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A gravity approach of agricultural trade: The nexus of the EU and African, Caribbean and Pacific countries

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Abstract: The European Union (EU) is one of the biggest traders of agricultural products. In 2017, extra-EU agricultural trade accounted for 7.4% of the total EU international trade. Furthermore, Europe is the main destination for agricultural goods arriving from African, Caribbean and Pacific (ACP) trading partners. The paper analyses the effect of geographical proximity, cultural similarity, free trade agreements on bilateral agricultural trade as well as intra-industry trade between EU member states and its trading partners (intra and extra EU trade), employing gravity model for a period of 1996–2017. Regression results suggest that EU countries export more agricultural products to their common markets. In addition, the export costs of agricultural products are lower if the EU and its external trading partners are culturally similar; have the same religion or both have regional trade agreements. We found a moderate intra-industry trade between the EU and ACP countries at 18%. The results indicate rather inter-industry trade between EU and non-EU members, with a lower index level for ACP countries. A higher positive impact is revealed on the agricultural import between ACP-EU countries than export.

Keywords: African, Caribbean and Pacific countries; agricultural trade; European Union; gravity model; intra-industry trade

The European Union (EU) is an important player in the world economy. Nowadays, the EU is deeply integrated into global markets. Moreover, the EU is one of the biggest exporters and importers of agricultural products in the world. The extra-EU trade in agricultural products accounted for 7.4% of the total EU international trade in 2017. Trade analysis of the agricultural products is crucial for the EU Common Agricultural Policy (CAP) and trade policy, which also manages trade relations with non-EU countries.

The EU trade of agricultural products is doubled between 2002 and 2017, equivalent to average annual growth of 5.4% (Eurostat 2018). According to the recent statistics, the USA was the main recipient of EU agricultural exports (16%), followed by China (8%), Switzerland (6%), Japan, Russia (5%) and Norway (4%). Furthermore, Brazil and the United States (8%) were the main origins of EU agricultural imports followed by Norway, China (5%), Argentina and Ukraine (4%). China and the United States are ranked among the top four biggest agricultural trading partners of the EU (Eurostat 2018).

Trade plays a crucial role in the economic integration and growth of African, Caribbean and Pacific (ACP) countries (EC 2019). Therefore, the EU intends to support trade diversification by shifting ACP countries' reliance on commodities to higher-value products via the so-called Economic Partnership

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Agreements[1] (EPAs). The majority of ACP countries are either implementing an EPA or have concluded EPA negotiations with the EU (EC 2018). Consequently, EU agricultural export might have less trade barrier to ACP countries and *vice versa* comparing to other non-EU countries. Furthermore, the EU trade with ACP countries represents more than 5% of EU imports and exports while the EU is also the main destination for agricultural goods of ACP countries (EC 2018).

The gravity equation is evidence for the relationship between the size of economies, their distances and the amount of their trade. The gravity equations have been used to refer to a variety of different specifications for determining bilateral trade flows (Head and Mayer 2013). The intra-industry trade (IIT) is a commonly accepted tool for analysing trade patterns in the international literature (Nilsson 1997; Qasmi and Fausti 2001; Sharma 2002; Leitão 2012; Jámbor 2014; Łapinska 2014; Onogwu et al. 2014; Jámbor and Leitão 2016) and used in gravity models.

However, the EU-ACP trade relation is not negligible, in turn, limited articles were already published in international trade literature investigating agricultural trade between the EU and non-EU or ACP countries explored by gravity models (Persson 2008; Bourdet and Persson 2010; Cipollina et al. 2013). In addition, we cannot find an up-to-date study referring to the actual pattern of the agricultural trade between the EU and ACP countries.

Therefore, the research considers the costs of agricultural trade of the EU-27 countries and its trading partners, focusing on ACP relations. Moreover, it investigates the effect of geographical distances, cultural similarity, EU membership, EU-ACP relations and the role of regional trade agreements using panel econometrics, between 1996 and 2017.

The paper has multiple contributions to the literature. First, it employs a large sample gravity model, assesses the intra-industry trade (IIT) within the EU member states as well as between EU and non-EU, EU-ACP countries. Second, the paper aims to discover the trade advantage or disadvantage in EU-ACP relations. Third, we revisit the empirical works of Helpman (1987), Hummels and Levinsohn (1995) to consider the countries characteristics as explanatory variables of intra-industry trade (IIT). These variables have theoretical support on classic models of Krugman (1979), Lancaster (1980), Helpman and Krugman (1985). Finally, it investigates the trade costs with specific insight into the EU-ACP relationships.

