International Journal of Economics and Finance; Vol. 14, No. 11; 2022
ISSN 1916-971X E-ISSN 1916-9728
Published by Canadian Center of Science and Education

Informality, Trade Facilitation, and Trade Flows: Evidence from Guinea-Bissau

Julio Vicente Cateia[1], Luc Savard[2], Edivo Oliveira de Almeida[3] & William Barbosa[4]

[1] Université Laval, Quebec, Canada

[2] Mohammed VI Polytechnic University, Technopolis, Morocco

[3] State University of Campinas, Brazil

[4] University of Sao Paulo, Brazil

Correspondence: Julio Vicente Cateia, Université Laval, Quebec, Canada.

Received: August 27, 2022 Accepted: October 12, 2022 Online Published: October 14, 2022

doi:10.5539/ijef.v14n11p21 URL: https://doi.org/10.5539/ijef.v14n11p21

Abstract

This paper aims to assess the role of informality and trade facilitation on the export probability of Guinea-Bissau. We include informality in the Fréchet function, which gives the expression for the country's supply probability. We find that Guinea-Bissau is about 7.2% less likely to export due to the 1% increase in informality. The export's probability increases by about 1.7%, 4%, and 1.1% due to a 1% increase in trade facilitation, R&D stock, and year of education. These results are significant at the usual levels. We suggest a development agenda aimed at reducing the level of informality in this country.

Keywords: development, empirical trade analysis, informality, trade facilitation, economy of Guinea-Bissau

JEL CODES: F14; C01; C33; O5.

1. Introduction

It is well known that least developed countries (LDCs) have a less steep trade profile than developed ones. High trade costs related to geographic barriers have been used to explain some of these differences (e.g., Seetanah et al., 2016; Reddy, 2011). Economists also point out that informality and poor trade facilitation play an important role in explaining trade costs in LDCs. This paper explores the relative importance of informality and trade facilitation in explaining export's probability of a small open and poor country, Guinea-Bissau.

We use CEPII (Centre D'estudes prespectives et D'informations Internationals) database on trade costs, which we matched with the World Bank's world development and trade facilitation indicators to build a panel from 1960 to 2015. The share of Guinea-Bissau's trade flows in world trade is less than 0.1 percent in 2019. Although Guinea-Bissau belongs to the West African Economic and Monetary Union (WAEMU), this country exports only 10% of its products to the members of that community. Partly because of the few linguistic ties that puts it in isolation, as it is the only mainland country in the region where Portuguese is the official language, and in part because it is one of the poorest in the region with a high degree of informality: about 69 percent of the population is poor or extremely poor, about 52 percent work in the informal sector, and 8 percent of the roads are unpaved. The GDP (Gross Domestic Product) per capita is about 600 US dollars in 2019 (World Bank, 2021). Therefore, this is a natural place to analyze the implications of informality and trade facilitation on trade flows.

Our study fits to several literature. A growing literature in economic documents the impacts of informality (Golub & Mbaye, 2009; Chalfin, 2001) and trade facilitation (Chen & Novy, 2009; Portugal-Perez & Wilson, 2012; Beverelli et al., 2015) on trade outcomes. Informal trade has been used to explain why official trade statistics indicate very little intra-African trade (Golub, 2012), while a plethora of studies has examined the impacts of trade facilitation on economic outcomes in terms of how much it reduces trade costs (Chen & Novy, 2009), how much it increases trade flows (Wilson et al., 2003) and employment and growth (WTO, 2015) as well as how much it generates the diversification of the export agenda (Beverelli et al., 2015). While this insight is intuitive and compelling, the role of informality and trade facilitation as weakness factor of trade in developing countries is not well documented, and there is no study carried out for Guinea-Bissau aiming at analyzing their impacts on the country's predicted export probability

This paper builds on and contributes to these past studies. First, to add value to the not well documented literature on the determinants of trade of Guinea-Bissau, we review Eaton and Kortum (2002) trade model and then use it to also document the empirical regularity that market size and geography are important to explain bilateral trade flows. Second, we have extended this model to include informality in the Fréchet used to represent the supply' probability. The goal is to analyze the impacts of informality and trade facilitation on the country's probability of exporting a good at a lower price to the destination market. Past studies (e.g., Santos & Tenreyro, 2006) show that estimates may be biased when the dependent variable concentrates many zeros. Thus, in addition to traditional methods, we apply a probit regression that allows to identify the effects of covariates on the export probability.

We find key results. In line with previous studies (e.g., Chen & Novy, 2009; Beverelli et al., 2015), we find evidence that the export's probability increases by about 1.7 percentage points due to a 1% increase in trade facilitation in terms of reduction in shipment time. The country is about 7.2 percentage points less likely to export due to the 1% increase in informality. Moreover, we observe that the country's export probability increases by about 4 percentage points as R&D stock increases by 1%. And an additional years of schooling leads to about 1.1 percentage points increase in export probability. These results are statistically significant at the usual levels and suggest a development agenda aimed at reducing the level of informality in this country.

