

## Determinants of trade flows to Agadir Agreement countries: gravity model three-way approach

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**Abstract.** *This paper investigates the determinants of trade flows to the Agadir Agreement countries comprising 57 trading partners during the period of 2000-2019, using the gravity model. The results found that there is no effect of distance, cultural convergence, and colonial history on the trade flows of Arab countries. which is contradict to the expected results when using the gravitational model. This mixed findings led us to test the Poisson pseudo-maximum likelihood with High-Dimensional Fixed-Effects (PPMLHDFE), Which in turn fulfills the requirements for multi-lateral resistance. In addition, the findings show the importance of income for bilateral trade flows, while the increase in the number of Agadir Agreement countries has a negative impact. Trade flows in Agadir Agreement countries are affected negatively by long distance, and positively by border, linguistic similarity and colonial past. In addition, the findings show the importance of free trade agreements (FTAs) in increasing bilateral flows between parties involved, as the Agadir Agreement contributed by 29.35%, while trade flows to the Agadir Agreement countries with their trade partners, with whom they have a trade agreement, increased by 47.25%. As for the diversification index, it shows good explanatory power on trade flows; therefore, the most salient suggestion is to focus on export diversification.*

**Keywords:** gravity model, trade flows, Agadir Agreement countries, free trade agreement, diversification index.

**JEL Classification:** F12, F10, F15.

## 1. Introduction

Most extant literature on international trade has evinced that trade liberalization is crucial for economic development and to achieve welfare economies. This has made institutions, such as the World Bank, the International Monetary Fund (IMF) and the World Trade Organization (WTO) to adopt a policy of trade liberalization, based on the fact that the reduction in customs duties on goods after World War II led to growth in the global economy and international trade. However, Siddiqui (2015) claimed that countries may not benefit from free trade based on the principle of comparative advantage; they should instead follow a cautious policy of openness that is in their own interest. One of the most important features of a country's trade liberalization policy is its entry into regional trade agreements (RTAs). Baier and Bergstrand (2007) claimed that free trade agreements (FTAs) stimulate trade between member countries by 100% compared to the rate of increase in trade between non-member countries. Anderson and Yotov (2016) posited this increase is due only to the lifting of tariff barriers. They also found that the benefits realized from FTAs are not homogeneous for all countries; in fact, they are quite dissimilar. Baier et al. (2018) attributed this disparity to the economic structure of countries, which makes costs unequal. This leaves countries, especially developing ones, in doubt about the feasibility of establishing RTAs. Developing countries face many structural problems, as their exports are limited to a specific number of products; in addition, they lack diversity and cannot match global exports, especially in recent years, which have witnessed tremendous development of technological products.

Several studies have been conducted on determinants of foreign trade flows in an international context (Gourdon, 2009, Gouveia et al., 2018); in Islamic countries (Jafari et al., 2011); in European countries (Christie, 2002, Papazoglou, 2007); in Asian countries (Kubendran, 2020, Prasai, 2014, Singh and PADHI, 2020); and in African countries (Pasara and Dunga, 2020). However, taking into account recent developments, for example, the decrease in the number of FTAs signed and the cancellation or exit of many of them, such as Brexit, a change in global demand for exports, global value chains and political instability in many regions of the world, we find there is a need for an empirical study to determine the variables affecting trade flows between countries.

This paper examines the determinants of trade flows to the Agadir Agreement countries using the gravity model, by focusing on the impact of FTAs, as well as political stability and diversification of exports indicators. In addition, we add new evidence to international trade theories on the determinants of external trade flows between countries.

## 2. Literature review

### 2.1. Gravity model

Many models can be used to measure the determinants of foreign trade, such as WITS-SMART. However, the gravitational model remains the most widely used model, despite its decades-long lack of a proper theoretical foundation. Initially, gravitational model has been introduced by Tinbergen (1962) and Pöyhönen (1963). Where they have identified