MATERIAL AND METHODS

The assumptions of the Newton Laws applied to the gravitational model of trade have been implemented over the past decades. The empirical gravity studies usually evaluate trade costs between two countries, demonstrating that there is a multiplicative association between trade and countries' GDP as well as an inverse relationship between trade and bilateral geographic distance (Tinbergen 1962; Pöyhönen 1963; Caves 1981). The most recent empirical studies (Braha et al. 2017; Balogh and Jámbor 2018) show that common language, trade agreements, cultural and historical features promote bilateral trade and reduce trade costs. Furthermore, Gould (1994), Grin (1994), Breton (1999) prove that the common official language, migrations, common borders, geographical proximity are supporting international trade. Thus, the common language and the historical and cultural background of countries are important explanatory factors of the global trade. Moons and Van Bergeijk (2013) point out that the common language spoken allows eliminating trade barriers and expanding bilateral trade relations between economies with linguistic, cultural or historical similarities. Anderson (1979), Helpman and Krugman (1985), Hummels and Levinshon (1995), Rauch (1999) conclude that the gravitational model is explained through monopolistic competition, with increasing returns to scale and economies of scale.

Relevant literature

The empirical study of Hatab et al. (2010) researched the determinants of agricultural exports for the Egyptian case, using panel techniques (OLS, Fixed Effects, Random Effects) for the period 1994–2008. The Albanian agricultural exports were investigated by Braha et al. (2017) applying Poisson Pseudo-Maximum Likelihood estimation technique considering the period 1996 to 2013. Balogh and Jámbor (2018) evaluated the impact of culture, common langue and free trade agreements in the wine industry. Recently, Port wine

[1]The history of Economic Partnership Agreements is dating back to the Cotonou Agreement. Economic Partnership Agreements are WTO-compatible agreements focusing on ACP development, taking account of their socio-economic circumstances to help ACP countries benefit from the agreements.

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exports were investigated by Gouveia et al. (2018) using a gravity approach with Hausman-Taylor estimator.

Persson (2008) analysed the effects of trade facilitation for ACP countries and the Economic Partnership Agreements of the EU. Significant negative trade effects are found for the transaction costs of most EPA groups. Cipollina et al. (2013) studied the EU trade policies and suggested that preferences have only a minor impact (3% of EU imports) on trade.

The literature also mentions some studies that evaluate the two-way trade and intra-industry trade of agricultural products (Jámbor 2014; Łapinska 2014). Moreover, the empirical studies on agri-food intra-industry trade (Pelzman 1977; McCorriston and Sheldon 1991; Hirschberg et al. 1994; Qasmi and Fausti 2001; Sharma 2002; Onogwu 2014) have supported the theoretical models of Krugman (1979), Lancaster (1980), Eaton and Kierzkowski (1984), Hummels and Levinshon (1995).

The agricultural and food industry between Poland and the European Union was investigated by Łapinska (2014) for the period 2002–2011. IIT was employed as dependent while income per capita differences, geographical distance, European Union countries, common language, and the trade imbalance as explanatory variables. The econometric results suggest that common language, EU membership have a positive effect on IIT. By contrast, income per capita differences and trade imbalance are negatively correlated with IIT. Jámbor (2014) examined the determinants of horizontal and vertical IIT applied in agriculture between EU-27 and the New Member States. The author concluded that the EU accession has a positive effect on horizontal and vertical IIT.

Despite the importance of EU-ACP trade relationships, only limited studies are available in international trade literature (Persson 2008; Bourdet and Persson 2010; Cipollina et al. 2013) that investigates EU agricultural trade by gravity models considering the ACP trading partners.

Methodology

Regression models frequently employ OLS or Pseudo-Poisson maximum likelihood (Santos and Tenreyro 2006, Braha et al. 2017, and Balogh and Jámbor 2018).

In this study, we employ a standard gravity model for a sample of EU-27 agricultural trade and 242 destination countries, for the period 1996–2017, using Pseudo-Poisson maximum likelihood (PPML) estimation.