The remainder of the study is structured as follows. Section 2 presents the conceptual framework. Section 3 presents the empirical strategies and results. Section 4 concludes.

2. Method

We use J. Eaton and S. Kortum trade model (hereinafter, EK model). The EK model is a continuation of the Dornbusch, Fischer, and Samuelson (1977) Ricardian model. The model setup are as follows: countries $i = 1, \dots N$ producing continuum of goods $j \in [0,1]$, with productive efficiency $z_i(j)$, c_i cost of a bundle of inputs which is the same across commodities within a country, and d_{ni} the geographical barriers.

We focus on the supply side novelty as demand side is derived in the usual way. The starting point is that country i take into account the role of the geographical barriers when delivering good j to country n, so that the c.i.f price ($P_{ni}(j)$ is (EK, 2002, p. 1743):

$$P_{ni}(j) = \underbrace{\left(\frac{c_i}{z_i(j)}\right)}_{Unit\ cost} \underbrace{d_{ni}}_{Trade\ barrier} \tag{1}$$

The technology $z_i(j)$ is the realization of a random variable Z_i drawn independently for each good j from a country-specific probability distribution. The probability of country i to supply good j to country n, π_{ni}, is conditional on the $i's$ lowest price. F_i is the Fréchet with the expression for π_{ni} (EK, 2002, p. 1743):

$$F_i(z) = e^{T_i z^{\theta}} \tag{2}$$

The log trade shares as functions of wages and parameters of the model is:

$$ln\pi_{ni} = lnX_{ni} - lnX_n = \underbrace{ln\left(\gamma T_i w_i^{-\theta}\right)}_{Country\ i\ FE} + \underbrace{ln\left(X_n {p_n}^{\theta}\right)}_{Country\ n\ FE} - \theta \underbrace{ln\left(d_{ni}\right)}_{Gravity} \tag{3}$$

By normalizing (3) by n's domestic offers (X_{nn}) and substituting p_n in (3) in the resulting expression, yields:

$$ln\pi_{ni} = lnX_{n\imath}^{\cdot} - lnX_n^{\cdot} -= S_i - S_n - \theta lnd_{ni} \tag{4}$$

where $X_{n\imath}^{\cdot} = X_{ni}/X_{nn}$, and $S_i (= lnT_i - \theta lnw_i)$ is the country i's state of technology adjusted by its labor costs, measuring i's competitiveness.

This is the keys equation of EK trade model. It relates the country participation in world trade to geographic barriers and its relative competitiveness. According to EK, trade sensitivity to input costs and geographical barriers depends on the technological parameter (reflecting the heterogeneity of goods in production) instead of the preference parameter (reflecting the heterogeneity of goods in consumption). The more heterogenous productivities across producers of a commodity, the strongest the cost advantage of the lowest cost supplier. As a result, the trade flows respond to geographic barriers at the *extensive margin*: as a source becomes more expensive or remote, its exports become more restrictive to a range of goods.

3. Results

Since Equation (5) has a gravity form, we can rewrite it as:

$$x_{nit}^{\cdot} = \beta_i s_{it} - \beta_n s_{nt} - \theta d_{ni} - \varepsilon_{nit} \tag{5}$$

where S_i (S_n) is the source (destination) labor market size and the absorption capacity proxied by local population pop_o ($pop\_d,$) and GDP per capita $gdpper\_o$ ($gdpper\_d$), both expected to boost the

source-country bilateral trade; while d_{ni} is an aggregate of several trade costs such as physical distance between i and n, d_k; i and n sharing a border, b; official language, l; colonial hiritage, c; common currency, e_h; and common legal pre and post transition institution, m_a and m_b, respectively. Countries with same binary outcomes are expected to trade more, but trade costs decrease trade flows across the pairs; and $\varepsilon_{ni} = {\varepsilon_{ni}}^2 + {\varepsilon_{ni}}^1$ is a composite error term. ${\varepsilon_{ni}}^2$ is the country specific component affecting two-way trade as ${\varepsilon_{ni}}^2 = {\varepsilon_{in}}^2$, while ${\varepsilon_{ni}}^1$ affects one-way trade. ${\varepsilon_{ni}}^2$ and ${\varepsilon_{in}}^2$ are no-orthogonals, so that $E({\varepsilon_{ni}}^2{\varepsilon_{in}}^2) = {\sigma_2}^2$. We use the generalized lest squares (GLS) to estimate (6) as the ordinary least square estimator is inefficient.

