)	<b>-3.129</b> (2.390)	<b>-2.274</b>
Observations	767	767	775	775
R-squared	0.677	0.683		

$i$  indicates the Sub-Saharan African country, and  $j$  the OECD partner country. Notes: Robust standard errors are in parentheses. \*Indicates that the coefficient is significant at the 10% level; \*\*Indicates that the coefficient is significant at the 5% level; \*\*\*Indicates that the coefficient is significant at the 1% level. Source: Author's calculations based on the study data.

First of all, we estimated the export equation using the PPML and Heckman methods without including the variable measuring governance (PPML1 and Heckman1), specifically the corruption index. Next, we estimated the export equation incorporating all variables, including the governance variable. As a result, by integrating the governance variable into our model (PPML2 and Heckman2), the

coefficient of determination improved from 67% to 68%. Consequently, nearly 68% of Sub-Saharan Africa's exports are explained by the exogenous variables in our model, demonstrating a strong explanatory power of the independent variables in our models.

However, it is worth noting that, while there are no strict rules or precise scales to indicate whether the value of the coefficient of determination ( $R^2$ ) should be considered "poor" or "excellent", an excessively high value ( $R^2$  or adjusted  $R^2$  exceeding 85%) may conceal a significant issue (notably endogeneity), leading to entirely erroneous results. Furthermore, it is often impossible to achieve values deemed "satisfactory" due to the limitations of the available data for analysis. It is therefore not uncommon for econometricians to settle for an  $R^2$  of "only" 40% (or even 30%). In this context, our coefficient of determination is more than adequate, and striving for a high coefficient of determination should not be an end in itself.

Our reference estimation method remains the PPML and serves as the basis for our interpretation.

The regression coefficients enable us to determine the direction and nature of the relationship between the endogenous variable and the exogenous variables.

Regardless of the estimation method used (PPML or Heckman), the GDP coefficient, for both Sub-Saharan African countries and their OECD partners in exports, is significant at the 1% threshold and positively signed. This aligns with our expectations and the insights of the gravity model.

We also observe that the coefficient of our variable of interest (trade aid) is significant at the 1% level and negatively signed, indicating that trade aid and exports do not evolve in the same direction. This is consistent with our expectations and confirms the first hypothesis of this study: trade aid negatively impacts the exports of Sub-Saharan African countries. Moreover, this result suggests that trade aid adversely affects the exports of Sub-Saharan African countries. The subcontinent appears to suffer from dependency on trade aid, which is perceived merely as a rent rather than an incentive to produce and export more tradable goods. Nevertheless, this result aligns with Keynes's fundamental psychological law, which states that an increase in income leads to an increase in consumption (imports) that is less than proportional to the increase in income.

The trade costs coefficient is significant at the 1% level and negatively signed, which is consistent with our expectations. Additionally, trade costs are considered a resistance factor to trade in the economic literature. Thus, an increase in trade costs leads to a reduction in Sub-Saharan Africa's exports to the OECD.

The governance coefficient is significantly negative at the 5% level, which aligns with our expectations and economic literature, given the fragility of institutions in Sub-Saharan Africa.

The coefficients of the two indicator variables (common language and colonial link) are not significant, contrary to our expectations. However, the lack of significance of these coefficients could be explained by the expansion of Sub-Saharan Africa's trade partnerships to other countries such as China and India, which are

not connected to Sub-Saharan Africa by language or any historical ties.

#### 4.2. Results and Discussions on the Estimation of the Model Explaining the Effect of Trade Aid on Imports

**Table 2** presents the estimation results of the equation modelling the imports of Sub-Saharan African countries from the OECD, using the PPML method on the one hand, and the Generalised Least Squares (GLS) method on the other, to ensure the robustness of our results.

**Table 2.** Estimation results of the model using the PPML and GLS methods explaining the effect of trade aid on imports.