The standard formula of gravity equation is calculated as follows (Bergstrand 1989; Anderson and van Wincoop 2003; Blanes 2005; Braha et al. 2017; Gouveia et al. 2017; Balogh and Jámbor 2018):

$$TRADE_{ij} = \beta_0 \times \frac{\left(GDPi^{\beta 1} \times GDPj^{\beta 2}\right)}{Dist_{ij}^{\beta 3}} \times \varepsilon_{ij} \quad (1)$$

where $TRADE_{ij}$ is the trade flow from country i to country j; β_0 is a constant of the gravity equation; GDP_i captures exporter's GDP; GDP_j represents the importer country's GDP; $Dist_{ij}$ denotes the geographical distance; ε_{ij} represents the error term.

Log-linear form of the gravity Equation (2) is calculated by taking the natural logarithms of these variables (Bacchetta et al. 2012):

$$\mathrm{Ln}TRADE_{ij} = \beta_0 + \beta_1 \mathrm{Ln}GDP_i + \beta_2 \mathrm{Ln}GDP_j + \\ + \beta_3 \mathrm{Ln}Dist_{ij} + \varepsilon_{ij} \quad (2)$$

In addition to the classical variables (importer and exporter GDP, and geographic distance), researchers have introduced additional factors to the gravitational equations such as islands-landlocked countries, common borders, common language or cultural features (past colonial history, common religion) and free trade agreements. La Porta et al. (1999), Kang and Fratianni (2006), Linders and de Groot (2006), Balogh and Jámbor (2018) supported the assumptions of this variable on international trade.

In the past decades, the analyses of intra-industry trade (IIT) received considerable research attention in the literature. IIT refers to the trade of similar products belonging to the same industry, used when the same types of goods are both imported and exported (Grubel and Lloyd 1975; Bergstrand 1983; Handjiski et al. 2010).

Grubel and Lloyd (1975) proposed an index for intra-industry trade, calculated as follows:

$$GL_i = 1 - \left[\left|X_i - M_i\right| / \left(X_i + M_i\right)\right] \quad (3)$$

where GL denotes the Grubel–Lloyd index; X_i denotes the export; M_i represents the import of good i.

The value of the GL index varies between 0 and 1. 0 indicates complete inter-industry trade[2] and 1 sig-

[2]Inter-industry trade is defined as trade between two countries where the goods are from different sectors. In contrast, intra-industry trade (IIT) captures the traded goods of the same sector.

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nals complete intra-industry trade. The index also can be multiplied by 100 to obtain values in percent.

Data and econometric specifications

Based on the empirical evidence of gravity literature the following hypotheses are tested here:

H_1: Standard gravity hypothesis applies for EU extra and EU-ACP agricultural trade.

In empirical gravity models, larger countries trade more, therefore, the size of economies (GDP) have a positive effect on trade flow (Bacchetta et al. 2012). The literature suggests that trade costs increase with geographical distances (Bacchetta et al. 2012; Head and Mayer 2013). If the trader country is landlocked that makes the trade costs higher (Bacchetta et al. 2012) since the sea access enables cheaper water transport compared to land transport (rail and road transport). Trade costs are lower in those countries that are similar culturally because they know better each other's business practices (Hummels and Levinshon 1995; Bacchetta et al. 2012; Braha et al. 2017; Balogh and Jámbor 2018).

H_2: The EU export more agricultural products to culturally related destination countries since the cultural similarity reduces trade costs.

The European Common Market guarantees the free movement of goods, capital, services, and labour within the European Union. Consequently, trade within the EU might be more advantageous and trade costs are lower within the EU.

H_3: The European Common Market is more beneficial for intra-EU agricultural trade than extra EU trade.

The empirical studies of Braha et al. (2017), describe a positive impact of the European Common Market on agricultural trade. The EU with the common market became a single market and a customs union between its member states. Various research on international trade validates that free trade agreements promote trade flows (Łapinska 2014; Jámbor and Leitão 2016).

H_4: Free trade agreements between the EU and non-EU countries are encouraging agricultural trade and reduce the costs of trade.

Lower trade barriers stimulate trade by reducing trade costs (Bacchetta et al. 2012) and ease exporter's access to destination markets. Furthermore, the EU is a major trading partner of ACP countries and the main destination for agricultural goods from ACP countries. The Economic Partnership Agreements (EPAs) support trade diversification by shifting ACP countries' reliance on commodities to higher-value products (EC 2018). Consequently, EU agricultural export has less trade barrier to ACP countries than other non-EU countries.

H_5: The costs of trade are lower in the case of agricultural products shipped from EU to ACP countries.

In this research, we applied strongly balanced panel data of the agricultural trade of the EU-27 Member States and their trading partners, between 1996–2017. The dependent variable comes from EU-27 bilateral agricultural trade data of World Bank (2018a) Harmonised System database in aggregated category (agricultural products including 678 aggregated products for 010111–530290 category), used in a level form.