The data on trade costs are from the CEPII database, which we emerged with the World Bank's world development and trade facilitation indicators from 1960 to 2015 using year and country identifiers. Table 1 reports the descriptive statistics of the variables, which are weighted by trading partner share in trade flows of Guinea-Bissau. All gravity variables except for the distance are weighted. For example, to obtain the per income of country of destination (gdpcap_d), we compute,

$$\text{gdpcap\_d} = \alpha_d \sum_d^n GDPCAP_d \tag{6}$$

where α_d is the trade (export) share by destination market. We sort in descending order in the last column the trade partner. All African trade partners of Guinea-Bissau are also members of WAEMU. The *Export share* is defined as in the EK model, i.e., the expenditure share of goods from Guinea-Bissau in the trade partner's total expenditure. The exports are at sectorial level and at 2-digit. The agricultural sectors include crop producers, such as cashew nuts, mangoes, cassava, sugarcane, etc. The manufacturing sectors include all processed products. The *Export probability* is an indicator equals to 1 if sector j exports product i to the destination market at time t, and 0, otherwise. Trade resistance is measured as the distance between the capital of the trade partner and capital of Guinea-Bissau.

The institution's role in bilateral trade is assessed through an index informing the functioning of legal institutions in the pre and after transition from planned to market economies. Guinea-Bissau practiced the central planning regime up to 1986 when the Structural Adjustment Program was implemented. We built two indexes for before (*Common pre_trans*) and after (*Comomon post_trans*) the transition period, which erroneously was the same for the sample of trading partners in Africa.

The two measures of trade facilities are: Nontrade_facility1 and Nontrade_facility2. The former includes tariffs per product, while the later measures the time required for a shipment in the country of destination to be effectively processed. Nontrade_facility1 are from the World Trade Organization and Nontrade_facility2 are obtained from the World Bank's development indicator.

Table 1. Descriptive statistics

Variable	Observations	Mean	Standard Dev.	Maximum	Minimum	Partner
Export share	966	20.092	6.297	0.300	24.764	Portugal
pop_o	1,176	1.049	0.347	0.635	1.844	Cape Vert
pop_d	1,176	2.835	2.275	2.914	7.223	Gambia
gdpcap_o	966	5.476	0.533	4.722	6.521	India
gdpcap_d	1,090	7.552	1.744	4.250	10.944	Senegal
Distance	1,176	8.277	1.116	5.861	9.548	Netherlands
Export probability	1,176	.547619	.497939	0	1	Singapore
contiguity	1,176	0.095	0.293	0	1	South Korea
Common langue	1,176	0.0952	0.293	0	1	Panama
Common colony	1,176	0.0476	0.213	0	1	Thailand
Common currency	1,176	0.0612	0.239	0	1	Russia
Common pre_trans	1,176	0.619	0.485	0	1	Mauritanea
Comon post_trans	1,176	0.666	0.471	0	1	Marocco
Years education	834	9	0.518	6	10	Japan
Informality	245	2.783	0.869	0.916	4.812	Italy
Common area	1,176	0.653	0.475	0	1	United Kin.
Nontrade_facility1	245	2.504	1.509	0.510	5.448	France
Nontrade_facility2	245	2.030	0.381	1.098	2.708	Ivory Coast
R&D	245	3.204	0.700	1.704	4.912	Guinea

Source: CIIP database, World Bank, and World Trade Organization databases. Authors' computation in R. Note: pop_o (gdpcap_0) is the population (GDP per capita) of the country of export source, Guinea-Bissau; pop_d (gdpcap_d) is the population (GDP per capita) of bilateral trade partners. Nontrade_facility1(Entry cost_d) is the customs burdens and Nontrade_facility2 (Entry_proc_d) is the time it takes to process a shipment at the destination country. United Kin. is the United Kingdom.

The informality index is treated as in the work by Thiele and Piazolo (2002), by calculating the value added and share of formal and informal activities by sector (Table 2). The informal activities are the weighted values of informality, defined as the proportion of informality in a sector activity multiplied by its share in the value-added (Column I*III). Finally, we include years of education in the source country from world Bank.

Table 2. Share of formal and informal activities in the agricultural sectors,

Sector	Informal activity	Formal activity	VA share	Weighted informal	Weighted formal
	I	II	III	I*III	II*III
1. AGR	0.793	0.207	0.243	0.193	0.05
2. NONAGR	0.100	0.900	0.223	0.022	0.201

Sources: The Authors'.

Note. *Sector* is the number of sector; *Informal activity* is the share of informal activity in that sector, *formal activity* is the share of formal activity in that sector; *VA share* is the sectorial share of all agricultural activities; *Weighted informal* is the weighted share of the informal activities; *Weighted formal* is the weighted share of the formal activities (source: Cateia, Savard, Freitas, 2022). *VA share* is the sector share in agricultural value added (Source: Faostat - crops production; and World Bank Development indicators, WBDI –Value added by macro sector). AGR and NONAGR is the agricultural and non-agricultural export sectors, respectively.