finding the factors controlling the total supply of the importing country and the aggregate demand of the exporting country as a major objective. Later on, Anderson (1979) has developed its physical model and through building the model of differentiating product by country of origin on the assumption of Armington-CES. Another study by Bergstrand (1990), he revealed that similarity in per capita income raises intra-industry trade volume for both the Heckscher-Ohlin-Samuelson (supply) and demand (Linder) causes simultaneously. Deardorff (1998) rejected the claim by Helpman and Krugman (1985) the gravity model could not be applied to the Heckscher-Ohlin hypotheses. Eaton and Kortum (2002) developed a Ricardian model of bilateral trade based on differences in production technology, distance and price levels. Anderson and Van Wincoop (2003) found what they termed as 'multilateral resistance' and defined it as, "the average theoretically appropriate barrier of trade". Although multilateral resistance is difficult to obtain empirically, this is the most important step in the search for strong theoretical rooting. Therefore, what can be concluded from the search for solutions to the problem of determining the model is that there is no single commercial model that explains the theoretical derivation; only assumptions and consideration of the multiple factors that give credibility to the gravitational equation.

The theoretical development of the gravity model has been accompanied by a difference in the methods and tools of its standard estimation. The Ordinary Least Squares (OLS) method is commonly used with the traditional gravity equation. With the adoption of the idea of multilateral resistance, the use of the fixed-effects model and fixed-effects two-way model increased. (Kepaptsoglou et al., 2010) The problem of linear logarithm, heteroscedasticity and loss of information, is due to the presence of zero trade flows in previous models. Linders and De Groot (2006) claimed that they cannot explain trade flows with zero value eliminated after entering the logarithm. They also suggested the Tobit estimator, truncated regression models and the Probit model, and the choice must be according to economic and econometric considerations. Silva and Tenreyro (2006) and Pfaffermayr (2020) developed a PPML model that gave different results from those obtained in the conventional gravitational equation or fixed-effects estimation in the linear logarithm of international trade determinants, such as small Gross Domestic Product (GDP) coefficients and exaggeration of the role played by distance and colonial past. Burger et al. (2009) noted that the Silva and Tenreyro (2006) model is prone to problems of excessive dispersion and zero flows. To solve this, they proposed estimates of constant effects of Poisson (negative binomial, zero amplified). The Poisson pseudo-maximum likelihood with High-Dimensional Fixed-Effects (PPMLHDFE) model by Larch et al. (2019) and Correia et al. (2020) was designed to solve many of the previous problems; in addition, it has great speed and multiple dimensions, and the presence of multiple fixed-effects that express on the multilateral resistance.

## 2.2. The Determinants of Foreign Trade of Agadir Agreement Countries

Based on the support of the European Commission and the 2001 Agadir Declaration by Egypt, Jordan, Morocco and Tunisia, to establish a FTA in 2004, the FTA come into force in March 2007. (Dahem and Saïdane, 2014) Péridy (2005) predicted that the impact of the Agadir Agreement on the trade of its member states would be weak, due to high trade costs

and limited export potential. Kahouli and Maktouf (2015) recommended that countries should move towards establishing RTAs in order to increase trade flows. Fath-Allah (2015) proved that the volume and direction of the trade of Arab countries is positively affected by the overlapping RTAs. Abdullah et al. (2014) concluded that the GDP, the population, and the degree of trade openness, increase the volume of intra- Arab Maghreb Union trade (intra-AMU), while the distance between countries has a negative impact on the growth of bilateral trade flows. Hatab et al.(2010) demonstrated that agricultural exports from Egypt to their trading partners are not affected by trade openness, while RTAs are not significant. Elmorsy (2015) listed the importance of GDP and common borders as major factors in determining Egypt's trade with Common Market for Eastern and Southern Africa (COMESA) and indicated that the obstacle that limits intra-trade the most is similarity of exports and poor infrastructure. Busse et al. (2012) found that the effect of FTAs or the WTO on Jordan's trade is limited, with the exception of the FTA with the United States of America (USA). Abu-Lila (2018) found that the real exchange rate has no effect on trade flows to Jordan. Jabri (2020) concluded that Morocco's contracting of a FTA with the European party has negatively affected its foreign trade and competitiveness. Khouilid and Echaoui (2017) acknowledged that the impact of non-tariff measures applied by 28 countries on Moroccan exports is negative, and it varies according to the sector and the level of growth of the importing country. For example, the protection level imposed by Jordan is 26.65%, Egypt is 36.33%, and the European Union is 12.09%.