The model employs economic size (exporter's and importer's GDP), geographical distances (shortest distances between capital cities), cultural distances (common official language, common religion, island-landlocked dummies), free trade area, EU memberships, ACP countries as explanatory variables. The PPML estimation method (Santos and Tenreyro 2006) was applied to estimate the gravity equation for the EU agricultural trade and IIT in Equations (4–5).

In Equations (4–5), $EU\ agricultural\ trade_{ij}$ variable represents the agricultural export from EU-27 to its trading partner, the agricultural import from trading partner to EU-27, and EU agricultural total trade (agricultural export plus import of the EU-27 member states), zero trade flows are included.

In the model, dependent variables (agricultural exports, imports, trade and *GL* index) are derived from the World Bank (2018a). The *GL* index is employed at level forms in percentage (varies between 0 and 100) measuring IIT. ln*GDPexp* is the logarithm of the exporter's GDP (of EU member states expressed in cur-

$$EU\ agricultural\ trade_{ij} = \alpha + \beta_1 \ln GDPexp_i + \beta_2 \ln GDPimp_j + \beta_3 \ln dist_{ij} + \beta_4 comlang\_off_{ij} + \beta_5 contig_{ij} + \\ + \beta_6 comrelig_{ij} + \beta_7 landlocked_{ij} + \beta_8 RTA_{ij} + \beta_9 EU\_O_{ij} + \beta_{10} EU\_D_{ij} + \beta_{11} ACP_{ij} + u_{ij} \quad (4)$$

$$GL\ index_{ij} = \alpha + \beta_1 \ln GDPexp_i + \beta_2 \ln GDPimp_j + \beta_3 \ln dist_{ij} + \beta_4 comlang\_off_{ij} + \beta_5 contig_{ij} + \beta_6 comrelig_{ij} + \\ + \beta_7 landlocked_{ij} + \beta_8 RTA_{ij} + \beta_9 EU\_O_{ij} + \beta_{10} EU\_D_{ij} + \beta_{11} ACP_{ij} + u_{ij} \quad (5)$$

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rent USD), ln*GDPimp* illustrates the logarithm of GDP for importer country (in current USD) including EU and non-EU members. The ln*dist* measures the simple distance between the capital cities of traders in kilometres. The common official language (*comlang_off*) equals to 1 if trader countries have common official primary language, 0 otherwise. Contiguity (*contig*) equals to 1 if both traders have common borders. The landlocked variable is 1 if both traders are landlocked, 0 otherwise. Common religion (*comrelig*) takes 1 if both countries have a common main religion, 0 otherwise. *RTA* is a dummy that equals to 1 if both countries have regional trade agreements, 0 otherwise. The EU membership is measured by *EU_O* (1 if origin country is an EU member in the given year) and *EU_D* (1 if a destination country is an EU member in the given year). Finally, *ACP* (*EU_TO_ACP*) is 1 if the agricultural trade is realised between the EU and ACP countries. The set of bilateral dummies are derived from CEPII (2018); the detailed description (Table S1) and summary statistics for each variable (Table S2) [Tables S1–2 in the electronical supplementary material (ESM); for ESM see the electronic version].

Pattern of EU trade

Regarding the pattern of the EU bilateral agricultural trade (Figure 1), Germany, France, the UK, Italy, and the Netherlands realised the highest amount of agricultural export during the analysed period within the EU, emphasising the importance of intra-EU trade.

Moreover, the older EU member states (Germany, France, the UK, Italy, and the Netherlands) can be considered as the top destinations of the EU-27 agricultural products, underlining the trade advantage of the European Common Market. On the other hand, non-EU countries are also comprised in the sample (as EU trade destinations) of which the USA, Russia, Switzerland, Japan, and China were the most significant considering EU extra trade. Among these trading partners, larger countries (e.g. Germany, France, USA, Canada, and China) accounted for higher trade flows for agricultural products predicting the validity of standard gravity hypothesis (larger countries trade more).

Figure 1 indicates that the share of the observation comprising EU to ACP export destination countries reached 24% in the sample, between 1996 and 2017, by contrast, its share of export in terms of value, was only 1.65% compared to the value of total EU-27 agricultural export, during the analysed period. In addition, the EU imported only 3.3% of its agricultural products from ACP countries in value. The top ACP export destinations of EU agricultural products were South Africa, Angola, Nigeria, Senegal and Cote d'Ivoire (Ivory Coast).