Through these data, first, we estimate a standard gravity equation (Table 3). We present the results in the data columns in terms of the effect of covariates on all export share, and by manufacturing and agriculture export shares only. These are the baseline results for the standard gravity equation. First, we observe that 1% population growth and the GDP per capita of the source-country have decrease the its exports share in the destination market by about 4 and 0.06 percentage points, respectively. Conversely, the variation of 1% of the trading partner's population and GDP per capita have increase this share by about 2 and 1.3 percentage points, respectively. Geographical distance, in terms of physical distance across capitals, has a negative impact on the exports share, with a drop of about 2.5 percentage points. These effects are statistically significant at usual levels.

Second, in regression by sectors, we observe the same pattern of results when we move to the final two columns, which report results of the impact of covariates on manufactured and agriculture exports share in the destination market. The more intense effects in the manufacturing regression reflects the fact that the trade in manufactured goods is not robust in the country, so that shocks in the exogenous variables imply in substantial variations in their exports share. Differently from the previous results, source-country's GDP per capita does not have statistically significant impacts on the exports share of manufactured and agricultural goods in the destination market, while the impacts of the local population are statistically insignificant on the exports share of agricultural goods.

Table 3. Standard gravity trade regression

Variable	All share	Manufacturing only	Agriculture only
Pop_o	-3.781	-5.560	-2.869
	(1.693)**	(0.683)***	(2.174)
Pop_d	1.735	1.920	1.850
	(0.087)***	(0 .068)***	(0.106)***
gdpcap_o	-0.061	-0.507	-0.552
	(0.885	(0.364)	(1.004)
gdpcap_d	1.342	0.892	1.667
	(0.115)***	(0.146)***	(0.142)***
Distance	-2.525	-3.195	-2.806
	(0.180)***	(0.11)***	(0.228)***
Constant	26.403	16.423	53.687
	(4.861)***	(1.981)***	(5.462)***
Wald chi2	432.04	2730.87	341.61
Prob > chi2	0.000	0.000	0.000
Overall R2	0.323	0.975	0.339
Observations	909	75	671

Source: Authors' estimation in R.

Note. * p <0:10, ** p <0:05, *** and p <0:01. () Standard errors. _o indexes the source-country; and _d indexes all the destination countries. Manufacturing only (Agriculture only) are the results when we control if the export share is of the manufacturing (agriculture) sector.

We extend our analysis to include broader-distance effects on bilateral trade flows (Table 4). A Plethora of past studies has included the role of contiguity (Havranek & Irsova, 2017), common language (Lameli et al., 2015; Lohmann, 2011), common colony (Mitchener & Weidenmier, 2008), common currency and monetary Union (Glick & Rose, 2016; Mirona et al., 2013; Rose, 2000) in explaining trade outcomes. By doing so, we observe that there is a positive border effect of about 5 percentage points on the total export share, about 0.4 percent on the manufactured export share only, and about 7.5 percentage points on the agricultural exports share. Our results are consistent with past seminal evidence by McCallum (1995) which shows, for the case of across Canadian provinces, and of these with the U.S States bilateral trade, that the border matters for the trade outcomes. Recently, Coughlin and Novy (2021) show that the border effect is sensitive to aggregation where larger regions or countries are associated with smaller border effects.

We also find positive language effects of about 5 percentage points on Guinea-Bissau's export share and in the destination market, around 16 and 6 percentage points on the share of manufactured and agricultural goods, respectively. These results are consistent with study by Lameli et al. (2015). Meanwhile, the idea underlying the preposition that countries in the same colony trade more with each other is that these countries tend to share the heritage of similar institutional and cultural practices and deal more easily. In line with work Lameli et al. (2015) Mitchener and Weidenmier, we find positive effects of the colony on total export shares and share of manufactured goods. The effect of the common colony on the share of exports of agricultural goods is statistically insignificant.

There are negative effects of the common legal institution in the pretransition (i.e., before 1986), but positive impact of the common legal institution in the post transition period (i.e., after 1986) on export shares, explained mainly due to the increase in the share of agricultural exports in the destination market, since the share of manufactured goods is statistically insignificant.

Finally, we add to the standard gravity equation the Customs union index (Common trading area) and common currency on the share of Guinea-Bissau exports in the destination market. Common trading area has positive effects on the aggregate export share and on the share of agricultural exports but reduces the share of manufactured goods in the destination market. Given that Guinea-Bissau uses the same currency as its trading partners, the share of aggregate exports and agricultural goods export increase, but decrease by about 10 percentage points the manufactured export share.