### 3. Methodology and Data

This study identifies the factors that determine the volume of trade flows to the Agadir Agreement countries, namely, Tunisia, Egypt, Morocco and Jordan (exporting countries) with 57 trading partners (importing countries) for the period of 2000-2019. It is estimated in two stages with a choice between two models. The first stage of estimation is done according to pooled regression (OLS), fixed-effects model (FEM) and random-effects model (REM). In the second stage, the estimation process is done according to the fast PPMLHDFE.

The first step is to estimate the factors that explain the trade flows of the Agadir Agreement countries using the gravitational equation (1):

$$\begin{aligned} \ln trt_{ijt} = & \eta_0 + \eta_1 \ln GDP_{it} + \eta_2 \ln GDP_{jt} + \eta_3 \ln POP_{it} + \eta_4 \ln POP_{jt} + \\ & \eta_5 \ln Distw_{ij} + \eta_6 \ln Contig_{ij} + \eta_7 Comlan_{ij} + \eta_8 Col_{ij} + \eta_9 FTA_{ijt} + \eta_{10} Agadir_{ijt} + \\ & \eta_{11} \ln pol_{it} + \eta_{12} \ln pol_{jt} + \eta_{13} \ln idiver_{jt} + \eta_{14} \ln idiver_{jt} + \varepsilon_{ijt} \end{aligned} \quad (1)$$

Where:  $\ln$  is the natural logarithm;  $t$  denotes duration;  $i$  and  $j$  are the exporting and importing country, respectively;  $trt$  is the dependent variable, which is the size of the bilateral trade flows;  $GDP$  and  $POP$  are Gross Domestic Product and population, respectively;  $DISTW$  is the weighted geographical distance;  $Contig$ ,  $Comla$  and  $col$  are dummy variables express of borders, language, and colonial respectively, and take the value 1 in the case of commonborders, common language, and colonial and the value 0 otherwise.  $FTA$  is a dummy variable that express the two countries'  $i$  and  $j$  have FTA, and

take the value "1" in the case of member, and the value 0 otherwise. *Agadir* is a dummy variable that express the Agadir Agreement, and it takes the value "1" if the two parties are members of the agreement, and the value "0" otherwise. *pol* is political stability and absence of violence/terrorism index; *idiver* is export diversification index, whose value ranges between 0 and 1 - the closer to zero, the higher the degree of export diversification;  $\varepsilon_{ijt}$  is the error term, and  $\eta_\alpha$  are model parameters  $\alpha = 0,1,2, \dots,14$ .

The second step in the assessment process is that we followed the approach taken by (Larch et al., 2019) and (Correia et al., 2020):

$$TR_{ijt} = \exp(\theta_{it} + \phi_{jt} + E_{ij} + P'X_{ijt}) + U_{ijt} \quad (2)$$

Where: *TR* denotes the bilateral trade flows;  $\theta_{it}$  and  $\phi_{jt}$  refer to the variables of the exporting and importing country that change over time, respectively;  $E_{ij}$  is fixed-effect of the exporting-importing country;  $X_{ijt}$  are common variables between exporter-importer that change over time; and  $U_{ijt}$  is error term. By substituting in equation (2), the explanatory variables proposed in our model of the structural gravity equation is as in the final model represented by equation (3):

$$TRT_{ijt} = \exp(\alpha + \rho_1 \ln GDP_{it} + \rho_2 \ln POP_{it} + \rho_3 \ln pol_{it} + \rho_4 \ln idiver_{it} + \rho_5 \ln GDP_{jt} + \rho_6 \ln POP_{jt} + \rho_7 \ln pol_{jt} + \rho_8 \ln idiver_{jt} + \rho_9 \ln Distw_{ij} + \rho_{10} Contig_{ij} + \rho_{11} Comlan_{ij} + \rho_{12} Col_{ij} + \rho_{13} FTA_{ijt} + \rho_{14} Agadir_{ijt}) + U_{ijt} \quad (3)$$

For data collection, we imported the World Bank database for the variables of GDP and population; total trade by IMF (Direction of Trade Statistics [DOTS]); CEPII for distance, border, colonial link and common language variables; Transparency International for political stability and absence of violence/terrorism; and UNCTAD for export diversification index.