In Table 1, past colonial trade relationship is observed between the major EU agricultural exporters and its top trading partners (e.g. former British colonies: South Africa, Nigeria, Ghana or former French colonies: Senegal, Cote d'Ivoire, Cameroon, Benin, Dominican Republic, Gabon).

To analyse the pattern of EU trade, intra-industry trade (IIT) was also discovered by *GL* index. Regarding intra-EU trade (Figure 2), the *GL* index reached 52.8% on average, with the highest value recorded in Germany (65%) and the lowest in Malta (19%). In other words, most of the EU members favour intra-

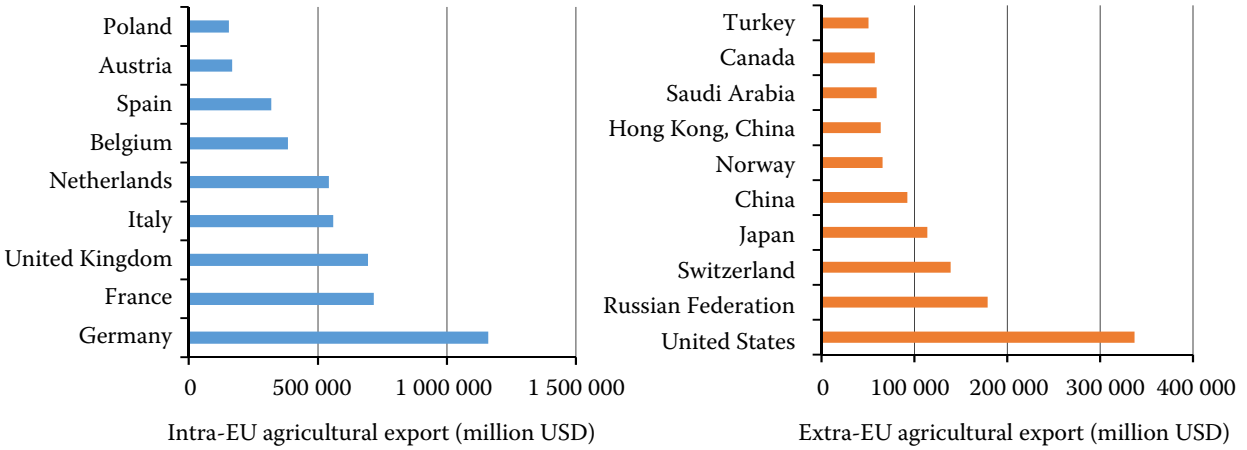

Figure 1. Intra and extra European Union (EU) agricultural export, top 10 destinations of EU, mean, 1996–2017

Source: own calculation based on World Bank (2018a) and CEPII (2018)

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Table 1. European Union (EU) and African, Caribbean and Pacific (ACP) agricultural trade relations, top 10 exporters and its destinations, in the sample, 1996–2017

Top exporters	EU to ACP export (million USD)	Top destinations	EU to ACP export (million USD)
France	31 989	South Africa	19 958
Netherlands	22 572	Angola	14 982
United Kingdom	14 609	Nigeria	14 765
Portugal	10 362	Senegal	7 262
Germany	10 284	Cote d'Ivoire	7 091
Belgium	10 199	Ghana	4 823
Spain	8 518	Cameroon	4 507
Italy	7 908	Benin	4 322
Ireland	6 591	Dominican Republic	4 009
Denmark	3 180	Gabon	3 611

Source: own calculation based on World Bank (2018a)

industry agricultural trade within the Common European Market (*GL* > 50%) indicating trade between similar agricultural products.

By contrast, in terms of extra EU trade (EU to non-EU countries), the *GL* index reached only 21% on average. With Canada (61%) in the first place followed by the USA (56%) while in indices of Christmas Island and Western Sahara indicates complete inter-industry trade (0%).