Table 4. Extended gravity trade regression

Variable	All share	Manufacturing only	Agriculture only
Pop_o	-4.938	-6.483	-5.130
	(1.334)***	(3.996)	(1.688)****
Pop_d	1.731	1.403	1.398
	(0.084)***	(0.253)***	(0.100)***
gdpcap_o	-0.159	12.358	-.340
	(0.694)	(2.079)***	(0.770)
gdpcap_d	1.633	0.048	1.499
	(0.104)***	(0.313)	(0.120)****
Distance	-2.042	-2.713	-1.164
	(0.276)***	(0.827)***	(0.331)***
Contiguity	5.059	23.742	7.511
	(0.675)***	(2.022)***	(0.795)***
Common langue	4.094	16.504	5.741
	(0.565)***	(1.693)***	(0.668)***
Common colony	0.3596	14.187	-0.780
	(0.900)	(2.698)***	(1.046)
Common pre_trans	-9.985	1.981	-5.024
	(0.670)***	(2.008)	(0.805)****
common post_trans	6.712	-0.240	1.725
	(0.675)***	(2.024)	(0.810)**
Common area	1.064	-9.886	4.444
	(0.675)***	(1.143)***	(0.492)***
Common currency	2.632	-0.735	2.702
	(0.576)***	(1.726)	(0.685)***

Constant	21.472	-24.728	39.560
	(4.410)***	(13.213)*	(5.009)***
Wald chi2	1276.52	514.33	1059.53
Prob > chi2	0.000	0.000	0.000
Overall R2	0.587	0.364	0.616
Observations	909	75	671

Source: Authors' estimation in R.

Note. * p <0:10, ** p <0:05, *** and p <0:01. () Standard errors. _o indexes the source-country; and _d indexes all the destination countries.

3.1 Extension

An important factor in the EK model is that it is flexible enough to accommodate discrete analysis as the left side in the structural equation (4) indicates the probability of shipments from the source-country to the destination market at a lower price. Through the *intensive margin*, we observe that the country exports a limited number of agricultural goods in which 3 products represent about 90% of all exports. This reflects in many zeros in the *extensive margin* measured by the EK model. This has very important empirical implications. For instance, econometricians would argue that the statistically insignificance of the common currency parameter on manufacturing exports may reflect the small sample as $n = 75$, which may be insufficient to meet the asymptotic property of the GLS estimator. Applied trade economists have been concerned with this problem of many zeros in the dependent variable, and Santos Silva and Tenreyro (2006) have developed a best-fit estimator to estimate trade flows with zero-concentrated sampling distribution. However, we do not have better results when we apply this estimator. Thus, we let the left side of equation (7) to be Pareto distributed. First, to discover the parameter θ, we estimate:

$$ln\dot{X}_{nit} = \theta d_k + \theta b + \theta l + \theta c + \theta e_h + \theta m_a + \theta m_b + \varepsilon_{nit} \tag{7}$$

where X_{nit} is export share explained by an aggregate of several trade costs.

Second, we represent the source-country competitiveness as follows:

$$S_{it} = \delta_0 + \delta_R lnR_{it} + \delta_H \left(\frac{1}{H_{it}}\right) + \theta lnw_{it} + \tau_{it} \tag{8}$$

where R_i is country $i's$ Research and Development (R&D) stock, H_i is average years of schooling, and τ_i is the error term. Note that in this equation the wage is correlated with the error term, given the labor market equilibrium condition in EK model for which the country's wage rises with the level of technology. As in EK (2002), we use the total workforce as instruments for wages. Third, we introduce informality in EK model by rewriting the Fréchet as:

$$F_i(z) = e^{T_i(q_i)z^{\theta}} \tag{9}$$

where $q_i > 0$ is the degree of informality across the continuum. The state of technology T_i depends on q_i, so that the location of the distribution in each country also responds to the variability in q_i.

Finally, we estimate the following probit model:

$$\int_0^1 \pi_{n,j,i,t} = \alpha_0 + \beta \int_0^n S_{it} + \hat{\theta} \int_0^n \widehat{X_{it}} + \lambda \int_0^n q_{it} + w_{it} \tag{10}$$

where $\pi_{i,t}$ is an indicator equal to 1 if country i exports good j to country n at time t, and 0 otherwise; $\widehat{X_{it}}$ are estimates of (10) representing the aforementioned source-country comparative advantages across the continuum; $\oint$. is an operator that tracks each variable values, from 0 to 1 for $\pi_{n,j,i,t}$ and from 0 to n observations for the exogenous covariates; and w_{it} is the transformation of τ_{it}.

Table 5 reports the baseline results for probit regressions, where we parsimoniously add more control variables as we move along the columns from I to III. We present the results in the data columns in terms of the effect of wages, competitiveness, informality, and country of destination trade facilitation on the probability of consignments. We analyze results by columns. In Column I, we observe that, holding other factors at their business-as-usual levels, the country is about 10.5 percentage points less likely to participate in the foreign market (i.e., to send consignments or to export) due to the 1% increase in local wage. This reflects the fact that, for a given level of technology, an increase in wages decreases the competitiveness of the sector as $S_i = lnT_i - \theta lnw_i$. Conversely, 1% increase in wages in the destination market increases by about 0.77 percentage points the probability that the Guinea-Bissau exports a good to that market. The countries competitiveness effects on export probability are statistically significant at the usual levels.