#### 4. Results

The following Table provides the econometric results of the model and their explanations. Table (1) displays the results of estimating the model. As a first step, we chose the appropriate model from among the OLS, FEM, REM. Poolability test result showed the advantage of FEM over OLS. The Breusch and Pagan test showed the acceptance of the alternative hypothesis and the advantage of the REM. Hausman's test demonstrated a preference for the FEM versus the REM. The Fisher statistic ( $F = 84.4$ ) is significant at the 1% level, which means that the overall model is significant.  $R^2 = 0.3006$ , indicating that the explanatory variables explain the dependent variable by 30.06%.

The results of the FEM estimation show the importance of GDP in influencing the volume of trade flows, especially in Agadir Agreement countries. Increasing GDP by 1% raises the trade exchange with their trading partners by 1.06%. The effect of the population size is different between the exporting and importing countries. Trade flows to the Agadir Agreement countries decreases by 1.25% when the population increases by 1%. Augier et al. (2005) justified this by the tendency of densely populated countries to meet their needs

from the domestic market. Trade flows to the trading partners of Agadir Agreement countries increases by 0.58% when their population increases by 1%. Their trade flows are not affected by long-distance, shared borders, same language and colonial past. These results are consistent with the findings of Kahouli and Maktouf (2015), Mele and Baistrocchi (2012), and Felbermayr and Toubal (2010). This is explained by the weakness of trade between Arab countries. Bilateral trade flows to the Agadir Agreement countries are positively affected by their entry into FTAs at a rate of 30.7%. This increase in trade exchange is due to the abolition of customs duties and the reduction of non-tariff barriers that countries impose on their imports. The Agadir FTA has resulted in an increase in intra-trade by 25%, which confirms the viability of this agreement. The absence of political stability, as well as violence and protests, have negatively affected trade flows by 9%, and this is due to the imbalance in local production, whereby increased imports represent the bulk of Agadir's trade. The diversification index expresses the extent to which the exported products of a country differ or are identical to the structure of global trade. When the value is close to zero, it indicates that the country's exports are diversified and coincide with global exports, while the more the value approaches 1, the diversity of the country's exports decreases with global demand. The results show the negative impact of the mismatch of exports of the countries studied, with global exports approaching 50%.

**Table 1.** Results of gravity equation estimation

Dependent Variable	(PPMLHDFE) TRT	(OLS) Intrt	(FEM) Intrt	(REM) Intrt
Ingdpi	0.912*** (0.1)	0.595*** (0.058)	1.06*** (0.053)	0.772*** (0.044)
Ingdpj	0.409*** (0.055)	0.873*** (0.017)	0.358*** (0.034)	0.47*** (0.03)
Inpopi	-1.339*** (0.295)	0.139*** (0.049)	-1.252*** (0.132)	-0.282*** (0.074)
Inpopj	0.152 (0.169)	0.124*** (0.014)	0.584*** (0.073)	0.339*** (0.034)
Indistw	-0.839*** (0.043)	-0.903*** (0.027)		-0.709*** (0.086)
Contig	0.949*** (0.078)	1.041*** (0.107)		1.183*** (0.397)
comlan	0.582*** (0.106)	0.77*** (0.044)		0.422*** (0.148)
col	0.469*** (0.091)	0.399*** (0.103)		0.617 (0.38)
FTA	0.472*** (0.066)	-0.171*** (0.047)	0.307*** (0.04)	0.272*** (0.039)
Agadir	0.294*** (0.089)	0.239** (0.094)	0.25*** (0.078)	0.234*** (0.078)
Inpoli	0.052 (0.037)	-0.129*** (0.042)	-0.091*** (0.028)	-0.101*** (0.028)
Inpolj	0.04 (0.049)	0.034 (0.023)	0.037 (0.024)	0.036 (0.023)
Inidiveri	-1.004*** (0.367)	1.316*** (0.184)	-0.47** (0.207)	-0.351* (0.2)
Inidiverj	-0.563*** (0.183)	0.223*** (0.056)	-0.496*** (0.145)	-0.386*** (0.119)
_cons	16.422*** (5.244)	-8.621*** (0.532)	-0.384 (2.046)	-5.074*** (1.219)
Observations	4632	4622	4622	4622

Dependent	(PPMLHDFE)	(OLS)	(FEM)	(REM)
Variable	TRT	Intrt	Intrt	Intrt
R <sup>2</sup>	0.8961	0.7027	0.3006	0.6430
F-statistics		781.23***	540.53***	
Wald chi2	1615.49***			5749.27***
F-test			84.40***	
BP-test				20328.04***
hausman test			107.09***	

Source: Author (\*, \*\*, \*\*\* denotes significance at 10%, 5%, 1% level).