Moving toward ACP destination countries (Figure 3), we have found a moderate *GL* index for ACP countries at 18% on average, with the highest level for South Africa (41%), followed by Dominican Republic, Sudan, Nigeria and Mauritius (*GL* < 32%). These figures suggest that between EU and non-EU members (*GL* = 25%) rather inter-industry trade is realized, with a lower index level for ACP countries (*GL* = 18%). These statistics reveal that inter-industry trade (instead of IIT) dominates the EU-ACP trade relation. It indicates the EU members exchanged mainly similar (processed) agricultural products with each other. By contrast, ACP countries were able to exchange mostly different agricultural products (raw materials) with the EU

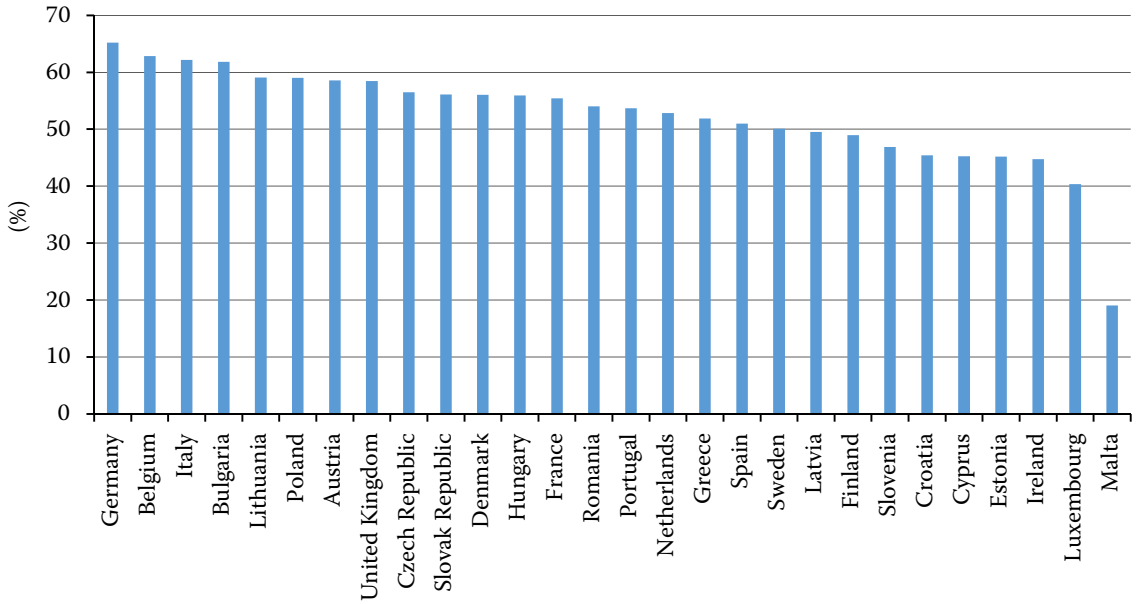

Figure 2. Grubel–Lloyd (*GL*) index (mean) calculated for European Union (EU) 27 intra agricultural trade (EU to EU), 1996-2017

Source: own calculation based on World Bank (2018a) and CEPII (2018)

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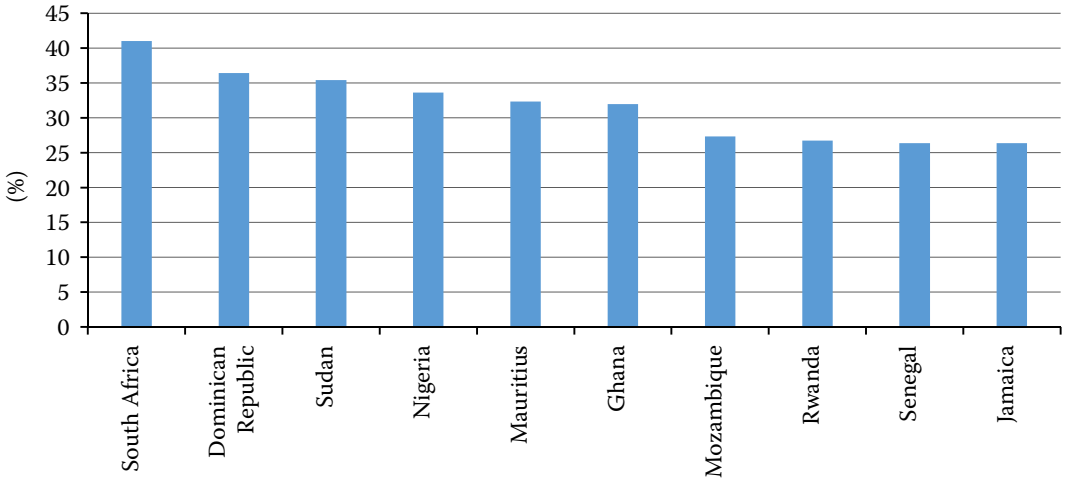

Figure 3. Grubel–Lloyd (*GL*) index calculated for European Union (EU) to African, Caribbean and Pacific (ACP) agricultural trade, top 10 ACP destinations of the EU, 1996–2017

Source: own calculation based on World Bank (2018a) and CEPII (2018)

than they imported (processed products) from the EU, realizing only moderate grains from trade partnerships in value, in line with Cipollina et al. (2013).