Meanwhile, the country is about 0.358 percentage points more likely to export due to the 1% increase in the heterogeneity across goods within the continuum. This reflects the fact that as variability in productivity of j

decreases if increasing $\hat{\theta}$, the comparative advantages in $j-1$ good increase, which in turn increases the export probability of the country as well. The impact of comparative advantage on export probability is statistically significant even at 1%. We also find that increasing the degree of informality by 1% leads to a decreasing of about 1.5 percentage points in the export's probability. This result is also significant at 1% and reflects the effect of informality on the country's competitiveness, as T_i is in function of q_i.

In Column II, we add years of education on the baseline regression. Although the significance of the parameters remains as much as in Column I, we observe impacts of the covariates to be more intensives. We find that an additional year of schooling in the source country increases the export's probability by about 1.1 percentage points. We can think about this result as being related to the fact that more years of schooling can lead to improvements in procedures (i.e., in the way of producing, negotiating, etc.), which have a positive impact on the country's exports. While this may sound like a standard wisdom, in our model, the transmission mechanism is that the country's competitiveness increases with its population's level of education. The effect of education on an export probability is also significant at usual levels.

In column II, we add the effect of R&D on the country's export probability. In this extended regression, we observe the effects of wages, comparative advantages, and informality on export probability to be more intense than in the baseline regression whose results are reported in Column I. Like additional years of schooling, we observe the country's exports to increase by about 4 percentage points due to a 1% increase in R&D stock. This result is significant at 1%.

Furthermore, we observe that lower trade facilitation in terms of increasing by 1% the customs cost (Entry cost_d) and shipment processing time at ports (Entry_proc_d) in the destination market result in a decrease of about 0.3 and 1.7 percentage points in the export's probability. These results for customs cost and processing time are significant at 10% and 5%, respectively, and consistent with previous findings. For instance, past works by Coşar and Fajgelbaum (2016) show evidence from China's industrial-level data that transport costs lead to regional specialization in export-oriented industries close to ports. Using data from colonial India, Donaldson (2012) found, through a general equilibrium model, that expansion of railways reduced trade costs and interregional prices, which boost trade flows. Dennis and Shepherd (2011) estimated the impact of trade facilitation on export diversification in a sample of 118 developing countries. They found evidence that 10 percent reductions in international transportation costs and domestic paperwork such as documentation, ground transportation, port and customs fees are associated with export diversification gains of 4% and 3%, with customs costs particularly playing an important role in explaining these results.

Table 5. Probit regression results

Variable	I	II	III
Wage_o	-10.580	-13.689	-12.154
	(4.043)***	(4.6013)***	(4.874)**
Wage_d	0.769	1.073	1.084
	(0.118)***	(0.164)***	(0.163)***
$\hat{\theta}$	0.358	0.458	0.592
	(0.119)***	(0.150)***	(0.202)***
Informality	-1.531	-1.184	-7.238
	(0.361)***	(0.404)***	(2.211)***
Years education		1.073	
		(0.339)***	
R&D			4.049
			(1.188)***
Entry cost_d			-0.271
			(0.161)*
Entry_proc_d			-1.687
			(0.159)**
Constant	5.001	-4.461	3.481
	(1.279)***	(3.173)	(2.088)*
Pseudo R2	0.2028	0.295	0.3333
Prob > chi2	0.000	0.000	0.000
Observations	245	233	233

Source: Authors' estimation in R.

Note. * p <0:10, ** p <0:05, *** and p <0:01. () Standard errors. _o indexes the source-country variable; and _d indexes all the country of destination variables.

We control by monetary union, as Guinea-Bissau belongs to the WAEMU. It is argued that countries in the same customs community tend to standardize burdens on exports, which enhances each country's bilateral trade. Thus, controlling for the effects of WAEMU means estimating the country export's probability given that trade resistance factors have been reduced by its counterparts. Regarding the baseline results in Table 5, we now observe that education and trade costs in the destination market do not have statistically significant effects on the export's probability (Table 6). This result emphasizes the role of common trading area in explaining bilateral trade outcomes. However, the most important result is that the degree of informality impacting more on the country's export probability as reported in the Column III. In fact, the country is about 18 percentage points less likely to export due to a 1% increase in the degree of local informality.

Table 6. Probit regression by monetary union

Variable	I	II	III
Wage_o	-9.232	-13.248	-9.446
	(2.614)***	(4.835)***	(4.947)***
Wage_d	1.0279	1.932	2.970
	(0 .199)***	(0.316)***	(0.627)***
$\hat{\theta}$	0.4823	0.585	0.0160
	(0.181)***	(0.263)**	(0.379)
Informality	-2.9756	-3.511	-18.086
	(0.561)***	(0.724)***	(5.235)***
Years education		0.858	
		(0.710)	
R&D			6.3546
			(2.367)***
Entry cost_d			0.696
			(0.400)*
Entry_proc_d			-1.8175
			(1.860)
Constant	8.1451	2.681	1.808
	(1.853)***	(6.719)	(4.244)
Pseudo R2	0.3007	0.559	0.6695
Prob > chi2	0.000	0.000	0.000
Observations	143	133	134

Source: Authors' estimation in R.