Estimation Techniques	Estimation using the PPML method		Estimation using the Heckman method	
	Model 2A	Model 2B	Model 2A	Model 2B
Dependent variables	Imports	Imports	Imports	Imports
Independent variables	$\ln M_{ij}$	$\ln M_{ij}$	$\ln M_{ij}$	$\ln M_{ij}$
GDP of the African country $i$ ( $\ln PIB_i$ )	<b>0.0386***</b> (0.00248)	<b>0.0364***</b> (0.00256)	<b>0.754***</b> (0.0303)	<b>0.715***</b> (0.0332)
GDP of the OECD country $j$ ( $\ln PIB_j$ )	<b>0.0251***</b> (0.00169)	<b>0.0247***</b> (0.00166)	<b>0.473***</b> (0.0472)	<b>0.467***</b> (0.0470)
Aid for Trade received by country $i$ from $j$ ( $\ln APC_{ji}$ )	<b>0.00248***</b> (0.000603)	<b>0.00242***</b> (0.000597)	<b>0.0460***</b> (0.0119)	<b>0.0448***</b> (0.0118)
Colonial link between countries $i$ and $j$ ( $Lien_{colij}$ )	<b>0.0371***</b> (0.00448)	<b>0.0371***</b> (0.00454)	<b>0.716***</b> (0.109)	<b>0.715***</b> (0.109)
Common language between countries $i$ and $j$ ( $Lang_{comij}$ )	<b>-0.00526*</b> (0.00309)	<b>-0.00313</b> (0.00315)	<b>-0.0788</b> (0.0884)	<b>-0.0414</b> (0.0889)
Transport costs between countries $i$ and $j$ ( $\ln Couts_{ij}$ )	<b>-0.0877***</b> (0.00791)	<b>-0.0819***</b> (0.00853)	<b>-1.629***</b> (0.119)	<b>-1.529***</b> (0.124)
Governance level of country $i$ ( $Gouv_{it}$ )		<b>0.00986***</b> (0.00352)		<b>-0.171***</b> (0.0607)
Constant	<b>1.701***</b> (0.0742)	<b>1.729***</b> (0.0719)	<b>-5.154***</b> (1.671)	<b>-4.661***</b> (1.672)
Observations	775	775	775	775
R-squared	0.673	0.677		

$i$  indicates the Sub-Saharan African country, and  $j$  the OECD partner country. Notes: Robust standard errors are in parentheses. \*Indicates that the coefficient is significant at the 10% level; \*\*Indicates that the coefficient is significant at the 5% level; \*\*\*Indicates that the coefficient is significant at the 1% level. Source: Author's calculations based on the study data.

The estimation using the GLS method confirms the robustness of our results previously estimated by the PPML method. The interpretation of the results is therefore based on the PPML estimation method, which is presented as the reference method for estimating gravity equations.

The estimation of the gravity equation modelling imports shows a coefficient of determination of 67%, both with the partial equation and the complete equation (including the variable measuring governance). This reflects the strong explanatory power of our exogenous variables. The results show that all the coefficients are statistically significant.

The coefficients of certain traditional variables in the gravity model retained in our framework, namely the GDPs of the trading partners and the dummy variable indicating the colonial link, are significant at the 1% threshold with a positive sign, which is consistent with our expectations and the principles of the gravity model. Furthermore, the coefficient of the indicator variable indicating the presence or absence of a common language is significant at the 10% threshold but has a negative sign, which is not consistent with our expectations.

Regarding trade costs for imports, the coefficient is significantly negative at the 1% threshold, which aligns with the economic literature, as they represent resistance factors to trade. The coefficient of the variable measuring governance is significant at the 1% threshold and negatively signed. This result is consistent with our expectations, considering the fragility of institutions in Sub-Saharan Africa.

Finally, the coefficient of our variable of interest is significant and positively signed, which aligns with our expectations and, in particular, with the second hypothesis of this study, which posits that trade aid is positively associated with the imports of Sub-Saharan African countries.

## 5. Conclusion

At the conclusion of this research, it is worthwhile to recall that the problem guiding our investigations was centred on examining the effect of trade aid on trade flows between Sub-Saharan African countries and the OECD. Economic literature inspired our research hypotheses, and econometric analysis served as a framework to affirm or refute these hypotheses.

The results obtained from the empirical analysis validate our research hypotheses, which are worth reiterating. The first hypothesis posited that trade aid has a negative effect on the exports of Sub-Saharan African countries to OECD countries. The second hypothesis considered that trade aid has a positive effect on the imports of Sub-Saharan African countries from the OECD. The results of the empirical analysis are also consistent with the theory of twin financing deficits underpinning this research. Trade aid is thus ineffective, as it contributes to maintaining a trade deficit in Sub-Saharan African countries. It is therefore recommended that development partners focus trade aid on import substitution strategies in beneficiary countries.

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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