The fourth column in Table (1) indicates the results for PPMLHDFE (*Wald chi2* = 1615.49) which is significant at the 1% level, and this shows the significance of the overall model. The value of the coefficient of determination of the model *pseudo R*<sup>2</sup> = 0.896 indicates that the explanatory variables explain the dependent variable by a large percentage of 89.6%. Trade flows to Agadir Agreement countries are affected positively by their economic size but to a lesser extent than their influence in the FEM. The results of the PPMLHDFE estimation concur with the FEM model regarding the effect of population on bilateral flows to the country *i*. However, the results for country *j* are opposite as they show insignificance. The effect of distance on Agadir's total trade with its trading partners is negative and strong. The three-dimensional estimation model (source - importer - time) shows the positive and statistically significant effect at the level of 1% for countries that share common borders and the same language and have a colonial past, with total trade rates of 94.87%, 58.2% and 46.86%, respectively. These results differ completely from the FEM, but are consistent with the classical gravity models. The political stability index, despite having a positive impact on bilateral trade flows, is not significant. The difference in the pattern of country *i*'s exports from the global export pattern weakens trade flows by 100%.

## 5. Conclusion

The question for international trade theorists is what are the factors that make a country trade with a specific country less than other countries. The gravitational equation model is the most successful model to find the factors that have explanatory power in justifying the difference in the levels of bilateral trade exchange. To investigate the effect of different determinants of trade on total flows to Agadir Agreement countries, the study used a three-dimensional gravity model with 57 trade partners for 20 years (2000-2019). The results show the positive and important effects of the size of GDP. The population size is negative for the Agadir countries and insignificant for their trading partners. The distance coefficient is negative and it shows the opposite effect of distance length. The geographical, cultural, and colonial past convergence reflects positively on bilateral trade flows. These results are in tandem with the gravity model and contrary to the FEM, which completely eliminates their influence on trade flows. Trade flows to Jordan, Tunisia, Egypt and Morocco increase with the countries with which they have a FTA by 47.2%, especially the European party, which is the largest partner of these countries. The Agadir Agreement has also contributed to an increase in intra-trade by 29.4%. Despite the negative impact of political instability on the FEM estimator, it is not significant in the PPMLHDFE estimator. The inconsistency of a country's exports with the structure of global exports reduces its trade exchange with

its trading partners, as the total trade of Agadir Agreement countries has decreased by 100% and by 56% for importing countries.

The study has some recommendations for the politicians of the Agadir countries to develop their foreign trade with their trading partners. Concerning FTAs, in addition to entering into private FTAs with partners at the same level of growth as the African FTAs, work must be done to enhance the inter-trade of Agadir countries by exploiting the integration opportunities available in the sectors of leather, clothing, pharmaceuticals and agriculture. An initiative must be taken to reduce non-tariff barriers that hinder the flow of goods. Joint Arab economic action must also be taken to benefit from geographical proximity and cultural similarities among these countries. Conditions that suit the countries of the Agadir Agreement must be reformulated with its main European partner, to be able to benefit from Pan-Euro-Mediterranean cumulation of origin to allow exports of Agadir countries to penetrate more markets. It is also necessary to reduce the non-tariff obstacles, such as environmental and health standards, that the European party uses as the main pretext in the face of the flow of exports from Agadir countries. We also call for the optimization of the FTA with Turkey and the isolation of political differences on the economic front. In the area of export development and diversification, Agadir countries should reduce the concentration of their products to a limited number of commodities by reviewing macro- and microeconomic policies to encourage investment. Adopting an industrial and agricultural policy can enhance competitiveness, besides upgrading the infrastructure. Finally, political stability and control of corruption must be restored in order to facilitate the flow of Agadir exports to its trading partners.

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