Note. * p <0:10, ** p <0:05, *** and p <0:01. () Standard errors. _o indexes the source-country variable; and _d indexes all the country of destination variables.

We control also by top 10 main trading partner of Guinea-Bissau (Table 7). We found impacts being smaller than previously reported, however, the signs of the estimated parameters are the same for the baseline and extended regressions. This endorses the robustness of our results, and it also emphasizes the role of informality on trade outcomes in developing countries.

Table 7. Probit regression by main trading partner

Variable	I	II	III
Wage_o	-8.727	-10.397	-10.009
	(4.615)**	(5.039)**	(5.201)**
Wage_d	0.976	1.1438	1.16 7
	(0.136)***	(0.170)***	(0.174)***
$\hat{\theta}$	0.714	0.6559	0.7610
	(0.1621)***	(0.172)**	(0.223)***
Informality	-1.249	-0.739	-6.486
	(0.4579)***	(0.501)	(2.344)***
Years education		0.539	
		(0.386)	

R&D			3.408
			(1.248)***
Entry cost_d			-.1956
			(0.163)
Entry_proc_d			-1.158
			(0.8453)
Constant	6.817	2.681	4.302
	(1.537)***	(3.896)	(2.252)
Pseudo R2	0.2665	0.3196	0.3545
Prob > chi2	0.000	0.000	0.000
Observations	219	207	207

Source: Authors' estimation in R.

Note. * p <0:10, ** p <0:05, *** and p <0:01. () Standard errors. _o indexes the source-country variable; and _d indexes all the country of destination variables.

We have shown some consistency of our results with previous findings. However, it is worth discussing them also based on the country's reality. Located on the West Coast of Africa, the country has a population of about 1.8 million inhabitants, of whom 60% live in rural areas and 40% in small urban cities. There is a practice of informal trade between and within ethnic groups that is estimated to represent about 40 percent of trade. A type of this informal trade is locally known as Djulas. The Djulas took advantage of the inefficiency of the government's existing control mechanisms and the structure of tariffs had little influence on the products they trade. The truth is that increasing government requirement always increases informal cross-border trade, causing few products to be registered by official trade statistics. Thus, our dependent variable in the standard gravity equation could only reveal little about trade share, which justifies the probability approach.

We found interesting results through the probabilistic specification. We emphasize the importance of comparative advantages and labor costs on economic outcomes. The education and R&D are important to explain trade flows. More importantly, we find that, in poor countries with 52 percent of the population working in the informal sector, the trade outcomes can be improved if degree of informality decreases. Meanwhile, we found that trade facilitation matter for the country's participation in the international market. Past works by Iwanow and Kirkpatrick (2007) and Hoekman and Nicita (2011) found corroborated evidence.

4. Conclusion

The main objective of this work was to estimate impacts of informality and trade facilitation on the export probability of Guinea-Bissau. This country, isolated on the West Coast of Africa, is one of the poorest worldwide with high informality in economic activities. Thus, trade statistics may only be reporting a small portion of trade performed.

We estimate the standard gravity model to confirm the empirical regularity that economic size and geography, proxied by distance, contribute to impact bilateral trade. We extend a continuum goods model to include informality in trade analysis. We find that informality and trade facilitation matter to trade outcomes. These results are statistically significant at the usual levels.

Our study suggests that standard trading models can be used to include each country fundamentals. The probability approach may also be useful to deal with excessive concentration of zeros at one extreme of the distribution of the dependent variable. Furthermore, the political implications are that trade policy agenda must take into account both the macro and micro impact of informality. Especially, Guinea-Bissau may exploit its comparative advantages as to boost trade flows by increasing investment in education as well as in research and development.

References

Beverelli, C., Neumueller, S., & Teh, R. (2015). Export Diversification Effects of the WTO Trade Facilitation Agreement. *World Development, 76*, 293-310. https://doi.org/10.1016/j.worlddev.2015.07.009

Cateia, J. V., Savard, L., & Freitas, C. A. (2022). Economic impacts of infrastructure investment with different funding mechanisms: evidence from Guinea-Bissau. *Cogent Economics & Finance*, *10*(1), 1-17. https://doi.org/10.1080/23322039.2022.2101226

Centre D'estudes prespectives et D'informations Internationals (CEPII). *CEPII Data*. Retrieved from http://www.cepii.fr/CEPII/en/bdd_modele/download.asp?id=6

Chalfin, B. (2001). Border Zone Trade and the Economic Boundaries of the State in North-East Ghana. *Africa, 71*(2), 202-24. https://doi.org/10.3366/afr.2001.71.2.202

Chen, N., & Novy, D. (2009). International trade integration: A disaggregated approach". *CEP discussion paper n.0908*. Centre for Economic Performance, LSE. https://doi.org/10.2139/ssrn.1368640