RESULTS AND DISCUSSION

Table 2 presents the gravity regression results for EU (comprising EU and non-EU) agricultural export, import, trade, and *GL* index including zero trade flows, applying trade in absolute value and *GL* index in percent, using Pseudo-Poisson maximum likelihood (PPML).

Based on the estimations, the size of exporter's GDP (of the EU member states) and the importer's GDP affect positively while geographical distance, and landlocked attributes negatively related to EU agricultural trade confirming standard gravity hypothesis for agricultural products (H_1). Braha et al. (2017), Hatab et al. (2010), Balogh and Jámbor (2018) give support to our results.

The estimated distance coefficients of EU agricultural trade (–0.2 and –0.74) are closely related to the elasticity of trade to distance that is usually between –0.7 and –1.5 in empirical gravity models in line with Bacchetta et al. (2012).

We found a negative impact of geographical distance on intra-industry trade in line with Łapinska (2014), Jámbor (2014) revealing that the intra-industry trade increases while the geographical distance decreases between trade partners. The classic empirical works of Loertscher and Wolter (1980), and Balassa and Bauwens (1987) give support to our result. The positive effect of common official language and religion on trade flow are revealed in all models indicating the reduction of agricultural trade costs (H_2) along with Gould (1994), Grin (1994), Breton (1999), Linders and de Groot (2006), Balogh and Jámbor (2018). Moreover, the studies of Lafay et al. (1999), and Zhan et al. (2005) also found a positive effect on intra-industry trade.

The agricultural trade within the EU is more advantageous if the origin and the destination countries both are already accessed to the EU confirming the European Common Market hypothesis (H_3). If we compare the estimation for agricultural export and import, we can observe that in terms of import (0.484), the ACP countries have a higher positive impact on EU trade than agricultural export from EU to ACP (0.225). It indicates that the EU agricultural export to ACP has a moderate effect (lower trade costs) than EU import from ACP countries (ACP export to EU).

In summary, these models can prove the hypothesised relationship (common cultural, historical and geographical link) between the EU with their non-EU, and ACP trading partners in terms of agricultural trade (H_1 and H_2). The European Common Market hypothesis is supported (H_3). The results also confirm the positive role of the regional trade agreements (RTA) in the EU and non-EU relations (H_4).

Furthermore, the estimations suggest significant positive common trade relations between the EU and ACP countries emphasizing the importance of Economic Partnership Agreements (EPAs) and confirming H_5. On the other hand, regarding the agricultural products, this trade relationship is more beneficial for EU

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Table 2. Estimation results for European Union agricultural export

Variables	(1) *EU_agri_export*	(2) *EU_agri_import*	(3) *EU_agri_trade*	(4) *GL_index*
ln_*exp_GDP*	0.715***	0.776***	0.744***	0.176***
	(0.000)	(0.000)	(0.000)	(0.000)
ln_*imp_GDP*	0.724***	0.647***	0.683***	0.130***
	(0.000)	(0.000)	(0.000)	(0.000)
ln_*dist_cap*	–0.741***	–0.376***	–0.563***	–0.195***
	(0.000)	(0.000)	(0.000)	(0.000)
landlocked	–0.388***	–0.133*	–0.259***	–0.0340
	(1.68e-05)	(0.0587)	(0.0006)	(0.133)
contig	0.731***	0.696***	0.707***	0.00576
	(0.000)	(0.000)	(0.000)	(0.698)
comlang_off	0.188***	0.372***	0.279***	0.202***
	(1.28e-06)	(0.000)	(0.000)	(0.000)
comrelig	0.215***	0.639***	0.441***	–0.0572***
	(2.36e-08)	(0.000)	(0.000)	(0.000)
RTA	–0.206***	–0.227***	–0.220***	0.156***
	(9.40e-11)	(5.04e-09)	(0.000)	(0.000)
EU_O	0.540***	0.130***	0.330***	–0.143***
	(0.000)	(0.000459)	(0.000)	(0.000)
EU_D	0.675***	1.178***	0.916***	0.205***
	(0.000)	(0.000)	(0.000)	(0.000)
EU_TO_ACP	0.225***	0.484***	0.402***	0.0313**
	(6.19e-08)	(0.000)	(0.000)	(0.0140)
Constant	–28.81***	–31.09***	–29.11***	–7.527***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	94 738	94 738	94 738	78 687
Pseudo R^2	0.690	0.681	0.756	0.219