Coşar, A. K., & Demir, B. (2016). Domestic road infrastructure and international trade: Evidence from Turkey. *Journal of Development Economics, 118*, 232-244. https://doi.org/10.1016/j.jdeveco.2015.10.001

Coşar, A. K., & Fajgelbaum, P. (2016). Internal Geography, International Trade, and Regional Specialization. *American Economic Journal: Microeconomics, 8*(1), 24-56. https://doi.org/10.1257/mic.20140145

Coughlin, C. C; & Novy, D. (2021). *Estimating Border E§ects: The Impact of Spatial Aggregation*. University of Warwich. https://doi.org/10.1111/iere.12520

Dennis, A., & Sheperd, B. (2011). Trade Facilitation and Export Diversification. *The World Economy, 34*(1), 101-122. https://doi.org/10.1111/j.1467-9701.2010.01303.x

Dornbusch, R., Fischer, S., & Samuelson, P. A. (1977). Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods. *American Economic Review, 67*, 823-839.

Eaton, J., & Kortum, S. (2002). Technology, geography, and trade. *Econometrica, 70*(5), 1741-1779. https://doi.org/10.1111/1468-0262.00352

Glick, R., & Rose, A. K. (2016). Currency Unions and Trade: A Post-EMU Reassessment. *European Economic Review, 87*, 78-91. https://doi.org/10.1016/j.euroecorev.2016.03.010

Golub, S. S. (2012). Entrep ôt Trade and Smuggling in West Africa: Benin, Togo, and Nigeria. *The World Economy, 35*(9), 1139-61. https://doi.org/10.1111/j.1467-9701.2012.01469.x

Golub, S. S., & Mbaye, A. A. (2009). National Trade Policies and Smuggling in Africa: The Case of The Gambia and Senegal. *World Development, 37*(3), 595-606. https://doi.org/10.1016/j.worlddev.2008.08.006

Havranek, T., & Irsova, Z. I. (2017). Do Borders Really Slash Trade? A Meta-Analysis. *IMF Economic Review, 65*, 365-96. https://doi.org/10.1057/s41308-016-0001-5

Hoekman, B., & Nicita, A. (2011). Trade Policy, Trade Costs, and Developing Country Trade. *World Development, 39*(12), 2069-2079. https://doi.org/10.1016/j.worlddev.2011.05.013

Iwanow, T., & Kirkpatrick, C. (2007). Trade Facilitation, Regulatory Quality and Export Performance. *Journal of International Development, 19*(6), 735-753. https://doi.org/10.1002/jid.1399

Lameli, A., Nitsch, V., S ödekum, J., & Wolf, N. (2015). Same Same But Different: Dialectsand Trade. *German Economic Review, 16*(3), 290-306. https://doi.org/10.1111/geer.12047

Lohmann, J. (2011). Do language barriers affect trade? *Economics Letters, 110*(2), 159-162. https://doi.org/10.1016/j.econlet.2010.10.023

Mirona, D., Miclausa, P., & Vamvu, D. (2013). Estimating the Effect of Common Currencies on Trade: Blooming or Withering Roses? *Procedia Economics and Finance, 6*, 595-603. https://doi.org/10.1016/S2212-5671(13)00177-9

Mitchener, K. J., & Weidenmier, M. (2008). Trade and Empire. *Economic Journal, 118*(533), 1805-1834. https://doi.org/10.3386/w13765

Portugal-Perez, A., & Wilson, J. S. (2012). Export Performance and Trade Facilitation Reform: Hard and Soft Infrastructure. *World Development, 40*(7), 1295-1307. https://doi.org/10.1016/j.worlddev.2011.12.002

Reddy, K. (2011). Developing Africa: Trade barries, liberalization and and inequality in the World Trade Organization. *Africa Journal of Business Management, 22*(5), 8687-8696. https://doi.org/10.5897/AJBM10.1314

Rose, A. K. (2000). One Money, One Market: Estimating the Effect of Common Currencies on Trade. *Economic Policy, 30*(15), 8-45. https://doi.org/10.1111/1468-0327.00056

Santos, S. J., & Tenreyro, S. (2006). The Log of Gravity. *Review of Economics and Statistics, 88*, 641-58. https://doi.org/10.1162/rest.88.4.641

Seetanah, B., Sannassee, R. V., & Fauzel, S. (2016). Trade facilitation and trade flows: Evidence from Africa in World Trade Organization.

Thiele, R., & Piazolo, D. (2002). Constructing a Social Accounting Matrix with a Distributional Focus - the Case

of Bolivia. *Kiel Working Paper No. 1094*. https://doi.org/10.2139/ssrn.299160

Wilson, J. S., Mann, C. L., & Otsuki, T. (2003). Trade Facilitation and Economic Development: A New Approach to Quantifying the Impact. *The World Bank Economic Review, 17*(3), 367-389. https://doi.org/10.1093/wber/lhg027

World Bank. (2021). *World Bank Development Indicators*. Retrieved from https://databank.worldbank.org/source/world-development-indicators

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/4.0/).