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; p-values in parentheses; *agri* – agricultural; *exp* – export; *imp* – import; *GDP* – gross domestic product; *GL* – Grubel–Lloyd; EU – European Union; *dist_cap* – distance between capital cities; *landlocked* – landlocked countries; *contig* – contiguity; *comlang_off* – common official language; *comrelig* – common religion; *RTA* – Regional Trade Agreements; *EU_O* – European Union's country as origin of trade; *EU_D* – European Union's country as destination of trade; *EU_TO_ACP* – European Union's country exporting to a country in African, Caribbean and Pacific region

Source: own calculation based on World Bank (2018a), World Bank (2018b), and CEPII (2018)

member states (with lower export costs, estimated coefficient at 0.225) compared to ACP countries (import coefficient at 0.484) (Table 2). More specifically, the EU is able to export agricultural products to ACP at lower trade costs than import from the ACP. In conclusion, the EU provides a trade advantage for ACP countries, however, this trade advantage is only moderate in terms of agricultural import, more favourable for EU-ACP export than ACP-EU trade.

CONCLUSION

Trade analysis of the agricultural products is essential for the EU Common Agricultural Policy and for common trade policy, which manages EU trade relations with non-EU countries.

The paper presented quantitative research of the gravity model, and investigated the characteristics of the cross-border trade flows of agricultural products,

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with specific devotion to the EU-ACP relationships. This research also considers the cross-country analysis to explain the determinants of intra-industry trade (IIT). To analyse the pattern of EU bilateral trade, IIT was discovered by *GL* index. The result for the *GL* index revealed a high intra-industry trade between EU member states and inter-industry trade between EU and non-EU members, with a lower index level for ACP countries (18%). However, the share of ACP countries consists of one-quarter of the EU agricultural export partners, the EU import from ACP is more expensive (trade costs are higher) than EU export to ACP.

Furthermore, we analysed the hypothesised effects of cultural, geographical proximity, free trade agreements, EU membership on the trade costs of the EU agricultural products. Econometric models were calculated for all EU export destinations (EU, and non-EU countries), employing a panel gravity model from 1996 to 2017. Furthermore, it investigated the role of ACP countries in the EU trade.

Results suggest that standard gravity hypothesis also applies to the EU agricultural trade. The findings of the article confirmed that more agricultural trade can be realised between larger EU and non-EU countries, the transport costs increase in line with the geographical distance and it is higher for landlocked trading partners (lack of sea access).

The costs of the EU agricultural trade could be lower if trading partners have common cultural relations, or both are the members of the EU or entered into a regional trade agreement.

However, the EU provides an advantage for ACP countries, from the perspective of the ACP countries this trade advantage remains moderate (higher trade costs for ACP) during the analysed period.

The IIT equation allows us to infer important considerations. The size of markets measured by per capita income is expected a positive signal (Greenaway et al. 1995; Jámbor and Leitao 2016). The result shows that EU-ACP relations present dimension to differentiate products. The coefficients of geographical distance and trade agreements show that commercial relations allow the reduction of transport costs between trading partners. Our results find empirical support in the studies of Badinger and Breuss (2008), and Blanes (2005). Moreover, the common language promotes intra-industry trade, allowing for lowering transaction costs.

In terms of policy recommendation, our results suggest that in ACP-EU relations, the EU has more benefits from agricultural trade (lower export costs for EU to ACP trade, selling processed products) than ACP countries (higher import costs for ACP trade to EU, importing raw materials), therefore, the EU should provide more market opportunities for ACP region to make trade more mutual. Moreover, ACP-EU relations should strengthen commercial and industrial policy agreements in order to proliferate innovation and differentiation of agricultural products. The states should support the most competitive companies in the agricultural sector, thus strengthening the agricultural cluster. The contribution of the paper to the empirical literature is multiple. First, it adopts a large sample of EU-27 agricultural industry. Second, the results are robust for the European Union and also for ACP countries. Third, it revealed a significant trade advantage between the EU and ACP countries in term of agricultural products. Finally, the gravity model supported our specifications of the EU common market hypothesis, regional trade agreements, and the EU-ACP trade hypothesis.

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